Alaska Outer Continental Shelf

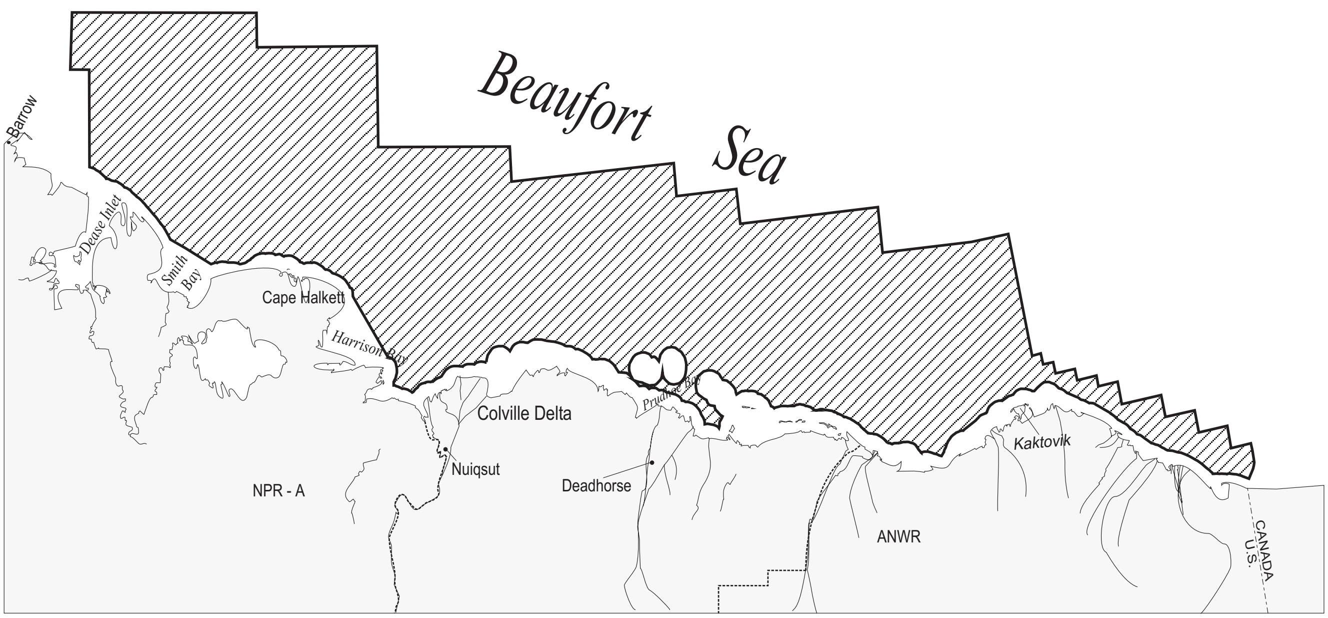
OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area

Oil and Gas Lease Sales
186, 195, and 202

Final Environmental
Impact Statement

Volume I
(Executive Summary, Sections I through VI)



MMS
U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

BEAUFORT SEA PLANNING AREA OIL AND GAS LEASE SALES 186, 195, AND 202
Final Environmental Impact Statement
OCS EIS/EA, MMS 2003-001, in 4 volumes:
Volume I, Executive Summary, Sections I through VI
Volume II, Section VII, Bibliography, Index
Volume III, Tables, Figures, and Maps for Volumes I and II
Volume IV, Appendices

The summary is also available as a separate document:
Executive Summary, **MMS 2003-002.**

The complete EIS is available on CD-ROM (**MMS 2003-001 CD**) and on the Internet (**http://www.mms.gov/alaska/cproject/Beafort Sea/**).

This Environmental Impact Statement (EIS) is not intended, nor should it be used, as a local planning document by potentially affected communities. The exploration, development and production, and transportation scenarios described in this EIS represent best-estimate assumptions that serve as a basis for identifying characteristic activities and any resulting environmental effects. Several years will elapse before enough is known about potential local details of development to permit estimates suitable for local planning. These assumptions do not represent a Minerals Management Service recommendation, preference, or endorsement of any facility, site, or development plan. Local control of events may be exercised through planning, zoning, land ownership, and applicable State and local laws and regulations.

With reference to the extent of the Federal Government's jurisdiction of the offshore regions, the United States has not yet resolved some of its offshore boundaries with neighboring jurisdictions. For the purposes of the EIS, certain assumptions were made about the extent of areas believed subject to United States' jurisdiction. The offshore-boundary lines shown in the figures and graphics of this EIS are for purposes of illustration only; they do not necessarily reflect the position or views of the United States with respect to the location of international boundaries, convention lines, or the offshore boundaries between the United States and coastal states concerned. The United States expressly reserves its rights, and those of its nationals, in all areas in which the offshore-boundary dispute has not been resolved; and these illustrative lines are used without prejudice to such rights.

Alaska Outer Continental Shelf

OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, and 202

Final Environmental Impact Statement

Volume I
(Executive Summary, Sections I through VI)

Author
Minerals Management Service
Alaska OCS Region

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

February 2003

Beaufort Sea
Multiple Sales (186, 195, and 202)
Environmental Impact Statement

Draft ( ) **Final (X)**

Type of Action: Administrative (X) Legislative ( )

Area of Proposed Effect: Offshore marine environment, Beaufort Sea coastal plain, and the North Slope Borough of Alaska.

Responsible Agency: U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue
Anchorage, AK 99508-4302

Abstract: This environmental impact statement (EIS) assesses three lease sales in the Proposed Final 2002-2007 5-Year Oil and Gas Leasing Program for the Beaufort Sea OCS Planning Area. Sale 186 is scheduled for 2003; Sale 195 for 2005; and Sale 202 for 2007. The proposed sales include consideration of 1,877 whole or partial lease blocks in the Beaufort Sea Planning Area, covering about 9.8 million acres (3.95 million hectares).

The area considered for the proposed action (Alternative I) is located seaward of the State of Alaska submerged lands boundary, extending from 3 miles to approximately 60 miles offshore and to water depths more than 600 feet, from the Canadian Border on the east, to Barrow, Alaska on the west. For each alternative, the EIS evaluates the effects to the human, physical, and biological resources from routine activities and from the unlikely chance of a large oil spill. Other alternatives include Alternative II (No Lease Sale), which means cancellation of the sale, and four deferral Alternatives (III through VI), which would eliminate various subareas from leasing. A cumulative-effects analysis evaluates the environmental effects of the proposed action with past, present, and reasonably foreseeable future OCS lease sales, as well as non-OCS activities.

Five standard lease Stipulations and 16 standard Information to Lessee (ITL) clauses are evaluated as part of the proposed action. The EIS also evaluates optional stipulations and ITL's.

For further information regarding this EIS, contact:

Paul L. Lowry
Minerals Management Service
949 East 36th Ave., Rm. 308
Anchorage, AK 99508-4302
(907) 271-6574

Dr. George Valiulis
U.S. Department of the Interior
Minerals Management Service
381 Elden Street (MS 4320)
Herndon, VA 20170-4817
(703) 787-1662

ACRONYMS
ABBREVIATIONS
AND
SYMBOLS

Acronyms, Abbreviations and Symbols

ACI	Alaska Consultants, Inc.
ACMP	Alaska Coastal Management Program
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area (study)
Area ID	Area Identification
Call	Call for Information and Nominations
CFR	Code of Federal Regulations
CMP	Coastal Management Plan
CZM	Coastal Zone Management
EA	Environmental Assessment
EIS	Environmental Impact Statement
ERA	Environmental Resource Area
FONSI	Finding of No Significant Impact
FR	*Federal Register*
ISER	Institute for Social and Economic Research
ITL	Information to Lessees (clause)
LC_{50}	96-hour lethal concentration for 50% of test organisms
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
NSB CMP	North Slope Borough Coastal Management Program
NSBMC	North Slope Borough Municipal Code
PM_{10}	particulate matter less than 10 microns in diameter
PSD	Prevention of Significant Deterioration
OCS	Outer Continental Shelf
UAA	University of Alaska, Anchorage
USDOI	U.S. Department of the Interior
U.S.C.	United States Code
dB re 1µPa	decibels re 1 microPascal
°	degree(s)
%	percent

THE 2003 BEAUFORT SEA MULTIPLE–SALE

FINAL EIS

What It Includes

and

How It's Structured

The 2003 Beaufort Sea Multiple-Sale EIS
What it Includes and How It's Structured

Overview and General Information

These two pages provide a quick overview of what is in this draft environmental impact statement (EIS) and how it is structured. Because the draft EIS is somewhat complicated, we in the Minerals Management Service (MMS) urge you to read this first.

In April 2002, the Secretary of the Interior issued a Proposed Final 5-Year Offshore Oil and Gas Leasing Program for 2002-2007. It includes three lease sales on the Beaufort Sea outer continental shelf—Sale 186 scheduled in 2003, Sale 195 in 2005 and Sale 202 in 2007. This multiple-sale EIS assesses environmental effects of these sales, all three of which consider for leasing the same geographical area in the Beaufort Sea (from near the City of Barrow to the Canadian border). As MMS begins preparations for each of the latter two sales, we will do an Environmental Assessment (EA) to determine if the EIS is still adequate or if a supplemental EIS is needed. Those EA's will be available for public review and comment.

The MMS has successfully used offshore multiple-sale EIS's in the Gulf of Mexico Region. Such an approach is encouraged by the National Environmental Policy Act (NEPA). It avoids publication of nearly duplicate documents and staff "burnout" in local, State, and Federal reviewing agencies and saves MMS staff and financial resources. It also focuses readers on the key environmental issues that are very similar for each sale.

Traditional knowledge information and observations appear throughout the EIS, along with those of Western science.

We have attempted to use and cite the latest and best information available in this EIS. When information in the literature was limited, authors used their best professional judgment in describing effects. If you have any suggestions about the format and writing style, we hope you include them in your comments. If you feel any critical references were omitted, please describe them as specifically as possible. Thank you.

This draft EIS is available in paper copy and as a CD/ROM. The CD/ROM is convenient to use, has numerous hyperlinks, and saves substantially on paper, printing, and postage costs.

Executive Summary: This sets out the geographic scope and context of the proposed sales and then summarizes the issues raised in written and oral scoping comments. We introduce the concept of infrastructure/water depth zones and lay out the development scenarios we created for purposes of analysis for each sale in each zone. We describe three groups of effects of the proposal (Alternative I) for each sale: effects from routine permitted activities, effects from an unlikely large oil spill, and cumulative effects.

The Executive Summary then summarizes the effects of No Action (Alternative II) and the effects of the four deferral alternatives: the Barrow, Nuiqsut, and Kaktovik Subsistence Whaling Deferrals and the Eastern Deferral (Alternatives III-VI). Finally, we touch on the mitigating measures and a context for considering alternatives and mitigating measures.

Section I Purpose and Background of the Proposed Actions: This section gives fairly conventional treatment to the purpose, need, and description of the proposed actions for the three sales in addition to the legal mandates and a summary of the results of the scoping process.

We then describe the six alternatives, the sale proposal, no action, and four deferrals, all of which are the same for the three sales. Next is our rationale for "scoping out" other recommended deferrals. We then list the mitigation measures (both the Stipulations and Information to Lessees [ITL clauses]) and summarize information on Indian Trust Resources and Environmental Justice. The section ends with a description of the NEPA process for the three sales and our attempt to keep the EIS as concise as possible.

Section II Alternatives, Including the Proposed Action: We start with a detailed description of our analytical approach to assessing the hydrocarbon-resource potential of the Beaufort Sea and the development scenarios of offshore operational activities that we create and use to estimate environmental effects. We introduce the "opportunity index" to describe the risk-weighted probability of discovering and developing an economic field in particular areas of the Beaufort Sea.

We then describe in detail each of the 6 alternatives and each of the 5 standard and 3 additional stipulations and 16 standard and 1 additional ITL clause.

Section III Description of the Affected Environment: This is a fairly standard description of the physical characteristics, biological resources and social systems.

Section IV– Environmental Consequences: This is the heart of the EIS. We begin with detailed information on all the basic assumptions used in our assessment of effects. Then, we describe the positive and negatives effects of taking no action (Alternative II). The bulk of the analysis of effects in this section is grouped by the 16 resource categories that we address:

- Water Quality
- Lower Trophic-Level Organisms
- Fishes
- Essential Fish Habitat
- Endangered and Threatened Species
- Marine and Coastal Birds
- Marine Mammals
- Terrestrial Mammals
- Vegetation and Wetlands
- Economy
- Subsistence-Harvest Patterns
- Sociocultural Systems
- Archaeological Resources
- Land Use Plans and Coastal Management
- Air Quality
- Environmental Justice

Under most all of the above categories, we first present the general effects of noise, disturbance, etc. from permitted activities and then the general effects of oil spills and the effects of an unlikely large spill with associated cleanup activities. We then analyze the effects on the particular resource category of each alternative, with subheadings for each sale. We treat a few categories, such as Economy and Environmental Justice, somewhat differently.

We end the section with analysis of a variety of topics required by NEPA, the effects of natural gas development and production, and the effects to resources from a very large, but extremely unlikely, blowout oil spill.

Section IV Cumulative Effects: This section presents the conceptual approach used in analyzing cumulative effects, then details the past, present and reasonably foreseeable future activities that contribute to cumulative effects. The bulk of the analysis is cumulative effects by resource. We assess sequentially the cumulative effects on the 16 previously-mentioned resource categories and end each subsection with a concluding statement of the contribution that the proposal for Sale 186 makes to the cumulative effects.

Section VI Consultation and Coordination: Here we include organizations and/or individuals with whom we consulted, who provided written or oral scoping comments, or are on our mailing list. We also include a list of contributing authors and support staff.

Section VII Review and Analysis of Comments Received: This section provides copies of the comments we received by letter, email, or as testimony at the hearings. We have assigned a number to each letter (L-0001 to L-0040) and assigned the name to each public hearing (i.e. PH Barrow or PH Kaktovik). Within each letter and pubic hearing we have identified the comments requiring a response with another three digit number. The combination of both these numbers (L-0020.001 or PH Barrow.001) provides a unique identifier for each comment and response. The responses to comments for each letter or public hearing are provided immediately after the letter or hearing. E-mails tend to be repetitive and contain comments previously answered either within the letter or public hearing comments; consequently, we have included representative examples of e-mails received. E-mails are numbered with an E followed by the sequence in which it was received at the Alaska Region Website (E-2301).

Appendices: These include technical information on oil spills, resource estimates, the Endangered Species Act, other applicable laws and regulations, and the scoping report.

EXECUTIVE SUMMARY

CONTENTS OF EXECUTIVE SUMMARY

Executive Summary: Beaufort Sea Multiple Sale Environmental Impact Statement for Sales 186, 195, and 202

ES.1.a Introduction and Background

This environmental impact statement (EIS) assesses three lease sales in the Proposed Final 2002-2007 5-Year Oil and Gas Leasing Program for the Beaufort Sea OCS Planning Area. Sale 186 is scheduled for 2003; Sale 195 for 2005; and Sale 202 for 2007. Federal regulations (40 CFR 1502.4) suggest analyzing similar sales in a single EIS. The proposal for each sale is to offer 1,877 whole or partial lease blocks in the Beaufort Sea Planning Area, covering about 9.8 million acres (3.95 million hectares) for leasing (see Map 1). The proposed sale area is seaward (up to 60 miles offshore) of the State of Alaska submerged lands boundary in the Beaufort Sea. It extends from the Canadian Border on the east to near Barrow, Alaska on the west. Although the water depths may exceed 600 feet, most, if not all, exploration and development activities that may occur likely would take place in water depths less than 125 feet. For purposes of analysis, the MMS assumes that 460 million barrels of oil could be discovered and produced for each sale, based on an estimated range of 340-570 million barrels per sale. Only a small percentage of the blocks available for lease under the proposed action for Sales 186, 195, and 202 likely would be leased. Of the blocks that would be leased, only a portion would be drilled. Of these, only a very small portion, if any, likely would result in production. At this time, gas is not considered economically recoverable. See Map 17 – Historical Sales, Areas Previously Offered in Beaufort Lease Sales; and Map 16 – Historical Sales, Blocks Leased in Previous Beaufort Sales.

ES.1.b Scoping

Scoping is the ongoing public process to identify issues to be analyzed in depth in the EIS. Public scoping meetings were held in Barrow, Kaktovik, Nuiqsut, and Anchorage. We received both oral and written comments from a number of constituents. Respondents include affected local, tribal, State and Federal agencies, the petroleum industry, Native groups, environmental and public interest groups, and concerned individuals. The input we received from these sources aided us in identifying significant issues, possible alternatives, and potential mitigating measures. As part of our local scoping process, we held a government-to-government dialog with Native groups, both in formal agency meetings and in the open public forum. Traditional Knowledge, Environmental Justice, Indian Trust Resources, and Government-to-Government Coordination are addressed in this EIS.

The MMS identified the following major issues from the scoping comments:

- habitat disturbances and alterations, including discharges and noise
- disturbance to bowhead whale-migration patterns from resulting activities
- protection of subsistence resources and the Inupiat culture and way of life
- effects from accidental oil spills
- incorporation of traditional knowledge in the EIS and its use in decisionmaking
- cumulative effects of past, present, and reasonably foreseeable future activities on the people and environment of Alaska's North Slope
- development of a single EIS for each proposed lease sale, rather than one multiple-sale EIS covering all proposed lease sales, is favored by the NSB

ES.1.c Infrastructure/Water-Depth Zones

For purposes of analysis, the MMS has divided the Beaufort Sea Planning Area into three zones. These zones are defined primarily by their proximity to existing North Slope infrastructure and secondarily by water depths. Distance from existing infrastructure is a major economic factor. The farther away a project is located from existing infrastructure, the higher the costs; therefore, a greater quantity of oil is needed to make the project economic. Water depths will influence the types of structures used for exploration and development. The Near/Shallow Zone is located in the central Beaufort Sea (offshore Prudhoe Bay) between the Canning River on the east and Colville River on west in water depths less than 30 feet (about 10 meters) (see Map 4). The Midrange/Medium Zone is farther away from development, extending from Barter Island in the east to Cape Halkett in the west and in water depths between 30 and 100 feet (about 10-30 meters). The Far/Deepwater Zone extends from the Canadian Border in the east to near Barrow in the west, and water depths may exceed 600 feet (200 meters), although we expect most development would take place in water depths less than 125 feet (35 meters) and within 25 miles from shore.

Past experience has shown that exploration and subsequent development likely will expand into areas that are more remote and of higher cost after opportunities are largely exhausted in areas that are easily accessible. For this reason, the development scenarios and associated analyses will change slightly with each sale. We assume that with the holding of each sale, commercially recoverable resources will lie in deeper offshore water and/or farther from existing infrastructure. However, no one can know, with any degree of certainty, how, when and if development will actually evolve in the Beaufort Sea.

ES.1.d Development Scenarios for Each Sale

For Sale 186, the MMS estimates most leasing (70%) would take place in the Near Zone, 20% in the Midrange Zone, and only 10% in the Far Zone. For purposes of analysis, we assume two potential developments in the Near Zone and one in the Midrange Zone. For Sale 195, industry interest would broaden with 50% of the leasing in the Near Zone, 30% in the Midrange Zone, and 20% in the Far Zone. We assume two potential developments would occur, one in the Near Zone and one in the Midrange Zone. For Sale 202, industry interest would move farther offshore and away from the central Beaufort Sea. We assume 40% of the leasing would occur in the Near Zone, 30% in the Midrange Zone, and 30% in the Far Zone; we assume a single development in the Far Zone. Although the scenarios prepared for this EIS assume a reasonable percentage of leasing and one development in the Far Zone until Sale 202 leases, companies could bid on and be awarded leases in any of the zones in any of the three sales. Moreover, the effects evaluated in this EIS that are attributed to any particular zone or sale for the scenarios MMS developed could occur as a result of any lease sale, if they occur at all.

ES.1.e Environmental Effects of the Proposal (Alternative I) for Sales 186, 195, and 202

See Map 2 for Beaufort Sea Multiple-Sale Deferral Alternatives.

ES.1.e(1) Effects from Routine Permitted Activities

If any of the lease sales are held and result in exploration and/or development, routine industrial activities associated with oil exploration and development would generate some degree of disturbance, noise, and discharges into the environment (see Table IV.A-4). The EIS found that no significant effects are anticipated from routine permitted activities. Significance thresholds are defined in Section IV.A.1 of the EIS.

Potential effects to water quality from any or all of the sales would be of short duration and localized to a few square kilometers from the discharge site, but there likely would be no regional effects. Effects to lower trophic-level organisms from increased turbidity from permitted construction activities would be local and short term. Nearby benthic organisms would experience sublethal effects from permitted discharges of drilling muds and cuttings over the life of the field. No measurable effect on fish populations (including incidental anadromous species) would be likely. Although a few individual fish could be harmed or killed during construction, most fish in the immediate area likely would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect likely on overwintering fish populations. Effects to essential fish habitat potentially likely would be greatest in the central Beaufort Sea onshore area, where the lakes and rivers in the area provide the best freshwater (overwintering) habitat. Effects on prey to essential fish habitat likely would be localized, with low population changes in abundance and distribution and for a short time. Ice-road construction, which uses some freshwater, could have moderate to low effects to onshore freshwater habitat by removing up to 15% of an overwintering waterbody. Removal of water from a lake or deep-water hole in a river potentially could reduce survival of overwintering juvenile salmon.

The endangered bowhead whale may exhibit temporary avoidance behavior to seismic surveys, vessel and aircraft activities, drilling, and construction, but overall effects to bowheads from disturbance and noise likely would be temporary and nonlethal. Disturbance associated with construction activities of the threatened spectacled and Steller’s eiders may cause decreased fitness or production of young. Eider mortality from collisions with structures is not likely to be a significant effect. Frequent disturbance during the construction of exploration or production facilities may cause decreased fitness or production of young to marine and coastal birds. Bird mortality from collisions with structures is not likely to be a significant effect. Small numbers of marine mammals (pinnipeds, polar bears, and beluga and gray whales) could be affected, with recovery expected in about 1 year. Small numbers of terrestrial mammals (caribou, muskoxen, grizzly bears, and arctic foxes) may be affected by construction activities, with recovery expected in 1 year. Caribou could be displaced within 1-2 kilometers along the pipeline and roads, but this should not affect caribou migration and overall distribution. Destruction of less than a few hundred acres of vegetation and wetlands from gravel mining, construction of a landfall gravel pad, and onshore pipeline installation likely would occur, with effects persisting for more than 10 years. Periodic disturbances could affect subsistence-harvest resources, but no resource or harvest area likely would become unavailable, and no resource population likely would experience an overall decrease.

Chronic disruptions to sociocultural systems likely would occur, but these disruptions are not likely to cause permanent displacement of ongoing traditional activities of harvesting, sharing, and processing subsistence resources. No “disproportionately high adverse effects” as defined by the Environmental Justice Executive Order would likely occur from planned and permitted activities associated with any of the three proposed OCS lease sales evaluated in this EIS. Disturbance of historic and prehistoric archaeological resources is possible, but not likely, during exploration and development activities both onshore and offshore. However, terrestrial and marine archaeological surveys should identify any potential resource prior to activities taking place, and they can be avoided or their effects can be mitigated. Air quality effects likely would not cause ambient air quality standards to be exceeded.

Based on the assumed discovery and development of 460 million barrels of oil, some economic benefits could occur as a result of each lease sale: $15 million in revenue to the North Slope Borough, $190 million to the State of Alaska, and $930 million to the Federal Government. An average of 800 jobs over 30 years could occur, and if so, they would represent about $1.7 billion in total personal income for these workers. Alternative I also likely would result in a longer lifespan for the Trans-Alaska Pipeline System. No conflicts are anticipated with the Statewide standards of the Alaska Coastal Management Plan or the enforceable policies of the North Slope Borough.

ES.1.e(2) Effects in the Unlikely Event of a Large Oil Spill

Other effects from any or all of the sales are possible from unlikely events, such as a large, accidental oil spill. The MMS's estimated mean number of one or more spills greater than or equal to 1,000 barrels for any one of the proposed sales is 0.11, and the most likely number of spills greater than or equal to 1,000 barrels is zero for any of the proposed sales. The chance of one or more large spills greater than or equal to 1,000 barrels for each of the three sales is 8-10%. For purposes of analysis, we assume one large spill of either 1,500 barrels (platform spill) or 4,600 barrels (pipeline spill). In the unlikely event of such an oil spill, significant adverse effects could occur to local water quality; common, spectacled, and Steller's eiders; long-tailed ducks; subsistence harvests; and sociocultural systems. However, the low probability of such an event, the likelihood that a spill will not move into all portions of a given area, and the seasonal nature of the resources inhabiting the area, make it quite unlikely that a large oil spill would occur and contact substantial portions of these resources. With regard to seasonality, although spectacled eiders, long-tailed ducks, and common eiders are present on the North Slope for only 3-5 months of the year, the potential exists for cumulative effects from contact in succeeding years if all oil is not removed from the environment the first year.

Water quality could be affected by hydrocarbons from small spills, resulting in local, chronic hydrocarbon contamination. In the unlikely event of a large spill, hydrocarbons could exceed the 1.5 parts per million acute toxic criterion for water quality during the first day of a spill and the 0.015 parts per million chronic criterion for about a month thereafter in a small bay. Such an oil spill could have lethal and sublethal effects on less than 1% of the plankton and lower trophic-level organisms in the coastal band of high production and (assuming a winter spill) less than 5% of the epontic organisms in the landfast-ice zone. Recovery of plankton stock likely would occur within a week (2 weeks in bays). A large spill likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).

We estimate less than a 0.5% chance of a large oil spill occurring and contacting nearshore Beaufort Sea fish habitat, where fish tend to concentrate during the spring and summer to feed and move about. Oil spills are likely to result in minor, short-term effects on relatively small numbers of fishes. A large oil spill probably would pose some risk to essential fish habitat, and these effects would be considered moderate, because salmon and salmon habitat would recover within one generation. One year of smolting salmon could be affected, and salmon populations likely would recover. Effects on freshwater and marine habitats likely would be low. Some bowhead whales likely would experience temporary, nonlethal effects, if a large oil spill occurred. The probability of oil contacting whales likely would be considerably less than the probability of oil contacting bowhead habitat. In the unlikely event a large spill occurred and contacted bowhead habitat during the fall migration, some whales likely would be contacted by oil, and it is possible that a few could die as a result of the contact. In the event of such a spill in the vicinity of spectacled eiders, mortality likely would be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality would not be expected to occur while the population exhibits a declining trend. Low Steller's eider mortality would be likely from a large oil spill in late spring or in early summer. Recovery of the Alaska population from spill-related losses, however, would not occur while the regional population is declining. In the unlikely event of a large oil spill, mortality to marine and coastal birds likely would reflect local population size and vulnerability determined by seasonal habitat use and the stage of annual cycle at the time of contact (for example, molting versus nonmolting). Depending on the completeness of oil cleanup, the risk of contact may extend to future seasons when vulnerable birds are present. Long-tailed duck mortality likely would exceed 1,000 individuals, while that of other common species, such as king eider, common eider, and scoters, likely would be in the low hundreds. For loon species, mortality likely would be fewer than 25 individuals each. During migration periods, potentially much greater mortality could occur as new migrants enter the spill area.

A large oil spill, even though unlikely, could result in the loss (lower reproductive rates or death of individual animals) of small numbers of marine mammals (seals, walruses, polar bears, and beluga and gray whales), perhaps 100-200 ringed seals but probably fewer than 10-20 spotted seals, 30-50 bearded seals, fewer than 100 walruses, 6-10 polar bears, and fewer than 10 beluga and gray whales, with populations likely recovering within about 1 year. For terrestrial mammals, such a spill during the same period that the animals used the coastal waters or nearshore areas, would likely result in the loss of no more than a small number of caribou (a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery estimated to occur within about 1 year. A large oil spill and spill-cleanup activities could affect a few acres of vegetation and wetlands for more than 10 years.

A large oil spill likely would affect the local economy and create additional employment of 60-190 jobs for up to 6 months. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major (significant) effects could occur with impacts from shoreline contamination, tainting concerns, cleanup disturbance, and disruption of subsistence-harvest practices and the sociocultural systems. Oil-spill cleanup could increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The effects of a large oil spill to air quality would be a small local and temporary increase in the concentration of gaseous hydrocarbons due to evaporation of the spill. The concentrations of criteria pollutants likely would remain well within Federal air quality standards. Oil-spill-cleanup activities also could disturb archaeological sites. Because large oil spills are unlikely events, no adverse effects are anticipated to the Statewide standards of the Alaska Coastal Management Plan or the enforceable policies of the North Slope Borough.

ES.1.e(3) Cumulative Effects

The MMS does not expect any significant cumulative impacts to result from any of the routine activities associated with Alternative I for Sale 186. For the cumulative analysis in this EIS, effects of the other alternatives for Sale 186, if chosen, and for Alternative I for Sales 195 and 202 and the other action alternatives, would be essentially the same as those for Alternative I for Sale 186. This is because in the cumulative effects analysis, we assess the estimated contribution of Alternative I for Sale 186 to the estimated combined effects of all the past, present, and reasonably foreseeable activities that are likely to affect the same resources likely be affected by Sale 186. The differences in effects among the proposed sales and their alternatives are so small, that we cannot reliably distinguish measurable differences relative to the combined estimated effects in the cumulative effects analysis. Another reason we cannot reliably distinguish measurable differences is due to the inherent uncertainty involved in estimating the combined effects of the potential future activities.

If the activities associated with scenarios developed for Alternative I for Sale 186 occurred, we estimate that they would contribute about 9% of the offshore cumulative effects in the Beaufort Sea from oil exploration and development and about 2% of the combined cumulative onshore and offshore effects. In the unlikely event of a large offshore oil spill, some significant cumulative effects could occur, such as adverse effects to common and spectacled eiders, long-tailed ducks, subsistence resources, sociocultural systems, and local water quality. However, the low probability of such an event, the likelihood that a spill would not move into all parts of a given area, and the seasonal nature of the resources inhabiting the area, make it unlikely that a large oil spill would occur and contact substantial portions of these resources. Although spectacled eiders, long-tailed ducks, and common eiders are present on the North Slope for only 3-5 months out of the year, the potential exists for cumulative effects from contact in succeeding years if all oil is not removed from the environment the first year. A resource may be present in the area but would not necessarily be contacted by a spill that covered only part of the area. A large oil spill, however unlikely, could affect the availability of bowhead whales, or the resource might be considered tainted and unusable as a food source. The potential for adverse effects to some key resources (bowhead whales, subsistence-harvest patterns, polar bears, eiders, and caribou) from such a large spill are of concern and warrant continued close attention.

ES.1.e(4) Agency-Preferred Alternative

As required by the National Environmental Policy Act Council on Environmental Quality regulations, the MMS has identified a preferred alternative for this final EIS. The agency-preferred alternative is Alternative I, along with the standard stipulations and ITL clauses, plus three optional mitigating measures: Stipulation 7 - Pre-Booming Requirements for Fuel Transfers; Stipulation No. 8 - Lighting of Structures to Minimize Effects to Spectacled and Steller's Eiders; and ITL No. 17 - Information to Lessees on Archaeological and Geological Hazards Reports.

We do not provide a separate evaluation of this alternative, because it would repeat the entire analysis provided for Alternative I (See Section IV.C of the EIS). The effects of the agency-preferred alternative essentially are the same as those noted for Alternative I with some additional protection to bowhead whales, subsistence-whaling activities, eiders, and archaeological resources. Also, the protections provided by the agency-preferred alternative would be about the same as those provided by selection of all four of the deferral alternatives.

ES.1.f Effects of Alternatives II through VI

In addition to Alternative II - No Lease Sale, four deferral alternatives were identified during the scoping process for analysis in the EIS. These action alternatives are evaluated as options for each of the three proposed sales (186, 195, and 202). Although Alternatives III through VI provide limited additional protection to resources that could be affected by oil and gas activity in the deferral areas, the deferrals do not change the estimated significant adverse effects identified in Section ES.1.e of this Executive Summary for any of the three sales.

Alternative II (No Lease Sale) equals cancellation of the sale. Several individuals suggested this alternative during scoping. Neither the estimated possible oil production nor the potential environmental effects resulting from the proposed actions for Sales 186, 195, or 202 would occur. While this alternative would provide protection to the environmental resources in the Federal offshore area of the Beaufort Sea, the environmental impacts from a global perspective likely would not be decreased. Most of the oil that would not be produced in the U.S. if Alternative II were selected instead would be imported to the U.S. in foreign tankers. Assuming that the amount of oil resources used in the U.S. continues at current rates, oil production in foreign countries would be increased; therefore, the environmental consequences described under Alternative I would not occur, but the production and transportation of the replacement oil would cause environmental consequences elsewhere. From a global perspective, selection of Alternative II (No Lease Sale), would be a decision for the U.S. to export these environmental effects. This same transfer of environmental consequences holds true for any oil not produced if any of the other deferral alternatives are chosen.

Also, the U.S. would suffer a substantial loss of economic benefits if Alternative II were selected. For Sale 186, Alternative II would result in a loss of about $15 million in revenue to the North Slope Borough, $190 million to the State of Alaska, and $930 million to the Federal Government. An average of about 800 jobs over 30 years would be lost, representing a total of about $1.7 billion of total personal income for these workers. Alternative II (No Action) also likely would result in a shorter lifespan for the Trans-Alaska Pipeline System. The economic losses if Sale 195 and 202 are not held would be similar.

Alternative III - Barrow Subsistence Whaling Deferral would defer offering 26 whole or partial blocks located in the western part of the U.S. Beaufort Sea, with 1,851 whole or partial blocks (about 9.6 million acres) remaining available for leasing. This alternative was developed in response to issues raised by Barrow residents and the Alaska Eskimo Whaling Commission concerning reduction of potential adverse effects to subsistence whaling activities near Barrow. The aerial extent of the potential deferral is based, in part, on data provided by the Alaska Eskimo Whaling Commission and is designed to add protection for subsistence-whaling areas in the vicinity where most whale strikes have occurred near Barrow over the past decade. Deferring this area for any of the three lease sales would provide limited additional protection to all the resources in the area, but the overall effects likely would be essentially the same as Alternative I. Deferring these blocks from any lease sale could reduce effects on subsistence resources, particularly the bowhead whale hunt in the vicinity of Barrow. This deferral also would reduce, by about 1%, the opportunity of discovering and developing an economic oil field from the lease sale.

Alternative IV - Nuiqsut Subsistence Whaling Deferral would defer offering 30 whole or partial blocks located offshore of Nuiqsut, with 1,847 whole or partial blocks (about 9.6 million acres) remaining available for leasing. This alternative was developed in response to issues raised by Nuiqsut residents and the Alaska Eskimo Whaling Commission concerning reduction of potential impacts to subsistence whaling activities near Cross Island, which is the base for most Nuiqsut whale-hunting activities. It is based, in part, on data provided by the Alaska Eskimo Whaling Commission and is designed to provide additional protection for subsistence-whaling areas in the vicinity where most whale strikes have occurred near Nuiqsut over the past decade. Deferring this area from any of the three proposed lease sales would provide limited additional protection to all the resources in the area, but the overall effects likely would be essentially the same as Alternative I. Deferring these blocks from any lease sale could reduce effects on subsistence resources, particularly the bowhead whale hunt in the vicinity of Cross Island. This deferral also would reduce, by about 5%, the opportunity of discovering and developing an economic oil field from the lease sale.

Alternative V - Kaktovik Subsistence Whaling Deferral would defer offering 28 whole or partial blocks located offshore of Kaktovik, with 1,849 whole or partial blocks (about 9.7 million acres) remaining available for lease under this alternative. This alternative was suggested by and based on data provided by the Alaska Eskimo Whaling Commission to protect subsistence-whaling areas in the vicinity where most whale strikes have occurred near Kaktovik over the past decade. Deferring this area from any of the three proposed lease sales would provide additional limited protection to all the resources in the area, but the overall effects likely would be essentially the same as Alternative I. Deferring these blocks from any lease sale could reduce effects on subsistence resources, particularly the bowhead whale in the vicinity of Kaktovik. This deferral also would reduce, by about 3%, the opportunity of discovering and developing an economic oil field from the lease sale.

Alternative VI - Eastern Deferral would defer offering 60 whole or partial blocks located east of Kaktovik, with 1,817 whole or partial blocks (about 9.6 million acres) remaining available for leasing. This area was suggested during scoping as an important bowhead whale-feeding area. However, a recent study of bowhead whale feeding in this area does not confirm this suggestion.

Deferring this area from any of the three proposed lease sales would provide limited additional protection to all the resources in the area, but the overall effects likely would be essentially the same as Alternative I. Deferring these blocks from any lease sale could reduce some effects on subsistence resources. This deferral also would reduce, by about 3%, the opportunity of discovering and developing an economic oil field from the lease sale.

The scenarios for all alternatives, except the No Lease Sale alternative, for Sales 186 and 195 assume development would occur in the Near and Midrange zones. The same level of activity likely would occur regardless of the alternatives evaluated. The MMS analysts identified a benefit to subsistence-harvest patterns and sociocultural systems in selecting Alternatives III, V, and VI for Sale 202, because the scenario assumes exploration and development activity would be expected in the Far Zone. Selecting Alternative IV provides similar benefits to subsistence-harvest patterns and sociocultural systems for all three sales. However, these observed differences do not equate to significant differences of effects among alternatives or among sales. Likewise, although the effects of Alternatives III, V, and VI for Sales 186 and 195 do show observed differences, they do not equate to significant differences of effects.

If the Secretary of the Interior decides to proceed with each of the sales (186, 195, and 202), by not choosing Alternative II - No Lease Sale, the Secretary may choose one, all, some combination, or part of the deferral options to comprise the final Notice for Sale 186. The Secretary will have the full suite of options available for Sales 195 and 202 when those decisions are made in 2005 and 2007, respectively. The Secretary may choose the same options selected for Sale 186 or different options.

ES.1.g Mitigating Measures

Five standard lease stipulations are evaluated as part of all the alternatives for all three proposed lease sales. These stipulations are:

Stipulation 1 - Protection of Biological Resources

Stipulation 2 - Orientation Program

Stipulation 3 - Transportation of Hydrocarbons

Stipulation 4 - Industry Site-Specific Bowhead Whale-Monitoring Program; and

Stipulation 5 - Subsistence Whaling and Other Subsistence-Harvesting Activities.

We have included these stipulations in previous Beaufort Sea lease sales. Combined, these stipulations help lower the potential adverse effects of any proposed lease sale and help protect subsistence-harvest activities and sociocultural systems. Adoption of these measures would be a positive action under Environmental Justice. Stipulations 1 and 5 have been modified, but only slightly, from the version adopted for Sale 170. The list of blocks in Stipulation 4 has been updated.

Previous Stipulation 6 has been divided into two parts and two additional stipulations are evaluated in this EIS.

Stipulation 6 - Permanent Facility Siting in the Vicinity of Cross Island. Stipulation 6a would prohibit the siting of permanent oil- and gas-development facilities within a 10-mile radius seaward of Cross Island, a subsistence-whaling area used by the Native community of Nuiqsut, unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the North Slope Borough and the Alaska Eskimo Whale Commission, that the development will not preclude reasonable access to subsistence bowhead whales. Stipulation 6b is identical, except that it is applied to the area shoreward of Cross Island. The stipulation is designed to eliminate or reduce potential disturbance to subsistence activities. Stipulation 6a would provide some reduction in potential effects to subsistence-harvest patterns and sociocultural systems to the community of Nuiqsut. The primary subsistence-whaling area used by Nuiqsut is seaward of the barrier islands. Stipulation 6b would not lower the effects to any resource categories in a measurable way. Stipulation 6a could be as effective in lower impacts as selecting Alternative IV - Nuiqsut Subsistence Whaling Deferral.

Stipulation 7 - Pre-Booming Requirements for Fuel Transfers would lower the potential effects to subsistence resources and sociocultural systems by providing additional protection to the bowhead whale from potential fuel spills that may occur just prior to or during the bowhead whale-migration period. This stipulation would be an added caution to further reduce the chance of any fuel contacting a bowhead whale.

Stipulation No. 8 - Lighting of Structures to Minimize Effects to Spectacled and Steller's Eiders. The Biological Opinion for Sale 186 issued by the Fish and Wildlife Service on October 23, 2002, specifies a reasonable and prudent measure necessary and appropriate to minimize potential adverse impacts to this species. To be exempt from the prohibitions of Section 9 of the Act, MMS must comply with the terms and conditions identified in the Biological Opinion. This stipulation requires all structures to be lighted and/or marked to improve visibility to migrating spectacled and Steller's eider, the minimization of outward radiating light, and the reporting of any injured or killed spectacled or Steller's eider. The MMS and the Fish and Wildlife Service cooperatively will develop lighting requirements and identify where, when, and on what type of structures the requirements should be applied. Specific lighting requirements will be developed by April 1, 2004, at which time the MMS will issue these requirements. The lighting requirements do not apply between October 31 and May 1 of each year, when eiders are not likely to be present.

A lighting strategy will be jointly developed by the MMS and the Fish and Wildlife Service using available information on bird avoidance measures. This strategy will be modified, as appropriate, if significant new information on bird avoidance measures becomes available during activities covered by this consultation. Modification will be developed jointly by the MMS and the Fish and Wildlife Service.

For each of the three sales, 16 standard ITL clauses are evaluated as part of all the alternatives. We have included these ITL clauses in previous Beaufort Sea lease sales, and they were evaluated as part of all action alternatives for all three proposed sales. These ITL clauses provide useful information about other Federal and State rules and regulations that help lower environmental impacts for all three proposed sales. Several ITL clauses that had been adopted in previous sales were not included, because they provided outdated information or they have been superseded by other regulations.

An optional ITL clause, No. 17 - Information to Lessees on Archaeology and Geological Hazards Reports and Surveys, lists the particular blocks where lessees will be required to perform surveys and prepare archaeological reports for exploration and development plans. The ITL clause informs the lessee that the shallow-hazards reports, as required in 30 CFR 250.203(b)(1)(ix), and the archaeology report, as required in 30 CFR 250.194 for the blocks listed, are required to be submitted with exploration or development and production plans. This ITL clause is described in Section II.H.4 of the EIS.

ES.1.h Use of the "Opportunity Index" in Considering Alternatives and Mitigating Measures

The locations of future commercial offshore fields that are undiscovered at present are impossible to predict without exploration drilling. Petroleum-assessment models statistically analyze the geology and engineering characteristics of the area to determine the total resource volume that is expected to be economically viable to produce if discovered. While these total resource estimates are valid on a regional scale, they cannot be subdivided into smaller fractions and still be meaningful as real volumes of oil. However, a risk-weighting method can be used to define the chance that the resource volume will occur in a particular subarea.

We use the term "opportunity index" to describe that risk-weighted probability. To understand the index, suppose for example, that an OCS area contained a total of 500 million barrels of economically recoverable oil in any of five prospects. Also suppose that each prospect is the same size and equally likely to contain recoverable oil. The risk-weighted volume assigned to each prospect would be 100 million barrels. The opportunity index assigned to each prospect would be 20%. This means that there is a 20% chance (or 1-in-5 chance) that 500 million barrels could be discovered in any single prospect, but the others would be dry. If a deferral option removed two of the five prospects, we would not subtract 200 million barrels from the total but would lose 40% of the opportunity to discover the 500 million barrels.

The opportunity index is defined by outputs from geologic and economic assessment models based on currently available data. These models assume that leasing, exploration, and development are unrestricted by regulations or industry funding. In reality, access to untested tracts and exploration budgets are key determinants of the level of industry interest in an area. Oil prices and Government regulations also are key determinants. Low oil prices and overly restrictive regulations could lessen industry interest in an area despite its high geologic potential. Future oil prices are difficult to foresee, and future corporate strategies for leasing are impossible to accurately predict. We can base our analysis of resource potential only on past leasing trends and petroleum assessments using current data. Each company may have a very different perspective of the development potential of a frontier area such as the Beaufort Sea. The key concept is that industry will only bid on tracts that they believe have some chance of becoming viable oil fields.

Notwithstanding the value of the opportunity index in understanding how to think about the likelihood of finding oil and gas resources, we caution the reader to exercise care in drawing conclusions about the opportunity index in relation to the aforementioned Alternatives III through VI.

Citation

Richardson, J.W., and D.H. Thomson. 2002. Email dated April 25 to S. Treacy, USDOI, MMS, Alaska OCS Region; subject: results of the bowhead whale feeding study.

TABLE OF CONTENTS

TABLE OF CONTENTS

VOLUME I

VOLUME II

VOLUME III

Figure Number **Title**

Section III

VOLUME IV

SECTION I

PURPOSE AND BACKGROUND OF THE PROPOSED ACTION

Contents for Section I

I. Purpose and Background of the Proposed Actions

I.A. Purpose, Need, and Description

The purpose of the proposed Federal actions addressed in this Environmental Impact Statement (EIS) is to offer for lease, in three separate sales, areas on the Beaufort Sea Outer Continental Shelf (OCS) that might contain economically recoverable oil and gas resources. This EIS is the National Environmental Policy Act (NEPA) analysis for the first proposed sale enabling the Minerals Management Service (MMS) to conduct the sale-decision process. For efficiency, and consistent with Executive Order 13212 of May 18, 2001, to expedite energy-related projects, this EIS also will be used as the primary NEPA analysis for the second and third sales. However, separate sale-decision processes will be conducted on each of those sales at later dates. The President's National Energy Policy recommends the continuation of OCS oil and gas leasing on a predictable schedule. Domestic energy production is not expected to rise enough to meet all of the Nation's demand, but an increased domestic energy supply will reduce foreign imports and provide jobs within the United States.

These Federal actions will provide qualified bidders the opportunity to bid on certain blocks in the Beaufort Sea to gain conditional rights to explore, develop, and produce oil and natural gas. The three proposed Federal actions addressed in this EIS are for Alaska Region Beaufort Sea Sales 186, 195, and 202 that are scheduled in the OCS oil- and gas-leasing program for 2002-2007. This EIS is the sole NEPA analysis for Sale 186 and the primary NEPA analysis for Sales 195 and 202. It analyzes the potential environmental impacts in each of the sales, including estimated exploration and development and production activities, on the physical, biological, and human environments.

The OCS Lands Act of 1953 (67 Stat. 462), as amended (43 United States Code [U.S.C.] et seq. (1994)), established Federal jurisdiction over submerged lands on the OCS seaward of the State boundaries. Under the OCS Lands Act, the U.S. Department of the Interior (USDOI) is required to manage the leasing, exploration, development, and production of oil and gas resources on the Federal OCS. The OCS Lands Act sets forth a number of findings and purposes with respect to managing OCS resources. Those principles generally pertain to recognizing national energy needs and related circumstances and addressing them by developing OCS oil and gas resources in a safe and efficient manner that provides for environmental protection, fair and equitable returns to the public, State and local participation in policy and planning decisions, and resolution of conflicts related to other ocean and coastal resources and uses.

The Secretary of the Interior (Secretary) oversees the OCS oil and gas program and is required to balance orderly resource development with protection of the human, biological, and physical environments while simultaneously ensuring that the public receives an equitable return for these resources and that free market competition is maintained. Section 18 of the OCS Lands Act requires receipt of fair market value for OCS oil and gas leases and the rights they convey. The Secretary is empowered to grant leases to the highest qualified responsible bidder(s) on the basis of sealed competitive bids and to formulate such regulations as necessary to carry out the provisions of the OCS Lands Act. The Secretary has designated the MMS as the administrative agency responsible for the mineral leasing of submerged OCS lands and for the supervision of offshore operations after leases are issued.

To date, seven lease sales have been held in the Beaufort Sea Planning Area since 1979 (see Map 16). Thirty exploration wells have been drilled (see Map 17), and the MMS approved a development and production plan for the Northstar Project, which straddles Alaska State and Federal waters. Northstar began production on October 31, 2001. The MMS also received a development and production plan for the Liberty Project, which is wholly located on the Federal OCS. A final EIS was written on the project and published in May 2002. The applicant, BP Exploration (Alaska) Inc. (BPXA), announced that it has put the project on the shelf, pending a re-evaluation of costs but has not as yet officially withdrawn its application, although that may happen.

In the Proposed Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007 (USDOI, MMS, 2002), the Secretary has scheduled to have three sales in the Alaska OCS Region's Beaufort Sea Planning Area. Sale 186 is scheduled to be held in 2003, Sale 195 in 2005, and Sale 202 in 2007. In keeping with the 5-year program, the MMS has prepared a single EIS for all three Beaufort Sea sales. The proposed actions analyzed in this EIS are for each of the three scheduled Beaufort Sea sales. Federal regulations allow for several similar proposals to be analyzed in one EIS (40 Code of Federal Regulations [CFR] 1502.4). The resource estimates and scenario information on which this EIS analysis is based are presented as a range of resources and activities that could be associated with each of the three sales. The EIS will be used for decisions on Sale 186. The MMS will prepare an Environmental Assessment or supplemental EIS for Sales 195 and 202. Formal consultation with the public will be initiated for these two sales to obtain input to assist in the determination of whether or not the information and analyses in this EIS are still valid. A sale-specific Information Request will be issued that specifically describes the action for which MMS is requesting input. The sale process for Sale 186 will require a minimum of 2 years to complete. The sale processes for Sales 195 and 202 will be somewhat shorter.

As noted earlier in this section, seven OCS lease sales have been held in the Beaufort Sea Planning Area over the past 2 decades, resulting in the development of one joint State-Federal oil field (Northstar). To encourage leasing and development, the MMS is considering incentives in the form of suspensions of royalties for certain oil-production volumes from new leases. The scenarios generated for environmental analysis in this EIS are optimistic compared to historical trends for two reasons: (1) optimistic development scenarios ensure that the environmental analysis covers the potential effects at the high end of possible petroleum activity levels, and (2) the scenarios also would cover an increase in activities that may occur as a result of royalty-relief incentives if they are approved by the Secretary of the Interior. Without incentives, the proposed OCS sales still could result in leasing and exploration. However, under these conditions, we anticipate minimal industry interest in offshore development because of the marginal economic viability of oil discoveries in difficult locations. With incentives, or with long-term oil prices of $30 per barrel, offshore development activities are more likely to approach the levels shown in Table II.A.1.

On September 19, 2001 (pursuant to 30 CFR 256.23 and 40 CFR 1501.7), the Call for Information and Nominations (Call) and Notice of Intent for Oil and Gas Lease Sales 186, 195, and 202 was published in the *Federal Register* (66 *FR* 48268). Nominations and comments on the Call and comments on the Notice of Intent closed on November 5, 2001. The Call was published to gather preliminary information and nominations from interested parties on oil and gas leasing, exploration, and development and production within the proposed area. This provided an opportunity for the oil industry, governmental organizations, tribal and local governments, environmental groups, the general public, and all other interested parties to comment on areas of interest or special concern in the proposed lease-sale area. The comments received on the Notice of Intent are discussed in Section I.C - Results of the Scoping Process.

The MMS Alaska Regional Director sent a memorandum to the Associate Director, Offshore Minerals Management recommending the area to be analyzed in this EIS. The Area Identification (ID) formally identified the location and extent of the area of study for the EIS. The decision document was sent to the MMS Director on January 7, 2002, and the Area ID announcement for Lease Sale 186 (the first sale under the proposed 5-year program for 2002-2007) was made on January 10, 2002, and included 1,877 whole or partial blocks (about 9.7 million acres, or 3.9 million hectares). This area is located seaward of the State of Alaska submerged-lands boundary and extends from 3 to approximately 25 miles offshore in water depths ranging from approximately 25-120 feet (see Map 1). After further analysis, the scoping report was revised and a decision was made in May 2002 that identified the four alternatives and the mitigating measures to be evaluated in this EIS.

Consistent with Section 102(2)(C) of the NEPA, this final EIS describes the proposed lease sales and the natural and human environments, presented an analysis of potential adverse effects on these environments, described potential mitigating measures to reduce the adverse effects of offshore leasing and development, described alternatives to the proposed Federal actions, and presented a record of consultation and coordination with others during EIS preparation. The draft EIS was filed with the Environmental Protection Agency on June 17, 2002, and its availability was announced in the *Federal Register* (67 *FR* 42253). The MMS announced the availability of the draft EIS in the *Federal Register* (67 *FR* 41730) and through other public media. The public had 90 days to review and comment on the draft EIS. Public hearings were held after release of the draft EIS, and specific dates and locations for public hearings were announced in the *Federal Register* (67 *FR* 41730). The MMS obtained oral and written comments at the hearings from interested members of the public. After receipt and consideration of comments on the draft EIS, the MMS determined the scope of this final EIS.

By regulation and law, the MMS is required to review and analyze the environmental effects of this proposed leasing program. Through the scoping process, we asked for comments and concerns about this proposed program. We have used this information to focus our analysis and to generate reasonable alternatives for analysis. Through the remainder of the process, we will continue to solicit information and suggestions.

We have responded to comments on this draft EIS, both written and oral, in Section VII. This includes letters, public hearings, government-to-government meetings, and from e-mails sent to the MMS e-mail address.

The MMS has identified an agency preferred alternative to be Alternative I, including the standard stipulations and ITL Clauses, plus three additional mitigating measures: Stipulation 7 - Pre-Booming Requirements for Fuel Transfers; Stipulation No. 8 - Lighting of Structures to Minimize Effects to Spectacled and Steller's Eiders; and ITL No. 17 - Information to Lessees on Archaeological and Geological Hazards Reports**.** Although we have identified an agency-preferred alternative, as required by NEPA Council on Environmental Quality regulations, we will continue to maintain an open mind throughout the final EIS comment period and decision process and we will continue to consider and evaluate comments and all reasonable options.

I.B. List of Legal Mandates

The following list references legal mandates that affect Federal activities proposed on the OCS. These statutes are Federal public laws enacted by Congress and are associated with proposed leasing, exploration, development and production, or other activities that might significantly affect the OCS. This is not intended to be a comprehensive list of all the laws but rather to acquaint the reader with the law. Readers should always consult the entire text of the laws for updated information and additional requirements.

Further information, explanations, or summaries of the following legal mandates and for other legal requirements (executive orders, regulations, agreements, etc.) that directly or indirectly relate to the Department of the Interior, MMS, and other Federal Agencies' regulatory responsibilities for mineral leasing, exploration, and development and production activities on leases located in the submerged lands of the OCS located offshore Alaska may be found in Appendix E of this EIS.

- Submerged Lands Act of 1953 (43 U.S.C. § 1331 et seq.)
- Outer Continental Shelf Lands Act of 1953, as amended (43 U.S.C. § 1331 et seq.)
- National Environmental Policy Act of 1969, as amended (42 U.S.C. § 4321 et seq.), and the Council on Environmental Quality regulations (40 CFR parts 1500 through 1508)
- Alaska National Interest Lands Conservation Act of 1980 (16 U.S.C. § 3101 et seq.)
- Clean Air Act of 1970 and the Clean Air Act Amendments of 1990 (42 U.S.C. § 740 et seq.)
- Federal Water Pollution Control Act of 1972, as amended (33 U.S.C. § 1251 et seq.), and the Clean Water Act of 1977 (91 Stat. 1566)
- Coastal Zone Management Act of 1972, as amended (16 U.S.C. § 1451 et seq.), the Coastal Zone Reauthorization Amendments of 1990 (P.L. No. 101-508), and the Coastal Zone Protection Act of 1996 (P.L. No. 104-150)
- Energy Policy and Conservation Act of 1975 (42 U.S.C. § 6213 et seq.)
- Export Administration Act of 1969 (50 App. U.S.C. 2405(d))
- Marine Mammal Protection Act of 1972, as amended (16 U.S.C. § 1361 et seq.)
- Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. § 703-712)
- International Convention of the Prevention of Pollution from Ships and Marine Plastics
- Pollution Research and Control Act of 1988 (33 U.S.C. § 1901 et seq.)
- Marine Protection, Research, and Sanctuaries Act of 1972, as amended (33 U.S.C. § 1401-1445 and 16 U.S.C.§ 1431-1445)
- National Fishing Enhancement Act of 1984 (33 U.S.C. § 2101 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Act of 1976 (16 U.S.C. § 1801 et seq.)
- Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 et seq.)
- National Historic Preservation Act of 1966, as amended (16 U.S.C. § 470 et seq.)
- Oil Pollution Act of 1990, as amended (33 U.S.C. § 2701 et seq.)
- Rivers and Harbors Appropriation Act of 1899 (33 U.S.C. § 401 et seq.)
- Resource Conservation and Recovery Act of 1976 (42 U.S.C. § 6901 et seq.)
- Ports and Waterways Safety Act of 1972, as amended (33 U.S.C. § 1221 et seq.)
- Merchant Marine Act of 1920 (commonly referred to as the Jones Act) (P.L. 66-261)
- Federal Oil and Gas Royalty Management Act of 1982 (30 U.S.C. § 1701 et seq.)
- Arctic Research and Policy Act of 1984 (15 U.S.C. § 4101 et seq.)
- Executive Order 13212 - Actions to Expedite Energy-Related Projects
- Executive Order 13175 - Consultation and Coordination with Indian Tribal Governments
- Executive Order 13158 - Marine Protected Areas
- Executive Order 12114 - Environmental Effects Abroad
- Executive Order 13112 - Invasive Species
- Executive Order 13007 - Indian Sacred Sites
- Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

I.C. Results of the Scoping Process

Scoping is defined as "an early and open process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). The Notice of Intent published for Oil and Gas Lease Sales 186, 195, and 202 describes the scoping process MMS followed for this EIS. Throughout the scoping process, comments are invited from any interested persons, including affected Federal, State, tribal and local governments; any affected Native groups; conservation groups; and private industry for early identification of the most important issues for analysis in this EIS. Scoping is very important, because it provides those with an interest in the OCS program an early opportunity to participate in the events leading up to the final publication of an EIS and aids the MMS in determining the significant issues and alternatives to be analyzed in an EIS. The intent of scoping is to avoid overlooking important issues that should be analyzed in an EIS. The entire text of the Scoping Report is in Appendix F of this EIS.

In response to the Call/Notice of Intent, nine written comments and/or nominations were received: three companies commented and submitted nomination information, and comments were received from the State of Alaska, Office of the Governor, Division of Governmental Coordination; the North Slope Borough, Offices of the Mayor and the Planning Department Director; the Alaska Eskimo Whaling Commission Director; the City of Wainwright, Office of the Mayor; and a joint letter from the Sierra Club, Arctic Connection, The Wilderness Society, and Greenpeace. The nominations received indicated that different companies had interest in various portions of the sale area and, when considered in total, they cover the entire sale area.

Scoping for this multiple-sale EIS included reviewing the comments received on the Call and Notice of Intent; comments submitted at the scoping meetings; re-evaluation of the issues raised and analyzed in the EIS's for previous Beaufort Sea Planning Area lease sales (Sales BF, 71, 87, 97, 124, 144, and 170); and MMS staff evaluation and input. Scoping comments were used to identify major issues, alternatives to the proposed action, and measures that could mitigate the effects of the proposed Federal actions. Scoping comments were requested from the public through newspaper, radio, and television advertisements in the North Slope Borough communities of Barrow, Nuiqsut, and Kaktovik and in Anchorage. Letters were sent to the Mayor of the North Slope Borough and the Mayors of Barrow, Nuiqsut, and Kaktovik. Scoping meetings were held in 2001 in Nuiqsut (October 16), Barrow (October 18), Kaktovik (October 19), and Anchorage (October 26). Government-to-Government scoping meetings were held with the Native Village of Barrow, the Mayor of the North Slope Borough and the Alaska Eskimo Whaling Commission on October 18, 2001. A Government-to-Government meeting also was held with the Nuiqsut Tribal Council on October 16, 2001. An additional meeting was requested by the Alaska Eskimo Whaling Commission and the Inupiat Community of the Arctic Slope and was held on November 15, 2001. All commenters strongly supported the adoption of the Beaufort Sea Sale 170 mitigating measures in sales covered in this EIS. Environmental justice was discussed with participants on the North Slope, both in the Government-to-Government meetings and with individual participants at the scoping meetings.

While the first phase of scoping is complete, the scoping process will continue through the publication of the final EIS, and additional outreach meetings will be held, as needed, or requested by local communities. The scoping process will continue throughout of the life of the multiple-sale EIS. As each sale analyzed within this document is considered for leasing, the scoping process will be initiated.

I.C.1. Major Issues Considered in the EIS

The major issues analyzed in this EIS are the direct result of concerns raised during the scoping process. Based on these issues, the MMS selected the following resource topics for effects analyses in Section IV.C: water quality; lower trophic-level organisms; fishes; essential fish habitat; endangered and threatened species; marine and coastal birds; marine mammals; terrestrial mammals; vegetation-wetland habitats, economy; subsistence-harvest patterns; sociocultural systems; archaeological resources; land use plans and coastal management programs; air quality; and environmental justice.

Significant Environmental Issues: While many environmental issues were raised in scoping, few significant ones were identified that were not addressed to some degree in the previous Sale 170 final EIS published in February 1998. Since Sale 170, the first offshore development and production island in State and Federal Alaska waters—Northstar—has been built and has come online. Actual offshore development has raised feelings of environmental uncertainty by local residents; many do not trust the engineering designs to overcome known North Slope environmental constraints. Many concerns extend to the Liberty development and production project, which is under review.

The following environmental issues are identified and analyzed in this EIS as important resources, activities, systems, or programs that could be affected by petroleum exploration, development and production, and transportation activities associated with proposed Sales 186, 195, and 202. The cumulative effects of past, present, and future activities on each of these resources, activities, systems, or programs also are analyzed in this EIS.

I.C.1.a. Habitat Disturbance to Marine and Terrestrial Mammals, Fish, and Birds and Alteration of Migration Patterns on Bowhead Whales

Habitat disturbance and alteration could result from both offshore and onshore construction activities associated with the operation of petroleum facilities, depending on the location of activities.

I.C.1.a(1) Habitat Disturbance

Habitat disturbance, including noise, would be associated with air traffic, vessel operations, traffic along gravel and ice roads, marine and over-the-ice seismic activities, offshore drilling, dredging, vessels involved in icebreaking and ice-management operations, and facility construction. The primary concern in all communities and of the North Slope Borough is interference with the bowhead whale hunt. Depending on the type and time of occurrence of potential operations, these habitat disturbances could have short- to long-term, local to regional effects on fishes (particularly anadromous species such as the Arctic cisco), marine and coastal birds, marine mammals, caribou, and endangered and threatened species such as the bowhead whale and spectacled eider, all of which will have an effect on subsistence hunting and fishing. Issues related to the above species will be evaluated with additional NEPA analysis for new projects when they are submitted to the MMS.

I.C.1.a(2) Habitat Alteration

Habitat alteration, including reduction, would be associated with both onshore and offshore construction activities that include the construction of pipelines and ice and gravel roads, dredging-excavation and dumping of dredged material, removal of gravel from onshore sites, and dumping of onshore gravel in offshore locations. Depending on the type, timing, and location of potential operations, they could have short- to long-term, local to regional effects on lower trophic-level organisms; fishes (especially Arctic cisco) and other anadromous species; marine and coastal birds; marine mammals; endangered bowhead whales (especially in the spring lead system and fall-feeding area); caribou; archaeological resources; and subsistence-hunting and -fishing activities because of reduced access to the resources. The MMS does not have the legal authority to mitigate disturbances to wildlife from the routing of an onshore pipeline, but the State of Alaska does.

I.C.1.b. Protection of Inupiat Culture and Way of Life

The Inupiat believe their culture and way of life need to be protected from effects associated with petroleum development. As such, potential activities might lead to social disruption and a change in cultural values through employment changes, further displacement of the subsistence lifestyle by a cash economy, and the alteration of subsistence-harvest patterns as discussed in relation to other significant issues previously noted in this section. The EIS discusses and evaluates sociocultural and health systems of local communities.

I.C.1.c. Effects of Oil Spills

I.C.1.c(1) Contamination and Effects

The Inupiat are concerned that a spill could adversely affect many of the traditional food sources and, thereby, affect the economic and cultural well-being of the North Slope. Resources affected by an oil spill that are crucial to Inupiat subsistence include anadromous fish, such as the Arctic cisco, and various marine and coastal birds. The temporary or permanent elimination of primary subsistence foods would cause North Slope residents to either shift to less-desired subsistence resources or replace them with western foods.

The likelihood of large oil spills is very low. However, in the unlikely event that a large oil spill occurred, it could contaminate the affected marine and coastal environments and, depending on the amount and time of the year, have short- to long-term, local to regional effects on those resources and sociocultural systems in and adjacent to the planning area. Such an oil-spill event could have a significant impact on water quality. In situ burning of spilled oil could affect the air quality of the region for a limited time. Lower trophic-level organisms within the spill area also could be affected. Marine mammals, including endangered and threatened species, such as the bowhead whale, could be affected as they migrate through the Beaufort Sea. The bowhead whale is integral to the continuation and survival of the cultural and subsistence lifestyle of the Inupiat. Both the spectacled eider and the Steller's eider are listed as threatened species and could be affected.

I.C.1.c(2) Fate, Behavior, and Cleanup of Spilled Oil

The fate and behavior of spilled oil in the marine and coastal environments and the capability and effectiveness of spill cleanup are of major concern to local communities. Identified concerns include:

- the availability and adequacy of containment and cleanup technologies, especially during broken-ice conditions;
- the ability to detect and clean up pipeline spills and spills under ice;
- the effects of winds and currents on the transport of spilled oil within ice;
- the removal of oil from contaminated water, sediments, and ice;
- the toxicological properties of fresh and weathering oil; and
- the air pollution that would result from the at-sea evaporation or burning of spilled oil.

This concern has intensified in recent years as industry, in three oil-spill-cleanup drills, has not proven their ability to adequately clean up spilled oil with mechanical equipment in relatively calm environmental conditions in ice-infested waters. Other nonmechanical tactics are available in these conditions.

I.C.1.d. Other Significant Issues

The following discusses other significant issues related to petroleum-development activities that were raised during the scoping process.

I.C.1.d(1) Traditional Knowledge

Incorporation of traditional knowledge in past EIS's, although acknowledged, still does not seem to satisfy those who criticize this aspect. Concern seems to center around not recognizing traditional knowledge on the same level as scientific knowledge. The MMS has cited instances where traditional knowledge is quoted within the EIS text; but critics want to know where traditional knowledge has been a part of the decisionmaking process. Villages seemed to appreciate the fact that MMS has taken the traditional knowledge gathered over the last 25 years of public testimony and put this together on a usable, searchable CD-ROM for local use. The MMS will continue to communicate with the Alaska Eskimo Whaling Commission and whaling captains to gain insight into local conditions. Traditional knowledge (i.e., fish species and subsistence values) will continue to be incorporated into EIS text and provided to MMS decisionmakers.

Furthermore, traditional knowledge does not apply equally to all resource categories described and evaluated in this EIS. Much of the traditional knowledge that is incorporated in our EIS's has been provided by Inupiat Elders and leaders at previous meetings and hearings concerning proposed OCS activities. Traditional knowledge information often is focused on their primary areas of concern: subsistence species (bowhead whales, marine and terrestrial mammals, fish, and birds) and subsistence activities, and their effects on the Native people and their sociocultural systems. Traditional knowledge information also has been provided about ice and icebergs, currents, and other physical aspects of gathering subsistence foods in the harsh arctic environment. This focus of available traditional knowledge is reflected in this EIS. There is far more traditional knowledge information presented in this EIS about bowhead whales and subsistence activities than there is about economics or land use plans. Readers and decisionmakers should not interpret the differences in the levels of traditional knowledge information presented in each resource category to be an indication that Native groups and local inhabitants are not concerned with the potential effects to these resources. Rather, this indicates that the consistent collection of information over the history of Inupiat cultural, and some Western science categories, such as economics and land use plans, have not existed long enough to generate a rich body of traditional information of the sort already available for resources such as ice and bowhead whales.

I.C.1.d(2) Cumulative Effects on Resources and Social Systems

In this EIS, we analyze cumulative effects of oil and gas operations on biological resources (for example, caribou migration restricted in relation to pipeline routes and onshore effects, including fishing in the Colville River) and physical resources and social systems (for example, development impacts to the Inupiat way of life, and loss of access to family ancestral ice cellars in Prudhoe Bay) in and adjacent to the planning area from past, present, and future arctic oil and gas lease sales and other major projects. The MMS still hears criticism about the absence of a detailed database of environmental conditions existing before oil and gas operations occurred on the North Slope. The National Research Council is conducting a 2-year research project on cumulative effects of oil and gas operations on the North Slope. While the results are unavailable for this document, they will be considered in the preparation of future NEPA documents.

I.C.1.d(3) Include All Sale 170 Mitigating Measures

All of the mitigating measures, stipulations, and notices to lessees from the last lease sale (Sale 170) should be incorporated into this Beaufort Sea multiple-sale EIS.

I.C.1.e. Issues Raised During Scoping that Were Considered but Did Not Warrant Further Detailed Analysis in the EIS

The following issues were raised during the scoping process for this sale and previous Beaufort Sea lease sales. These concerns were fully evaluated by MMS staff but are not being analyzed further for the reasons indicated.

I.C.1.e(1) Revenue Sharing/Impact Assistance

One primary and repeated request of the North Slope Borough and all of the North Slope villages is the need for revenue sharing (also known as impact assistance) to local communities from OCS receipts. Impact assistance would require congressional action to authorize funds in any particular year.

In its September 20, 2002, comments on the draft EIS, the Alaska Eskimo Whaling Commission asked that the MMS “include mitigation impact assistance in its list of proposed alternatives.” The Commission noted that MMS’s reasons for rejecting their request for impact funding was that the MMS claims that it has no authority to do so. They correctly state that “an alternative need not be in the agency’s cognizance in order for the agency to include it in the EIS.” They also state that: “MMS’s inclusion of impact assistance in its discussion of alternatives would alert the President and Congress to the need for impact assistance in northern Alaska.”

The MMS has not included impact assistance as an alternative for this EIS, because it addresses mitigation of the effects of the proposed action rather than serve as an alternative to the size, timing, or location of the proposed action. The MMS believes that issues relating to size, timing, or location are most appropriate for consideration as separate alternatives. However, the MMS has fully considered the issue of impact assistance as herein discussed.

Impact assistance is a programmatic issue that affects all the states, counties (boroughs), cities, and villages near OCS activities, and it was discussed in MMS's new 5-year plan. Comments received on impact assistance were included within the material forwarded to the President and Congress in the *Proposed Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007, April 2002*. This programmatic document was the more appropriate forum to address this nationwide issue. For additional information about revenue sharing, please see, in particular, Section 1.2.5.1 of the final EIS for the 5-year program (USDOI, MMS, 2002a).

Congress has been aware of the issue. Impact assistance with a single-year appropriation for FY 2001–The Coastal Assistance Program–was enacted by Congress. This legislation had its impact assistance roots in a broader Congressional bill, the Conservation and Reinvestment Act, which was not enacted. The Coastal Assistance Program was passed as a compromise measure that amended the OCS Lands Act. The program authorized a one-time appropriation of $150 million divided among the seven states with offshore oil activities: Alabama, Alaska, California, Florida, Louisiana, Mississippi, and Texas. Sixty-percent of the funds were divided equally among the producing states, and 40% was based on proximity to OCS production. Based on the law's formula, Alaska received a one-time appropriation of $12,208,723, of which $7,935,670 was allocated to the State and $4,273,053 was divided among the coastal political subdivisions. Funds were distributed to eligible communities based on population, coastline miles, and relative distance from any OCS leased tracts. The allocation for the North Slope Borough was $1,939,680. The National Oceanic and Atmospheric Administration (NOAA) administered the Coastal Assistance Program.

The Department of the Interior and the MMS have taken an active role in impact-assistance proposals. When requested by Congressional members or the Administration, staff has prepared information and support for proposed legislation going back to at least the late 1970's. This included participation on an Administration Cabinet Council task force on impact assistance in the early 1980's and developing a formula and drafting legislative language to provide funds allocated to both the coastal states and local coastal governments based on their proximity to offshore oil and gas activities. Legislation was introduced; however, it passed only in the House.

Throughout the 1980's and 1990's, the MMS continued working diligently on impact-assistance efforts requested by Congress. Congress used the proximity formula as the core of the impact-assistance formula and drafted additional legislative language for several bills that were introduced. These initiatives, however, also failed to become law. Finally, the original proximity concept was the key part of the Coastal Impact Assistance Program legislation, supported by members of the Alaska Congressional delegation that provided FY 2001 funds directly to the North Slope Borough.

Several forms of revenue-sharing-type funds already are available to coastal states and localities through several existing laws: Section 8(g) of the OCS Lands Act, the Land and Water Conservation Fund, the Historic Preservation Fund, and the Tribal Preservation Fund. Because other agencies handle distribution of several of these funds, the public usually is not aware that the funding source for several of these programs comes from OCS-related income.

Section 8(g) of the OCS Lands Act provides for a sharing of all Federal revenues for areas lying wholly or in part within the 3-mile wide area between the State's seaward boundary, which is 3 miles from shore, out to 6 miles. Twenty-seven percent of all Federal revenue goes to the State of Alaska. Alaska has received more than $520 million as a result of this revenue-sharing provision. The State of Alaska distributes percentages of these 8(g) funds (royalty payments, bonus bids, and rental payments) into the Alaska Permanent Fund Dividend Program, its school fund, the Alaska Constitutional Budget Reserve, and Alaska's Unrestricted General Fund

The Land and Water Conservation Fund can provide the National Park Service up to $900 million in the fund each year, if authorized by Congress. Since 1971, Federal offshore leasing has provided about 90% of this money. The law provides for a system of funding for Federal, State, and local parks and conservation areas. It gives states and local governments incentives to plan and invest in their own park and recreational use systems. The State has received more than $29 million from this fund.

The Historic Preservation Fund also is used to make grants to local communities. Revenues from Federal offshore mineral leases sustain this fund up to $150 million, if authorized by Congress. Since 1968, more than $1 billion in grant funds have been awarded to states, territories, tribal organizations, and the National Trust for Historic Preservation. The State of Alaska has received more than $9 million from this fund.

The Tribal Preservation Program, administered by the National Park Service, assists Native Americans in preserving their historic properties and cultural traditions. The program is dedicated to working with tribes, Alaska Native groups, Native Hawaiians, and national organizations to preserve and protect resources and traditions that are of importance to Native Americans. For FY 2000, the Village of Barrow received $48,915 from this grant program for *Documenting Commercial Whaling History in the Western Arctic from the Inupiat Perspective*.

Impact-assistance mitigation, if enacted by Congress, would help MMS further meet the intent of the Environmental Justice Executive Order (Presidential Executive Order 12898) with respect to the effect of the OCS oil and gas program on the Native populations of Alaska. However, as noted above and in the Scoping Report (Appendix E), the Department does not have the authority to fund such an alternative or mitigation for any or all of these three sales or for any OCS sales without authorization from Congress.

I.C.1.e(2) Participation of Local Communities

The need for active participation and involvement, including decisionmaking authority, of the North Slope Borough and local communities was another issue raised at each of the scoping meetings. Examples are Borough, City, and Native village participation in reviewing oil-industry operations, developing monitoring programs, and helping write the various NEPA documents. Locals would like to be brought to Anchorage and be a part of the internal review process of industry-submitted projects. The MMS will continue to engage local governments and tribes in Government-to-Government meetings to share information and discuss potential solutions.

I.C.1.e(3) Global Climate Change

Global climate change and the contribution OCS activities make to greenhouse gas emissions are more appropriately addressed as a programmatic concern in Section 4.1.2 of the Final Environmental Impact Statement for the Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007. This is in accordance with the recommendation of the Council of Environmental Quality, Draft Guidance Regarding Consideration of Global Climate Change in Environmental documents Prepared Pursuant to the National Environmental Policy Act, October 8, 1997, that this issue be addressed at the program level rather than at the project level. The final EIS estimated total emissions of carbon dioxide and methane for activities associated the 5-year program. In the Alaska OCS Region, estimates indicate that production activities could emit about 75% of the carbon dioxide emissions, while tankers carrying Alaska North Slope crude between Valdez and the West Coast contribute about 10% to the total. Tankers produce most of the methane emissions, with the remainder coming primarily from production facilities. The combined carbon dioxide and methane emissions from the entire proposed OCS 5-year program, including the Alaska region, are about 0.04-0.08% of the nationwide total. The estimated combined carbon dioxide and methane emissions from the entire OCS program activities would be about 0.01-0.02% of the global emissions.

I.C.1.e(4) Process Issues

Commenters suggested that areas deferred (i.e., bowhead subsistence-hunt areas) or deleted from past Beaufort Sea sales should be removed permanently from consideration for leasing. The EIS looks at deferring areas for each of the three sales evaluated in this EIS. The Secretary decides whether to offer for leasing or to continue to exclude areas on a sale-by-sale basis. The proposed actions for this EIS are to conduct three sales in the Beaufort Sea: Sale 186 in 2003, Sale 195 in 2005, and Sale 202 in 2007. The EIS will enable the MMS to conduct the prelease decision processes for Sales 195 and 202 more efficiently, consistent with Executive Order 13212 of May 18, 2001, to expedite energy-related projects.

Federal NEPA regulations allow several similar proposals to be analyzed in one EIS (40 CFR 1502.4). The requirements of NEPA, the Coastal Zone Management Act, and all other applicable statutes will be met for all three Beaufort Sea sales.

A suggestion was made that MMS have industry provide job opportunities and training for local communities to help their economy. Under a prelease- or postlease-sale EIS, the MMS does look at and evaluate the local community in relation to the proposed action. However, the MMS has no authority to require an operator to provide local hire. We can and do suggest this to industry, but we cannot enforce such a suggestion. We understand industry does do some local hiring.

Some scoping commenters suggested that a continuum or momentum exists between leasing, exploration, and eventual production and development phases of the Federal oil- and gas-leasing program. Their perception is that once the leasing process begins, it is not stoppable until an oil and gas facility is in place. The OCS Lands Act and the regulations consider these as four separate phases, each of which has a separate decision process attached to that phase. Therefore, four NEPA documents are prepared for these various phases: (1) a national 5-year leasing program; (2) a lease sale for a specific planning area; (3) an exploration plan; and (4) a production and development plan. Each NEPA phase has a different level of analysis, depending on the specificity of the information being submitted for review.

I.C.1.e(5) Other Cumulative Activities

One commenter to the draft EIS suggested the cumulative analysis consider and evaluate military operations; cleanup of abandoned, contaminated sites; research operations (especially icebreaker supported); and other activities taking place on the North Slope and Beaufort Sea. Information about future military operations is limited and the current level of military operations and cleanup activities of abandoned sites onshore have not translated to measurable effects. The more extensive spatial and temporal parameters of the cumulative case tend obscure any minor changes from such activities. There is very little information about potential research using icebreaker support, and we are unaware of any information indicating such activities would occur on a regular basis or pose any major environmental impact to the resources on the North Slope. Normally, all research activities must comply with the Endangered Species Act and the Marine Mammal Protection Act; hence these effects would be minimal.

I.C.2. Alternatives Suggested During the Scoping Process

I.C.2.a. Alternatives to be Further Evaluated

The following six Alternatives are considered in this EIS for Sales 186, 195, and 202:

- Alternative I, the Proposal
- Alternative II, No Lease Sale
- Alternative III, Barrow Subsistence Whaling Deferral
- Alternative IV, Nuiqsut Subsistence Whaling Deferral
- Alternative V, Kaktovik Subsistence Whaling Deferral
- Alternative VI, Eastern Deferral

These alternatives (see Map 2) were developed during the scoping process in response to comments and concerns and further refined by MMS decisionmakers.

I.C.2.a(1) Alternative I - The Proposal

Alternative I, the Proposal for each sale, would offer for lease those blocks selected as a result of the Area ID. The Beaufort Sea multiple-sale program area includes 1,877 whole or partial blocks covering 9,770,000 acres (about 3,954,000 hectares) in the Beaufort Sea (see Maps 1 and 2). This alternative reflects a range of resource development and activity from 340-570 million barrels of recoverable oil for each sale. For purposes of analysis, we assume that 460 million barrels of oil will be recovered as a result of each sale. The program area was identified as being of high and medium interest to industry and is the entire area of the Call. In January 2002, the acting Director of MMS designated the program area to be the area that would be considered for leasing through the Proposal. The Area ID process for Sales 195 and 202 will take place later; however, the aerial extent selected cannot be larger than the area evaluated in Alternative I of this EIS. Because the proposed sale area (Alternative I) is the same as the entire Beaufort Sea program area in the 2002-2007 5-year program, the sale area cannot be larger unless the 5-year program is amended. For this to happen, a new 5-year program would need to be initiated and evaluated, which is very unlikely to happen.

I.C.2.a(2) Alternative II - No Sale

This alternative would remove the entire area of the Proposal from leasing.

I.C.2.a(3) Alternative III - Barrow Subsistence Whaling Deferral

This alternative was developed by the MMS in response to comments received in Barrow. This deferral was developed as a potential way to reduce conflicts between bowhead whale subsistence hunters and offshore oil and gas operations and was based on bowhead whale-strike data provided by the Alaska Eskimo Whaling Commission. This alternative would offer for leasing all of the area described for Alternative I except for a subarea located in the western portion of the proposed sale area. Alternative III would offer 1,851 whole or partial blocks, comprising 9,632,000 acres (about 3,898,000 hectares). The areas that would be removed by the Barrow Subsistence Whaling Deferral (see Map 2) consist of 26 whole or partial blocks, approximately 138,000 acres, about 1% of the Alternative I area. This option is being analyzed to estimate potential protection of Barrow subsistence-use zones and wildlife areas, particularly comprising an area in which whales have been taken (based on known whale-strike data). This option analyzes whether the deferral would provide increased protection to bowhead whales from potential noise and disturbance from exploration or development and production activities. The majority of the bowhead whale subsistence-hunting area near Barrow is in an area of the Chukchi Sea, which already was removed from leasing consideration in the proposed final 5-Year Offshore Oil and Gas Leasing Program for 2002-2007.

I.C.2.a(4) Alternative IV - Nuiqsut Subsistence Whaling Deferral

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located off of Cross Island. Alternative IV would offer 1,847 whole or partial blocks, comprising 9,608,000 acres (about 3,888,000 hectares). The areas that would be removed by the Nuiqsut Subsistence Whaling Deferral (see Map 2) consist of 30 whole or partial blocks, approximately 162,000 acres, about 2% of the Alternative I area. This option is being analyzed to assess the effectiveness of potential protection of Nuiqsut subsistence-use zones and wildlife areas where whales have been taken (based on known whale-strike data). Requests for such possible protection were made by the Alaska Eskimo Whaling Commission, the Native Village of Nuiqsut, and the North Slope Borough.

I.C.2.a(5) Alternative V - Kaktovik Subsistence Whaling Deferral

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located off of Barter Island. Alternative V would offer 1,849 whole or partial blocks comprising 9,649,000 acres (about 3,905,000 hectares). The area that would be removed by the Kaktovik Subsistence Whaling Deferral (see Map 2) consists of 28 whole or partial blocks, approximately 121,000 acres, about 1% of the Alternative I area. This area is being considered for deferral in response to a request by the Native Village of Kaktovik because of the potential disturbance to Kaktovik’s traditional, known subsistence-whaling areas. The area was delineated using whale-strike maps provided by the Alaska Eskimo Whaling Commission.

I.C.2.a(6) Alternative VI - Eastern Deferral

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located east of Kaktovik. Alternative VI would offer 1,817 whole or partial blocks, comprising 9,487,000 acres (about 3,839,000 hectares). The area that would be removed by the Eastern Deferral (see Map 2) consists of 60 whole or partial blocks, approximately 283,000 acres, about 3% of the Alternative I area. It adjoins an area that the State of Alaska has deferred in recent State sales. This option evaluates the need for protection of this area as requested by the Native Village of Kaktovik, the Alaska Eskimo Whaling Commission, and the North Slope Borough regarding the possible importance of the area to bowhead whales and other general concerns about the environment there.

I.C.2.a(7) Agency Preferred Alternative

As required by the National Environmental Policy Act Council on Environmental Quality regulations MMS has identified a preferred Alternative for this Final EIS. The agency preferred alternative is Alternative I, which includes the standard stipulations and ITL clauses, with three optional mitigating measures: Stipulation 7 - Pre-Booming Requirements for Fuel Transfers; Stipulation No. 8 - Lighting of Structures to Minimize Effects to Spectacled and Steller's Eiders; and ITL No. 17 - Information to Lessees on Archaeological and Geological Hazards Reports.

We do not provide a separate evaluation of this alternative because it would repeat the entire analysis provided in Alternative I (See Section IV.C) which includes analysis of the effectiveness of all standard and optional mitigating measures, including those chosen as part of the agency preferred alternative.

Although we have identified an agency preferred alternative, we will continue to maintain an open mind throughout the final EIS comment period and decision process and we will continue to consider and evaluate comments and all reasonable options.

I.C.2.b. Alternatives Considered but not Included for Further Analysis

Four general areas in the Beaufort Sea were recommended for deferral in comments to the September 19, 2001, Call and Notice of Intent and in the October and November 2001 scoping meetings. These were areas east of Barrow, areas around and to the east of Cross Island, areas near Kaktovik, and areas off the Arctic National Wildlife Refuge. The deferrals analyzed in the draft EIS (see Section III of the Scoping Report) respond to some of the specific deferral recommendations. This section responds to the balance of the deferral recommendations. In the following, we first discuss areas recommended for deferral and our conclusions regarding those deferrals for specific parts of the Beaufort Sea. Then we look at other considerations relevant to these recommendations. Finally, we provide the rationale for our conclusion on which recommended deferrals are analyzed in the EIS and which are scoped out.

I.C.2.b(1) Areas from Barrow East to Harrison Bay

In written comments, (See Appendix E, Section B.1, Scoping Report) the State of Alaska supports all areas deferred from past sales, the Mayor of the North Slope Borough and the Sierra Club et al., recommended that such deferrals be removed permanently from leasing in the planning area. The Mayor also recommended that the spring lead system and eastern Beaufort Sea should be deferred from all Beaufort Sea sales in the 2002-2007 offshore leasing program. The Alaska Eskimo Whaling Commission recommended that areas used for the bowhead whale subsistence hunt be removed permanently from any future consideration for OCS leasing. Phillips Alaska Exploration opposed discretionary deferrals and arbitrary exclusions, Shell Oil supported leasing the entire nearshore area out to about 15 miles, and BPXA endorsed the sale schedule but did not comment on specific areas of the Beaufort Sea. In verbal comments at the Barrow meeting with the North Slope Borough and the Alaska Eskimo Whaling Commission, those who spoke wanted MMS to permanently remove from leasing important subsistence-use areas, such as the spring lead system and areas that might be used by bowhead whales for feeding. In the November meetings, the Alaska Eskimo Whaling Commission provided maps of potential deferral areas that were developed by the Barrow and Nuiqsut Whaling Captains, and the Inupiat Community of the Arctic Slope stated their general opposition to all OCS drilling in the Beaufort Sea.

Although it is not the deferral area included in the Barrow Whaling Captains' map, we are analyzing the Barrow Subsistence Whaling Deferral on the western edge of the planning area that, although much smaller (26 versus 588 whole or partial blocks), is based on whale-strike data provided by the Alaska Eskimo Whaling Commission. Also, in response to requests by Barrow residents, the North Slope Borough, and the Alaska Eskimo Whaling Commission, the Secretary removed other areas. Specifically, in her decision on the 5-Year proposed final program, she removed from leasing consideration portions of the subsistence-use area/spring lead system to the west of this deferral area in the westernmost part of the Beaufort Sea Planning Area, and the subsistence-use area/spring lead system in the Chukchi Sea.

Preliminary oil-field analysis of the Beaufort Sea Planning Area indicates that the 588 whole or partial blocks depicted as a candidate for deferral on the map submitted by the Alaska Eskimo Whaling Commission would reduce, by an estimated 18%, the opportunity of discovering and developing an economic oil field, if Alternative I were chosen for one of the three Beaufort Sea sales covered by this EIS. This compares to an estimated reduction of about 1% for the Barrow Subsistence Whaling Deferral.

II.C.2.b(2) Areas Around and East of Cross Island

In written scoping comments (see Appendix E, Section B.1 - Scoping Report) applicable to Nuiqsut subsistence whaling, in addition to what appears for Barrow, the State of Alaska recommended that MMS apply a Cross Island Stipulation (No siting of Permanent Facilities within 10 Miles of Cross Island). The Mayor of the North Slope Borough believed this 10-mile distance is arbitrary and too small, and the area should be expanded to cover various aspects of the Nuiqsut traditional bowhead whale harvest and expanded more to the east to prevent the potential for whales to deflect due to production noise. The people of Nuiqsut want the Cross Island area permanently dropped from leasing consideration.

Although it is not the deferral recommended by the Nuiqsut Whaling Captains, we do include analysis of a smaller Nuiqsut Subsistence Whaling Deferral (30 versus 94 whole and partial blocks) that is based on whale-strike data provided by the Alaska Eskimo Whaling Commission. This deferral option does include some blocks to the east of the 10-mile radius. We also analyze two versions of the no-surface-occupancy stipulation for Cross Island, one for seaward portions of the 10-mile radius area and one for shoreward portions. Furthermore, access to tracts in the vicinity of Cross Island may be needed, because the State has leased tracts in the adjacent State waters. Should oil be discovered on these State tracts, leasing of the adjacent Federal tracts would prevent drainage of Federal oil.

Regarding production noise from permanent industrial facilities on the OCS, companies will be required to demonstrate to the National Marine Fisheries Service that any such proposed facilities will be in compliance with the Marine Mammal Protection Act and Endangered Species Act as they seek to obtain incidental harassment authorizations and avoid conflicts with subsistence activities.

The 94 whole or partial blocks depicted as a candidate for deferral on the map developed by the Nuiqsut Whaling Captains would reduce, by an estimated 19%, the opportunity of discovering and developing an economic oil field. This compares to an estimated reduction of about 2% for the Nuiqsut Subsistence Whaling Deferral.

I.C.2.b(3) Areas that are Offshore from the Arctic National Wildlife Refuge

In scoping comments for this EIS, the Mayor of the North Slope Borough said that the eastern Beaufort Sea should be deferred from all three sales in the 2002-2007 leasing program. In comments on the 5-year offshore leasing program, the Mayor of the City of Kaktovik expressed a preference for onshore development, recommended that the area off of the Arctic National Wildlife Refuge be excluded from leasing until the Refuge is opened for development, and that all OCS blocks within 50 miles of the city be excluded. Citing these comments from Kaktovik, the Sierra Club et al. said in their scoping comments for this EIS that they supported the City of Kaktovik's request for a deferral area offshore from the Canning River to the Canadian border. This area includes 173 whole or partial blocks. Deferring it would reduce, by an estimated 23%, the opportunity of discovering and developing an economic oil field. The deferrals in Alternatives V (Kaktovik Subsistence Whaling Deferral) and VI (Eastern Deferral) cover 88 of these same blocks and run offshore of about 60% of the coastline of the Arctic National Wildlife Refuge. The selection of Alternatives V or VI would reduce, by an estimated 3% each, the opportunity of discovering and developing an economic oil field.

Although no prohibition on offshore leasing is included in the statutes governing the Arctic National Wildlife Refuge, its Comprehensive Management Plan restricts the use of the Refuge for infrastructure to support any offshore development. Also, any OCS activity or infrastructure (including pipelines to shore) would not be approved without thorough technical and environmental reviews and would have to meet the requirements of the Marine Mammal Protection Act, the Endangered Species Act, and other Federal and State statutes that help protect the natural resources of the area and environment.

The Kaktovik Whaling Captains did not submit a map but indicated that they wanted the area known as the "Barter Island" deferral from Sales 124 and 144 as a deferral for these three sales. The northern part of the "Barter Island" deferral from OCS Sale 144 is excluded from the proposed final 5-year offshore program. Alternative V, the Kaktovik Subsistence Whaling Deferral, includes the Sale 144 deferral area plus a few extra blocks on the west side to more fully cover the area where Alaska Eskimo Whaling Commission data shows whale strikes were made.

I.C.2.b(4) Other Considerations Relevant to Requests for Deferrals Off Barrow, Cross Island, and the Arctic National Wildlife Refuge

There are five standard stipulations (see Section I.C.3) included as part of all deferral alternatives for Sales 186, 195, and 202. These are mitigating measures that will help protect the bowhead whale. The first four stipulations provide for specific protections, and the fifth is a mechanism to address unresolved conflicts between the oil and gas industry and subsistence activities. This mechanism has proven to be effective in protecting the whale hunt while allowing oil and gas activity to proceed. The mechanism can apply to whatever unreasonable subsistence-related conflicts are not resolved by other means. We also are including a possible addition to a notice of Information to Lessees (ITL) clause (ITL 7 - Information on the Availability of Bowhead Whales for Subsistence-Hunting Activities) indicating that for development plans, lessees are encouraged to consider noise-abatement methods, if needed, to reduce activity noise that may occur during and in the vicinity of the migration.

I.C.2.b(5) Rationale for Conclusions on These Three Recommended Deferrals

A primary objective of the OCS Lands Act is to make lands available for oil and gas leasing in an environmentally acceptable manner, taking into consideration protection of the marine, coastal, and human environments. An objective we undertake to meet NEPA requirements is to write an EIS that is as straightforward and as easy to understand as possible, given the inherent difficulty in estimating uncertain potential environmental effects of uncertain potential exploration and development activities based on projections of uncertain potential leasing results of planned future sales. Given the four deferral alternatives already included for analysis, these three deferral options would contribute little in the way of additional analysis to an EIS that must cover an already complicated set of issues.

We consider that the Barrow, Nuiqsut, and Kaktovik Subsistence Whaling Deferral alternatives, when combined with the other mitigating measures (stipulations and ITL clauses) to be analyzed in the EIS, would provide about the same level of protection of the environment as the preceding three recommended deferral areas, but they would allow at least some oil and gas exploration and development to proceed. Regarding the Arctic National Wildlife Refuge, we believe that the merits of including such a deferral option are in large part covered by analysis of Alternatives V and VI.

Furthermore, the analyses of six alternatives (Proposal, No Action, and four deferral alternatives), and the mitigating measures cited above for the bowhead whale subsistence hunting and other natural resources possibly affected by offshore exploration and development, meet NEPA requirements and provide alternatives that achieve the objectives of the OCS Lands Act.

I.C.3. Mitigating Measures

I.C.3.a. Mitigating Measures Suggested During the Scoping Process

The following standard mitigating measures have been adopted in our most recent sales in the Beaufort Sea and will be considered and evaluated as part of the Proposal and alternatives for the Beaufort Sea multiple-sale EIS. The effectiveness of these stipulations is evaluated in Section II.H.1.

I.C.3.a(1) Standard Stipulations

All stipulations are considered part of the proposed action and all alternatives.

No. 1 - Protection of Biological Resources
No. 2 - Orientation Program
No. 3 - Transportation of Hydrocarbons
No. 4 - Industry Site-Specific Bowhead Whale-Monitoring Program
No. 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities

These standard stipulations are described in more detail in Section II.H.1.

I.C.3.a(2) Additional Stipulations for Consideration in the EIS

These additional standard stipulations also are evaluated in the EIS. All of the stipulations are options for consideration in lieu of or in addition to the deferral alternatives or other mitigating measures. We evaluate the inclusion of other stipulations that are developed during the EIS process.

Stipulations 6a and 6b - No Siting of Permanent Facilities in the Vicinity of Cross Island. These potential stipulations were developed to reduce effects and potential conflicts between subsistence whaling activities that occur annually at Cross Island and oil and gas activities that may occur in the same area. The full text for both of these stipulations is provided in Section II.H.2.

For purposes of analysis, the Cross Island stipulation is divided into two parts. Stipulation 6a applies the 10-mile radius around Cross Island outside the barrier islands. Stipulation 6b applies the 10-mile radius to those blocks within the barrier islands (see Map 3).

Stipulation 7 - Pre-Booming Requirements for Fuel Transfers. This potential stipulation requires deployment of oil-spill boom of the fuel barge, if fuel transfers (excluding gasoline transfers) are proposed just prior to and during the whale migration for fuel amounts of 100 barrels or more. This stipulation is applicable to the blocks and migration times listed in Stipulation No. 4 - Industry Site-Specific Bowhead Whale-Monitoring Program. This stipulation was developed to reduce potential adverse effects from diesel fuel, which is very toxic and could adversely affect bowhead whales if such a spill occurred during or just prior to the annual whale migration.

Stipulation No. 8 - Lighting of Structures to Minimize Effects to Spectacled and Steller's Eiders. The Biological Opinion for Sale 186 issued by the FWS on October 23, 2003 specifies a reasonable and prudent measure necessary and appropriate to minimize potential adverse impacts to these species. In order to be exempt from the prohibitions of Section 9 of the Act, MMS must comply with the terms and conditions identified in the Biological Opinion. This stipulation requires all structures to be lighted and/or marked to improve visibility to migrating spectacled and Steller's eider, the minimization of outward radiating light, and the reporting of any injured or killed spectacled or Steller's eider. The lighting requirements do not apply between October 31 and May 1 of each year when eiders are not likely to be present.

A lighting strategy will be jointly developed by the MMS and FWS using available information on bird avoidance measures. This strategy will be modified, as appropriate, if significant new information on bird avoidance measures becomes available during activities covered by this consultation. Modification will be developed jointly by MMS and the FWS.

I.C.3.a(3) Standard ITL Clauses

The following standard ITL clauses (1 through 16) apply to OCS activities in the Beaufort Sea area and are considered part of the proposed action and alternatives for the Beaufort Sea multiple-sale EIS.

No. 1 - Information on Community Participation in Operations Planning
No. 2 - Information on Kaktovikmiut Guide *In this Place*
No. 3 - Information on Nuiqsutmiut Paper
No. 4 - Information on Bird and Marine Mammal Protection
No. 5 - Information to Lessees on River Deltas
No. 6 - Information on Endangered Whales and the MMS Monitoring Program
No. 7 – Information on the Availability of Bowhead Whales for Subsistence-Hunting Activities

No. 8 - Information on High-Resolution Geological and Geophysical Survey Activity
No. 9 - Information on Polar Bear Interaction
No. 10 - Information on the Spectacled Eider and the Steller's Eider
No. 11 - Information on Sensitive Areas to be Considered in Oil-Spill-Contingency Plans
No. 12 - Information on Coastal Zone Management
No. 13 - Information on Navigational Safety
No. 14 - Information on Offshore Pipelines
No. 15 - Information on Discharge of Produced Waters
No. 16 - Information on Use of Existing Pads and Islands

These ITL clauses are described in Section II.H.3.

I.C.3.a(4) Additional ITL Clauses for Consideration in the EIS

The MMS decided it would be useful to information to the public and future lessees to add the following optional ITL clause, No. 17 - Information to Lessees on Archaeology and Geological Hazards Reports and Surveys, lists the blocks where lessees will be required to perform surveys and prepare archaeological reports for exploration and development plans. The ITL informs the lessee that the shallow hazards reports as required in 30 CFR 250.203(b)(1)(ix) and the archaeology report as required in 30 CFR 250.194 for the blocks listed, (See Map 15) are required to be submitted with exploration or development and production plans. This ITL clause is described in Section II.H.4.

I.C.3.b. Mitigating Measures Not Considered in this EIS

During the preparation of the draft EIS, the MMS evaluated the merits of adding an ITL clause to encourage lessees to consider noise-abatement methods, if needed, to reduce activity noise that may occur during and in the vicinity of the whale migration. However, no one commented on the merits of such an ITL, either in the hearings or through written comments. While lessees and operators may choose to incorporate noise-abatement techniques into their facility and equipment designs, the MMS did not find any merit in creating a mitigating measure or requirement at this time. This type of requirement may be considered and evaluated later during the environmental assessment of exploration and development plans.

I.D. Indian Trust Resources

The Federal Government does not recognize the validity of claims of aboriginal title and associated hunting and fishing rights that have been asserted for unspecified portions of the sale area. Therefore, the MMS anticipates that the proposed action or alternatives will have no significant effects on Indian Trust Resources. While the Department of the Interior does not recognize these resources as Indian Trust Resources, this EIS considers the potential effects of lease-sale activities on Native Alaskan communities as they relate to economics, subsistence-harvest patterns, sociocultural systems, and environmental justice. The MMS consults with federally recognized tribes consistent with the Presidential Executive Memorandum dated April 29, 1994, on Government-to-Government Relations with Native American Tribal Governments; Executive Order 13175 dated November 6, 2000, on Consultation and Coordination with Indian Tribal Governments; and the January 18, 2001 Department of the Interior-Alaska Policy on Government-to-Government Relations with Alaska Native Tribes.

MMS attended several government to government meetings in July, coincidental with the time frame for the hearings. Government-to-Government meetings were held with the Native Village of Nuiqsut, Native Village of Barrow, and the Inupiat Community of the Arctic Slope. The MMS contacted the Native Village of Kaktovik requesting a government to government meeting, but they opted to testify at the Public Hearing instead. They said they were too busy to come to two meetings, and, in any case, the same people would come to the public meeting.

Following are the summaries of the meetings as prepared by MMS staff.

I.D.1. Summary of Native Village of Nuiqsut Government-to-Government Meeting

Native Village of Nuiqsut and Community Attendees: Frank K. Long, Jr. (Vice President, Tribal Counsel Member, Native Village of Nuiqsut); Bernice Kaigelak (Treasurer, Native Village of Nuiqsut); Zena Kasak (Tribal Administrator, Native Village of Nuiqsut); Sarah Kunaknana (Tribal Counsel Member, Native Village of Nuiqsut); Eli Nuikapigak (Mayor, Nuiqsut City); Isaac Nukapigak (Tribal Counsel Member, Native Village of Nuiqsut); and James Taalah (Tribal Counsel Member, Native Village of Nuiqsut).

MMS Attendees: Paul Stang (Regional Leasing Supervisor, Anchorage); Renee Orr (Chief, Leasing Division, Herndon); Dr. George Valiulis (Environmental Assessment Division, Herndon); Albert Barros (Community Liaison, Anchorage); and Angela Mazzullo (Budget Analyst, Washington, D.C.). Nathaniel Hile from Computer Matrix Court Reporters from Anchorage also attended the meeting.

Meeting Summary: A meeting was held with representatives of the Native Village of Nuiqsut at 7 p.m. on Tuesday, July 23, 2002, at the Nuiqsut City Hall Building. Subject matter ranged from Government-to-Government concerns to comments on the draft EIS. The Nuiqsut representatives expressed concern over having yet another Federal lease sale in the Beaufort Sea, because they had testified so many times in the past against OCS leasing. They felt that from a safety perspective, drilling in the Beaufort Sea was very dangerous because of historic storms, currents, earthquakes, and ice forces. They were most concerned about an oil spill having a negative effect on their subsistence resources and subsistence lifestyle. They do not want to be run off of Cross Island or have limited access to this location, because this is their main bowhead whaling staging camp site. They expressed frustration in not gaining sufficient industry employment opportunities once a company did drill on the North Slope, and the inability of MMS to secure local funding (impact assistance) for actions taking place in their backyard. Several expressed discrimination by the oil industry against Natives in general, in obtaining jobs and treating them as an equal. They felt that current and past oil and gas operations may be impacting their fish and marine mammal resources as industry infrastructure seem to be displacing once abundant wildlife, with some fish and pinnipeds having unexplained lumps and tumors which they attribute to possible oil and gas activities. They want an EIS for each specific lease sale not one multiple-sale EIS, and they want all the current deferrals to be included and expanded in the final EIS.

The MMS listened to their concerns and explained the current leasing program, giving an overview of the process. The MMS explained the relationship between the 5-year leasing program and the current Beaufort Sea multiple-sale oil and gas leasing effort, displaying maps to outline the sale area and showing the limits of the various alternatives being considered. We explained how the NEPA analysis was being written for three sales under one EIS cover, and that local input will be gathered for an Environmental Assessment at each successive lease sale stage with the option of writing another EIS if changing conditions warranted. We explained that the decision for impact assistance was something granted by Congress and, although MMS has a long history of support for such legislation, funding has been limited in relation to what the locals desire. We asked about the problem of deformed fish and pinnipeds that Nuiqsut residents raised and said that to our knowledge, this is not oil-industry related, but that we have ongoing environmental studies which may be able to shed some more light on this concern. We explained Stipulations 6a and 6b regarding the Cross Island. Several locals described past environmental conditions and wondered how industry could work safely in this type of environment. No big issues were solved; each just listened to the other explain their position either as a local member or as a governmental agency.

I.D.2 Summary of Native Village of Barrow Government-to-Government Meeting

Native Village of Barrow Attendees: Percy Nusunginya (Vice-President, Tribal Counsel Member); James Patkotak (Secretary, Tribal Counsel Member); Ellen Kanayurak (Treasurer, Tribal Counsel Member); Rosabelle Rexford (Tribal Counsel Member); Tommy Olemaun (Sergeant At Arms, Tribal

Counsel Member); Thomas Brower, III (Natural Resources Manager); and Neil Bjornsted (Tribal Grant Writer).

MMS Attendees: Paul Stang (Regional Leasing Supervisor, Anchorage); Fred King (Chief, Environmental Assessment Section, Anchorage); Albert Barros (Community Liaison, Anchorage); and Angela Mazzullo (Budget Analyst, Washington, D.C.).

A meeting was held with representatives of the Native Village of Barrow at a Special Tribal Council Meeting, at 2 p.m. on Thursday, August 1, 2002, at the Native Village of Barrow facilities. We discussed a range of topic subject matter, includes concerns about the Beaufort Sea draft EIS and other ongoing and planned OCS activities. They expressed concerns about having three different lease sales at different times, all under the umbrella of a single EIS. The past EIS's were lease-sale specific, and they did not see the need for a change. They were very concerned about the potential impact of an oil spill upon their Native food resources and lifestyle, if a sale were to go forward. They also asked if sanctuaries or habitat zones were being set aside for each sale. The issue of sanctuaries may have been seen as similar to the proposed lease-sale deferrals.

The MMS apologized for the week's delay in the meeting, but weather prevented us from getting to Barrow, and the attendees said they appreciated the rescheduled meeting. The MMS gave an overview of the 5-year program and how the Beaufort Sea multiple-sale lease sales fit into this mix. The MMS explained through words and maps the various sale schedules and the alternatives and emphasized that the MMS was not proposing marine or wildlife sanctuaries. The MMS explained the multiple-sale EIS process; however, the locals indicated that they still wanted three individual EIS's. We explained the 3-mile State jurisdiction, the MMS OCS jurisdiction, and the International Law of the Sea limits. Some present indicated that through Inupiat law, their lands extended past the shoreline out onto the ice and beyond. The participants from Barrow said they appreciate MMS meeting with the tribal governments; we seem to be the only Federal or State agency that does so before an action actually takes place. We explained that we translated the draft EIS Executive Summary into Inupiat and asked if it was useful. We found out that the translator we used had a different dialect from others in the room and although helpful, it was not quite on target. The group decided that their conversations at this meeting expressed the Native Village of Barrow concerns and they would not be attending the Public Hearing that evening.

I.D.3 Summary of Inupiat Community of the Arctic Slope (ICAS) Government-to-Government Meeting

ICAS Attendees: Arnold Brower, Jr. (President); Doreen Lampe (Treasurer); Delbert Rexford; Bill Tegoseak (Executive Director); Rebecca Brower (Tribal Operations Officer); Ellen Farantz (Finance Director); Carolyn Edwards (Realty); and James Patkotak (Natural Resources Officer). Participating via teleconference: John Hopson, Jr. (Native Village of Wainwright); Billy Nashoalook, Sr. (Native Village of Wainwright); Harry Hugo (Native Village of Anaktuvuk Pass); and Jack Schaeffer (Native Village of Point Hope).

MMS Attendees: Paul Stang (Regional Leasing Supervisor, Anchorage); Fred King (Chief, Environmental Assessment Section, Anchorage); Albert Barros (Community Liaison, Anchorage); and Angela Mazzullo (Budget Analyst, Washington, D.C.).

Meeting Summary: The MMS attended a meeting with participants representing the ICAS in Barrow on Thursday, August 1, 2002, at the North Slope Borough's teleconference center. Subjects ranged from Government-to-Government concerns to comments on the draft EIS. Those attending expressed concerns that other villages along the North Slope–Wainwright, Pt. Lay, and Pt. Hope–were not invited/included in scoping for these proposed lease sales, because they also harvest the bowhead/beluga whales that passed through waters in which oil company operations might influence these species. They also wanted some sort of remuneration (impact-assistance funding) for all the time and travel their staff expended in reviewing EIS documents. They were talking about an annual funding agreement between the MMS and the ICAS. They were recommending a subsistence activity sanctuary and indicated that they may go to court to fight another Beaufort Sea lease sale. The Pt. Hope representative opposed all OCS activities, including seismic, from the Canadian border to Pt. Hope. He felt that OCS activities could be conducted from onshore using slant drilling, so as not to impact subsistence resources, hunting, or harvests. One participant wanted the ICAS Natural Resource Director at village meetings with MMS so that they can hear local views on OCS oil and gas issues.

MMS apologized for having to reschedule this meeting due to weather conditions a week ago, and appreciated the scheduled meeting to talk about any issues ICAS had about government-to-government issues or the draft EIS. We explained through words and maps the 5-year leasing program, the multiple-sale Beaufort Sea leasing program, and how MMS focuses its scoping efforts mainly for those communities adjacent to the actual proposed lease sale area. When a Chukchi Sea sale is considered, the three mentioned villages will be heavily involved in scoping. The MMS explained the various alternatives being considered and how they were arrived at.

The ICAS wanted to know what was included in the discussions at the Nuiqsut and Kaktovik public hearings, and MMS gave them a synopsis. Several participants did not feel that MMS was listening to North Slope residents because for years, they have been voicing opposition to OCS leasing. The MMS said that they have been listening, making adjustments to sale boundaries, and adding alternatives; however, as a Government Agency we still had a mandate to offer OCS acreage for industry leasing. There was some reference to a Canadian meeting in which the Northwest Territory was working directly with the local tribal governments; ICAS wants this same local negotiation for U.S. OCS leasing.

The MMS explained a little bit about the coming Chukchi sales and how that would be coordinated with villages on the Chukchi Sea. The ICAS suggested an annual funding agreement with MMS, so that they can better participate with local meetings; the MMS said that was not provided for under the current regulations. the ICAS wanted to know how the alternatives were chosen, and we explained how we used the whale-strike data as a base to make some boundaries. The ICAS then wanted to know why we have not set aside critical habitat for whales, fish, or birds. We responded that such jurisdiction fell to other agencies' mandates, but we would discuss this with them if they made such a suggestion formally. The ICAS said that they would be sending further comments on this proposed lease sale to MMS. (Note: none were received.). The ICAS gave us a mailing list to send 12 additional draft EIS's to their board members. (Note: This was done when the team got back to the office). The ICAS requested that for future meetings, the MMS provide more advance notification of pending meetings, and what is on the agenda. They also suggested the MMS provide door prizes to get better attendance. Dialog between the MMS and the ICAS was concluded; the MMS listened and responded, but it seemed that ICAS was not satisfied with all the answers received.

I.E. Environmental Justice Executive Order 12898

The Presidential Executive Order on Environmental Justice requires agencies to incorporate environmental justice into their missions by identifying and addressing environmental effects of their proposed programs on minorities and low-income populations and communities. The Department of the Interior has developed guidelines in accordance with Presidential Executive Order 12898. The MMS participated in the development of these guidelines. The MMS's existing process of involving all affected communities and Native American and minority groups in the NEPA-compliance process meets the intent and spirit of the Executive Order. However, we are continuing to identify ways to improve the input from all Alaskan residents, not only by commenting on official documents but also by contributing their knowledge to the scientific and analytical sections of the EIS.

Environmental concerns generally were identified during the scoping process for the Beaufort Sea sales. The potential effects of sale activities on the issues raised by these concerns are addressed in Section IV.C.16 on Environmental Justice.

In the unlikely event of a large accidental oil spill, there is the likelihood for disproportionately high adverse effects on Inupiat subsistence-harvest activities and sociocultural systems. Disproportionate high adverse effects are not expected to occur from routine exploration and development activities. Specific mitigating measures have been developed to address the impacts of exploration and development activities on subsistence activities and subsistence resources, particularly the bowhead whale. By incorporating the stipulations on Subsistence Whaling and other Subsistence Activities and Industry Site-Specific Bowhead Whale-Monitoring Program, impacts from OCS activities on important subsistence resources would be mitigated but not eliminated.

I.F. The National Environmental Policy Act Process for Sales 186, 195, and 202

We are using a different approach in both format and structure for this lease-sale EIS than we used for previous EIS's for the Beaufort Sea area. This section details why and how this difference came about and the advantages we see from this change.

Once a lease sale is held within a particular geographic area, the results of scoping for subsequent lease sales within the next several years tend to reflect industry interest and the comments received on the initial sale in the same area. This initial multiple-sale EIS addresses the concerns expressed by local, State, Federal, and public reviewers and issues addressed within the specific EIS. Additional lease-sale proposals and NEPA documentation covering the same geographic area may further clarify issues; however, much of the text of both comments received and EIS's written repeat the text of previous documents already in the public domain. Over the years, reviewers have expressed reluctance to review and comment on a NEPA document that looks very similar to the one they just reviewed. Indications of industry interest show that in subsequent sales within a geographic area, interest generally declines if exploration is unsuccessful, because the most likely prospects are leased and explored first. This is based on the fact that there have been no big discoveries on the Beaufort Sea OCS. If such a discovery is made as a result of a sale, this trend could reverse.

Preparing the Beaufort Sea multiple-sale EIS does not set a precedent. The MMS Gulf of Mexico Region has been publishing single multiple-sale EIS's for the last two 5-year oil and gas leasing programs. Also, the Northeast National Petroleum Reserve-Alaska EIS, which was completed in August 1998, will be used for more than one sale.

Within the Alaskan Beaufort Sea Planning Area, the MMS Alaska OCS Region has held 7 oil and gas lease sales: Sales BF (1979), 71(1982), 87 (1984), 97 (1987), 124 (1990), 144 (1996), and 170 (1998). In the Beaufort Sea, 688 leases were issued as a result of those sales, and 30 exploration wells were drilled. One development and production project (Northstar) has been approved. A second (Liberty) received NEPA review, and a final EIS was published in May 2002. Although MMS published the Liberty final EIS, the applicant has placed their Development and Production Plan application on hold pending further cost analysis. The Beaufort Sea has been an area of high interest to industry. The NEPA documentation conducted for these lease sales included a draft and final EIS for each action. In addition, a supplemental EIS was written for Sale BF in 1980, and draft and final EIS's for a Proposed Arctic Sand and Gravel Lease Sale were written in 1982 and 1983, making a total of 19 EIS documents written for activities in the Beaufort Sea that are in the public domain.

Although this EIS addresses three proposed sale actions, only one sale decision will be made every other year. This EIS analyzes impacts for Sale 186, which is scheduled for 2003. A Call and Notice of Intent were issued at the beginning of the prelease process to explain the multiple-sale approach for the EIS. The Area ID selected the same area identified in the 5-year program for 2002-2007. Separate Area ID's will be conducted for Sales 195 and 202. They will be equal to or smaller than the area studied in this EIS. A Notice of Sale will be issued for each sale, after completion of the final NEPA document for each sale.

If the Secretary of the Interior decides to proceed with each of the sales (186, 195, and 202), by not choosing Alternative II - No Action, the Secretary may choose one, all, some combination, or part of the deferral options to comprise the final Notice for Sale 186. The Secretary will have the full suite of options available for Sales 195 and 202 when those decisions are made in 2005 and 2007, respectively. The Secretary may choose the same options selected for Sale 186 or different options.

For purposes of analysis, we introduce in this EIS the concept of three geographic/economic zones (Map 4). See Appendix F Exploration and Development Scenarios for a more detailed discussion of this concept. Exploration and development activities under this EIS could take place in any zone from any of the proposed sales. For analysis, we focus on development in the Near and Midrange zones for Sales 186 and 195 and the Far Zone for Sale 202. This is a reasonable scenario given the current infrastructure. If companies buy leases in the Far Zone at Sale 186, resulting exploration and development, if any, likely would be similar to that described for Sale 202. If exploration and development take place in the Midrange and Far zones, the effects likely would be similar to those identified for Sales 195 and 202.

Preparing a multiple-sale EIS enables us to conduct the prelease decision processes for subsequent sales (Sales 195 and 202) more efficiently, consistent with Executive Order 13212 issued on May 18, 2001, to expedite energy-related projects. This EIS incorporates by reference previous EIS's and updates existing text and data, with emphasis on new information since the last EIS was written, and explain the multiple-sale process.

Before starting the process for Sales 195 and 202, the MMS will initiate consultation with the public. An Information Request will be issued, specifically asking for input on the scheduled sale being considered. A NEPA review will be conducted for each subsequent sale. An Environmental Assessment (EA) will be prepared to determine whether or not the information and analyses in this single EIS for multiple-sales are still valid for each subsequent sale under consideration. This EA will focus on new information and/or data since publication of the final Beaufort Sea multiple-sale EIS. Consideration of the EA and any comments received in response to the Information Request will result in either a Finding of No Significant Impact (FONSI) or a determination that a supplemental EIS is warranted.

Because the EA will be prepared for a proposal that "is, or is closely similar to, one which normally requires the preparation of an EIS" (40 CFR 1501.4(e)(2)), a FONSI will be available for public review for 30 days before a decision is made. The EA/FONSI will be sent to the Governor of the State of Alaska, and its availability announced in the *Federal Register*. The FONSI will become part of the Record of Decision prepared for the decision on the Notice of Sale.

If the EA determines additional analysis is needed, we may need to prepare a supplemental EIS (40 CFR 1502.9). Some of the factors that could justify a supplemental EIS are a significant change in resource estimates, significant new information, significant new environmental issue(s), or a significant change in the proposed action. The supplemental EIS will focus on addressing the significant issues and analyses.

I.F.1. Sale 186 Process

This EIS includes an analysis of offering for lease, three different times, the Federal offshore area within the Beaufort Sea Planning Area as defined in the 2002-2007 proposed final 5-year program. The EIS also includes an assessment of alternatives and cumulative effects. The cumulative effects analysis evaluates the contribution of Alternative I for Sale 186 to the past, present, and reasonably foreseeable activities, including State and Federal onshore and offshore activities on the North Slope and in the Beaufort Sea. The two subsequent sales in this 5-year program (Sales 195 and 202) are evaluated as part of those reasonable for foreseeable activities. The cumulative effects of the alternatives for Sale 186 and for Sales 195 and 202 and their alternatives are expected to be essentially the same as those for Alternative I for Sale 186. This is because the potential effects of each sale are based on the same oil and gas resource level; each sale would affect the same physical, biological, and human resources; and each sale is scheduled to occur in the same area within the 5-year period. Slight differences may occur in the contributions to cumulative effects from the various alternatives of the three sales. However, they are so small relative to the overall cumulative effects to which they are being compared, that they cannot be meaningfully measured.

For purposes of analysis, we defined the production volumes expected from leasing in the program area. Anticipated production and associated activities are analyzed based on economic resource estimates established at the beginning of the 2002-2007 5-year program. The EIS analyzes the effects of exploration, development, and production quantitatively to the degree possible, using different economic and development scenarios individually for each sale. Impacts that cannot be estimated quantitatively are estimated qualitatively. The EIS analyses will be used by reference as the basis for the analyses in the EA's or supplemental EIS's prepared for subsequent sales (Sales 195 and 202) in the planning area during the 2002-2007 5-year program.

The description of activities to take place is broad enough to encompass the range of resources and activities expected for any of the three sales. The resource estimates and accompanying scenario information for the area considered for analysis in the EIS is presented as a range of resources and activities based on different economic conditions.

The scenarios cover a range of resources and activities that are likely to result from the proposed actions. The two later sales will be subject to an EA or supplemental EIS. This EIS assumes that standard mitigating measures are in place as part of the Proposal; the EIS assesses the effects of possible new mitigating measures added to existing standard mitigating measures. The effects are analyzed quantitatively (if possible) or qualitatively. Oil-spill-modeling runs were conducted for the program area.

Based on the results of scoping, alternatives are analyzed that defer certain blocks from the sale. Alternatives are evaluated by comparing changes in resource production and environmental effects relative to the entire program area. Alternative I for each sale includes all the blocks in the Beaufort Sea Planning Area, as defined in the 2002-2007 5-year program. The final EIS identifies the agency-preferred alternative.

The MMS resource-assessment models are designed around the concept that the entire area is open for exploration. The model identifies and tests all prospects to determine their commercial viability. To support this approach, the EIS clearly describes the inherent uncertainty in estimating undiscovered resources and the fraction of this unknown volume likely to be discovered and developed relative to perceived industry interest/effort. This uncertainty is magnified by the uncertainty associated with estimates of the environmental and socioeconomic effects resulting from the assumed exploration and development scenarios. The EIS also discusses the accuracy of resource estimates for the various alternatives or limited number of sales.

The EIS evaluates the biological effects as required under the Endangered Species Act, including all exploration activities in the Beaufort Sea Planning Area for Sales 186, 195, and 202. The draft EIS, which also gave our Biological Evaluation, was submitted to the National Marine Fisheries Service and the Fish and Wildlife Service to initiate formal consultation. The Fish and Wildlife Service prepared programmatic Biological Opinions for species under their jurisdiction for all OCS leasing and exploration activities to be conducted in the Beaufort Sea. The National Marine Fisheries Service issued a new Beaufort Sea Biological Opinion dated May 25, 2001, that included all OCS leasing and exploration activities in the Beaufort Sea OCS Planning Area. The MMS requested that the National Marine Fisheries Service uphold their May 2001 Biological Opinion concerning Beaufort Sea oil and gas leasing and exploration activities for proposed Lease Sales 186, 195, and 202. The MMS has determined that activities expected from the proposed Sales 186, 195, and 202 are similar to those considered in the May 25, 2001, Beaufort Sea Biological Opinion. The MMS also has determined that there is no new information regarding effects of these activities on bowhead whales nor are there any activities not previously considered in the Beaufort Sea Biological Opinion and the National Marine Fisheries Service agreed with our assessment.

The EIS also includes analysis of essential fish habitat and consultation that covers leasing and exploration activities for all three sales.

I.F.2. Processes for Subsequent Sales 195 and 202

After Sale 186 is held, if it is held, the MMS will decide whether to initiate the planning process for the next sale with an EA and, if warranted, a supplemental EIS. The MMS will review current issues and new information and, if that review results in no significant change from those addressed in the multiple-sale EIS, the MMS will prepare an EA and issue a FONSI. If that review results in new issues or sufficient new information not addressed in the multiple-sale EIS, the MMS will prepare a supplemental EIS. As soon as the decision is made, the MMS will announce its intention to prepare either an EA or a supplemental EIS through a press release, or mailout, and issue a *Federal Register* notice.

I.G. Streamlining Statement

Readers of this multiple-sale EIS, as with the previous Sale 170 EIS, are alerted to some differences in this EIS from previous Alaska OCS Region EIS's. While this EIS is more complicated because it addresses three sales, we have tried to streamline the EIS to provide a more concise, reader-friendly, and useful analysis of potential effects and impacts of proposed activities.

We are attempting to eliminate much of the repetition from previous EIS's. We analyze new, relevant information and incorporate background information by reference, when appropriate, providing only a concise summary for text continuity.

Such streamlining follows the intent of the Council on Environmental Quality regulations in 40 CFR § 1502.21, which encourage agencies to incorporate material by reference into an EIS to decrease volume without impeding agency analysis and public review of the action being considered. In this EIS, we cite the incorporated material and briefly describe its content. All material incorporated by reference is reasonably available for inspection by interested persons within the public comment period and is available in local libraries and from the MMS Alaska OCS Region office.

I.H. Important Differences between the Draft EIS and the Final EIS

The following summarizes some of the more important changes that have been made in the final EIS as a result of the public review of the draft EIS.

- The Alternatives (deferral options) stayed the same; no new additions or deletions were included, although the descriptive titles for Alternatives III, IV, and IV where changed from "Subsistence Whale" to "Subsistence Whaling."
- Alternative I is identified as the Agency-Preferred Alternative and is addressed in Section II.I.
- Stipulation No. 8 – Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider was added, as required by the Fish and Wildlife Service's Biological Opinion.
- Text revisions focused on major issues dealing with marine mammals, subsistence, the bowhead whale, and environmental justice. These sections incorporated new information as well as sources of traditional knowledge. Where comments warranted other changes or presentation of new or additional information, revisions were made to the appropriate text in the final EIS. If changes or additions were made to the text as a result of comments received, Section VII includes the comments received plus our response to that comment.

SECTION II

ALTERNATIVES INCLUDING THE PROPOSED ACTION

Contents for Section II

II. Alternatives, including the Proposed Action

This section discusses the sale approach and structure (Section II.A), the resource estimates, development scenarios, and a summary of effects for each of the three sales covered in this EIS for the proposed action, Alternative I (Section II.B), the No Lease Sale Alternative (Section II.C), and each of the deferral alternatives to the proposed action (Sections II.D through II.G). Section II.H discusses mitigating measures. These include the standard mitigating measures that are a part of the proposed action and alternatives and an evaluation of the effectiveness of additional stipulations that are considered in this EIS. Section II.I describes the Agency-Preferred Alternative(s).

II.A. Approach to Analysis and Oil and Gas Resource Potential

II.A.1. Approach to Analysis

This EIS encompasses the three proposed Beaufort Sea lease sales (Sales 186, 195, and 202) that are identifed in the 2002-2007 5-year program. The MMS has divided the Beaufort Sea Planning Area into three zones: Near/Shallow (Near Zone), Midrange/Medium (Midrange Zone), and Far/Deepwater (Far Zone) (see Map 4). We have done this for purposes of analysis because of the unique environmental characteristics of each zone and the logistics required for development. The zones are defined primarily by their proximity to existing North Slope infrastructure and secondarily by water depths. Water depths will influence the types of rigs and platforms used for exploration and development. Additional description of new infrastructure requirements is contained in Appendix B, and a discussion of potential developmental effects for each of the zones is given in Section IV.A. Effects are analyzed in Section IV.C for each of the three proposed sales and their six alternatives. Cumulative effects are analyzed in Section V.

Table II.A-1 indicates that most of the activities associated with the three sales are expected in the Near Zone, although leasing, exploration, and some development could take place anywhere in the large Beaufort Sea Planning Area. (When we use the term “expected” in this EIS, we are indicating what would be expected if the scenarios we constructed for evaluation purposes actually happen. Similar scenarios in past EIS’s generally have not been realized.) Nevertheless, past experience onshore and in State waters has shown that exploration and subsequent development will expand into more remote and higher cost areas after opportunities are largely exhausted in areas more readily accessible from existing infrastructure. A basic description of the physical characteristics, infrastructure development, and potential resource estimates for each of the zones follows.

II.A.1.a. Near/Shallow Zone

This zone is in the central Beaufort Sea in shallow water offshore Prudhoe Bay, where a considerable amount of infrastructure exists (see Map 4). Water depths typically are 10 meters or less, and distances from existing facilities are not more than a few tens of miles. This geographic zone extends from the Colville River on the west to the Canning River on the east. Expected development generally can be described as being relatively small fields producing at modest rates with short, small-diameter pipelines. Development platforms probably would be artificial gravel islands or mobile concrete structures set on the seafloor. Small fields could lower their development cost by using adjacent processing facilities, and small satellite oil pools could be tapped using extended-reach wells drilled from existing production islands. Overall, new oil fields developed in this zone represent a very minor addition to ongoing activities in this part of the Beaufort Sea. We expect that no new landfalls, shore bases, or new onshore processing facilities would be required.

II.A.1.b. Midrange/Medium Zone

This zone surrounds the Near Zone (see Map 4) and extends into deeper and more remote areas of the Beaufort OCS. It includes areas in water depths to approximately 30 meters and extends from Cape Halkett on the west to Barter Island on the east. New fields in this zone would be farther from existing oil and gas infrastructure, and the costs of developing new oil fields will be higher, which means that the oil pools would have to be somewhat larger then those in the Near Zone. Development could resemble the Near Zone in shallow-water areas, although more emphasis could be placed on extended-reach drilling and subsea wells to recover oil from areas farther offshore. Pipelines would be bigger and longer and would carry higher flow rates from these larger fields. Some large projects could involve more than one platform, and a new pipeline landfall could be required. Staging and logistical support still would be from the Prudhoe Bay area, and no new shore base would be necessary. Because this zone is at the fringe of existing development on the North Slope, new development projects could introduce changes to the level of activities experienced in this area.

II.A.1.c. Far/Deepwater Zone

This zone covers the remainder of the program area (see Map 4), extending from offshore Barrow on the west to the Canadian border on the east. All of the deepwater areas (deeper than 30 meters) in the Beaufort multiple-sale area would be included in this zone. New fields in this zone are much farther from existing North Slope infrastructure, and the costs to develop new oil fields would be substantially higher, which means that the commercial oil pools would have to be much larger than those in the other two zones. Small oil fields in the Far Zone might be discovered by exploration; however, these small fields likely would not be economic or developed in the near term. Development could resemble a combination of the other two zones, because remote areas contain shallow, medium, and deepwater. More emphasis could be placed on extended-reach drilling and subsea wells to recover oil from deepwater areas farther offshore. Pipelines would be larger and longer and would carry higher flow rates from these larger fields. A new large-diameter onshore pipeline could be required to connect to the existing feeder system to the Trans-Alaska Pipeline System. Most projects would involve several platforms (perhaps different types in different water depths) along with a new pipeline landfall. Staging and logistics support would be from a new shore base constructed in a favorable location to handle both overland and marine transportation subject to seasonal constraints. Because this zone is mostly beyond the influence of existing infrastructure on the North Slope, new development projects could introduce significant changes to the level of activities experienced in this area.

II.A.2. Oil and Gas Resource Potential

Crude oil is expected to be produced as a result of these three proposed lease sales, if commercial discoveries are found and developed. No gas resources in the Beaufort Sea are feasible to produce, because no gas-transportation system exists from the North Slope to outside markets. For purposes of analysis, we assume that 460 million barrels could be discovered and produced from each of the three sales. The 460 million barrels we assume to be discovered and developed in each sale would be 20% of the total multiple-sale area resources. These assumptions reflect the difficulty in finding new prospects, current technology, and industry effort.

Table II.A-2 indicates the number of blocks deferred by each alternative (II through VI) and the number of blocks that remain in the proposed sale area for each of the sales, should the deferral be selected. Table II.A-3 indicates the opportunity index (commercial chance) that commercial-sized resources may be contained in each deferral alternative. This opportunity index is shown as a percentage (probability) and represents the probability that commercial fields would be leased, drilled, discovered, and developed in a specific deferral area. No one can accurately define the location of future oil fields. Because commercial oil resources are not uniformly distributed, oil pools covered by only a few tracts could contain all of the economically recoverable reserves in the sale area. The remainder of the area could either lack the geology to produce large oil pools or have other conditions that would preclude commercial viability. It is important to note that this resource estimate reflects the current data and knowledge of the MMS. Individual companies could have a much different view of the oil potential in the Beaufort Sea OCS. Future leasing patterns may reflect different industry views regarding the possible location of commercial-sized fields in the program area.

The locations of future commercial offshore fields that presently are undiscovered are impossible to predict without exploration drilling. Petroleum-assessment models statistically analyze the geology and engineering characteristics of the area to determine the total resource volume that is expected to be economically viable to produce if discovered. While these total resource estimates are valid on a regional scale, they cannot be subdivided into smaller fractions and still be meaningful as real volumes of oil. However, a risk-weighting method can be used to define the chance that the resource volume will occur in a particular subarea.

We use the term “opportunity index” to describe that risk-weighted probability. To understand the index, suppose, for example, that an OCS area contained a total of 500 million barrels of economically recoverable oil in any of five prospects. Suppose, also, that each prospect is the same size and equally likely to contain recoverable oil. The risk-weighted volume assigned to each prospect would be 100 million barrels. The opportunity index assigned to each prospect would be 20%. This means that there is a 20% chance (or one-in-five chance) that 500 million barrels could be discovered in any single prospect, but the others would be dry. If a deferral option removed two of the five prospects, we would not subtract 200 million barrels from the total but would lose 40% of the opportunity to discover the 500 million barrels.

The opportunity index is defined by outputs from geologic and economic assessment models based on currently available data. These models assume that leasing, exploration, and development are unrestricted by regulations or industry funding. In reality, access to untested tracts and exploration budgets are key determinants of the level of industry interest in an area. Oil prices and government regulations also are key determinants. Low oil prices and overly restrictive regulations could lessen industry interest in an area despite its high geologic potential. Future oil prices are difficult to foresee, and future corporate strategies for leasing are impossible to accurately predict. We can base our analysis of resource potential only on past leasing trends and petroleum assessments using current data. Each company may have a very different perspective of the development potential of a frontier area such as the Beaufort Sea. The key concept is that industry will only bid on tracts that they believe have some chance of becoming viable oil fields.

Notwithstanding the value of the opportunity index in understanding how to think about the likelihood of finding oil and gas resources, we caution the reader to exercise care in drawing conclusions about the opportunity index. The reader needs to keep in mind the full context of the preceding paragraphs when considering the opportunity index figures cited for Alternatives III through VI in Sections D through G that follow.

II.B. Alternative I - the Proposal for Sales 186, 195, and 202

In this section, we describe (a) the three-sale/three-zone structure, (b) resource estimates and development scenarios, and (c) timing of activities. For additional information on resources and development activities, see Appendix B and Section IV.A.1 of this document. Section II.B.3 and Tables II.A-4, II.A-5, and II.A-6 provide a summary of effects by resource category for each of the sales.

Alternative I, the Proposal for Sales 186, 195, and 202, offers for lease the entire area outlined on Map 1. This Alternative encompasses 1,877 whole or partial blocks that cover 9,770,000 acres (about 3,954,000 hectares). This area, minus leased blocks, would be offered in each of the three sales. For each of the proposed sales, the MMS assumes three different exploration and development scenarios. The level of activities and types of exploration and development components are further grouped into three geographic zones (see Map 4) based primarily on distance to existing infrastructure and secondarily by water depth.

Resource estimates for each of the proposed sales vary between 340 million and 570 million barrels of oil, assuming a market price of oil between $18 and $30 per barrel (in 2000$). For purposes of analysis, we use a single production volume of 460 million barrels of oil for each sale.

II.B.1. Sale 186

The basic assumption is that as the lease-sale program progresses, activities would expand into more distant zones. The most accessible and easiest tracts are expected to be developed first. For purposes of analysis, we expect that 70% of all blocks leased for this sale would be in the Near Zone, 20% in the Midrange Zone, and only 10% in the Far Zone (see Table II.A-1).

II.B.1.a. Sale 186 Exploration Activities

We assume that exploration activity (seismic surveys and drilling) begins in the year following Sale 186 (scheduled for 2003) and continues at a rate of one exploration well per year for a total of six exploration wells. We assume three commercial discoveries (two discoveries in the Near Zone and one in the Midrange Zone, a 50% success rate), which is very optimistic. Following the next discovery, we assume delineation wells would employ the same drilling rig and continue over a 2-year period. Two delineation wells may be drilled in a single season as rig mobilization has already happened. Artificial ice islands grounded on the seabed are likely to be used as drilling platforms in shallow water (less than 10 meters), and nearshore operations would be supported by ice roads over the landfast ice. Gravel islands are not likely to be constructed to drill exploration wells in OCS waters (generally deeper than 10 meters), although older artificial islands or natural shoals could be used as a base for temporary gravel or ice islands. Bottom-founded platforms (set on the seafloor) could be used to drill prospects in water depths of 10-20 meters, and drillships would be used to drill prospects in water deeper than 20 meters. Because mobile ice conditions in deeper water makes ice roads unfeasible, deeper water (Far Zone) operations would take place during the summer open-water season and would be supported by icebreakers and supply boats.

II.B.1.b. Sale 186 Development Activities

In our development schedule (Table IV.A-1), we assume that the first commercial discovery would be made in 2005, 2 years after Sale 186 is held. We assume that three new fields ranging in size from 120-220 million barrels of oil would be discovered in alternate years. Assuming no delays in permitting, production platforms could be installed in 4 years following the discovery well. The MMS assumes that the fields discovered and developed would be this size and could be produced by one production platform, perhaps as a satellite with minimal onsite processing facilities. Each platform would contain one rig for development-well drilling and well-workover operations. Gravel islands would be the favored design for production facilities in water depths approximately 15 meters or less, and bottom-founded platforms would be employed for production facilities in water depths to 35 meters. Some oil may be produced by wells using extended-reach drilling technology, which would enable the operators to reach oil pools located in strata that lie beneath deeper OCS waters. However, the volume of oil developed by extended-reach drilling likely would represent a minor proportion of the total production from the three new fields.

The route selection and installation of offshore pipelines would take 1-2 years, and could occur either in the summer open-water season, during mid- to late winter when landfast ice has stabilized, or both. New onshore pipeline sections would take 1 year to complete with construction activities taking place simultaneously with installation of the offshore pipeline. We assume that offshore pipelines would be trenched as a protective measure against damage by ice in all water depths less than 50 meters (164 feet). Onshore pipelines would be elevated 5 feet above ground level on vertical support members. The onshore pipeline corridor, and shore-facility construction would be concurrent with the offshore platforms installation.

Because of their relatively small size, new offshore projects would use the existing infrastructure (processing facilities and pipeline-gathering systems) wherever possible. Produced oil would be gathered by existing pipeline systems within the Prudhoe Bay/Kuparuk field areas and transported to Pump Station 1 of the Trans-Alaska Pipeline. We assume that Oliktok Point (using the Kuparuk or Milne Point field infrastructure), the Northstar pipeline landfall, West Dock (using the Prudhoe Bay field infrastructure), and the Badami field would be the primary landfalls.

Production rates would quickly ramp up to peak production rates for 3 years before declining. A typical field cycle from discovery to abandonment lasts 21 years, or approximately 5 years from discovery to startup, a 15-year production life, and 1-year abandonment phase. Considering the staggered discovery times of the fields, activities resulting from Sale 186 could last until the year 2033 (Table IV.A-1 and Appendix B).

II.B.2. Sale 195

We expect that as each lease sale proceeds, blocks would be leased in increasingly distant zones. The most accessible and easiest tracts should be developed first. We assume that many of those blocks would be leased and explored for Sale 186. For Sale 195, we expect activities to extend farther into the Beaufort Sea, into the Midrange Zone. We expect the percentage of all blocks leased for this sale in the Near Zone should fall to 50%, the percentage of blocks leased in the Midrange Zone should rise to 30%, and the remaining 20% of the blocks would be leased in the Far Zone (see Table II.A-1).

Sale 195 Exploration and Development Activities. Sale 195 exploration and development activities and timeframes likely would vary only slightly from Sale 186. Total exploration and development wells drilled would be the same (Table IV.A-2), and the type of exploration and production platforms used would be the same. Exploration drilling would begin in 2005, 2 years after the sale is held. A commercial discovery would be assumed 3 years after the sale, with production platforms installed beginning in 2012. We assume two new fields (as opposed to three for Sale186) would be discovered, with production potential for each field ranging from 120-340 million barrels of oil. The first production platform would be online in 2012 with production beginning 1 year later. Production from Sale 195 tracts is expected to continue until 2036, 3 years beyond the end of Sale 185 production. Assumed pipeline landfall sites for this sale would be the same as assumed for Sale 186; however, because of the assumed potential for Sale 195 to develop resources in blocks farther from existing infrastructure, a new support facility is forecast to be constructed near Point Thomson. The Exxon Corporation is proposing the development of the Point Thomson field, which includes offshore lease tracts in State waters. If the field is developed, a support facility would be constructed at Point Thomson independent of any activities related to Sale 195.

II.B.3. Sale 202

We expect that as each lease sale proceeds, blocks would be leased in increasingly distant zones. For Sale 202, we hypothesize that activities would extend even farther into the Beaufort Sea; into the Midrange and Far zones. We estimate the percentage of all blocks leased for this sale in the Near Zone should fall to 40%, the percentage of blocks leased in the Midrange Zone would stay at 30%, and the percentage of blocks leased in the Far Zone would rise to 30% (see Table II.A-1).

Sale 202 Exploration and Development Activities. Exploration and development timeframes and activities might vary somewhat from those considered for Sales 186 and 195 (see Table IV.A-3). Exploration activities would be expected to begin 3 years after the sale date, with an estimated total of 11 exploration and delineation wells drilled over an 8-year period. Exploration platform types used for Sale 202 also likely would be the same as those described previously for Sale 195. However, for the production phase, deeper and/or more distant production operations, should they occur, may require bottom-founded ice-reinforced steel or concrete structures. For Sale 202, we assume that a single field would produce 460 million barrels of oil over its life from two platforms, a main and a satellite platform. Some production may come from extended-reach drilling and/or subsea completions to reach oil pools that may lie under deeper waters. For Sale 202, the first production platform is estimated to be completed in 2018, with production beginning the next year. Oil production could continue until 2038. We assume that there could be 35 miles of offshore pipeline for this alternative, which is 5 miles shorter than for Sales 186 and 195. However, Sale 202 assumes a new landfall distant from existing oil infrastructure and, therefore, its development may require a new overland pipeline. Candidate sites for a new pipeline landfall could be Point Thompson and Smith Bay, among others. Please see Table IV.A-4, Section IV.A.1, and Appendix B for a further comparison of these sales.

II.B.4. Summary of Effects by Sale

In this section, we summarize the effects by category of holding the three sales, should the Secretary decide to hold Sale 186 in 2003 (Table II.A-4), Sale 195 in 2005 (Table II.A-5), and Sale 202 in 2007 (Table II.A-6). For purposes of analysis, the MMS assumes that 460 million barrels of oil could be discovered and produced for each sale, based on an estimated range of 340-570 million barrels per sale. Only a small percentage of the blocks available for lease under the proposed action for Sales 186, 195, and 202 likely would actually be leased. Of the blocks that may be leased, only a portion would be drilled and of these, only a very small portion, if any, likely would result in production. At this time, gas is not considered economically recoverable.

If any of the lease sales are held and result in exploration and/or development, routine industrial activities associated with oil exploration and development would generate some degree of disturbance, noise, and discharges into the environment. The EIS found that no significant effects are anticipated from routine permitted activities. Significance thresholds are defined in Section IV.A.1. Although small oil spills are accidental in nature, they are expected to happen should exploration, development, and production occur; therefore, we include the effects of small spills to the environment in this part of the analysis.

Other accidents or unplanned activities, primarily large oil spills equal to or greater than 1,000 barrels of oil, are not expected to occur. The probability of a large spill equal to or greater than 1,000 barrels for each of the three sales is 8-10% (see Table A.1-5). For analytical purposes, the analysis assumes one large spill of either 1,500 barrels (platform spill) or 4,600 barrels (pipeline spill). The low probability of such an event, combined with the seasonal nature of the resources inhabiting the area, make it highly unlikely that a large oil spill would occur and contact these resources. Spectacled eiders, long-tailed ducks, and common eiders are present on the North Slope for only 3-5 months out of the year. Bowhead whales migrate through the area in the spring and fall, and the length of time a whale could contact oil would likely be limited to days or weeks. Even if a resource is present in the area, the oil may not contact it. In the unlikely event of such a large oil spill, significant adverse effects could occur to local water quality; common, spectacled, and Steller's eiders; long-tailed ducks; subsistence harvests; and sociocultural systems.

The effects summarized by resources for Sale 186 are presented in Table II.A-4, Sale 195 in Table II.A-5, and Sale 202 in Table II.A-6. The summaries of significant effects noted above apply to each individual sale and for all of the deferral alternatives for each sale. The deferral alternatives (Alternatives III through VI) provide various degrees of protection to the resources in or near those specific areas for each sale; however, none of the deferral alternatives changes the level of significant impacts identified above for any of the proposed sales. This is primarily because all of the alternatives for all of the sales assume the same amount of oil (460 million barrels) would be developed, even though the opportunity to find that volume of oil changes with the selection of one or more alternatives. The economics of developing an oil field in the Beaufort Sea requires that certain minimum quantities of oil be discovered, otherwise, development will not occur. While the economic quantities required for development vary between the Near, Midrange, and Far zones, the amount of oil MMS assumes in the EIS for the alternatives in each of the three sales does not vary. In addition, many of the key resources migrate in and out of the Beaufort Sea area, and many of the key species use large areas of the Beaufort Sea area when they are present.

The scenarios that MMS developed for Sales 186 and 195 are very similar, with leasing and exploration, development, and operations occurring from both sales in the Near and Midrange zones. Therefore, the effects to each of the resources from both of these sales are very similar. The MMS scenarios for Sales 186 and 195 expect most of the activities to occur in the central Beaufort Sea; therefore, Alternatives III, V, and VI, which are outside the central area, do not provide identifiable benefits or differences. For Sale 202, the scenarios developed by MMS, assume activities would occur outside of the central Beaufort Sea area, and the EIS identifies different levels of effects between the deferral alternatives, although none of the alternatives change the overall level of significance effects.

In addition to Tables II.A-4, II.A-5, and II.A-6, Table IV-Summary provides a summary by resource category for all alternatives and sales.

II.C. Alternative II - No Lease Sale

Under this Alternative, each of the proposed sales in the Beaufort Sea multiple-sale program would not be approved. None of the potential 0.46 billion barrels of oil would be produced for each sale, and none of the environmental effects that would result from proposed oil development associated with each sale would occur in the Beaufort Sea area. No potential oil spills and no effects to the physical, biological, or human environment from development from this sale would occur along the Beaufort Sea coast. The economic benefits, royalties, and taxes to the Federal and State Governments would be forgone. A similar decision could be made for each sale.

To replace the .046 billion barrels of oil not developed from each sale in the Beaufort Sea multiple-sale program, a large portion of the oil likely would be imported from other countries. Other substitutes (for example, nonpetroleum fuels, solar energy, nuclear energy, conservation) could replace a small part of the lost production. The mix of imported oil and other substitutes will be market driven. See Section IV.B of this EIS, and Sections 2.5 and 4.7 (Pages 2-36 to 2-37 and 4-187 to 4-202) of the OCS Oil and Gas Leasing Program: 2002-2007 Final EIS (USDOI, MMS, 2002a), which is incorporated by reference. That analysis shows that nationwide, imports would replace 86-88% of the lost oil. Conservation would replace about 6-7%, and increased use of natural gas would replace about 4-5% of the lost oil production. Increased onshore oil production is estimated to offset about 3% of lost offshore production. However, even if Alternative II were selected, the Beaufort Sea still would be exposed to other ongoing oil and gas and other activities in the area.

Because of the projected high level of imports, the associated environmental impacts from producing oil and transporting that oil to market still would occur, but in a different location, and they probably would be of a different magnitude. Imported oil imposes negative environmental effects in producing countries and in countries along the trade routes. By not producing our own domestic oil and gas resources in the Beaufort Sea and elsewhere around the U.S., we are relying on imported oil. From a global perspective, by importing oil we are exporting at least a sizeable portion of the environmental impacts associated with oil we consume to other countries where the oil is produced and to those countries along the tanker routes. Also, these imports have attendant negative effects on the Nation's balance of trade (see Section IV.C).

II.D. Alternative III - Barrow Subsistence Whaling Deferral

This alternative was developed by the MMS in response to scoping comments received in Barrow. This deferral would reduce potential conflicts between bowhead whale subsistence hunters and offshore oil and gas operations, based on bowhead whale-strike data provided by the Alaska Eskimo Whaling Commission. This alternative would offer for leasing all of the area described for Alternative I except for a subarea located in the western portion of the proposed sale area. Alternative III would offer 1,851 whole or partial blocks, comprising 9.6 million acres (about 3.9 million hectares). The area that would be removed by the Barrow Subsistence Whaling Deferral (see Map 2) consists of 26 whole or partial blocks, approximately 138,000 acres (55,735 hectares), approximately 1% of the proposed sale area. This alternative also would result in a reduction of 1% of the commercial resources opportunity index from the proposed action (see Table II.A-3). This option is analyzed for protection of subsistence-use zones and wildlife areas, particularly comprising an area in which whales have been taken (based on known whale-strike data), to address issues of protecting areas of the Barrow subsistence whale hunt. Section IV.C of this EIS analyzes whether increased protection would be provided by this alternative to bowhead whales and subsistence activities from potential noise and disturbance from exploration or development and production activities. See Tables II.A-4, II.A-5, II.A-6, and IV.A-Summary. The majority of the bowhead whale subsistence-hunting area near Barrow includes area in the Chukchi Sea, which already was removed from leasing in the final 2002-2007 proposed 5-year program. While the selection of this alternative decreases the opportunity of discovering a commercial field, the resources in this area still could be affected by a large oil spill that occurred elsewhere in the sale area.

II.E. Alternative IV - Nuiqsut Subsistence Whaling Deferral

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located off Cross Island. Alternative IV would offer 1,847 whole or partial blocks, comprising 9.6 million acres (about 3.9 million hectares). The area that would be removed by the Nuiqsut Subsistence Whaling Deferral (see Map 2) consists of 30 whole or partial blocks, approximately 0.2 million acres (66 thousand hectares), about 2% of the Alternative I area. This alternative would result in a reduction of 5% of the opportunity of discovering and developing an economic field from a lease sale under Alternative I (see Table II.A-3). Section IV.C of this EIS analyzes whether this alternative would provides protection of subsistence-use zones and wildlife areas, particularly comprising an area in which whales have been taken (based on known whale-strike data). This alternative addresses issues of protecting areas of the Nuiqsut subsistence bowhead whale hunt as identified by the Alaska Eskimo Whaling Commission, the Native Village of Nuiqsut, and the North Slope Borough. See Tables II.A-4, II.A-5, II.A-6, and IV.A-Summary. Although the selection of this alternative decreases the opportunity of discovering a commercial field, the resources in this area still could be affected by a large oil spill that occurred from development offshore elsewhere in the Beaufort Sea.

II.F. Alternative V - Kaktovik Subsistence Whaling Deferral

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located off of Barter Island. Alternative V would offer 1,849 whole or partial blocks comprising 9.6 million acres (about 3.9 million hectares). The area that would be removed by the Kaktovik Subsistence Whaling Deferral (see Map 2) consists of 28 whole or partial blocks, approximately 0.1 million acres (50 thousand hectares), about 1% of the Alternative I area. This alternative would result in a reduction of 3% of the opportunity of discovering and developing an economic oil field from a lease sale under Alternative I (see Table II.A-3). This area would be considered for deferral because of the potential disturbance to

Kaktovik's traditional, known subsistence-whaling areas (based on known whale-strike data). An analysis is conducted in Section IV.C to determine if this alternative provides protection of traditionally used bowhead whale subsistence areas, as requested by the Native Village of Kaktovik. See Tables II.A-4, II.A-5, II.A-6, and IV.A-Summary. While the selection of this alternative decreases the opportunity of discovering a commercial field, the resources in this area still could be affected by a large oil spill that occurred elsewhere in the Beaufort Sea area.

II.G. Alternative VI - Eastern Deferral

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located east of Kaktovik. Alternative VI would offer 1,817 whole or partial blocks, comprising 9.5 million acres (about 3.8 million hectares). The area removed by the Eastern Deferral (see Map 2) consists of 60 whole or partial blocks, approximately 0.3 million acres (114 thousand hectares), about 3% of the Alternative I area. This deferral would result in a reduction of 3% of the opportunity of discovering and developing an economic oil field from a lease sale under Alternative I (see Table II.A-3). An analysis is conducted in Section IV.C of the level of protection of areas provided by this alternative, as requested by the Native Village of Kaktovik and the Alaska Eskimo Whaling Commission, and it adjoins an area that the State of Alaska has deferred in recent State sales. See Tables II.A-4, II.A-5, II.A-6, and IV.A-Summary. Although the selection of this alternative decreases the opportunity of discovering a commercial field, the resources in this area still could be affected by a large oil spill that occurred elsewhere in the Beaufort Sea area.

The MMS recently completed a bowhead whale-feeding study to assess the importance of the area to bowhead whales for feeding.

II.H. Mitigating Measures

Laws and regulations that provide mitigation are considered part of the Proposal (Alternative I) and Alternatives III through VI for Sales 186, 195, and 202. Examples include the OCS Lands Act, which grants broad authority to the Secretary of the Interior to control lease operations and, where appropriate, undertake environmental monitoring studies; the Consolidated Offshore Operating Regulations (which rescinded and replaced Alaska OCS Orders effective May 31, 1988); and the Fishermen's Contingency Fund.

Most of the following mitigating measures (Stipulations and ITL clauses) also are considered standard mitigating measures, because they have been selected in past OCS lease sales. Standard stipulations (Section II.H.1) and ITL clauses (Section II.H.3) are evaluated and factored into the effects analysis as part of the proposed action and alternatives. The environmental effects analyses in Section IV.C discuss the effectiveness of the stipulations described in this section where appropriate to a given resource. A summary of the overall effectiveness of each stipulation is provided in the following section, immediately after the text of the stipulation. Other mitigating measures were developed and analyzed in this EIS; these are found under Section II.H.2 for stipulations being developed. The optional stipulations are as follows: (a) Stipulation 6a No Siting of Permanent Facilities in the Vicinity of Cross Island for blocks outside the Barrier Islands, (b) Stipulation 6b No Siting of Permanent Facilities in the Vicinity of Cross Island for blocks inside the Barrier Islands, and (c) Stipulation 7 Pre-Booming Requirements for Fuel Transfers.

Some of the stipulations included in this analysis as assumed mitigating measures from past OCS oil and gas lease sales in the Beaufort Sea have been slightly reworded to bring them up-to-date with current information and situations (i.e., Protection of Biological Resources). Other changes were simply editorial (Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities).

The ITL clauses included as assumed mitigating measures also have been somewhat revised from past sales. Some have not been included, because they have been incorporated into the MMS operating regulations (i.e., Oil-Spill-Response Preparedness, Oil-Spill-Cleanup Capability, and Certification of Oil-

Spill-Financial Responsibility) or are no longer applicable (Arctic Biological Task Force). Some have been updated with current information (Bird and Marine Mammal Protection, Coastal Zone Management).

II.H.1. Standard Stipulations

The following standard stipulations are considered part of the proposed action and alternatives.

- No. 1 - Protection of Biological Resources
- No. 2 - Orientation Program
- No. 3 - Transportation of Hydrocarbons
- No. 4 - Industry Site-Specific Bowhead Whale-Monitoring Program
- No. 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities

A summary of the effectiveness of each stipulation follows the language of the stipulation

II.H.1.a. Stipulation No. 1 - Protection of Biological Resources

If biological populations or habitats that may require additional protection are identified in the lease area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RS/FO shall give written notification to the lessee of the RS/FO's decision to require such surveys.

Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to:

1. Relocate the site of operations;
2. Establish to the satisfaction of the RS/FO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;
3. Operate during those periods of time, as established by the RS/FO, that do not adversely affect the biological resources; and/or
4. Modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such findings to the RS/FO and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO has given the lessee direction with respect to its protection.

The lessee shall submit all data obtained in the course of biological surveys to the RS/FO with the locational information for drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RS/FO provides written directions to the lessee with regard to permissible actions.

Summary of the Effectiveness of Stipulation No. 1. The level of protection provided by this measure will depend on several factors:

- the size of population that might be subjected to adverse impacts and the number of individuals within the population that would be afforded protection by this stipulation;
- the overall size of habitat used by the resource of concern and the portion of that habitat that may be affected by offshore oil and gas operations; and
- the uniqueness of the population or habitat.

Thus, the effectiveness of the stipulation could vary widely. If only a few members of a large population or a small amount of a large habitat area were to be affected by oil and gas operations, the mitigative benefits would be minimal. However, if many individuals of a small population or most of the area of unique habitat is protected and the adverse effects are reduced or minimized because of this stipulation, then its effectiveness could be substantial. This stipulation lowers the potential adverse effects to lower trophic-level organisms, primary unknown kelp communities, or other unique biological communities, that may be identified during oil and gas exploration or development activities and provided additional protection. It also would provide protection to fish (including the migration of fish) from potential disturbance associated with oil and gas exploration, development, and production. This stipulation does not change the level of significant impacts that may occur from an unlikely large oil spill.

II.H.1.b. Stipulation No. 2 - Orientation Program

The lessee shall include in any exploration or development and production plans submitted under 30 CFR 250.203 and 250.204 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the Regional Supervisor, Field Operations. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas. The program shall address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provide guidance on how to avoid disturbance. This guidance will include the production and distribution of information cards on endangered and/or threatened species in the sale area. The program shall be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program shall also include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation.

The program shall be attended at least once a year by all personnel involved in onsite exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors.

The lessee shall maintain a record of all personnel who attend the program onsite for so long as the site is active, not to exceed 5 years. This record shall include the name and date(s) of attendance of each attendee.

Summary of the Effectiveness of Stipulation No. 2. This stipulation provides positive mitigating effects by requiring that all personnel involved in petroleum activities on the North Slope resulting from any leases issued from any of the three sales be aware of the unique environmental, social, and cultural values of the local Inupiat residents and their environment. This stipulation should help avoid damage or destruction of environmental, cultural, and archaeological resources through awareness and understanding of historical and cultural values. It also would help minimize potential conflicts between subsistence hunting and gathering activities and oil and gas activities that may occur. However, the extent of reduction offered by this stipulation is difficult to measure directly or indirectly.

This stipulation provides protection to fish (including the migration of fish), pinnipeds, polar bears, bowhead whales, gray whales, and beluga whales from potential disturbances associated with oil and gas exploration, development, and production by increasing the awareness of workers to their surrounding environment. It increases the sensitivity to and understanding by workers of the values, customs, and lifestyles of Native communities and reduces the potential conflicts with subsistence resources and hunting activities. This stipulation does not change or lower the level of significant impacts that may occur from an unlikely large oil spill.

II.H.1.c. Stipulation No. 3 - Transportation of Hydrocarbons

Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to recommendations of any advisory groups and Federal, State, and local governments and industry.

Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of an emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the Regional Supervisor, Field Operations.

Summary of the Effectiveness of Stipulation No. 3. This stipulation reflects the agency preference for transporting offshore oil and gas in pipelines, especially in the arctic environment, where much of the area is covered by sea ice for much of the year. This stipulation is consistent with the North Slope Borough Coastal Management Program policy. This stipulation helps reduce or moderate the potential effects to water quality, lower trophic-level organisms, fish and fish migration, endangered species, marine mammals, etc.; however, it does not reduce the potential significant adverse effects from an unlikely large oil spill to any of potentially affected resource to below significance threshold levels.

II.H.1.d. Stipulation No. 4 - Industry Site-Specific Bowhead Whale-Monitoring Program

Lessees proposing to conduct exploratory drilling operations, including seismic surveys, during the bowhead whale migration will be required to conduct a site-specific monitoring program approved by the Regional Supervisor, Field Operations (RS/FO); unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with the North Slope Borough (NSB) and the Alaska Eskimo Whaling Commission (AEWC), determine that a monitoring program is not necessary. The RS/FO will provide the NSB, AEWC, and the State of Alaska a minimum of 30 but no longer than 60 calendar days to review and comment on a proposed monitoring program prior to approval. The monitoring program must be approved each year before exploratory drilling operations can be commenced.

The monitoring program will be designed to assess when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these operations. In designing the program, lessees must consider the potential scope and extent of effects that the type of operation could have on bowhead whales. Experiences relayed by subsistence hunters indicate that, depending on the type of operations, some whales demonstrate avoidance behavior at distances of up to 35 mi. The program must also provide for the following:

(1) Recording and reporting information on sighting of other marine mammals and the extent of behavioral effects due to operations,
(2) Inviting an AEWC or NSB representative to participate in the monitoring program as an observer,
(3) Coordinating the monitoring logistics beforehand with the MMS Bowhead Whale Aerial Survey Project (BWASP),
(4) Submitting daily monitoring results to the MMS BWASP,
(5) Submitting a draft report on the results of the monitoring program to the RS/FO within 60 days following the completion of the operation. The RS/FO will distribute this draft report to the AEWC, the NSB, the State of Alaska, and the National Marine Fisheries Service (NMFS).
(6) Submitting a final report on the results of the monitoring program to the RS/FO. The final report will include a discussion of the results of the peer review of the draft report. The RS/FO will distribute this report to the AEWC, the NSB, the State of Alaska, and the NMFS.

Lessees will be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program. This peer review will consist of independent reviewers who have knowledge and experience in statistics, monitoring marine mammal behavior, the type and extent of the proposed operations, and an awareness of traditional knowledge. The peer reviewers will be selected by the RS/FO from experts recommended by the NSB, the AEWC, industry, NMFS, and MMS. The results of these peer reviews will be provided to the RS/FO for consideration in final approval of the monitoring program and the final report, with copies to the NSB, AEWC, and the State of Alaska.

In the event the lessee is seeking a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) for incidental take from the NMFS, the monitoring program and review process required under the LOA or IHA may satisfy the requirements of this stipulation. Lessees must advise the RS/FO when it is seeking an LOA or IHA in lieu of meeting the requirements of this stipulation and provide the RS/FO with copies of all pertinent submittals and resulting correspondence. The RS/FO will coordinate with the NMFS and advise the lessee if the LOA or IHA will meet these requirements.

This stipulation applies to the following blocks for the time periods listed and will remain in effect until termination or modification by the Department of the Interior, after consultation with the NMFS and the NSB.

Spring Migration Area: April 1 through June 15

OPD: NR 05-01, Dease Inlet. Blocks included: 6102-6111, 6152-6167, 6202-6220, 6252-6270, 6302-6321, 6354-6371, 6404-6423, 6454-6473, 6504-6523, 6554-6573, 6604-6623, 6654-6673, 6717-6723

OPD: NR 05-02, Harrison Bay North: Blocks included: 6401-6404, 6451-6454, 6501-6506, 6551-6556, 6601-6609, 6651-6659, 6701-6716

Central Fall Migration Area: September 1 through October 31

OPD: NR 05-01, Dease Inlet. Blocks included: 6102-6111, 6152-6167, 6202-6220, 6252-6270, 6302-6321, 6354-6371, 6404-6423, 6454-6473, 6504-6523, 6554-6573, 6604-6623, 6654-6673, 6704-6723, 6754-6773, 6804-6823, 6856-6873, 6908-6923, 6960-6973, 7011-7023, 7062-7073, 7112-7123

OPD: NR 05-02, Harrison Bay North. Blocks included: 6401-6404, 6451-6454, 6501-6506, 6551-6556, 6601-6609, 6651-6659, 6701-6716, 6751-6766, 6801-6818, 6851-6868, 6901-6923, 6951-6973, 7001-7023, 7051-7073, 7101-7123

OPD: NR 05-03, Teshekpuk. Blocks included: 6015-6024, 6067-6072

OPD: NR 05-04, Harrison Bay. Blocks included: 6001-6023, 6052-6073, 6105-6123, 6157-6173, 6208-6223, 6258-6274, 6309-6324, 6360-6374, 6410-6424, 6461-6471, 6513-6519, 6565-6566

OPD: NR 06-01, Beechey Point North. Blocks included: 6901-6911, 6951-6962, 7001-7012, 7051-7062, 7101-7113

OPD: NR 06-03, Beechey Point. Blocks included: 6002-6014, 6052-6064, 6102-6114, 6152-6169, 6202-6220, 6251-6274, 6301-6324, 6351-6374, 6401-6424, 6456-6474, 6509-6524, 6868-6574, 6618-6624, 6671-6674, 6722-6724, 6773

OPD: NR 06-04, Flaxman Island. Blocks included: 6301-6303, 6351-6359, 6401-6409, 6451-6459, 6501-6509, 6551-6559, 6601-6609, 6651-6659, 6701-6709, 6751-6759, 6802-6809, 6856-6859,

Eastern Fall Migration: August 1 through October 31

OPD: NR 06-04, Flaxman Island. Blocks included: 6360-6364, 6410-6424, 6460-6474, 6510-6524, 6560-6574, 6610-6624, 6660-6674, 6710-6724, 6760-6774, 6810-6824, 6860-6874, 6910-6924, 6961-6974, 7013-7022, 7066-7070, 7118-7119

OPD: NR 07-03, Barter Island. Blocks included: 6401-6405, 6451-6455, 6501-6505, 6551-6555, 6601-6605, 6651-6655, 6701-6705, 6751-6756, 6801-6807, 6851-6859, 6901-6911, 6958-6963, 7010-7013, 7061-7067, 7113-7117

OPD: NR 07-05, Demarcation Point. Blocks included: 6016-6022, 6067-6072, 6118-6125, 6169-6175, 6221-6226, 6273-6276, 6323-6326

OPD: NR 07-06, Mackenzie Canyon. Blocks included: 6201, 6251, 6301, 6351

Summary of the Effectiveness of Stipulation No. 4. This stipulation provides site-specific information about the migration of bowhead whales that could occur from oil and gas activities from the proposed lease sales. The information can be used to evaluate the threat of harm to the species and provides immediate information about the activities of bowhead whales and their response to specific events. This stipulation helps address the National Marine Fisheries Service concerns and recommendations to reduce potential effects to exploration activities. This stipulation also contributes incremental and important information to ongoing whale research and monitoring efforts and to the information database for bowhead whales. This stipulation helps reduce effects to subsistence-harvest patterns and to the overall sociocultural systems that place special value to bowhead whale harvests and the traditional activities of sharing this harvest with the other members of the community. This stipulation helps provide mitigation to potential effects of oil and gas activities to the local Native whale hunters and subsistence users. It is considered to be a positive action by the Native community under environmental justice.

II.H.1.e. Stipulation No. 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities

Exploration and development and production operations shall be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities (including, but not limited to, bowhead whale subsistence hunting).

Prior to submitting an exploration plan or development and production plan (including associated oil-spill contingency plans) to the MMS for activities proposed during the bowhead whale migration period, the lessee shall consult with the directly affected subsistence communities, Barrow, Kaktovik, or Nuiqsut, the North Slope Borough (NSB), and the Alaska Eskimo Whaling Commission (AEWC) to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented by the operator to prevent unreasonable conflicts. Through this consultation, the lessee shall make every reasonable effort, including such mechanisms as a conflict avoidance agreement, to assure that exploration, development, and production activities are compatible with whaling and other subsistence hunting activities and will not result in unreasonable interference with subsistence harvests.

A discussion of resolutions reached during this consultation process and plans for continued consultation shall be included in the exploration plan or the development and production plan. In particular, the lessee shall show in the plan how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. Lessees shall also include a discussion of multiple or simultaneous operations, such as ice management and seismic activities, that can be expected to occur during operations in order to more accurately assess the potential for any cumulative affects. Communities, individuals, and other entities who were involved in the consultation shall be identified in the plan. The Regional Supervisor/Field Operations (RS/FO) shall send a copy of the exploration plan or development and production plan (including associated oil-spill contingency plans) to the directly affected communities, and the AEWC at the time they are submitted to the MMS to allow concurrent review and comment as part of the plan approval process.

In the event no agreement is reached between the parties, the lessee, the AEWC, the NSB, the National Marine Fisheries Service (NMFS), or any of the subsistence communities that could be affected directly by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the subsistence communities, AEWC, NSB, NMFS, and the lessee(s) to specifically address the conflict and attempt to resolve the issues before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests. Upon request, the RS/FO will assemble this group if the RS/FO determines such a meeting is warranted and relevant before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests.

The lessee shall notify the RS/FO of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns. Lease-related use will be restricted when the RS/FO determines it is necessary to prevent unreasonable conflicts with local subsistence hunting activities.

In enforcing this stipulation, the RS/FO will work with other agencies and the public to assure that potential conflicts are identified and efforts are taken to avoid these conflicts.

Subsistence whaling activities occur generally during the following periods:

> **August to October**: Kaktovik whalers use the area circumscribed from Anderson Point in Camden Bay to a point 30 kilometers north of Barter Island to Humphrey Point east of Barter Island. Nuiqsut whalers use an area extending from a line northward of the Nechelik Channel of the Colville River to Flaxman Island, seaward of the Barrier Islands.
>
> **September to October**: Barrow hunters use the area circumscribed by a western boundary extending approximately 15 kilometers west of Barrow, a northern boundary 50 kilometers north of Barrow, then southeastward to a point about 50 kilometers off Cooper Island, with an eastern boundary on the east side of Dease Inlet. Occasional use may extend eastward as far as Cape Halkett.

Summary of the Effectiveness of Stipulation No. 5. This stipulation, which has evolved from the Oil/Whaler Cooperative Program required in Sale 97, has been adopted in all Beaufort Sea sales since Sale 124, although the wording and requirements of the stipulation have changed over time. This stipulation helps reduce potential conflicts between subsistence hunters and whalers and potential oil and gas activities. This stipulation helps to reduce noise and disturbance conflicts from oil and gas operations during specific periods, such as the annual spring and fall whale hunts. It requires that the lessees meet with local communities and subsistence groups to resolve potential conflicts. This stipulation reduces the potential adverse effects from the proposed sales to subsistence-harvest patterns, sociocultural systems, and to environmental justice. This stipulation was requested during scoping by the North Slope Borough and the Alaska Eskimo Whaling Commission. The consultations required by this stipulation ensure that lessees, including contractors, consult and coordinate both the timing and siting of events with subsistence activities.

This stipulation has proven to be effective in mitigating prelease (primarily seismic activities) and exploration activities through the development of the annual oil/whaler agreement between the Alaska Eskimo Whaling Commission and oil companies. The requirements of the stipulation apply to development and production activities and can reduce the potential adverse effects to subsistence-whaling activities.

This stipulation provides mitigation to same subsistence-whaling activities as those being addressed in potential Stipulations 6a and 6b. Stipulation 5 is more general and applies all oil and gas activities and to the whole sale area, if adopted. Stipulations 6a and 6b address only a very specific area around Cross Island for development and production. Stipulation 6a prohibits the siting of permanent facilities outside the barrier islands, unless the lessee demonstrates to the Regional Supervisor/Field Operations, in consultation with Alaska Eskimo Whaling Commission and the North Slope Borough, that the proposed facility will not preclude reasonable subsistence access to whales. The consultation and negotiation process for the lessee could be very similar to the process used for Stipulation 5.

Because of the consultative nature of this stipulation, we cannot determine the differences in protection offered to subsistence-whaling activities, specifically in the Cross Island area, between Stipulations 5 and 6a. Stipulation 6b, which limits the siting of permanent facilities inside the barrier islands would provide little if any additional protection to that offered by Stipulation 5, because subsistence whales and the whale migration occur seaward of the barrier islands.

II.H.2. Other Stipulations Developed for Consideration in this EIS

II.H.2.a. Stipulation No. 6a - Permanent Facility Siting in the Vicinity Seaward of Cross Island

Permanent OCS production facility siting within a defined 10-mile radius seaward of Cross Island will be prohibited unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the North Slope Borough and the Alaska Eskimo Whaling Commission, that the development will not preclude reasonable subsistence access to whales. In making such a demonstration, the lessee shall follow the processes and requirements for consultation and mitigation of unreasonable conflicts as set out in Stipulation No. 5.

For purposes of analysis and for decision making, this stipulation is divided into two parts. Stipulation 6a will apply the 10-mile radius around Cross Island only outside the barrier islands. Stipulation 6b will apply the 10-mile radius only to those blocks within the barrier islands. The EIS analysts will conduct their evaluation of the effects of the proposed action and its Alternatives taking into account these two subsets of Stipulation 6 and will discuss any difference in effects that these stipulations may cause.

> **OPD; NR 06-03 Beechey Point; Blocks:** 6415A; 6416A; 6417A; 6418A; 6419A; 6464B, D, F; 6465A, B; 6466A, B; 6467A, B; 6468A, B; 6469A, B; 6470A; 6514B, D, E, F, H; 6515B, C, D, E; 6516B, C, F; 6517B, D; 6518B; 6519A, B; 6520A; 6521A; 6565B; 6566B, E; 6568B; 6569A, B; 6570A, B; 6571A, C; 6618B, C, E; 6619A, B, C; 6620B, D; 6621B; 6670B.

Summary of the Effectiveness of Stipulation No. 6a. This stipulation prohibits permanent facilities within the 10-mile radius seaward of the barrier islands, unless the lessee demonstrates to the satisfaction of the MMS Regional Director, in consultation with the North Slope Borough and the Alaska Eskimo Whaling Commission, that the development will not preclude reasonable subsistence access. This stipulation would reduce the potential conflict between subsistence-hunting activities and oil and gas development and operational activities with the key areas seaward of Cross Island where the community of Nuiqsut's subsistence whaling takes place. This stipulation also could reduce that potential that noise from a facility in this area could deflect the bowhead whales farther offshore.

As stated above, Stipulation 5 and potential Stipulations 6a and 6b are directed towards mitigating potential subsistence conflicts. To a great extent, these stipulations are duplicative. They both require the lessee to meet and consult with the subsistence hunters. They both require negotiation and agreement before activities could proceed. Stipulation 5 covers exploration activities in addition to development and production activities over the entire sale area. Stipulations 6a and 6b cover permanent facilities only within a 10-mile radius seaward of Cross Island.

Stipulation 6a could prevent the development and production of oil and gas resources (if they exist and are discovered during exploration), if it is determined by the Regional Director that the proposed facilities would preclude reasonable access to subsistence bowhead whales.

II.H.2.b. Stipulation No. 6b - Permanent Facility Siting in the Vicinity Shoreward of Cross Island

Permanent OCS production facility siting within a defined 10-mile radius shoreward of Cross Island will be prohibited unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the North Slope Borough and the Alaska Eskimo Whaling Commission, that the development will not preclude reasonable subsistence access to whales. In making such a demonstration, the lessee shall follow the processes and requirements for consultation and mitigation of unreasonable conflicts as set out in Stipulation 5.

> **OPD; NR 06-03 Beechey Point; Blocks:** 6616B, H, I; 6664C, H, I; 6665C, G, H, I, K; 6666D, G, H, J; 6667C, D, G; 6668B, C, E, F; 6669B, D, F; 6717B; 6718B, C, E, F, G; 6719B; 6768B; 6769I, J.

Note. Except for the aerial extent, the text or wording in Stipulations 6a and 6b are identical. If both stipulations are selected, they may be combined. Their locations are shown on Map 3.

Summary of the Effectiveness of Stipulation No. 6b. Stipulation 6b prohibits permanent facilities within the 10-mile radius shoreward of the barrier islands, unless the lessee demonstrates to the satisfaction of the MMS Regional Director, in consultation with the North Slope Borough and the Alaska Eskimo Whaling Commission, that the development will not preclude reasonable subsistence access. This stipulation would reduce the potential for collisions with oil and gas facilities for marine and coastal birds, including the spectacled and Steller's eiders. This stipulation would provide little protection to subsistence-whaling activities, because the whale migration and most whale hunting (based on the whale-strike data) take place outside the barrier islands, not inside. This stipulation would provide little or no additional protection to subsistence whaling or bowhead whales from that provided by Stipulation 5. The increased protection offered by this stipulation to marine and coastal birds, including the spectacled and Steller's eiders, to eliminate potential collisions with offshore oil and gas facilities is not significant to the populations of concern.

II.H.2.c. Stipulation No. 7 - Pre-Booming Requirements for Fuel Transfers

Fuel transfers (excluding gasoline transfers) of 100 barrels or more occurring 3 weeks prior to or during the bowhead whale migration will require pre-booming of the fuel barge(s). The fuel barge must be surrounded by an oil-spill-containment boom during the entire transfer operation to help reduce any adverse effects from a fuel spill. This stipulation is applicable to the blocks and migration times listed in the stipulation on Industry Site-Specific Bowhead Whale-Monitoring. The Lessee's oil-spill-contingency plans must include procedures for the pretransfer booming of the fuel barge(s).

Summary of the Effectiveness of Stipulation No. 7. This stipulation would lower the potential effects to water quality, lower trophic-level organisms, subsistence resources, and sociocultural systems by providing additional protection to the bowhead whale from potential fuel spills that may occur just prior to or during the bowhead whale-migration period. This stipulation would be an added caution to further reduce the chance of any fuel spill contacting a bowhead whale. It would moderate the adverse effects of a fuel spill to water quality. Such a spill is unlikely to occur; however, if it did occur just prior to or during the whale migration, it could result in adverse impacts to the bowhead whale and subsistence hunting. This stipulation would be effective in reducing those risks of harm to a whale or that a harvested whale may be tainted from a potential spill by containing any potential spill within the boom area. This requirement applies only to period just prior to and during the whale-migration period. A similar procedure is part of the Northstar fuel-transfer plan.

II.H.2.d. Stipulation No. 8 – Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eiders

To minimize the likelihood that migrating spectacled or Steller's eiders will strike lease structures associated with offshore drilling, all structures so identified by MMS, must be lighted and/or marked in a manner that does not attract them and minimizes the likelihood they would collide with the structures. The MMS and the Fish and Wildlife Service will cooperatively develop lighting requirements and identify where, when, and on what type of structures the requirements should be applied. Specific lighting requirements will be developed by April 1, 2004, at which time MMS will issue these requirements.

The radiation of light outward from structures must be minimized by shading and/or light fixture placement to direct light inward and downward to living and work surfaces while minimizing light radiating upward and outward. These requirements will not apply between October 31 and May 1 of each year, when eiders are not likely to be present.

Lessees are required to report Steller's and/or spectacled eiders injured or killed through collisions with lease structures, to the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska at (907) 456-0499 for instruction on the handling and disposal of the injured or dead bird.

Summary of the Effectiveness of Stipulation No. 8. The Biological Opinion issued by the Fish and Wildlife Service specifies a reasonable and prudent measure necessary and appropriate to minimize potential adverse impacts to this species. To be exempt from the prohibitions of Section 9 of the Act, the MMS must comply with the terms and conditions identified in the Biological Opinion. This stipulation requires all structures to be lighted and/or marked to improve visibility to migrating spectacled and Steller's eider, the minimization of outward radiating light, and the reporting of any injured or killed spectacled or Steller's eider. The lighting requirements do not apply between October 31 and May 1 of each year, when eiders are not likely to be present.

A lighting strategy will be developed jointly by the MMS and the Fish and Wildlife Service using available information on bird-avoidance measures. This strategy will be modified, as appropriate, if significant new information on bird-avoidance measures becomes available during activities covered by this consultation. Modification will be developed jointly by the MMS and the Fish and Wildlife Service.

This stipulation could reduce the potential for spectacled and Steller's eiders to strike structures, which would lessen the potential effects of OCS exploration and development on these species.

II.H.3. Standard Information to Lessee Clauses

Information to Lessee clauses 1 through 16 are standard and apply to OCS activities in the Beaufort Sea. They are considered part of the proposed action and alternatives for the Beaufort multiple-sale EIS for analysis purposes.

No. 1 - Information on Community Participation in Operations Planning
No. 2 - Information on Kaktovikmiut Guide *In this Place*
No. 3 - Information on Nuiqsutmiut Paper
No. 4 - Information on Bird and Marine Mammal Protection
No. 5 - Information on River Deltas
No. 6 - Information on Endangered Whales and MMS Monitoring Program
No. 7 - The Availability of Bowhead Whales for Subsistence-Hunting Activities
No. 8 - Information on High-Resolution Geological and Geophysical Survey Activity
No. 9 - Information on Polar Bear Interaction
No. 10 - Information on the Spectacled Eider and Steller's Eider
No. 11 - Information on Sensitive Areas to be Considered in Oil-Spill-Contingency Plans
No. 12 - Information on Coastal Zone Management
No. 13 - Information on Navigational Safety
No. 14 - Information on Offshore Pipelines
No. 15 - Information on Discharge of Produced Waters
No. 16 - Information on Use of Existing Pads and Islands

No. 1 - Information on Community Participation in Operations Planning. Lessees are encouraged to bring one or more residents of communities in the area of operations into their planning process. Local communities often have the best understanding of how oil and gas activities can be conducted safely in and around their area without harming the environment or interfering with community activities. Involving local community residents in the earliest stages of the planning process for proposed oil and gas activities can be beneficial to the industry and the community. Community representation on management teams developing plans of operation, oil spill contingency plans, and other permit applications can help communities understand permitting obligations and help the industry to understand community values and expectations for oil and gas operations being conducted in and around their area.

No. 2 - Information on Kaktovikmiut Guide *In This Place*. The people of Kaktovik, the Kaktovikmiut, have compiled "A Guide for Those Wishing to Work in The Country of the Kaktovikmiut." The guide's intent, in part, is to provide information that may promote a better understanding of their concerns. Lessees are encouraged to obtain copies of the guide and to incorporate it into their Orientation Program to assist in fostering sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which they will be operating.

No. 3 - Information on Nuiqsutmiut Paper. The people of Nuiqsut, the Nuiqsutmiut, have compiled a paper for people working in their country. The paper provides information that may promote a better understanding of their concerns. Lessees are encouraged to obtain copies of the paper and to incorporate it into their Orientation Program to assist in fostering sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which they will be operating.

No. 4 - Information on Bird and Marine Mammal Protection. . Lessees are advised that during the conduct of all activities related to leases issued as a result of this sale, the lessee and its agents, contractors, and subcontractors will be subject to the provisions of the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 U.S.C. 1361 et seq.); the Endangered Species Act (ESA), as amended (16 U.S.C. 1531 et seq.); and applicable International Treaties.

Lessees and their contractors should be aware that disturbance of wildlife could be determined to constitute harm or harassment and thereby be in violation of existing laws and treaties. With respect to endangered species and marine mammals, disturbance could be determined to constitute a "taking" situation. Under the ESA, the term "take" is defined to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Under the MMPA, "take" means "harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal." These Acts and applicable Treaties require violations be reported to the NMFS or the FWS, as appropriate.

Incidental taking of marine mammals and endangered and threatened species is allowed only when the statutory requirements of the MMPA and/or the ESA are met. Section 101(a)(5) of the MMPA (16 U.S.C. 1371(a)(5)) allows for the taking of small numbers of marine mammals incidental to a specified activity within a specified geographical area. Section 7(b)(4) of the ESA (16 U.S.C. 1536(b)(4)) allows for the incidental taking of endangered and threatened species under certain circumstances. If a marine mammal species is listed as endangered or threatened under the ESA, the requirements of both the MMPA and the ESA must be met before the incidental take can be allowed.

Under the MMPA and ESA, the NMFS is responsible for species of the order Cetacea (whales and dolphins) and the suborder Pinnipedia (seals and sea lions) except walrus; the FWS is responsible for polar bears, sea otters, walrus, and birds. Procedural regulations implementing the provisions of the MMPA are found at 50 CFR Part 18.27 for FWS, and at 50 CFR Part 228 for NMFS.

Lessees are advised that specific regulations must be applied for and in place and that a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) must be obtained by those proposing the activity to allow the incidental take of marine mammals whether or not they are endangered or threatened. The regulatory process may require 1 year or longer.

Of particular concern is disturbance at major wildlife concentration areas, including bird colonies, marine mammal haulout and breeding areas, and wildlife refuges and parks. Maps depicting major wildlife concentration areas in the lease area are available from the RS/FO. Lessees are also encouraged to confer with the FWS and NMFS in planning transportation routes between support bases and lease holdings.

Lessees should exercise particular caution when operating in the vicinity of species whose populations are known or thought to be declining and which are not protected under the ESA; such as, Pacific walrus. These regulations have been extended until March 31, 2003 (50 CFR 18.123 et seq.). Incidental take regulations are promulgated only upon request and the FWS must be in receipt of a petition prior to initiating the regulatory process. Incidental, but not intentional, taking is authorized only by U.S. citizens holding an LOA issued pursuant to these regulations. An LOA or IHA must be requested annually.

Behavioral disturbance of most birds and mammals found in or near the lease area would be unlikely if aircraft and vessels maintain at least a 1-mile horizontal distance and aircraft maintain at least a 1,500-foot vertical distance above known or observed wildlife concentration areas, such as bird colonies and marine mammal haulout and breeding areas.

For the protection of endangered whales and marine mammals throughout the lease area, it is recommended that all aircraft operators maintain a minimum 1,500-foot altitude when in transit between support bases and exploration sites. Lessees and their contractors are encouraged to minimize or reroute trips to and from the leasehold by aircraft and vessels when endangered whales are likely to be in the area.

Human safety will take precedence at all times over these recommendations.

No. 5 - Information to Lessees on River Deltas. Lessees are advised that certain river deltas of the Beaufort Sea coastal plain (such as the Kongakut, Canning, and Colville) have been identified by the FWS as special habitats for bird nesting and fish overwintering areas, as well as other forms of wildlife. Shore-based facilities in these river deltas may be prohibited by the permitting agency.

No. 6 - Information on Endangered Whales and MMS Monitoring Program. Lessees are advised that the MMS intends to continue its area wide endangered bowhead whale monitoring program in the Beaufort Sea. The program will gather information on whale distribution patterns which will be used by MMS and others to assess impacts on bowhead whales.

The MMS will perform an environmental review for each proposed exploration plan and development and production plan, including an assessment of cumulative effects of noise on endangered whales. Should the review conclude that activities described in the plan will be a threat of serious, irreparable, or immediate harm to the species, the RS/FO will require that activities be modified, or otherwise mitigated before such activities would be approved.

Lessees are further advised that the RS/FO has the authority and intends to limit or suspend any operations, including preliminary activities, as defined under 30 CFR 250.201, on a lease whenever bowhead whales are subject to a threat of serious, irreparable, or immediate harm to the species. Should the information obtained from MMS or lessees' monitoring programs indicate that there is a threat of serious, irreparable, or immediate harm to the species, the RS/FO will take action to protect the species. The RS/FO may require the lessee to suspend operations causing such effects, in accordance with 30 CFR 250.168. Any such suspensions may be terminated when the RS/FO determines that circumstances which justified the ordering of suspension no longer exist.

No. 7 - Information on the Availability of Bowhead Whales for Subsistence Hunting Activities. Lessees are advised that the NMFS issues regulations for incidental take of marine mammals, including bowhead whales. Incidental take regulations are promulgated only upon request and the NMFS must be in receipt of a petition prior to initiating the regulatory process. Incidental takes of bowhead whales are allowed only if an LOA or an IHA is obtained from the NMFS pursuant to the regulations in effect at the time. An LOA or an IHA must be requested annually. In issuing an LOA or an IHA, the NMFS must determine that proposed activities will not have an unmitigable adverse effect on the availability of the bowhead whale to meet subsistence needs by causing whales to abandon or avoid hunting areas, directly displacing subsistence users, or placing physical barriers between whales and subsistence users.

Lessees are also advised that, in reviewing proposed exploration plans which propose activities during the bowhead whale migration, the MMS will conduct an environmental review of the potential effects of the activities, including cumulative effects of multiple or simultaneous operations, on the availability of the bowhead whale for subsistence use. The MMS may limit or require operations be modified if they could result in significant effects on the availability of the bowhead whale for subsistence use.

The MMS and the NMFS will establish procedures to coordinate results from site-specific surveys required by Stipulation No. 4 and NMFS LOA's or IHA's to determine if further modification to lease operations are necessary.

No. 8 - Information on High-Resolution Geological and Geophysical Survey Activity. Lessees are advised of the potential effect of geological and geophysical (G&G) activity to bowhead whales and subsistence hunting activities. High resolution G&G surveys are distinguished from 2-D and 3-D geophysical surveys by the magnitude of the energy source used in the survey, the size of the survey area, the number and length of arrays used, and duration of the survey period. High resolution G&G surveys are typically conducted after a lease sale in association with a specific exploration or development program or in anticipation of future lease sale activity. The 2-D and 3-D geophysical surveys are typically conducted prior to lease sales.

Lessees are advised that all G&G survey activity conducted in the Beaufort Sea Planning Area, either under the pre-lease permitting regulations at 30 CFR 251, or as part of an approved exploration or development and production plan under 30 CFR 250, is subject to environmental and regulatory review by the MMS. It is the intention of MMS to treat pre-lease G&G activities in a manner similar to the post-lease G&G activities. The MMS has standard mitigating measures which are applied to these activities, and lessees are encouraged to review these measures before developing their applications for G&G permits. Copies of the non-proprietary portions of all G&G permit applications will be provided by MMS to the NSB, the AEWC, and directly affected subsistence communities for comment. The MMS may impose restrictions (including the timing of operations relative to open water) and other requirements (such as having a locally approved coordinator on board) on G&G surveys to minimize unreasonable conflicts between the G&G survey and subsistence whaling activities.

Lessees and applicants are advised that MMS will require any proposed G&G activity to be coordinated with directly affected subsistence communities, the NSB, and the AEWC to identify potential conflicts and develop plans to avoid these conflicts. Copies of the results of any required monitoring plans will be provided by MMS to the directly affected subsistence communities, the NSB, and the AEWC for comment.

No. 9 - Information on Polar Bear Interaction. Lessees are advised that polar bears may be present in the area of operations, particularly during the solid-ice period. Lessees should conduct their activities in a manner which will limit potential encounters and interaction between lease operations and polar bears. The FWS is responsible for the protection of polar bears under the provisions of the MMPA of 1972, as amended. Lessees are advised to contact the FWS regarding proposed operations and actions that might be taken to minimize interactions with polar bears. Lessees also are advised to consult "OCS Study MMS 93-0008, Guidelines for Oil and Gas Operations in Polar Bear Habitats."

The FWS must be in receipt of a petition for incidental take prior to initiating the regulatory process. Incidental takes of polar bears are allowed only if an LOA or an IHA is obtained from the FWS pursuant to the regulations in effect at the time. An LOA or an IHA must be requested annually.

Lessees are reminded of the provisions of the 30 CFR 250.300 regulations which prohibit discharges of pollutants into offshore waters. Trash, waste, or other debris which might attract polar bears or be harmful to polar bears should be properly stored and disposed of to minimize attraction of, or encounters with, polar bears.

No. 10 - Information on the Spectacled Eider and Steller's Eider. . Lessees are advised that the spectacled eider (*Somateria fischeri*) and Steller's eider (*Polysticta stelleri*) are listed as threatened by the FWS and are protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

Spectacled eiders and Steller's eiders are present in the Chukchi and Beaufort seas during spring migration in May and June. Males return to the open sea in late June, while nesting females remain on the arctic coastal tundra until late August or early September. Onshore activities related to OCS exploration, development, and production during the summer months (May-September) may affect nesting spectacled eiders and Steller's eiders.

Lessees are advised that exploration and development and production plans submitted to MMS will be reviewed by the FWS to ensure that the spectacled eider and the Steller's eider and their habitats are protected.

No. 11 - Information on Sensitive Areas to be Considered in the Oil-Spill Contingency Plans (OSCP) Lessees are advised that certain areas are especially valuable for their concentrations of marine birds, marine mammals, fishes, other biological resources, or cultural resources, and for their importance to subsistence harvest activities, and should be considered when developing OSCP's. Identified areas and time periods of special biological and cultural sensitivity include:

(1) the lead system off Point Barrow, April-June;

(2) the salt marshes from Kogru Inlet to Smith Bay, June-September;

(3) the Plover Islands, June-September;

(4) the Boulder Patch in Stefansson Sound, June-October;

(5) the Camden Bay area (especially the Nuvugag and Kaninniivik hunting sites), January, April-September, November;

(6) the Canning River Delta, January-December;

(7) the Barter Island - Demarcation Point Area, January-December;

(8) the Colville River Delta, January-December;

(9) the Cross, Pole, Egg, and Thetis Islands, June-October;

(10) the Flaxman Island waterfowl use and polar bear denning areas, January-December; (Leffingwell Cabin, a National Historic Site, is located on Flaxman Island);

(11) the Jones Island Group (Pingok, Spy, and Leavitt Islands) and Pole Island are known polar bear denning areas, November-April; and

(12) the Sagavanirktok River delta, January-December.

These areas are among areas of special biological and cultural sensitivity to be considered in the OSCP required by 30 CFR 250.300. Lessees are advised that they have the primary responsibility for identifying these areas in their OSCP's and for providing specific protective measures. Additional areas of special biological and cultural sensitivity may be identified during review of exploration plans and development and production plans.

Industry should consult with FWS or State of Alaska personnel to identify specific environmentally sensitive areas within National Wildlife Refuges or State special areas which should be considered when developing a project-specific OSCP.

Consideration should be given in an OSCP as to whether use of dispersants is an appropriate defense in the vicinity of an area of special biological and cultural sensitivity. Lessees are advised that prior approval must be obtained before dispersants are used.

No. 12 – Information on Coastal Zone Management. MMS advises lessees that under the Coastal Zone Management Act (16 U.S.C. 1451 et. seq., Section 307), as amended, a State with an approved Coastal Zone Management (CZM) Plan reviews certain OCS activities to determine whether they will be conducted in a manner consistent with their approved CZM plan. This review authority is applicable to activities described in OCS exploration plans and development and production plans that affect any land or water use or natural resource within the State's coastal zone. Generally, the MMS may not issue a permit for activities described in a plan unless the State concurs or is conclusively presumed to have concurred that the plan is consistent with its CZM plan. In cases where concurrence is not given or presumed, the matter may be appealed to the Secretary of Commerce.

The Department of Commerce, National Oceanic and Atmospheric Administration revised the regulations at 15 CFR 930 implementing the Federal consistency provisions of the Coastal Zone Management Act effective January 8, 2001. These revised regulations were published in the Federal Register on December 8, 2000, at 65 FR 77124, et. seq.

The Alaska Coastal Management Plan includes Statewide standards found in 6 AAC 80 and enforceable policies found within approved coastal district programs. For the Beaufort Sea OCS mineral lease sales, the enforceable policies of the North Slope Borough Coastal Management Program and the Statewide standards are applicable.

No. 13 - Information on Navigational Safety. Operations on some of the blocks offered for lease may be restricted by designation of fairways, precautionary zones, anchorages, safety zones, or traffic separation schemes established by the USCG pursuant to the Ports and Waterways Safety Act (33 U.S.C. 1221 et seq.), as amended. Lessees are encouraged to contact the USCG regarding any identified restrictions. The U.S. Army Corps of Engineers permits are required for construction of any artificial islands, installations, and other devices permanently or temporarily attached to the seabed located on the OCS in accordance with Section 4(e) of the OCSLA, as amended.

For additional information, prospective bidders should contact the U.S. Coast Guard, 17th Coast Guard District, P.O. Box 3-5000, Juneau, Alaska 99802, (907) 586-7355. For Corps of Engineers information, prospective bidders should contact U.S. Army Corps of Engineers, Alaska District, Regulatory Branch (1145b), P.O. Box 898, Anchorage, Alaska 99506-0898, (907) 753-2724.

No. 14 - Information on Offshore Pipelines. Lessees are advised that the Department of the Interior and the Department of Transportation have entered into a Memorandum of Understanding, dated December 10, 1996, concerning the design, installation, and maintenance of offshore pipelines. See also CFR 250.1000(c)(1). Bidders should consult both departments for regulations applicable to offshore pipelines. Copies of the MOU are available from the MMS Internet site and the MMS Alaska OCS Region.

No. 15 - Information on Discharge of Produced Waters. Lessees are advised that the State of Alaska prohibits discharges of produced waters on State tracts within the ten-meter depth contour. Discharges of produced waters into marine waters are subject to conditions of National Pollutant Discharge Elimination System permits issued by the EPA, and may also include a zero-discharge requirement on Federal tracts within the ten-meter contour.

No. 16 - Information on Use of Existing Pads and Islands. During the review and approval process for exploration and development and production plans, MMS will encourage lessees to use existing pads and islands wherever feasible.

Summary of the Effectiveness of the ITL Clauses. The effectiveness of the above ITL clauses varies. The primary purpose or focus of all of these ITL clauses is to provide the lessee with information about the requirements or mitigation required by other Federal and State agencies. The ITL clauses themselves provide no mitigation. However, the regulations and mitigation required by the other agencies are effective and do lower potential adverse impacts from proposed oil and gas activities. To the extent that the ITL clauses enlighten lessees and their contractors to these mitigative measures, then the ITL clauses also may be considered effective.

II.H.4. Other Information to Lessee Clauses Developed for Consideration in this EIS

No. 17 - Information to Lessees on Archaeological and Geological Hazards Reports and Surveys. Lessees are referred to the regulations at 30 CFR 250.194, Archaeological Reports and Surveys, and 30 CFR 250.203(b)(1)(ix) for geologic hazard surveys and reports. Following is a list of specific blocks in the Beaufort Sea Planning Area on which an archaeological resource may exist and for which an archaeological report will be required.

OPD: NR 05-01, Dease Inlet: Blocks: 6604-6606, 6654-6657, 6704-6709, 6754-6761, 6804-6812, 6856-6864, 6909-6915, 6960-6969, 7011-7023, 7062-7073, 7113-7123

OPD: NR 05-02, Harrison Bay North; Blocks: 7001-7007, 7051-7059, 7101-7112

OPD: NR 05-03, Teshekpuk: Blocks: 6015-6024, 6067-6072

OPD: NR 05-04, Harrison Bay: Blocks: 6001-6015, 6052-6066, 6106-6115, 6157-6168, 6208-6223, 6258-6274, 6309-6324, 6360-6374, 6410-6424, 6461-6471, 6513-6519, 6565-6566

OPD: NR 06-03, Beechey Point: Blocks: 6202-6207, 6251-6257, 6301-6308, 6351-6361, 6401-6417, 6456-6469, 6509-6520, 6561-6570, 6612-6614, 6616, 6618-6623, 6664-6674, 6717-6724, 6768-6771, 6819-6822, 6870-6871

OPD: NR 06-04, Flaxman Island: Blocks: 6651, 6701-6702, 6751-6754, 6802-6808, 6857-6860, 6910-6912, 6920-6924, 6961-6974, 7013-7022, 7066-7070, 7118-7119

OPD: NR 07-03, Barter Island: Blocks: 6853-6855, 6901-6909, 6958-6960, 7010-7011, 7061-7063, 7113-7114

OPD: NR 07-05, Demarcation Point: Blocks: 6016-6017, 6067-6069, 6118-6120, 6169-6170, 6222-6223, 6273-6275, 6324-6325

The regulations at 30 CFR 250.203(b)(1)(ix) require a shallow hazards report be included in all Exploration Plans (EPs) or Development and Production Plans (DPPs) at the time they are submitted to MMS for completeness review. In addition, for the blocks listed above, lessees must include a final archaeological resources report as required by 30 CFR 250.194 as part of any EP or DPP submitted to MMS for completeness review. Lessees are encouraged to combine surveys whenever feasible. The MMS will not consider a plan complete or initiate the regulatory review process without these documents.

Lessees may not set a drilling or production facility on location until MMS has approved an EP or DPP. Lessees are advised that seasonal constraints may prevent the following from occurring in the same year: collection of required data, obtaining of any necessary permits and coastal consistency certification, and the initiation of operations including mobilization and set down of the facility at location. Lessees are encouraged to plan accordingly.

Summary of the Effectiveness of the ITL Clause No. 17 - Information to Lessees on Archaeological and Geological Hazards Reports and Surveys. The primary purpose or focus of all of these ITL clauses is to provide the lessee with information about the requirements to protect potential prehistoric and historic archaeological sites. The ITL clause provide no mitigation; however, it does enlighten lessees and their contractors to the existence of regulations, and that reports and surveys will be required as part of their exploration and development plans when they are submitted. The existing laws and regulation provide mitigation for archaeological sites through the identification of potential sites and recommend avoidance when possible.

II.H.5. Other ITL Clauses Considered in this EIS

During the preparation of the draft EIS, the MMS evaluated the merits of adding an ITL clause to encourage lessees to consider noise-abatement methods, if needed, to reduce activity noise that may occur during and in the vicinity of the whale migration. However, no one commented on the merits of such an ITL, either in the hearings or through written comments. While lessees and operators may choose to incorporate noise-abatement techniques into their facility and equipment designs, the MMS did not find any merit in developing a mitigating measure or requirement at this time. This type of requirement may be considered and evaluated later during the environmental assessment of exploration and development plans.

II.I. Description of the Agency-Preferred Alternative

The National Environmental Policy Act (NEPA) Council on Environmental Quality regulations require an agency-preferred alternative be identified in the final EIS. The MMS has reviewed our analysis of the alternatives in the EIS, comments received on the draft EIS, and other pertinent information and developed the MMS Agency-Preferred Alternative. The MMS Agency-Preferred Alternative is the Proposal for Alternative I, the 2002 -2007 program area with 5 standard stipulations, 2 optional stipulations, 16 standard ITL clauses, and one optional ITL Clause.

Stipulation No. 1 - Protection of Biological Resources
Stipulation No. 2 - Orientation Program
Stipulation No. 3 - Transportation of Hydrocarbons
Stipulation No. 4 - Industry Site-Specific Bowhead Whale-Monitoring Program
Stipulation No. 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities
Stipulation No. 7 - Pre-Booming Requirements for Fuel Transfers
Stipulation No. 8 - Lighting of Structures to Minimize Effects to Spectacled and Steller's Eiders]

ITL No. 1 - Information on Community Participation in Operations Planning
ITL No. 2 - Information on Kaktovikmiut Guide *In this Place*
ITL No. 3 - Information on Nuiqsutmiut Paper
ITL No. 4 - Information on Bird and Marine Mammal Protection
ITL No. 5 - Information to Lessees on River Deltas
ITL No. 6 - Information on Endangered Whales and the MMS Monitoring Program
ITL No. 7 - Information on the Availability of Bowhead Whales for Subsistence-Hunting Activities
ITL No. 8 - Information on High-Resolution Geological and Geophysical Survey Activity
ITL No. 9 - Information on Polar Bear Interaction
ITL No. 10 - Information on the Spectacled Eider and the Steller's Eider
ITL No. 11 - Information on Sensitive Areas to be Considered in Oil-Spill-Contingency Plans
ITL No. 12 - Information on Coastal Zone Management
ITL No. 13 - Information on Navigational Safety
ITL No. 14 - Information on Offshore Pipelines
ITL No. 15 - Information on Discharge of Produced Waters
ITL No. 16 - Information on Use of Existing Pads and Islands
ITL No. 17 - Information to Lessees on Archaeology and Geological Hazards Reports and Surveys

Section IV.C analyzes effects on the 16 different resource categories in by alternative and by sale. Sections IV.D through IV.H are general topics common to all resources. Section IV.I analyzes the effects of a low-probability, very large oil spill. Section V discusses the effects of cumulative impacts as defined by NEPA. Section V.C analyzes the cumulative effects on the same 16 resources.

Section II.H describes the Mitigating Measures that are incorporated as part of this Agency-Preferred Alternative. Standard Stipulations are described in Section II.H.1, and Other Stipulations Developed for Consideration in the EIS are described in Sections II.H.2.a through Section II.H.2.c. Standard ITL's are described in Section II.H.3, and other ITL Clauses Considered in the EIS are described in Section II.H.4.

Adopting specific stipulations and ITL's provides environmental protection to minimize the environmental effects. The Agency-Preferred Alternative is almost the same as Alternative I, a separate analysis is not included, because it basically would repeat the entire Alternative I analysis. We suggest interested readers review summary tables II.A-4, II.A-5, and II.A-6 and the summary of the effectiveness of Stipulations No. 7 and No. 8 and ITL No. 17 in Sections II.H.2 and II.H.4. If the reader wants additional information, it can be found in the full analysis of effects by resource in Sections IV.C and V.C.

This information is provided to meet the Council on Environmental Quality regulations and should not be considered as the final decision or as approval of the project. The MMS will develop its final Record of Decision for Sale 186 following the distribution of the final EIS and the Proposed Notice of Sale. The final decision(s) for Sales 186, 195, and 202 and supporting rationale may be different than the Agency-Preferred Alternative.

If the Secretary of the Interior decides to proceed with each of the sales (186, 195, and 202), by not choosing Alternative II - No Lease Sale, the Secretary may choose one, all, some combination, or part of the deferral options to comprise the final Notice for Sale 186. The Secretary will have the full suite of options available for Sales 195 and 202 when those decisions are made in 2005 and 2007, respectively. The Secretary may choose the same options selected for Sale 186 or different options.

SECTION III

DESCRIPTION OF THE AFFECTED ENVIRONMENT

Contents for Section III

III. Description of the Affected Environment

In this section, we describe the environment that the proposed leasing action and the alternatives would affect. This description of the affected environment is supplemented by other EIS's that describe the existing environment for the Beaufort Sea and North Slope area. This includes the final EIS's for Sales BF and 71 (USDOI, BLM, Alaska OCS Office, 1979, 1982) and 87, 97, 124, 144, and 170 (USDOI, MMS, 1984, 1987, 1990a, 1996a, 1998), which are incorporated by reference. Included also are information in the EIS's for the Northstar Development Project (U.S. Army Corps of Engineers, 1999) and the Liberty Development Project (USDOI, MMS, Alaska OCS Region, 2002a). Summaries of these descriptions, supplemented by additional material, as cited, follow.

A. PHYSICAL CHARACTERISTICS OF THE BEAUFORT SEA PLANNING AREA

The following six resource categories describe the physical environment:
- Geology
- Climate and Meteorology
- Oceanography
- Sea Ice
- Chemical Oceanography and Water Quality
- Air Quality

III.A.1. Geology

III.A.1.a. Petroleum Geology of the North Slope Province

Past Petroleum Activities. The North Slope of Alaska is a rich petroleum province with 24 producing oil fields, including Prudhoe Bay, the largest field ever discovered in North America (Figure III.A-1). Current estimates by the State of Alaska report that original North Slope oil reserves were 19.2 billion barrels (State of Alaska, Dept. of Natural Resources, 2000), of which 13 billion barrels has been carried through the Trans-Alaska Pipeline System to outside markets since 1977. Industry has estimated that another 5 billion barrels of oil could be found in satellite fields near present North Slope infrastructure. Oil production from northern Alaska is transported south through the 800-mile Trans-Alaska Pipeline to Valdez, Alaska where it is loaded on marine tankers bound for the U.S. West Coast and Pacific Rim markets. After reaching a peak in 1988 at slightly more than 2.0 million barrels per day, the present production from fields in northern Alaska is approximately 1.0 million barrels per day. Although discovered natural gas resources total nearly 35 trillion cubic feet, gas has not been exported from the North Slope because there is no gas-transportation system. Numerous proposals are being considered to commercialize the natural gas in northern Alaska; however, it is unlikely that North Slope gas will be delivered to markets before 2008.

Exploration of northern Alaska dates back to the 1920's in the Brooks Range foothills in areas now included in the National Petroleum Reserve-Alaska. The first significant oil discovery was at Umiat in 1946 during the Navy drilling program. The first competitive lease sale on Federal land was held in 1958 by the Bureau of Land Management near the Umiat (oil) and Gubik (gas) discoveries in the southeastern National Petroleum Reserve-Alaska. The first competitive lease sale for State lands on the North Slope was held in 1964, and a series of major discoveries were made in the next few years (Prudhoe Bay in 1968, Kuparuk in 1969, Milne Point in 1970). Since then, the State of Alaska has held 35 sales on the North Slope and nearshore Beaufort Sea. Full-scale oil production began in 1977 after the completion of the pipeline.

The first offshore lease sale was held in 1979, offering nearshore State and Federal tracts in the Beaufort Sea. As a result of this sale, several large oil fields were discovered, including Endicott/Duck Island (582 million barrels), Seal Island/Northstar (175 million barrels), Niakuk (115 million barrels), and Tern/Liberty (120 million barrels). Endicott was the first offshore facility constructed in the Beaufort Sea, and production started there in 1987. Northstar is the second production facility located offshore; it began production in late 2001. Liberty was expected to be the third offshore facility, but it has been suspended. All of these offshore fields are produced from manmade gravel islands in relatively shallow water (less than 40 feet).

Following the initial discoveries in the nearshore Beaufort Sea, a series of offshore lease sales were held by the Federal Government beginning in 1982. In Sale 71 (1982), bonus bids totaling $2.067 billion reflected industry expectations for the Beaufort Sea, particularly for the Mukluk Prospect in Harrison Bay. A single dry well on Mukluk condemned this large prospect and was a severe blow to hopes of finding another Prudhoe Bay-sized field offshore. Five more Federal OCS lease sales have been held (Sale 87 in 1984; Sale 97 in 1988; Sale 124 in 1991; Sale 144 in 1996; Sale 170 in 1999), resulting in a total of 688 tracts leased for $3.6 billion (Figure III.A-2). Thirty exploration wells were drilled to test 20 prospects on Federal tracts in the Beaufort Sea Planning Area. Nine exploration wells are listed as "capable of producing in paying quantities," and five fields have been considered for commercial development (Northstar, Sandpiper, Hammerhead, Kuvlum, and Liberty). With the exception of Northstar and Liberty, all other discoveries were considered noncommercial and the tracts were relinquished. After more than 2 decades of leasing and exploration in the Beaufort Sea, production has just begun from Federal OCS tracts (Northstar).

III.A.1.b. Geologic History

Northern Alaska has a geologic history spanning hundreds of millions of years (Figure III.A-3). Several tectonic episodes have rearranged the configuration of geologic basins and produced conditions favorable to forming oil and gas pools. Large structural features are now concealed beneath the nearly flat coastal plain and offshore continental shelf (Figure III.A-4). A discussion of the geologic history of the Beaufort Shelf is contained in Grantz and May (1982); Craig, Sherwood, and Johnson (1985); and Hubbard, Edrich, and Rattey (1987). In middle to late Devonian time, a mountain-building event (orogeny) deformed and metamorphosed Precambrian to early Paleozoic strata grouped into the Franklinian sequence (Figure III.A-3). These rocks generally form the basement complex for both seismic data (no coherent seismic signals) and economic potential (no prospective reservoirs). In some areas on the eastern Beaufort shelf, however, the Franklinian sequence is less deformed and could hold oil/gas pools.

From Late Devonian to Jurassic time, sediments were shed southward from a northern highland onto a south-facing continental shelf. Nonmarine sediments of the Endicott Group, marine carbonates of the Lisburne Group, clastics of the Sadlerochit group, and carbonates and clastics of the Shublik and Sag River formations are grouped into the Ellesmerian Sequence (Figure III.A-3).

In mid-Jurassic time, the old continental margin began to uplift and break apart (rift) along a trend roughly parallel to the present Beaufort Sea coastline. The northern landmass moved away from Alaska leaving behind the present Arctic Ocean basin. Uplift associated with the rift event eroded the Ellesmerian sequence and resulted in regional unconformities that are key elements in many of the North Slope oil and gas fields (Figure III.A-4). A series of fault-bounded rift basins became local depocenters for sediments of the Kingak and Kuparuk formations. These strata are grouped into the Rift Sequence (MMS terminology) and are equivalent to the Beaufortian Sequence of Hubbard, Edrich, and Rattey (1987) (Figure III.A-3).

Coincident with continental rifting, tectonic activity began in the area of the Brooks Range to the south. The ancestral Brooks Range was formed from older terranes pushed northward. The mountain belt shed sediments to the north into a deep geologic basin (Colville basin, Figure III.A-4). The Colville basin formed as an east-west trough parallel to the orogenic belt and was filled with deltaic and marine strata during Cretaceous time. These clastic strata are grouped into the Brookian sequence (Figure III.A-3). The lower part of the sequence contains a thick sequence of deepwater shales and turbidite sands assigned to the Torok Formation. The upper part of the deltaic sequence contains shallow marine to nonmarine sediments assigned to the Nanushuk and Colville groups (Figure III.A-3).

By mid-Cretaceous time, seafloor spreading fully opened the arctic oceanic basin flanking Alaska to the north. The Beaufort continental margin was defined by a series of down-to-the-north faults along a regional flexure informally called the "Hinge Line" that marks the transition from continental crust (older sedimentary rocks) to oceanic crust (younger volcanic rocks). A broad basement ridge (the Barrow Arch) separates the Colville basin in the south and the continental margin facing the present-day Arctic Ocean (Figure III.A-4). The Barrow Arch trends roughly parallel to the modern Beaufort Sea coastline from the Canning River westward into the Chukchi Sea. The majority of North Slope fields lie along the crest of the Barrow Arch, because it acted as a focal point for oil migration from surrounding geologic basins.

By late Cretaceous time, sediments of the Brookian Sequence prograded across the Barrow Arch and began to fill the fault-bounded basins on the continental margin. In late Cretaceous and Tertiary time, the basins were progressively filled in a generally northeastward direction. Rapid deposition from delta systems produced large-scale gravity faults that trend subparallel to the present continental shelf break.

From early Tertiary time to the present, orogenic activity in the Brooks Range moved northward. By the mid-Tertiary, structural deformation reached the eastern Beaufort shelf and produced the complex structural features from Camden Bay to the northern Yukon province.

III.A.1.c. Coastal Physiography

The Arctic Coastal Plain is a vast, low-angle sloping plain that extends north from the Brooks Range to the Beaufort Sea. It varies in width from about 105 miles (170 kilometers) in the central coast to its narrowest near the border with Canada, where the Brooks Range is only about 10 miles (16 kilometers) from the coast. This tundra-covered, frozen plain exhibits many permafrost features such as pingos, ice wedges, thaw lakes, and patterned ground. Rivers dissect the plain and form deltas along the coast, the largest being the Colville Delta. Deltas contain features such as distributary channels, small islands, barrier bars, spits, and lagoons. Typical coastal features include bluffs, terraces, wave-cut cliffs, and beach ridges.

Across the Beaufort Sea coast, average rates of erosion vary from 1.5-4.7 meters per year (5-15.4 feet per year) (see USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-2), and short-term rates of 30 meters (98 feet) per year have been measured (Hopkins and Hartz, 1978a). Wave action and thermokarst erosion lead to generally higher erosion rates on bluffs, headlands, and coastal segments consisting of fine-grained and permafrost material. River deltas are prograding features and do not show any net erosion.

III.A.1.d. Offshore Shallow Geology

Shallow geological and geophysical data provide information about marine geology, archaeology, geotechnical and engineering considerations, and the substrate for critical biological habitats on the outer continental shelf. These data also provide invaluable insight into past climate and sea levels. The term "shallow" usually means a depth from the seafloor to about 1,000 feet (300 meters), which normally includes Pleistocene and Holocene sediments of the Quaternary Period. In the following discussion, shallow geological data include maps, diagrams of cross-sections and boreholes, and data from rock or sediment samples; the geophysical data are mainly high-resolution seismic-reflection records from instruments such as side-scan sonars (aerial-type views), fathometers, subbottom profilers, boomers, mini-sparkers, and air- or waterguns (all cross-sectional records with variable power, penetration, and resolution).

Previous Work: The Beaufort Sea area is one of most studied shelves in the world. The most recent studies have been primarily for the oil and gas industry, but a great abundance of older publications on the Beaufort Sea describe the regional and shallow geology (Dinter, Carter, and Brigham-Grette, 1990; Craig, Sherwood, and Johnson, 1985). Older but very exhaustive information also is found in research reports by the U.S. Geological Survey in specific areas or on specific objectives (Barnes, Rearic, and Reimnitz, 1985; Barnes, McDowell, and Reimnitz, 1977, 1978; Barnes and Reimnitz, 1974, 1979; Barnes, Schell, and Reimnitz, 1984; Black, 1964; Boucher, Reimnitz, and Kempema, 1980; Bruggers and England, 1979; Dinter, 1982, 1985; Dunton, Reimnitz, and Schonberg, 1982; Grantz et al., 1980, 1982; Grantz and Dinter, 1980; Grantz, Dinter, and Biswas, 1983; Grantz and Eittreim, 1979; Greenberg, Hart, and Grantz, 1981; Hopkins and Hartz, 1978a; Hopkins, 1967; Hunter and Hobson, 1974; Reimnitz et al., 1980, 1982; Reimnitz and Bruder, 1972; Reimnitz, Graves, and Barnes, 1985; Reimnitz and Kempema, 1982a,b; Reimnitz and Maurer, 1978a; Reimnitz, Rodeick, and Wolf, 1974; Reimnitz and Ross, 1979; Reimnitz, Toimil, and Barnes, 1978; Rodeick, 1979; Rogers and Morack, 1978; and Wolf, Reimnitz, and Barnes, 1985).

The Bureau of Land Management and, subsequently, the Minerals Management Service's Outer Continental Shelf Environmental Assessment Program, funded many geological and geophysical studies of the Beaufort Sea (Aagaard, 1981; Barnes and Reiss, 1981; Barnes, 1981; Barnes and Hopkins, 1978; Barnes and Rearic, 1983, 1985, 1986; Barnes, Rearic, and Reimnitz, 1983; Barnes and Reimnitz, 1980; Barry, 1979; Biswas and Gedney, 1978, 1979; Briggs, 1983; Brower, Searby, and Wise, 1977; Cannon, 1981; Dunton and Schonberg, 1983; Harrison and Osterkamp, 1981; Hartz and Hopkins, 1980; Hopkins and Hartz, 1978b; Hopkins, 1981; Hunter and Reiss, 1983; Kempema, 1983; Lewbel 1984; Naidu et al., 1982; Osterkamp and Harrison, 1978a,b; Osterkamp and Payne, 1981; Phillips et al., 1985a,b; Phillips and Reiss, 1983a,b; Pritchard, 1978; Reimnitz, Barnes, and Phillips, 1983; Reimnitz et al., 1979; Reimnitz and Maurer, 1978b; Reimnitz, Ross, and Barnes, 1979; Rogers and Morack, 1981, 1982; Sellman, Neave, and Chamberlain, 1981; Stringer, 1982; and Wolf, Barnes, and Reimnitz, 1983).

Industry also has collected site-specific geological data (Miller, 1996, 1997, 1998, 1999; Harding Lawson Assocs., 1981a, 1985, 1988; Woodward-Clyde Consultants, 1981, 1982; EBA Engineering Inc., 1991, 1996; Dames and Moore, 1983a,b, 1985a,b, 1993; Fairweather E&P Services, 1997a,b; ENSR Consulting and Engineering, 1990; Northern Technical Services, 1985) and geophysical data (Arctic Geoscience, Inc., 1997; Blanchet et al., 2000; Coastal Frontiers Corporation, 1996, 1997, 1998a,b,c, 1999; Comap Geophysical Surveys, 1983, 1985a,b; Dames and Moore, 1983a,b,c, 1984, 1985a,b,c; Deepsea Development Services (SAIC), 1993, 1994; Fairweather E&P Services, 1997; Fugro-McClelland, 1990, 1992; Harding Lawson Associates, 1981, 1983, 1985, 1988; LGL Ecological Research Assocs., Inc., 1998; McClelland-EBA Inc., 1986; Northern Technical Services, 1985a,b; Pelagos Corporation, 1987, 1990a,b,c; and Watson Company, 1998, 1999) for geologic hazards analysis (Thurston, Choromanski, and Crandall, 1999). These industry data sets, illustrated in Figure III.A-5, have been combined into a public GIS database (USDOI, MMS, 2002b).

III.A.1.d(1) Quaternary Geological History

The Quaternary geological history of most of Alaska (approximately the last 2 million years) generally reflects the advance and retreat of large glaciers and the direct effects of glacial processes. However, in the Beaufort Sea area, glaciers played only a small or indirect role in shaping the physical environment. Glaciation generally was limited to alpine and mountain-front glaciers and reached the present-day coast perhaps only in the east near Camden Bay during the Pleistocene. Much more influential in the Quaternary history and geomorphology along the Beaufort Sea coast were the processes associated with glacial and eustatic sea-level fluctuations.

Since the late Pleistocene, sea level has fluctuated from 21-30 feet (7-10 meters) higher than today (about 70,000 years ago), to 270 feet (90 meters) or more lower than today (18,000 years ago) (see USDOI, MMS, Alaska OCS Region, 2002a:Table VI.C-2).

At the lowstand 18,000 years ago, the paleo-shoreline was seaward of the present-day barrier islands. Sea level generally has risen from 18,000 years ago until today, with a few notable times when it leveled off or retreated and drowned, eroded, and buried onshore features such as river channels, lagoons, paleo-shorelines and associated coastal features, permafrost and related features, and organic deposits. About 13,000 years ago, sea level stood at minus 165 feet (minus 50 meters), corresponding to the late Wisconsin glacial advance and, near the beginning of the Holocene 11,000 years ago, it began to rise to its present position, which was reached about 5,000 years ago.

It commonly is assumed that the Holocene marine transgression extensively eroded and "planed off" terrestrial landforms as they progressively were drowned by the rising water. However, evidence from high-resolution seismic-profiling systems and coring have indicated that some recognizable landform features and terrestrial strata exist offshore and, therefore, have at least partially survived the transgression. These landforms have been modified by marine processes such as ice gouging, wave erosion, current and strudel scouring, and sedimentation.

III.A.1.d(2) Offshore Geology

III.A.1.d(2)(a Offshore Physiography

The Beaufort Shelf is relatively narrow, ranging from about 57 miles (90 kilometers) in the west to 30 miles (50 kilometers) in the east. Barnes and Reimnitz (1974) divided the shelf into three zones based on surficial sediment textures and the sedimentary environment: the inner shelf, from the coast to the 20-meter (65-foot) isobath; the central shelf, from the 20-meter (65-foot) isobath to the shelf break (the 60-meter [190-foot] isobath); and the shelf break, between the 60-meter (190-foot) and 200-meter (650-foot) isobaths (Figure III.A-6).

III.A.1.d(2)(b) Barrier Islands

Barrier islands are found along most of the Beaufort coast (Figure III.A-7). Some of these are dynamic constructional islands, and some are remnants of the Arctic Coastal Plain. Active constructional islands migrate westward and landward. Hopkins and Hartz (1978a) determined migration rates of 19-30 meters (62-98 feet) per year westward and 3-7 meters (10-23 feet) per year landward. The islands generally are becoming narrower and are breaking up into smaller segments as they migrate. Between 1950 and 1978, Reindeer Island split in two. Cross, Argo, and Narwhal islands also have broken up in the recent past, and channels between the island fragments appear to be deepening (Reimnitz et al., 1979). The barrier islands of the McClure Island group (Figure III.A-8) gradually are moving to the south and west, as suggested in a comparison of ocean charts from 1952 and 1990 (see USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-3). Sediment derived from these islands probably is being redeposited as shoals and sand ridges. Dinkum sands, a shallow shoal between Narwhal and Cross islands (Figure III.A-8), stood 1 meter above mean high water in 1950 but, because of erosion, disappeared beneath the water in 1975 (Reimnitz, Ross, and Barnes, 1979). Ice push, storm surges, and longshore currents during the open-water season are the major causes of the migration and breakup of barrier islands. Sediment grain size and lithology indicate that most constructional islands are isolated from their original sediment source (Hopkins and Hartz, 1978a).

III.A.1.d(2)(c Stratigraphy

III.A.1.d(2)(c)1) Pleistocene Deposits

Offshore, Pleistocene strata generally are a continuation of those under the Arctic Coastal Plain. They underlie the Beaufort shelf or are exposed at the seafloor where Holocene sediments are absent. Pleistocene strata were deposited during fluctuating sea levels and are collectively called the Gubik Formation (Black, 1964). When sea level dropped, streams and rivers deposited sediments as alluvial layers and deltas that together formed a seaward-thinning wedge. When sea level rose, silts and clays, with some boulders carried by floating pack ice, were deposited to form a landward-thinning wedge. The part of the Gubik Formation that contains these "erratic" glacially transported boulders is called the Flaxman

Island member, which was deposited in a shallow marine environment approximately 70,000 years ago (Dinter, 1985).

Pleistocene strata on the shelf generally thicken seaward away from the Brooks Range. Based on shallow seismic data (Dinter, Carter, and Brigham-Grette, 1990), the thickness of the Gubik Formation is hundreds to several hundreds of feet (hundreds of meters). The base of the Gubik Formation offshore is not well defined on seismic data, because it is similar to the marine and deltaic strata of the underlying Tertiary Brookian sequence and displays similar acoustic-reflection properties. Some researchers have recognized two units within the Pleistocene strata, an upper unit, and a lower unit. The lower unit correlates with strata encountered in shallow cores that consist mainly of terrestrial beach, lagoon, delta, and alluvial deposits composed of sands, sandy gravels, and silty sands (Duane Miller & Assocs., 1997, 1998). This unit is predominantly a nonmarine member of the Gubik Formation. The upper Pleistocene unit generally consists of marine silts, clays, sands, and isolated organic-rich silts and peat. It contains occasional erratic boulders and cobbles and, in Foggy Island and Camden bays, boulders and cobbles crop out at the seafloor, as illustrated in Figures III.A-10a, 10b, and 11 (Thurston, Choromanski, and Crandall, 1999).

Their similarity to onshore deposits and evidence from core-hole data (Dinter, Carter, and Brigham-Grette, 1990) suggest that the seafloor exposures of boulders and cobbles are likely outcrops of the marine Flaxman Member of the Gubik Formation. Erosion of the Flaxman sediments left a lag made of gravel, cobbles, and boulders and, where concentrated on the seafloor, it is called the Boulder Patch (Figure III.A-9). These boulders support an abundant fauna (Reimnitz and Ross, 1979; Dunton, Reimnitz, and Schonberg, 1982).

III.A.1.d(2)(c)2) Holocene (Recent)

Holocene sediments generally are thin across the shallow Beaufort shelf. Geotechnical borings (Bruggers and England, 1979; Duane Miller & Assocs., 1997, 1998; Harding Lawson Assocs., 1981b) show that Holocene sediments are mainly soft, reworked marine silts, clays, and fine-grained sands.

The sources of these deposits are stream sediment, eroded coastal sediments, and fine-grained marine sediments carried by coastal currents. Seasonal storms, offshore currents, and ice scour rework and redistribute fine-grained sediments. This reworked Holocene veneer covers older Holocene and Pleistocene features such as drowned lagoons, stream channels, and more recent features like ice gouges and strudel-scoured depressions. Borings in older Holocene and Pleistocene strata have recovered medium-stiff to stiff silts, sands with local organic-rich silts and stiff clays, and peat (Duane Miller & Assocs., 1997, 1998).

The distribution of modern sediments on the Beaufort shelf is influenced by the original distribution of Pleistocene sediments on the emergent coastal plain, their modification by the Holocene marine transgression and associated changes in depositional environments, stream-sediment input, and the environmental and oceanographic conditions on the modern Beaufort shelf. In the present sedimentary regime, the intensity of ice gouging, wave and current activity, and the composition of sediment delivered from rivers and from coastal bluffs are the most important factors affecting sediment composition and texture.

In general, surface sediments east of Oliktok Point contain a greater coarse-grained fraction than those to the west. Most of this sediment is derived from coastal bluffs and reflects the character of sediments on the adjacent coastal plain. In the western Arctic Slope, the coastal plain is broad (the Brooks Range sediment source is more than 90 miles [150 kilometers] south of the present coast), and rivers crossing the coastal plain are characteristically slow and meandering. The coastal plain sediments are predominantly fine-grained fluvial and thaw-lake deposits. East of Oliktok Point, the coastal plain is narrower and higher in average gradient. There, coastal plain sediments are composed of coarse sediment derived from coalescing alluvial fans and braided river systems.

The inner shelf is characterized by moderately sorted to well-sorted silts and fine sand, which are actively transported by waves and currents during the open-water season. This area lies in the fast-ice zone and is relatively unaffected by ice gouging. In places, sedimentary bedforms are more common than ice gouges. These sediments are derived primarily from coastal erosion and river effluents. The central-shelf sediments are predominantly gravelly muds. These sediments are highly disrupted by ice gouging and few sedimentary structures are preserved. The coarse clasts in the muds are angular and frequently striated, indicating that they were deposited as ice-rafted debris. The shelf-break facies is characterized by a 2- to 8-inch (5- to 20-centimeter) thick unit of muddy gravel overlying a clayey silt unit. The surface unit generally becomes coarser grained to the east, where it contains abundant fauna and is bioturbated. In the lower clayey silt unit, bioturbation is uncommon. Water depths here prevent most modern ice gouging, because most ice keels do not reach the seafloor.

Superimposed on these general sediment zones are numerous areas of coarse-grained surface sediments on the Beaufort shelf. These generally are thin and discontinuous. However, large bodies of coarse sediment are located on the shelf as constructional islands (discussed under III.A.1.d(2)(b) Barrier Islands) and submerged shoals. The most prominent of the shoals is the Reindeer-Cross Islands ridge (Figure III.A-8), which extends several kilometers northwest of Reindeer Island (Rodeick, 1979). In Harrison Bay, two low, sandy shoals of coalescing sand waves occur. These shoals each may contain 100,000 cubic meters of sand (Briggs, 1983). High-resolution seismic profiles indicate that at least some of these shoals and sand waves are migrating over ice-gouged sediments.

In outer Harrison Bay, there is a series of shoals in 50-65 feet (15-20 meters) of water. These shoals probably are related to physical processes within the stamukhi zone; they are located on the shoreward edge of the stamukhi zone (Reimnitz and Maurer, 1978a). These shoals include Weller Bank in outer Harrison Bay and Stamukhi Shoal north of the Jones Islands. The surface of these features is covered by coarse sand and gravel. However, sandy mud found in ripple troughs on Weller Bank (Barnes and Reiss, 1981) indicates that finer material may underlie the surface of these features.

The distribution of clay on the Beaufort Shelf suggests that they are detrital and not formed in place by chemical alteration (Naidu and Mowatt, 1983). There is no obvious modern source for smectite clay on the outer shelf, and these may be relict Pleistocene or older sediments. This implies that modern sedimentation rates are low on these parts of the shelf.

Holocene sediments on the outer shelf of the Beaufort Sea are not well mapped, and their thickness is unknown. Uniboom lines, from Dinter (1982) indicate that the transparent layer he interprets as the Holocene sequence is wedge shaped, thickening to more than 150 feet (45 meters) at the shelf edge off Camden Bay. Reimnitz et al. (1982) collected grab samples from the outer shelf in the same area and reported the occurrence of relict surficial gravels. They suggest that much of what Dinter (1982) identified as Holocene in age actually is Pleistocene. Knowing the age of sediments on the outer shelf and upper slope is useful, because they are involved in massive slumps and would help determine the most recent age of slump activity. The Holocene sequence is thin or absent over the anticlines north of Barter Island, where historic seismicity and shallow faults exist.

III.A.1.d(2)(d) Seafloor Features

III.A.1.d(2)(d)1) Permafrost

The Beaufort shelf was exposed to the Arctic atmosphere during several Pleistocene lowstands of sea level (see USDOI, MMS, Alaska OCS Region, 2002a:Table VI.C-2). During this time, bonded permafrost formed to depths of several hundred meters beneath the exposed shelf (Hunter and Hobson, 1974). During subsequent highstands of sea level, the bonded permafrost partially melted both from above by thermal heating from warm seawater and by saline advection from the seawater into the underlying sediment, and from below by geothermal heating. Coreholes have shown that seafloor sediments are at or below the freezing point, although it is not bonded permafrost (Miller, 1996, 1997, 1998, 1999; Harding Lawson Assocs., 1981a, 1985, 1988; Woodward-Clyde Consultants, 1981, 1982; EBA Engineering Inc., 1991, 1996; Pelagos Corp., 1990a,b; Dames and Moore, 1983a,b, 1985a,b, 1993; Fairweather E&P Services, 1997a,b; ENSR Consulting and Engineering, 1990; Northern Technical Services, 1985).

III.A.1.d(2)(d)2) Ice Gouges

Ice gouging is intense and almost pervasive on the shallow Beaufort Sea shelf in water depths between 60 and 165 feet (18 and 50 meters) deep (Barnes and Rearic, 1985, 1986; Barnes, Rearic, and Reimnitz, 1985; Barnes, McDowell, and Reimnitz, 1977; Wolf, Reimnitz, and Barnes, 1985). Ice gouging is one of the most important agents of sediment reworking on arctic continental shelves. It is particularly important at midshelf and innershelf water depths. On the midshelf, ice ridges with deep keels intensely scour the seafloor to depths of several meters. Reimnitz and Barnes (1974) found gouges as deep as 18 feet (5.5 meters), with ridges 9 feet (2.7 meters) high (total relief of 27 feet [8.2 meters]), in 128 feet (39 meters) of water off Smith Bay. For planning purposes, ice gouges with 33 feet (10 meters) of relief may be expected. The maximum incision depth of ice gouges tends to increase with increasing water depth down to a depth of about 150 feet (45 meters) (Barnes, 1981).

Although ice gouges are found across the entire shelf, they are concentrated in the stamukhi zone, generally between the 60- and 100-foot (18- and 30-meter) isobaths (Figures III.A-12 and III.A-13). Ice gouging is most intense on the seaward slopes of shoals and islands near the stamukhi zone. Little or no ice gouging occurs on their shoreward side (Reimnitz et al., 1982). Off Prudhoe and Foggy Island bays, the inner boundary of high-intensity ice gouging is controlled by the island chains, generally 9-13 miles (15-20 kilometers) from the coast. In Harrison Bay where there are no barrier islands, two zones of high-intensity ice gouging occur: one near the 33-foot (10-meter) isobath and the other in 65 feet (20 meters) of water seaward of Weller Bank (Reimnitz, Toimil, and Barnes, 1978). These zones correspond to areas of abundant ice-ridge formation.

Inshore of the stamukhi zone (usually in water depths less than 60 feet [18 meters]), ice gouging is much less severe, with gouge depths generally less than 1 meter (see USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-9). According to Barnes, McDowell, and Reimnitz (1978), an average of 1% or 2% of the seafloor per year is gouged in this area, and current-related hydraulic bedforms dominate over ice gouges (Barnes and Reimnitz, 1974). Any ice gouges that formed would be buried by sand waves or sediment sheets.

Ice gouging is sparse in areas that lie beneath shorefast floating ice such as parts of Foggy Island Bay (Watson Company, 1998a,b, 1999; Arctic Geoscience, Inc., 1997; Blanchet et al., 2000; Coastal Frontiers Corporation, 1998), and Camden Bay (Fairweather E&P Services, 1997; Thurston, Choromanski, and Crandall, 1999). Modern ice gouging in areas of shorefast floating ice is confined to discontinuous, sparse, narrow, and shallow features (Figure III.A-14 and USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-6). In the shallow water of Camden Bay (20-30 feet [6-8 meters]), ice gouges generally are 6-12 feet (2-4 meters) wide and 3 feet (1 meter) deep. Foggy Island and Camden bays are protected from the large ice masses responsible for major ice gouging in other parts of the Beaufort Sea by the outlying barrier islands and by floating shorefast ice, which blocks most drift ice from entering the bay. The protection of the seafloor from gouging is what allows biological habitats to form in the Boulder Patch.

III.A.1.d(2)(d)3) Ice Push

On islands and coastal regions throughout the Beaufort Sea, ice-push and ice-override events transport and erode significant amounts of sediment. Ice push occurs when ice blocks, forced onshore by strong winds or currents, push sediment into ridges farther inland. On the outer barrier islands such as Narwhal and Cross islands, ice-push ridges up to 8 feet (2.5 meters) high and extending 330 feet (100 meters) inshore from the beach have been identified (Hopkins and Hartz, 1978a). Ice-push rubble has been found 65 feet (20 meters) inland over most of the arctic coast (Kovacs, 1984). At the Northstar pipeline shore crossing, ice rideup could extend as far as 32 feet (10 meters) inland (U.S. Army Corps of Engineers, 1999). Boulders in excess of 5 feet (1.5 meters) in diameter are found on some of these rubble piles. There are historic accounts of ice-push events, which have damaged manmade structures along the Beaufort coast. In January 1984, ice pileup overtopped the Kadluk, a 26-foot (8-meter) high caisson-retained drilling island located in Mackenzie Bay in the Canadian Beaufort Sea (Kovacs, 1984).

III.A.1.d(2)(d)4) Currents and Current Scour

Marine currents across the inner shelf of the Beaufort Sea are wind driven and strongly influenced by the presence or absence of ice. These coast-parallel currents transport sediment along barrier islands and coastal promontories. However, because of the short open-water season, the annual rate of longshore sediment transport is relatively low. Inner-shelf currents generally flow to the west in response to the prevailing northeast wind, although current reversals are common close to shore and during storms. On the open shelf, currents average 0.2 knot (between 7 and 10 centimeters per second) (Matthews, 1981). During storms, east-flowing currents with peak velocities of 2 knots (95 centimeters per second) have been measured, although typical storm-current velocities are an order of magnitude lower (Kozo, 1981). During the winter, under-ice currents generally are weak, less than 0.1 knot (2 centimeters per second), although some have been measured up to 0.5 knot (25 centimeters per second) in restricted passages around grounded ice blocks (Matthews, 1981). Geostrophic currents with velocities of up to 1 knot (50 centimeters per second) occur on the outer shelf, flowing parallel to the shelf-slope break in both easterly and westerly directions. The tidal range on the Beaufort shelf is small, 0.5-1 foot (15-30 centimeters) and, except in confined passages, tidal currents exert only a minor influence on the sedimentary regime (Matthews, 1981). However, they can be important scouring agents where waterflow on the shelf is restricted by bottomfast ice (Reimnitz and Kempema, 1982b) and by narrow passages between barrier islands and shoals.

III.A.1.d(2)(d)5) Strudel Scour

During spring runoff, landfast sea ice is inundated by river floodwaters. Extensive areas of the fast ice near major river mouths are covered as far as 3-4 miles (5-6.5 kilometers) from shore to depths of up to 5 feet (1.5 meters). When the floodwater reaches holes or small cracks in the ice, it rushes through with enough force to scour the bottom to depths of several meters by the process of strudel scour (Reimnitz, Rodeick, and Wolf, 1974). The resulting features are called strudel scours. Some of these strudel scours near major river mouths may be as deeps as 20 feet (6 meters) and as wide as 65 feet (20 meters) (Reimnitz, Rodeick, and Wolf, 1974). Generally, the craters are a few feet up to 10 feet deep (1-3 meters) and tens of feet across (Blanchet et al., 2000). Sheltered coastal areas and bays off major rivers, such as the Colville, Sagavanirktok, and Canning, are particularly susceptible to strudel scouring (Coastal Frontiers Corporation, 1999, 1998). In these areas, deltas can be totally reworked by strudel scouring in several thousand years (Reimnitz and Kempema, 1982a) (see USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-12).

III.A.1.d(2)(e) Subsurface Features

III.A.1.d(2)(e)1) Buried Channels

Buried, relict stream channels are evident throughout most of the inner and middle Beaufort shelf in areas offshore of modern river deltas (Figure III.A-10a). In Foggy Island Bay near the proposed Liberty Island, channels underlie the Holocene marine unit. These channels are cut into the Pleistocene unit and exhibit infill and overbank features (see USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-10). Most of these channels trend generally north and are extensions of the modern rivers such as the Canning or Sagavanirktok onto the paleo-Arctic Coastal Plain.

III.A.1.d(2)(e)2) Lagoons

Possible lagoon features are present in the shallow part of Foggy Island Bay and are expressed on seismic profiles as filled-in depressions. At the base of these depressions is a discontinuous, high-amplitude or “brightened” reflector, probably representing a peat layer (USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-1). Cores in the area (Duane Miller & Assocs., 1997, 1998) suggest such deposits are present (Dinter, Carter, and Brigham-Grette, 1990). Other areas in the shallow Beaufort shelf also may contain such features.

III.A.1.d(2)e)3) Permafrost

The occurrence and extent of permafrost offshore still is not well known. Bonded permafrost offshore appears to be related to the presence of overconsolidated, low-permeability silts and clays of the Flaxman Member of the Gubik Formation. These silts and clays form a barrier to the infusion of saltwater that would lower the thaw point and cause ice to melt (Duane Miller & Assocs., 1997).

Numerous refraction, borehole, and conductivity surveys indicate that permafrost is widespread beneath the Beaufort inner shelf. Seismic-refraction surveys were performed in Harrison Bay by Rogers and Morack (1981) and Neave and Sellmann (1983), in Simpson Lagoon by Neave and Sellmann (1983), on the barrier islands by Rogers and Morack (1981), and on the Canadian Beaufort shelf by Morack, McAulay, and Hunter (1983). Further data have been obtained from boreholes (Harding Lawson Assocs., 1979) and thermal probes in the BF-79 sale area (Rogers and Morack, 1981; Hopkins and Hartz, 1978b) and offshore of Cape Simpson (Harrison and Osterkamp, 1981). On the Canadian Beaufort, permafrost has been cored as far offshore as 32 kilometers north of Cape Bathurst (Hunter and Hobson, 1974). Seismic-refraction work by Sellmann, Neave, and Chamberlain (1981) indicates that on the Alaskan Beaufort shelf, a high-velocity layer interpreted to represent permafrost is present at least 15 kilometers north of Reindeer Island and at least 25 kilometers offshore of Harrison Bay.

The depth to the surface of subsea permafrost is highly variable, due to different degrees of ice bonding before it was inundated with warm water of the Holocene marine transgression and the amount and distribution of subsequent thawing probably due to the introduction of saline groundwater. Therefore, it is melting from above and below. In Stefansson Sound, U.S. Geological Survey boreholes (Harding Lawson Assocs., 1979) commonly encountered permafrost at depths shallower than 50 feet (15 meters). The depth to the surface of bonded permafrost varies greatly from less than 30 feet (9 meters) to greater than 98 feet (30 meters) over a distance of less than 7.5 miles (12 kilometers) (Harding Lawson Assocs., 1979). Some of the boreholes encountered a transition zone of partially bonded sediments between the unfrozen surface sediments and deeper, well-bonded sediments (Harrison and Osterkamp, 1981). This transition zone makes it difficult to accurately interpret the depth to the permafrost surface from both borehole logs and seismic-refraction data. Frozen sediment encountered in boreholes and interpreted to be well-bonded permafrost actually may be lenses of ice-bonded material in the transition zone. Similarly, high-velocity refractors may represent physical changes in the permafrost layer and may lie below the permafrost surface in the transition zone. As a result, there are differing interpretations of the depth to ice-bonded material between the U.S. Geological Survey boreholes (Harding Lawson Assocs., 1979) and the seismic refraction data of Rogers and Morack (1981).

Hopkins and Hartz (1978a) estimate that it takes only 40-50 years for well-bonded permafrost to form in a subaerial arctic environment. Permafrost, therefore, is expected to be present in the core of some barrier islands, which migrate across the seafloor. On Reindeer Island, the Humble Oil C-1 well encountered two layers of permafrost at depths of 0-62 feet (0-18.9 meters) and 298-420 feet (91-128 meters) (Sellmann and Chamberlain, 1979). The deeper layer probably is relict Pleistocene permafrost, while the shallow layer may have formed under modern arctic conditions since the island migrated to its present site.

The thickness of permafrost on the Beaufort shelf cannot be accurately determined from seismic-refraction data or shallow boreholes. However, the thickness of the permafrost layer beneath the coastal plain has been measured from numerous onshore wells in arctic Alaska and Canada. Onshore wells near Harrison Bay indicate that the permafrost layer thins to the west. East of Oliktok Point it is 1,640 feet (500 meters) thick, whereas west of the Colville River it is 984-1,312 feet (300-400 meters) thick (Osterkamp and Payne, 1981).

III.A.1.d(2)(e)4) Natural Gas Hydrates

Natural gas hydrates (solids composed of light gases caged in the interstices of an expanded ice-crystal lattice) commonly occur in deepwater areas of continental margins under low-temperature, high-pressure conditions (Macleod, 1982). On the Arctic shelf, gas hydrates may form at shallow depths associated with permafrost (Kvenvolden and McMenamin, 1980). In the Alaskan Arctic, gas hydrates are known to occur at shallow depths onshore at Prudhoe Bay (Kvenvolden and McMenamin, 1980), and hydrates may occur under similar conditions beneath the Beaufort inner shelf in areas underlain by permafrost (Sellmann, Neave, and Chamberlain, 1981; Collett, Barnett, and Beeman, 1994). Beneath the Beaufort continental slope, a gas-hydrate horizon is identified where water depths exceed 984 feet (300 meters) (Grantz et al., 1982; Collett, Barnett, and Beeman, 1994).

III.A.1.d(2)(f) Faulting and Seismicity

Several types of shallow faults are identified on the Beaufort shelf: high-angle, basement-involved faults that have both normal and strike-slip components (mapped principally along the Barrow Arch in Harrison Bay); listric growth faults (mapped seaward of the Hinge Line); reverse faults in outer Camden Bay and offshore of the Arctic National Wildlife Refuge; and down-to-the-north gravity faults (mapped along the shelf-slope break) (Grantz et al., 1982). Locally, two or more types may occur in close proximity.

High-angle faults occur along the Barrow Arch and are genetically related to basement tectonics of the Arctic Platform. In Harrison Bay, they offset Tertiary and older units (Craig and Thrasher, 1982). There is little evidence of Quaternary movement and no recent seismicity associated with these faults. However, they may act as conduits for gas migration, because "bright-spot" anomalies are commonly identified adjacent to the fault traces (Craig and Thrasher, 1982).

Shallow faults seaward of the Hinge Line include upper extensions of detached listric growth faults that have roots deep in the Brookian section, some of which may have been reactivated in late Cenozoic time. The distribution of these growth faults is known only partially because of a lack of high-resolution seismic coverage on the outer Beaufort shelf, especially in the west. These faults are mapped in greatest detail in the Camden Bay area where the Hinge Line approaches the Beaufort coast. Shallow faults also have been mapped beneath the outer shelf west of Cape Halkett and are reported to show 10-30 feet (3-10 meters) of Quaternary offset (Grantz, Dinter, and Biswas, 1983). In the Camden Bay area, near-surface faults have hundreds of feet (several tens of meters) of Quaternary offset (Grantz, Dinter, and Biswas, 1983) and, in contrast to the rest of the Beaufort shelf, Camden Bay is seismically active. Camden Bay is located at the northern end of a north-northeast-trending seismic zone that extends north from east central Alaska (Biswas and Gedney, 1979). The largest earthquake recorded in northeast Alaska was a magnitude 5.3 quake located 18 miles (30 kilometers) north of Barter Island (Biswas and Gedney, 1979). These events cluster along the axis of the Camden anticline. The faults in this area probably are older Hinge Line-related structures that were reactivated in late Tertiary and Quaternary time by the uplift of the Camden anticline (Craig, Sherwood, and Johnson, 1985). Seafloor expressions of active faults in Camden Bay mapped in the Warthog high-resolution survey area reach 10 feet (3 meters) (Thurston, Choromanski, and Crandall, 1999). Grantz and Dinter (1980) mapped fault scarps along two fault segments in Camden Bay, where they observed 20 feet (6 meters) of seafloor displacement. The evidence of seafloor scarps in this area is equivocal, however, because scarp heights are of the same magnitude as ice-gouge relief. In addition, the ice-gouging process should quickly smooth scarps formed on the seafloor. Therefore, active near-surface faults may be much more numerous in Camden Bay where ice gouging occurs than indicated by the number of seafloor scarps previously reported. Faults on the outer Beaufort shelf and upper slope are gravity faults related to large rotational slump blocks (Grantz and Dinter, 1980). On the eastern Alaskan Beaufort shelf, these slumps bound the seaward edge of the Beaufort Ramp. Shoreward of the Ramp, faults have surface offsets that usually range from 50-65 feet (15-20 meters) and, at one site, possibly as high as 230 feet (70 meters) (Grantz et al., 1982). The Beaufort Ramp itself may be a gigantic slump block, which is bounded by these gravity faults. The age of the shelf-edge faults is uncertain. If Grantz et al. (1982b) were correct in assuming that sediments on the outer shelf are Holocene in age, these faults have been active in Recent geologic time. If the surface sediments on the outer shelf are relict Pleistocene deposits, as suggested by Reimnitz et al. (1982), then these large gravity faults may have been quiescent throughout Holocene time (12,000 years Before Present to present). These faults pose an extreme hazard to bottomfounded structures on the outer Beaufort shelf and slope, because they could result in large downslope displacements. Even though there has been no historic seismicity associated with this type of fault on the Beaufort shelf, they may be moving by slow, aseismic creep. Large-scale gravity slumping of blocks on the outer shelf could be triggered by shallow-focus earthquakes centered in Camden Bay or in the Brooks Range, they also may be spontaneous or triggered by tidal forces, storm surges, or sediment loading.

III.A.1.d(2)(f)1) Sediment Slides

A chaotic sediment-slide terrane occurs along the length of the Beaufort outer shelf and upper slope seaward of the 164- to 197-foot (50- to 60-meter) isobath. Grantz et al. (1982b) have mapped several distinct landslide types, including large bedding-plane slides and block glides. The bedding-plane slides are most extensive on the Beaufort Ramp between 148° W. longitude and the Mackenzie Sea Valley (Grantz and Eittreim, 1979). These slides are 6-27 miles (10-43 kilometers) long and 230-750 feet (70-230 meters) thick. Pull-apart grabens and scarps are common on the landward margin of the slide terrane. Horizontal displacements of 656-7,544 feet (200-2,300 meters) are estimated to have occurred along slip planes that dip only 0.5-1.5 degrees (Grantz and Eittreim, 1979). The thinner slides probably are Holocene in age, although the sediments involved in sliding have not been directly dated.

Block glides are prominent between 155° and 158° W. longitude along the outermost shelf in water depths greater than 70 meters (Grantz and Eittreim, 1979). Multiple open cracks 26-56 feet (8-17 meters) deep, spaced 330-1,600 feet (100-500 meters) apart, occur throughout this slump terrane. Seismic-reflection data indicate that these blocks slide along failure surfaces, which are subparallel to the underlying bedding. The geomorphic character of the blocks indicates that they presently may be active.

Massive slumps occur on the Beaufort continental slope either spontaneously or by wave loading or earthquakes. As discussed previously, these features are bounded by gravity faults with total displacements estimated to be as great as 3,000 feet (1,000 meters) (Grantz et al., 1982).

III.A.1.d(2)(f)2) Overpressured Sediments

In the planning area, abnormally high pore pressures probably will be found in areas where Cenozoic strata are uncommonly thick, such as in the Kaktovik, Camden, and Nuwuk basins. Onshore in the Camden Basin, abnormal pressures are observed in both Tertiary and Cretaceous formations, where burial depths of Tertiary strata exceed 9,840 feet (3,000 meters). Abnormal pore pressures have not been encountered in onshore wells elsewhere on the Arctic Platform. In the Point Thomson area, pore-pressure gradients as high as 0.8 pounds per square inch per foot have been measured in sediments at burial depths of 13,120 feet (4,000 meters) (a pore-pressure gradient of 0.433 pounds per square inch per foot is considered normal). Excess pore pressures also are widespread in Cenozoic strata of the Mackenzie Delta area in the Canadian Beaufort (Hawkings et al., 1976).

In the Kaktovik Basin, the recently exhumed sedimentary rocks, which now lie near the axis of the Camden anticline, may preserve high pore pressures developed during a prior period of deep burial. The degree to which these sediments are overpressured would depend on the amount these sediments have been uplifted since folding began. Along the continental slope east of 146° W. longitude, a series of shale diapirs disrupts Tertiary sediments. These features have been attributed to liquefaction of the shale in response to an overpressured condition resulting from incomplete dewatering.

III.A.1.d(2)(f)3) Shallow Gas

Shallow gas is common in marine sediments. However, when gas is concentrated and under pressure by being trapped at shallow subsurface depths (about 300-3,000 feet [100-1,000 meters]), it poses a drilling hazard. Shallow gas is likely to be found on the Beaufort shelf, although no shallow gas has been detected in any offshore Beaufort Sea exploration wells due to avoidance of these anomalies, and because gas is not sampled at these shallow depths in an exploration well. Free-flowing gas was encountered directly in one U.S. Geological Survey borehole in Stefansson Sound (Harding Lawson Assocs., 1979). Also, numerous and various anomalies associated with gas or gas-charged sediments have been indicated on many seismic profiles throughout the area as isolated pockets possibly beneath permafrost, association with faulted strata, and as concentrations in Pleistocene coastal plain sediments and peat deposits (see USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-11). Published information on possible shallow gas, inferred from seismic data, include data from Stefansson Sound (Boucher, Reimnitz, and Kempema, 1980), in Harrison Bay (Craig and Thrasher, 1982; Sellmann, Neave, and Chamberlain, 1981), and on extensive areas of the outer shelf and upper slope (Grantz et al., 1982). In addition, many industry surveys collected for site clearance have indicated the possible presence of shallow gas (Thurston, Choromanski, and Crandall, 1999). Figure III.A-15 shows areas of acoustic anomalies in site surveys that probably are related to shallow gas.

Elsewhere beneath the inner shelf, the presence of gas is indicated by acoustically turbid zones and high-frequency signal attenuation on high-resolution seismic records. In Harrison Bay, Craig and Thrasher (1982) mapped shallow gas adjacent to near-surface faults on the basis of acoustic anomalies with bright spots (amplitude increase), reflector pulldown, and high-frequency signal attenuation.

On the outer shelf, a continuous band of acoustically turbid sediment, which Grantz et al. (1982b) interpret to be shallow gas, extends from the Canadian border west to at least 158° W. longitude. There also is a large area inferred to have a high concentration of shallow gas in the southwestern corner of the planning area north of Wainwright (Grantz et al., 1982a).

III.A.1.d(2)(f)4) Other Buried Features

Possible ice/sand-wedge, strudel-scour, ice-gouge, and small stream-cut features are visible on some records (see USDOI, MMS, Alaska OCS Region, 2002a:Figures VI.C-11 and VI.C-12), usually more toward shore. These relict features are covered over or filled in by Holocene deposits and they usually are no more than 3-6 feet (1-2 meters) below the seafloor.

III.A.2. Climate and Meteorology

Meteorological conditions primarily control the characteristics of the Beaufort Sea. Air temperature, precipitation, and wind speed and direction are the most important. Air temperature controls when river ice breaks up and how much heat transfers between the atmosphere and the water. Precipitation controls the timing and amount of freshwater input. Winds control the mixing and distribution of the water's physical properties by moving the water on the surface.

The onshore area next to the Beaufort multiple-sale area is within the Arctic Coastal Zone (Zhang, Osterkamp, and Stamnes, 1996). The Arctic Coastal Zone has cool summers and relatively warm winters, because it is near the ocean. Precipitation is lowest in this region, and more than 50% falls as snow. Table III.A-1 summarizes the climatic conditions for the Arctic Coastal Zone.

III.A.2.a. Air Temperature

Monthly average air temperatures for the Beaufort multiple-sale area rise above freezing only in June, July, and August. Even during these months, air temperature on any day may vary from near 0-20° Celsius. July typically is the warmest, with an average air temperature onshore of about 7-9° Celsius and offshore of 4-6° Celsius. December through March usually are the coldest months. Figures III.A-16, III.A-17, and III.A-18 show the seasonal variation of the mean monthly air-temperature maximums and minimums, over the period of record from 1949-1996 for Barter Island, Prudhoe Bay, and Barrow Alaska. Air temperatures generally remain below freezing for 9 months of the year. Average monthly temperatures range from -20 to +40° Fahrenheit at Barrow.

III.A.2.b. Precipitation

Figures III.A-16, III.A-17, and III.A-18 show the seasonal variation of the mean precipitation, snowfall, and snow depth averaged over the period of record from 1949-1996 for Barter Island, Prudhoe Bay, and Barrow. Summer rainfall is infrequent and averages less than 30 millimeters per month (Hummer, 1990, 1991). Occasional late-summer rainstorms can increase the amount of seasonal and annual rainfall. Although rainfall usually is light during the short summers, heavier rainstorms occasionally occur, most commonly in the foothills. Summer precipitation, generally greatest in July and August, is 114 millimeters at Sagwon (U.S. Department of Agriculture, 1996). Snow cover on the North Slope begins from late September to early October and disappears from late May through the middle of June (Zhang, 1993; Zhang, Stamnes, and Bowling, 1996). Warren Matumeak, a Barrow resident, reported that during the last part of September or October the weather begins to change; typically, snow is falling, and fog and ice form during this period (USDOI, MMS, 1990b:41). The timing of snowmelt varies mainly with changes in the incoming longwave radiation (Zhang, Bowling, and Stamnes, 1997). The average snow depth from January through April is 13.6, 3.7, and 10.2 inches, respectively, for Barter Island, Prudhoe Bay, and Barrow Alaska.

III.A.2.c. Winds

Wind speed and direction control coastal oceanographic conditions. Winds affect ice distribution, current speed and direction, vertical and horizontal mixing of watermasses, and wave action. The dominant wind direction in the open-water season is easterly to northeasterly. Easterly winds typically are more persistent in the early season (June and July). As the open-water season progresses, westerly winds are more frequent. Average wind speeds during the open-water season are near 5 meters per second in Stefansson

Sound. Wind speeds above 8 meters per second fully mix the vertical column of water in Stefansson Sound. Figure III.A-19 shows wind roses for Badami, Endicott, Milne Point, and Northstar for the year 2001.

Meteorological data from Tern Island in Foggy Island Bay during February through May show wind speeds ranging from 0-14 meters per second, with an average of 4-6 meters per second (Table III.A-2). The dominant wind direction during the ice-covered season is westerly.

Vincent Nageak stated: "It is difficult to find a leeward side among any of those three groups of islands…so we usually go to Foggy Island for protection (V. Nageak, as cited in Shapiro and Metzner, 1979). Regarding Cross Island, Archie Ahkiviana states:

> And then this high wind, we were down at Cross Island about a couple of years ago. We couldn't go off the island even though we'd gotten all our quotas in, 'cause of the high wind…. Well, there's just too much high winds. You know we go inside the Cross - those barrier islands. (Ahkiviana, as cited in USDOI, MMS, Alaska OCS Region, 2001b).

Archie Ahkiviana stated at the public hearing of the Liberty draft EIS:

> We have been observing very high strong winds nowadays at Cross Island. A very strong East wind blew over the Winch Shack which was 16' x 24' and was completely destroyed; and a second building 9' x 40' trailer was destroyed and was found blown over to the lagoon at Cross Island. These strong winds have recently been observed. The Nuiqsut whalers regard these very strong winds unusual and blame this on global warming and climatic changes. These incidents happened in the fall of 1999 (Ahkiviana, as cited in Alaska Eskimo Whaling Commission, 2001).

III.A.2.d. Storms

Lynch et al. (2001) show the Barrow high wind events from 1960-2000, concluding that high-wind events are common in fall and winter and rare in April, May, and June. They have not yet concluded whether the more frequent storms and the storms in April, May, and June are part of a new pattern. In the Sale 124 Public Hearing in Kaktovik, Mr. Ningeok stated that:

> …without any notice at all this storm would come upon us. No matter how beautiful a day, these sudden storms can come upon you. We were unloading the plane, at that moment, the plane did not leave, nor did we get done unloading the plane, and all the supplies for the DEW line were frozen out there because of this sudden snow storm which no one was able to do anything at all. (USDOI, MMS, 1990c).

Sarah Kunaknana reported that storms can come from different directions, but usually are from the north, and observed that the area inside the barrier islands is not affected heavily by storms (Sarah Kunaknan as cited in U.S. Army Corps of Engineers, 1999). Sarah Kunaknana indicated that a warm breeze and warming temperatures in the summer are indicators of an impending major storm (Nuiqsut Community Meeting, August 14, 1996 [USDOI, MMS, 1996b:2]). In recent public meetings, Barrow whaling captains John Nusunginya and James Ahsoak described how the weather changes constantly and is very unpredictable, and that the biggest storms occur in September (Barrow Whaling Captains Meetings, August 27 and 28, 1996 [USDOI, MMS, 1996c:3]). Jonas Ningeok, a Kaktovik resident, described the sudden and extreme storms that occur in the Alaskan Beaufort Sea:

> ...from experience, I know no matter how beautiful the day may look, in a moment's time, we can have a snow storm...that you can't even see [the] distance...to the end of the table.... It doesn't happen every year, but when it does happen, there's no telling [when].... As we were growing up, there have been several times when my...father [would] look up at the clouds, the sky, and tell us to get everything...all the firewood.... We'd get everything ready, and without any notice at all, it would seem like that all this storm would come upon us... (USDOI, MMS, 1990c:20-21).

III.A.2.e. Changes in the Arctic

Over the entire Arctic Ocean, the annual trend in surface-air temperature shows a warming of about 1.0° Celsius per decade in the eastern Arctic, primarily north of the Laptev and East Siberian seas, whereas the western Arctic shows no trend or even a slight cooling in the Canadian Beaufort Sea (Rigor, Colony, and Martin, 2000). During fall, the trends show a cooling of about 1.0° Celsius per decade over the Beaufort Sea and Alaska Sea (Rigor, Colony, and Martin, 2000). During spring a significant warming trend of 2° Celsius per decade can be seen over most of the Arctic. Summer shows no significant trend (Rigor, Colony, and Martin, 2000). Barrow has experienced a significant warming over the last 80 years, but this warming is not uniform for all seasons and is not uniform over the entire period from 1920-1980 (Lynch, et al. 2001).

For More Information on Meteorology: The EIS's for MMS Sales 124, 144, and 170; the Liberty Development and Production Plan; and the U.S. Army Corps of Engineers' Northstar Project discuss the regional meteorology of the Beaufort Sea (USDOI, MMS, 1990a, 1996a; 1998; USDOI, MMS, Alaska OCS Region, 2002a; U.S. Army Corps of Engineers, 1999). The Endicott Environmental Monitoring Reports from 1986 through 1990 discuss meteorology near Endicott and the surrounding area (Hummer, 1990, 1991; Cover, 1991; and Walter, Horgan, and Cover, 1991, 1992).

III.A.3. Oceanography

The Beaufort multiple-sale area lies within the Alaskan Beaufort Sea. The Alaskan Beaufort Sea extends from Point Barrow to the Canadian border. For this discussion, the Beaufort Sea is divided into two main areas: offshore, with water depths greater than 40 meters and nearshore, with water depths less than 40 meters.

III.A.3.a. Major Features and Water Depth

The Beaufort Sea multiple-sale area includes the continental shelf, slope, and rise of the Alaskan Beaufort Sea. Map 5 shows the major physiographic and bathymetric features within the sale area. Water depths within the sale area range from about 1 meter (approximately 3 feet) to more than 1,500 meters (4,921 feet). The major Beaufort Sea features are the barrier islands and shoals, the shelf, slope, rise, and abyssal plain. Shoals rise 5-10 meters (16-33 feet) above the surrounding seafloor and are found in water depths of 10-20 meters (33-65 feet). The barrier islands are low-lying features that move with time. These barrier islands are washed over in large storms. Islands in the Arctic exhibit characteristics of both the wave-dominated and mixed-energy types identified by Hayes (1976). Like typical wave-dominated barrier islands, most islands in the Arctic are narrow (less than 250 meters) and have low elevations (less than 2 meters). However, islands in the Arctic tend to be shorter (average less than 5 kilometers) than most wave-dominated islands (15-25 kilometers) (Stutz, Trembainis, and Pilkey, 1999). The shelf varies in width between Barrow and Canada. The major canyon is the Barrow Canyon just northeast of Barrow. The slope has water depths averaging from 60 (197 feet) to 1,500 meters (4,921 feet).

III.A.3.b. Offshore

The offshore is influenced primarily by the large-scale arctic circulation, which is driven by the large-scale atmospheric-pressure fields.

III.A.3.b(1) Circulation and Currents

Within the Beaufort multiple-sale area, the large-scale shelf and slope surface-water circulation is dominated by the Beaufort Gyre, which moves water to the west in a clockwise motion at a mean rate of about 5-10 centimeters per second (Map 5). Below the surface waters, on the slope, the Beaufort Undercurrent moves to the east with frequent reversals to the west (Coachman and Barnes, 1961, Aagaard et al., 1989). The Beaufort Undercurrent is part of a larger cyclonic circulation transporting Atlantic Water to the Canadian Basin. Long-term mean speeds of the undercurrent are about 5-10 centimeters per second, but daily mean values may be 10-times greater.

The Alaska Coastal Current flows northeastward along the Chukchi Sea coast at approximately 5 centimeters per second and drains into the Barrow Canyon (Johnson, 1989; Weingartner et al., 1998). Barrow Canyon mean currents range from 14-23 centimeters per second, with maximum current speeds of approximately 100 centimeters per second (Weingartner et al., 1998). Flow reversals occur in Barrow Canyon with upwelling. These reversals are tied to the pressure gradient associated with the variable longshore current (Johnson, 1989; Aagaard and Roach, 1990).

III.A.3.b(2) Temperature and Salinity

The subsurface water extends from near the surface to the bottom between the 40-to-50- and 2,500-meter isobaths and contains two watermasses from the Bering Sea (Mountain, 1974). The Alaska Coastal Water forms in the nearshore environments of the Bering and Chukchi seas from warm, low-salinity runoff and warmed Bering Sea Water. The Bering Sea Water is colder and more saline than the Alaska Coastal Water. Near Barrow, the Alaska Coastal Water has temperatures of 5-10° Celsius and salinities that generally are less than 31.5 parts per thousand; the Bering Sea Water temperatures are near 0° Celsius and have salinities of 32.2-33 parts per thousand (Lewbel and Gallaway, 1984). The Alaska Coastal Water mixes rapidly with the surface water in the Beaufort Sea and is not clearly identifiable east of Prudhoe Bay. The Bering Sea Water is traced as far east as Barter Island.

The data from conductivity, temperature, and density logs show a relatively constant salinity of approximately 33.1 parts per thousand along the Alaskan Beaufort Slope at about 120 meters east of 152° W. longitude (Okkonen and Stockwell, 2001). Temperatures range between -1.7° and -1.3° Celsius and generally are higher by about 0.1° Celsius west of 152° W. longitude than to the east (Okkonen and Stockwell, 2001). Pickart (2001) shows that this cold subsurface watermass is relatively stable seaward of the upper slope.

III.A.3.c. Nearshore

The nearshore is landward of the 40-meter water-depth line. This region is influenced primarily by the wind. Other influences include river discharge, ice melt, bathymetry, and how the coast is aligned.

III.A.3.c(1) General Seasonal Cycles

In the early summer (mid-June to mid-July), the ice melts, and rivers break up and overflow the frozen ocean. Open water occurs next to the river deltas and is mostly river water and ice meltwater (Niedoroda and Colonell, 1991). This water is brackish, meaning a mixture of fresh- and saltwater. Cold marine water lies adjacent to or below this surface layer (Colonell and Niedoroda, 1988). Due to the large density difference between the water layers and the greater-than-50% ice cover, there is little mixing of the fresh- and marine-water layers by the wind (Colonell and Niedoroda, 1988; Envirosphere, 1988b; LaBelle et al., 1983).

By midsummer (mid-July to mid-August), the open-water area becomes large enough for the wind to mix and circulate the water. The nearshore brackish water mixes to form a coastal watermass with a range of intermediate temperatures and salinity whose distribution is determined primarily by the wind.

By late summer, freshwater discharge generally is low, and air temperatures fall. The water becomes marine and fairly uniform throughout the nearshore and offshore regions. The open-water area becomes the largest for the season.

In October, landfast ice and offshore sea ice begin forming. By November, sea ice covers most of the area. Through the winter, water temperatures decrease and ice continues to form. Joseph Nukapigak stated: "...in the Arctic, nine months out of the year...we have sea ice" (Nukapigak, as cited in USDOI, MMS, 1995a).

III.A.3.c(2) General Circulation

There are two distinct periods—open water and ice covered—for nearshore circulation. The open-water circulation depends mostly on the wind, and the wind's direction is more important than its speed (Short et al., 1990). Map 5 shows that the generalized nearshore circulation is variable and depends on the winds direction. The wind's direction and how often it changes direction control the direction of surface currents, how long watermasses remain, and the amount of mixing between different watermasses. Thomas Napageak stated: "… they both work together, the current and the wind" (Napageak, as cited in Dames and Moore, 1996b:7). Other controls on circulation include river discharge, icemelt, bathymetry, and the configuration of the coastline. The water circulation below the mixed layer appears to be driven primarily by ocean circulation rather than the winds (Aagaard, Pease, and Salo, 1988).

The two dominant wind directions are northeast and southwest (Morehead et al., 1992). Under easterly winds, water moves to the west. Under westerly winds, common in the fall and winter, surface water moves to the east. The mean surface-current direction year-round is to the west and parallels the bathymetry. The nearshore surface water responds quickly, within 1-3 hours, to changes in the wind direction from sustained easterly (or westerly) to sustained westerly (or easterly) (Hanzlick, Short, and Hachmeister, 1990; Segar, 1990). Vincent Nageak stated: "Foggy Island is always the place to go when strong winds start from the west because the water is shallow there. The current is always to the east" (Nageak, as cited in Shapiro and Metzner, 1979).

In addition to the water's eastward or westward motion, water also moves toward the shore or away from the shore. Under easterly winds, some water moves from onshore to offshore. This circulation pattern causes the gradual removal of warm, brackish water from the nearshore and replaces it with colder, more salty (marine) water. Under westerly winds, some water moves from offshore to onshore. This circulation pattern causes the accumulation of warm, less saline water along the coast and the depression of cold, saline marine water.

The West Dock and Endicott causeways are manmade structures that act as barriers affecting the circulation and mixing of watermasses in the nearshore Beaufort Sea near Prudhoe Bay. Fechhelm et al. (2001) report that recent causeway breaches at West Dock mitigate differences in cross-causeway temperature and salinity observations during the open-water season. The breaches at the Endicott causeway had no observable effect.

In contrast to the open-water season, the landfast ice in the nearshore areas insulates the water from the effects of the winds. The circulation pattern is influenced by storms and brine drainage (Weingartner and Okkonen (2001).

III.A.3.c(3) Currents

During the open-water season, currents on the inner shelf range from zero to more than 68 centimeters per second during the open-water season (Woodward-Clyde Consultants, 1998). The highest speeds occur in the summer and fall (Weingartner and Okkonen, 2001). Between mid-October through June, current speeds seldom exceeded 10 centimeters per second. The currents are relatively weak, but there are events of several days' duration when current speeds averaged about 10 centimeters per second at all locations (Weingartner and Okkonen, 2001).

Archie Ahkiviana stated that the currents are very strong around Tern Island (Alaska Eskimo Whaling Commission, 2001). Mr. Tukle states: "With regards to Liberty, with the ocean currents that I've observed between Kaktovik, Barrow, and Nuiqsut, that Liberty Project that you guys are on is one of the strongest currents I ever seen on a slope between here and Barter Island." (Tukle, as cited in USDOI, MMS, Alaska OCS Region, 2001a). Mr. Tukle also states: "Right between Narwhal, that's north of this Liberty Project, right on the left side of Narwhal, that's the strongest current I ever seen between her and Kaktovik. And it's directly in between–almost in between Cross Island and Narwhal. It's every–it's there every single year" (Tukle, as cited in USDOI, MMS, Alaska OCS Region, 2001a).

III.A.3.c(4) Temperature and Salinity

The nearshore area exhibits a wide range of temperatures and salinities based on a generalized open-water pattern. The nearshore is made up of freshwater, marine water, and a mixture of both. The main factors determining the waters' characteristics are the wind, freshwater runoff, and sea ice. During early summer, the rivers overflood and the sea ice begins breaking up. The areas adjacent to the coast are warm and relatively fresh. These warm and freshwaters are underlain by marine waters resulting in a stratified water column. Storm events serve to mix the water column, which results in an unstratified water column that is mixed from the surface to the bottom.

During the winter the water column generally is unstratified and fairly uniform. Temperature decreases rapidly from late September through mid-October (Weingartner and Okkonen, 2001). It remains at the freezing point about -1.7° Celsius until June. Salinities are approximately 28-32 parts per thousand before the landfast ice develops. By January, salinities range from 24-35 parts per thousand (Weingartner and Okkonen, 2001).

III.A.3.c(5) Tides and Storm Surges

The semidiurnal tidal range is 6-10 centimeters in the Beaufort Sea (Matthews, 1980; Kowalik and Matthews, 1982; Morehead et al., 1992). Tidal currents generally are weak, about 4 centimeters per second (Kowalik and Proshutinsky, 1994). The level of the water changes constantly in response to the wind. Positive tidal surges occur with strong westerly winds, while negative surges occur with strong easterly winds. Roxy Ekowana stated: "Such a strong west wind…and I found out that it was also high tide" (Ekowana as cited in North Slope Borough, Commission on History and Culture, 1980:115). In a Northstar public meeting, Thomas Napageak relayed knowledge of the interaction between wind and water levels: "...you don't get...high tides [storm surges] on a northeast wind.... But when we've got the southwesterly wind, that's when the tide [water level] comes up." (Napageak, as cited in Dames and Moore, 1996b:7). Frank Long, Jr., described how a rising tide or storm surge can force water over the top of sea ice and flood river drainages: "If there's enough water that comes in, it'll bring the ice up, plus water will be flowing...up over the edge." (Long, as cited in Dames and Moore, 1996b:8). An example of a negative storm surge also was observed by Nuiqsut whaling captains who reported that in 1977, the water drained out of a bay near Oliktok Point and then came back in (Dames and Moore, 1996b:3).

III.A.3.c(6) Stream and River Discharge

Hydrologic data for the North Slope are sparse (Brabets, 1996). Tables III.A-3 and A-4 show the known flow characteristics of North Slope streams and rivers that drain into the Beaufort Sea. The available data show that all streams and rivers share somewhat unique flow characteristics. Flow generally is nonexistent or at least unmeasurable through most of the winter. Stream flow begins in late May or early June as a rapid flood event termed "breakup" that, combined with ice and snow damming, can inundate extremely large areas in a matter of days. More that half of the annual discharge for a stream can occur during a period of several days to a few weeks (Sloan, 1987). Most streams continue to flow throughout the summer but at relatively low discharges. Runoff is confined to the upper organic layer of soil, as the mineral soils are saturated and frozen at depths greater than 2-3 feet (Hinzman, Kane, and Everett, 1993). Rainstorms can produce increases in stream flow, but they seldom are sufficient to cause flooding. Stream flow ceases at most streams shortly after freezeup in September.

III.A.3.d. Changes in the Arctic

We do not know to what extent the recent chances in the Arctic are cyclic, whether they represent a trend, or if they are a modal shift (Morrison, Aagaard, and Steele, 2000). Widespread changes of temperature and salinity occurred in the central Arctic Ocean water column during the first half of the 1990-1999 decade. There were observations of widespread temperature increases in the Atlantic Water layer (Carmack et al., 1995; McLaughlin et al., 1996; Morrison et al., 1998; Grotefendt et al., 1998). This appears related to an increased temperature (Swift et al., 1998) and strength (Zhang et al., 1998) of the Atlantic inflow into the Arctic Basin. This warming, in turn, was associated with cyclical, large-scale shifts in atmospheric forcing (Proshutinsky and Johnson, 1997; Proshutinsky et al., 1999). Gunn and Muench (2001) report that the pronounced warming of Atlantic Water had tapered off by 1998-1999. Determining whether this trend persists depends on acquiring additional data. Additionally, the cold halocline layer, which insulates the sea ice from the relatively warm Atlantic waters, appears to have retreated from the Eurasian Basin in recent years (Steele and Boyd, 1998). This has important consequences for ice/ocean-heat exchange and ice-growth rates. The cause of the modified halocline layer likely is related to a diversion of Russian river runoff caused by atmospheric circulation anomalies.

III.A.4. Sea Ice

Sea ice is frozen ocean water with the salt leached out. The Beaufort multiple-sale area is covered by sea ice for three-quarters of the year from October until June. Sea ice has a large seasonal cycle, reaching a maximum extent in March and a minimum in September. The formation of sea ice has important influences on the transfer of energy and matter between the ocean and atmosphere. It insulates the ocean from the freezing air and the blowing wind.

There are three major forms of sea ice in the Beaufort multiple-sale area: landfast ice, which is attached to the shore, is relatively immobile, and extends to variable distances offshore; stamukhi ice; and pack ice, which includes first year and multiyear ice, moves under the influence of winds and currents.

III.A.4.a. Seasonal Generalities

There are wide-ranging spatial and temporal variations in the Beaufort multiple-sale area; however, during an "average year," there is a general pattern.

- September when shore ice forms; the river deltas freeze; and frazil, brash, and grease ice form within bays and near the coast.
- Mid-October when smooth, first-year ice forms within bays and near the coast. Thomas Napageak remarked: "...The critical months [for ice formation] are October, November, and December" (Napageak, as cited in Dames and Moore, 1996b:7).
- November through May when the sea ice covers more than 97% of the Beaufort multiple-sale area.
- Late May when rivers flood over the nearshore sea ice.
- Early June when the river floodwaters drain from the surface of the sea ice. Sarah Kunaknana stated: "In June and July when the ice is rotting in the little bays along the coast" (Kunaknana, as cited in Shapiro and Metzner, 1979).
- Early to mid-July when floating and grounded landfast ice breakup. The areas of open water with few icefloes expand along the coast and away from the shore, and pack ice migrates seaward. Vincent Nageak states: "The ice all along the coast on the mainland side of these islands rots early…" (Nageak, as cited in North Slope Borough, Commission on History and Culture, 1980). Samuel Kunaknana stated: "The ice goes completely out after July 4 around the Colville" (Kunaknana, as cited in Shapiro and Metzner, 1979).

III.A.4.b. Landfast Ice

Landfast ice usually is reformed yearly, although it can contain floes of multiyear pack ice. The two types of landfast ice are bottomfast and floating. Bottomfast ice is frozen to the bottom out to a depth of about 2 meters. The remaining ice is floating. By late winter, first-year sea ice in the landfast-ice zone is about 2 meters thick. The landfast-ice zone extends from the shore out to the zone of grounded ice ridges. These ice ridges initially form in about 8-15 meters of water, but by late winter they may extend beyond the 20-meter isobath. Map 6 shows the monthly progression of landfast ice throughout the Arctic winter.

The nearshore landfast ice generally is smooth. Etta Ekolook stated: "The ice inside the barrier islands is smooth and remains so until it thaws out in the spring time" (Ekolook, as cited in North Slope Borough, Commission on History and Culture, 1980). Tidal cracks form within the ice sheet. Bruce Nukapigak states:

> When it's high tide these cracks [tidal crack] usually widen and close or even jam up when the tide goes down…. There is this type of crack on both sides of McClure Islands out from the mainland to the ocean (Nukapigak, as cited by Shapiro and Metzner, 1979).

The onshore movement of sea ice in the landfast-ice zone is a relatively common event that generates pileups and rideups along the coast and on offshore barrier islands. The onshore pileups often extend up to 20 meters inland from the shoreline over both gently sloping terrain and up onto steep coastal bluffs. Ice rideup, in which the whole ice sheet slides relatively unbroken over the ground surface for more than 50 meters, do not happen often; rideups beyond 100 meters are rare. The landfast ice may move several hundred meters during early winter. Shapiro and Metzner (1979), in an article on extending the observations through oral histories, reference ice motion between Narwhal Island and the coast during a storm in November or December of 1924. Bruce Nukapigak stated: "At the same time these westerly winds cause movements in the ice between the barrier island and the mainland. But this is in the fall before it gets really thick" (Nukapigak, as cited in Shapiro and Metzner, 1979). Otis Akivgak recalled: "Even the shoreside ice piled up so high [on Pole Island] that it was hard to drive our dog team on it" (Akivgak, as cited in North Slope Borough, Commission on History and Culture, 1980).

Fast ice in later winter usually moves tens of meters but may move up to several hundred meters. Deformations take the form of pileups and rideups on the coastal and island beaches and rubble fields and small ridges offshore. As the winter progresses, extensive deformation within the landfast-ice zone decreases, as the ice in the landfast zone thickens, strengthens, and becomes more resistant to deformation. Elija Kakinya stated: "Right around Flaxman Island, on the lagoon side, that is behind the barrier islands, inward to the inland, after the ice formed and freezed it never moved or any disturbance that I can recall in that area" (Kakinya, as cited in Shapiro and Metzner, 1979). Jeannie Ahkivgak stated: "The ice between the barrier islands and the mainland doesn't pile up too much. Sometimes there would be small pressure ridges in there" (Ahkivgak, as cited in North Slope Borough, Commission on History and Culture, 1980).

In the early 1970's, Archie Brower recalled that:

> A few years ago I was traveling along the coast at Bullen Point, which is inside Maguire Island west of Flaxman Island. I saw how a garage that was about 30 feet above the water line on the coast had been destroyed by ice. I was traveling in late May, but the ice was so covered with old snow that I believe that it must have destroyed the garage in February or March of that year. Ice had piled up or near the garage from about ten feet high from the surface of the ground (Brower, as cited in North Slope Borough, Commission on History and Culture, 1980).

Herman Aishana also commented on the same event

> The other thing I've seen, and this was inside the Barrier Islands, over at Camden Bay – not Camden Bay, but at Bullen Point, that old DEW Line site over there – I saw that building over there demolished by ice piling up; and the garage over there [was also demolished]. Piled right into it, year. It was quite a ways off shore. It was about 100 yards or so [offshore]…. And the [building] was sitting about, oh, maybe a little over ten feet above sea lever. It's amazing. Yeah it didn't wipe out the whole building, but it really made a mess out of it; it was a metal building (Aishana, as cited in Kruse et al., 1983a).

During public hearings, the local residents of Nuiqsut and Kaktovik have described numerous incidents where the ice has come onshore and has come up over cliffs as high as 20-40 feet. Mr. Isaak Akootchook of Kaktovik stated that: "...the current is pretty strong. It can push (ice) all the way (up on) the shore, about 20 to 30 feet high. But we haven't seen this (for) about 50 years now." During the BF Public Hearing in Nuiqsuit, Mr. Neil Allen wrote:

> I have seen how strong the ice can be. In 1929 or 1930 I was living with my brother. In December, just before Christmas a very strong west wind came up. When the weather cleared, we went over to Icy Reef and we saw that the ice had pushed up on the island. My brother measured how thick the ice was. It was as thick as the length of the pole he carried which was 5-1/2 feet long. That thick sheet of ice had pushed over the island. In those days the island was about 20 feet high and 200 feet wide (USDOI, MMS, 1979a).

Mr. Phillip Tikluk of Kaktovik stated during the BF public hearings:

> But they don't know how strong the ice movements are. I have seen the ocean when it piles up and when it moves. With a little help of wind I have seen here in Barter Island when it piles up and when it hit the beach. We have a cliff out here which is maybe thirty or forty feet high and during the month of June if I remember right the ice moved and that ice maybe five to six feet thick climbs up over the cliff that's how strong it is. The ice five feet or six feet thick right on top of the thirty or forty foot cliff. I have seen the ice move right across from the ocean side to the lagoon, blocking the airport road. The ice starts to move, it doesn't stop at anything (USDOI, MMS 1979b).

III.A.4.c. Stamukhi Ice Zone

Seaward of the landfast-ice zone is the stamukhi, or shear, zone. This is a region of dynamic interaction between the relatively stable ice of the landfast-ice zone and the mobile ice of the pack-ice zone. Large pressure ridges and rubble fields occur between the moving pack ice and the stationary fast ice. When winds drive pack ice into fast ice, or grind it up against the fast ice laterally along the edge, pressure ridges are formed. These ridges will reach depths of 25 meters and act as sea anchors for the adjacent fast ice. The shear ice zone also contains many leads. When offshore winds carry loose ice away from consolidated ice, there is a large lead that forms between the edge of the fast ice and the shear ice. This phenomenon is common in the Beaufort Sea.

In the Beaufort Sea, the most ridging occurs in waters that are 15-45 meters deep. As shown in Map 6, one of the characteristics of the stamukhi zone is that some portions of the ice are grounded on the seafloor. The outer edge of the stamukhi zone advances seaward during the ice season.

During the BF Public Hearings in Nuiqsut, Mrs. Bessie Ericklook describes what happens when a pressure ridge meets a barrier island:

> I have seen how a sodhouse was covered up by a pressure ridge in the wintertime. The wind was so strong that it covered one end of this island. The ice is very dangerous and unpredictable in Oct./Nov. During one December on one of the islands, another sodhouse was completely covered by pressure ridge. The ice had cracked and the ice turbulent and it took two of Tookak's kids. Another movement and his wife was taken away. You cannot talk of the ice so easily. You cannot control nature, the wind. The wind is the greatest factor (USDOI, MMS, 1979a).

III.A.4.d. Pack-Ice Zone

The pack-ice zone lies seaward of the stamukhi zone and includes first-year ice, multiyear undeformed and deformed ice, and ice islands. The first-year ice that forms in the fractures, leads, and polynyas (large areas of open water) within the pack-ice zone varies in thickness from a few centimeters to more than a meter. Multiyear ice is defined as ice that has survived one or more melt seasons; undeformed multiyear ice is believed to reach a steady-state thickness of 3-5 meters. Undeformed ice floes with diameters greater than 500 meters occupy about 60% of the pack-ice zone; some floes may have diameters up to 10 kilometers.

Ridges are a prominent indicator of deformed ice. The height of most ridges appears to be about 1-2 meters; ridge heights up to 6.4 meters have been observed. The relationship between ridge-sail height and keel depths suggests a sail-to-keel ratio of about 1:4.5 for first-year ice ridges and 1:3.3 for multiyear ridges. Multiyear composite maps of major ridges indicate that (1) in the nearshore region, there is a pronounced increase in ridge density in the vicinity of shoals and large promontories; (2) massive ridges occur shoreward of the 20-meter isobath; and (3) in the eastern Beaufort Sea 30-40 kilometers from the coast, there is an increase in ridging from east to west.

Movement of the floating ice is controlled by atmospheric systems and oceanographic circulation. During the winter, movement in the pack-ice zone of the Beaufort Sea generally is small and tends to occur with strong winds of several days' duration. The long-term direction of ice movement is from east to west in response to the Beaufort Gyre; however, there may be short-term perturbations from the general trend due to the passage of low- and high-pressure weather systems across the Arctic. The velocity of the pack ice has been variously reported as having (1) a mean annual net drift of 1.4-4.8 kilometers per day and (2) an actual rate of 2.2-7.4 kilometers per day, with extreme events up to 32 kilometers per day. East and northeast winds drive the ice offshore; westerly winds move the ice onshore.

During the hearing in Barrow on the Beaufort Sea multiple sales, Mr. Hopson spoke:

> You know, like anybody else, I spent a total of 11 years in the Arctic Ocean, the – six of the 11 years, I spent six years floating around. I passed by that area three times coming in from the Barter Island, you know, on the – that other side going to there, you know, and the further north you go is not too bad, but, you know, the further closer you get to the mainland, you're going to pressure cooking (ph), the inside ice is so big that you just – momentum keep going there, you know, it just pushes you right out. And this island that I was in was four and a half miles wide, eight and a half miles longs, 115 feet thick, you know, it's part of a glacier from by Osmere, by Greenland, and when we got close, within 200 (ph) miles, we started moving, you know, 15 miles on a good, windy day. Fifteen miles, three knots, sometimes we just sit there. But it's kind of vicious, you know, but people need to do study before they start putting out leases, especially in the, you know, 30, 40 miles. You know, that's vicious (USDOI, MMS, Alaska OCS Region, 2002b).

III.A.4.e. Leads and Open-Water Areas

Data obtained from aerial and satellite remote sensing show that leads and open-water areas form within the pack-ice zone. Southwesterly storms cause leads to form in the Beaufort Sea.

Along the western Alaskan coast between Point Hope and Point Barrow, there often is a band of open water seaward of the landfast-ice zone during winter and spring. This opening is at some times a well-defined lead and at other times a series of openings in the sea ice, or polynyas. Between February and April, the average width is less than 1 kilometers (the extreme widths range from a few kilometers in February to 20 kilometers in April) and is open about 50% of the time. The Chukchi open-water system appears to be the result of the general westward motion seen in the Beaufort Gyre. Also, there appears to be a positive correlation between the average ice motion away from the coast and the mean wind direction, which is from the northeast for all months except July (Stringer and Groves, 1991).

III.A.4.f. Summer Ice Conditions

By the middle of July, much of the fast ice inside the 10-meter isobath has melted; and there has been some movement of the ice. After the first openings and ice movement from late May to early June, the areas of open water with few icefloes expand along the coast and away from the shore, and there is a seaward migration of the pack ice. The concentration of icefloes generally increases seaward. During summer, winds from the east and northeast are common. These winds drive the ice offshore; westerly winds move the ice onshore. Elijah Kakinya noted: "In some years when the ice goes out in spring, it isn't visible in summer. Some years the ice goes out and comes back and is visible, and hangs around all summer months" (Kakinya, as cited in North Slope Borough, Commission on History and Culture, 1980). Elijah Kakinya stated: "In summer months, when there is a westerly wind, you can see ice from shore. But when the wind is blowing from northeasterly, the ice always goes out…you can't see any ice from shore" (Kakinya, as cited in North Slope Borough, Commission on History and Culture, 1980:152). Vincent Nageak stated "…but in summer, huge ice chunks can pass the islands into Prudhoe Bay when the wind is from the west" (Nageak, as cited in North Slope Borough, Commission on History and Culture, 1980).

III.A.4.g. Changes in Arctic Sea Ice

The analysis of longer-term data sets and modeling indicate substantial reductions in both the extent and thickness of the arctic sea-ice cover during the past 20-40 years (Maslanki, Serreze, and Barry, 1996; Cavalieri et al., 1997; Rothrock et al., 1999; Vinnikov et al., 1999).

The extent of arctic sea ice (the area of ocean covered by ice), as observed mainly by satellite, has decreased at a rate of about 3% per decade since the 1970's (Parkinson et al., 1999; Johannessen et al., 1999). Within Canadian arctic waters, a similar rate of decrease has been observed over the period 1969-2000. The arctic sea-ice cover shows decadal oscillations superimposed on the decreasing trend after 1960 (Dresser, Walsh, and Timlin, 2000; Wang and Ikeda, 2000).

Comparison of sea-ice draft data acquired on submarine cruises between 1993 and 1997, with similar data acquired between 1958 and 1976, indicates that the mean ice draft at the end of the melt season has decreased by about 1.3 meters in most of the deepwater portion of the Arctic Ocean, from 3.1 meters in 1958-1976 to 1.8 meters in the 1990's. The decrease is greater in the central and eastern Arctic than in the Beaufort and Chukchi seas. Preliminary evidence is that the ice cover has continued to become thinner in some regions during the 1990's (Rothrock, Yu, and Maykut, 1999). The average thinning of the ice appears to be the result of both the diminished fraction of multiyear ice and the relative thinning of all ice categories.

III.A.5. Chemical Oceanography and Water Quality

Water's physical and chemical characteristics determine the quality of the marine aquatic environment. The constituents of the water mainly are composed of naturally occurring substances at nontoxic concentrations. However, the constituents may include manmade substances and a few naturally occurring ones at toxic concentrations—pollutants.

III.A.5.a. Pollutants

The principal sources of pollutants entering the marine environment in general include discharges from industrial activities (petroleum industry) and accidental spills or discharges of crude or refined petroleum and other substances. Because of limited municipal and industrial activity around the Arctic Ocean coast, most pollutants occur at low levels in the Arctic. The rivers (Colville, Kuparuk, Sagavanirktok, and Canning) that flow into the Alaskan Beaufort Sea remain relatively unpolluted by human activities, but carry into the marine environment sediment particles (fine enough to be suspended) with trace metals and hydrocarbons. Winds and drifting sea ice may play a role in the long-range redistribution of pollutants in the Arctic Ocean. The broad arctic distribution of pollutants is described in a report by the Arctic Monitoring and Assessment Program (1997) entitled *Arctic Pollution Issues: A State of the Arctic Environmental Report*.

The information on chemical oceanography, water quality, and pollutants in the Sale 170 final EIS and Liberty final EIS (USDOI, MMS, 1998; USDOI, MMS, Alaska OCS Region, 2002a) are summarized herein and incorporated by reference. The descriptions are augmented by the following additional information on hydrocarbons, trace metals, and turbidity. Information on other pollutants, including dissolved oxygen and hydrogen-ion concentration (pH/acidity/alkalinity) is summarized in the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a).

III.A.5.a(1) Hydrocarbons

Crude oil is composed mainly of hydrogen and carbon with minor amounts of sulfur, nitrogen, and oxygen; heavy metals such as vanadium also may be present. These elements form a variety of hydrocarbon compounds. Crude oil and coal are complex mixtures of saturated, polynuclear aromatic and other hydrocarbons. Saturated hydrocarbons, paraffins, and naphthenes, are the most common constituents of crude oil.

The hydrocarbons analyzed in the Beaufort Sea sediments included total resolved and unresolved saturated hydrocarbons (n-C9 through n-C40), polynuclear aromatic hydrocarbons, and triterpanes. Polynuclear aromatic hydrocarbons are composed of organic compounds from fossil fuels (coal and petroleum), biogenic processes, and pyrogenic or combustion sources. Pyrogenic sources include incomplete combustion of fossil fuels (internal combustion engine), other organic matter such as wood (forest fires) or trash, and volcanic activity. Pyrogenic polynuclear aromatic hydrocarbons are found in the atmosphere and widespread environmental contaminants. Triterpanes are derived from petroleum or biogenic sources.

Hydrocarbons concentrations in the Alaskan Beaufort Sea were sampled as part of the Beaufort Sea Monitoring Program, and have been analyzed by Shaw et al.; their analyses are summarized in the Liberty final EIS (Shaw et al. as cited in USDOI, MMS, Alaska OCS Region, 2002a). The EIS points out that there is no evidence that the hydrocarbon concentrations in Beaufort Sea sediments are derived from oil-industry activities. The following is some recent additional information from recent studies, including an MMS project called the Arctic Nearshore Impact Monitoring in the Development Area (ANIMIDA).

III.A.5.a(1)(a) Total Organic Carbon

Total organic carbon content of the sediments that were sampled in 1999 as part of the ANIMIDA Program ranged from 0.01% in the sandy sediment near the Northstar Island to 3.42% in the mud-rich sediment near the nearshore (Boehm et al., 2001). The mean concentration was 0.62%. Total organic content in these samples is typical of arctic shelf sediment. The variation in the total organic content of the surficial sediments is related to grain size.

III.A.5.a(1)(b) Saturated Hydrocarbons

For most Beaufort Sea stations, the total saturated hydrocarbon concentrations are low, ranging from 0.21-16 milligrams per kilogram (Boehm et al., 2001). These hydrocarbons are a mixture of terrestrial plant waxes with lower levels of petroleum hydrocarbons.

Samples of river sediments and peat have total saturated hydrocarbon values of 5.8-36 milligrams per kilogram and 21-32 milligrams per kilogram, respectively. Sediments were sampled in the Colville, Kuparuk, and Sagavanirktok rivers. Peat samples came from areas along the Colville and Kuparuk rivers. The compositions of saturated hydrocarbons in the river and peat samples were similar to the composition in Beaufort Sea surficial sediments. This similarity indicates a common source of saturated hydrocarbons for river sediments and nearshore surficial sediments.

The highest total saturated hydrocarbon value, 50 milligrams per kilogram, for this suite of samples was found at the station west of West Dock in Prudhoe Bay (Boehm et al., 2001). The sample from this station contained high concentrations of metals and indicated contamination from an anthropogenic source.

III.A.5.a(1)(c) Polynuclear Aromatic Hydrocarbons

Polynuclear aromatic hydrocarbon levels are within the range of values reported from previous studies in the Beaufort Sea and other areas (Boehm et al., 2001). The polynuclear aromatic hydrocarbons in most of the sediment samples were derived from petrogenic/fossil fuel (petroleum and coal), biogenic (perylene), and pyrogenic sources.

The station located west of West Dock had the highest polynuclear aromatic hydrocarbon concentration, 2,700 microgram per kilogram. This site also had a higher concentration of a number of the trace metals than did other sites. The high concentrations of polynuclear aromatic hydrocarbon indicate possible hydrocarbon contamination. The source of this contamination is discussed later in this section, where the triterpane components of the sediments are described.

Boehm et al. (2001) noted an increase in the ratios of pyrogenic to petrogenic polynuclear aromatic hydrocarbons between the samples collected from the same stations in 1989 and 1999; the mean ratios were 0.038 in 1989 and 0.096 in 1999.

Total polynuclear aromatic hydrocarbon values for the station samples in 1999 are much lower than the Effects Range-Low, 4,022 micrograms per kilogram (Long and Morgan, 1990); this includes the station west of West Dock. Boehm et al. (2001) noted that polynuclear aromatic hydrocarbon concentrations in the sediments sampled did exceed the Effects Range-Low for the 13 individual polynuclear aromatic hydrocarbon compounds for which these values have been developed. Boehm et al. (2001) concluded that the polynuclear aromatic hydrocarbon concentrations in the study area sediment are not likely to pose an immediate ecological risk to marine organisms in the area.

In 1997, Naidu et al (2001) sampled nearshore Beaufort Sea surface sediments to determine if there were any significant changes in the concentrations of selected trace metals and hydrocarbons as the result of ongoing oil and gas development between the Colville and Canning rivers. Of the 21 stations sampled, 20 were at the same locations occupied as part of the Beaufort Sea Monitoring Program that was mentioned in the previous paragraphs.

The hydrocarbons in the sediments sampled in 1997 (Naidu et al., 2001) consist of a mixture of organic matter of marine and terrestrial origin. The total saturated hydrocarbons range from about 201-12,498 nanograms per gram and are largely characteristic of biogenic sources. The low-molecular-weight saturated hydrocarbons are derived mainly from marine sources, and the high-molecular-weight saturated hydrocarbons come mainly from plant waxes in the coastal peats and possibly from coal residues. The polynuclear aromatic hydrocarbon assemblages in the sediments are very similar to those observed in coastal peats and river sediments. The concentrations of total polynuclear aromatic hydrocarbons range from about 21-2,185 nanograms per gram.

III.A.5.a(1)(d) Other hydrocarbons

The surface samples also were analyzed for pesticides, polychlorinated biphenyls (PCB's), semivolatile organic compounds, and selected volatile organic compounds. The presence of these substances either could not be detected, which occurred for the majority of the samples, or their concentrations were within a low range that was influenced by the detection method and the amounts were presented as estimates.

III.A.5.a(2) Trace Metals

Beaufort Sea trace metals were sampled as part of the Beaufort Sea Monitoring Program. The samples were analyzed by Boehm, and the results are summarized in the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a). The following is some recent additional information.

Beaufort Sea sediments were sampled in August 1999 as part of the ANIMIDA Program and analyzed for trace metals (Boehm et al., 2001). The sampling program included 15 stations that were part of the Beaufort Sea Monitoring Program. Six of the stations were in the southeastern portion of Stefansson Sound, five stations were located near the site of the Northstar development project; and four stations were located between the two areas. In addition, samples were collected at 12 new stations in Stefansson Sound and 15 new stations around the Northstar Island.

The concentrations of the metals in the marine sediments are comparable to the concentrations of those metals that have been analyzed in the past. Also, all the concentrations are below known Effects Range-Median concentrations, and most are below known Effects Range-Low concentrations.

Naturally occurring levels of trace metals in the surface sediments vary with sediment grain size, organic carbon content, and mineralogy (Boehm et al., 2001). In general, sediments consisting mainly of fine-grained (silt- and clay-size) particles contain more organic carbon and trace metals than sediments in which sand-, gravel-, and larger-size particles predominate. Compared to coarser grain particles, fine-grain particles have a larger active surface area available for adsorption of matter containing organic material or trace metals. Aluminum, or iron, can be used to normalize other metal values to offset variations caused by differences in grain size, organic carbon content, or mineralogy (Boehm et al., 2001). Aluminum is rarely introduced into the environment by anthropogenic process.

Normalizing metal concentrations with aluminum can be done to indicate possible contamination from past events or to identify potential sources of contamination and contaminated sites in the future. This technique was used by Boehm et al. (2001) to indicate possible contamination of marine sediments in the Beaufort Sea.

Normalizing barium concentrations with aluminum provides an example of this technique (Boehm et al., 2001). Barium is found in the earth's continental crust in relatively high concentrations (the average is 584 micrograms per gram) (Wedepohl, 1995, as reported in Boehm et al., 2001); by comparison, the average concentration of copper in the continental crust is 25 micrograms per gram. Concentrations of barium in the 1999 sediment samples ranged from 173-753 micrograms per gram; copper concentrations ranged from 4.0-46.9 micrograms per gram. Barium is a component of the naturally occurring mineral barite, and this compound is used in drilling muds. In the past, drilling muds have been discharged into the Beaufort Sea and could be discharged accidentally in the future.

Boehm et al. (2001) normalized other metal concentration with aluminum. Plots for aluminum versus both chromium and vanadium did not show any discernible anthropogenic inputs of these metals. Plots for aluminum versus copper, lead, cadmium, silver, arsenic, antimony, nickel, mercury, and cobalt showed anomalous values for these metals at a station located about 1.5 kilometers west of West Dock in Prudhoe Bay. Compared to all the stations sampled in 1999, the station near West Dock had the highest concentrations for all these metals except antimony. This site is near an area of high construction and development activity. The sediment from this site also had higher total saturated hydrocarbon and polynuclear aromatic hydrocarbon concentrations than any other site sampled.

One way to evaluate potential trace-metal contamination in sediments, and possible effects on biota, is to compare the sediment values with Effects Range-Low and Effects Range-Median values developed by Long and Morgan (1990) for sediment-sorbed contaminants. All the metal concentrations in the sample from the site west of West Dock, except for nickel and mercury, are below the Effects Range-Low for the respective metals; the concentrations for nickel and mercury were below the Effects Range-Median.

As previously noted, Naidu et al. (2001) sampled nearshore Beaufort Sea surface sediments to determine if there were any significant changes in the concentrations of selected trace metals as the result of ongoing oil and gas development between the Colville and Canning rivers. Of the 21 stations sampled, 20 were at the same locations occupied as part of the Beaufort Sea Monitoring Program that was mentioned in the previous paragraphs. The concentrations of the trace metals in the sediments sampled in 1997 (Naidu et al., 2001) are similar to the concentrations observed by other studies. Naidu et al. (2001) noted the concentrations of barium and vanadium were higher in the samples collected in 1997 compared to earlier samples, but the reasons for the differences are unknown. The levels of barium and vanadium are below or comparable to the values reported for unpolluted nearshore marine sediments (Naidu et al., 2001).

III.A.5.a(3) Turbidity

Turbidity in the Beaufort Sea is very different during the summer open-water period as opposed to the winter ice-covered period.

III.A.5.a(3)(a) Summer - Open Water

Satellite imagery and data on suspended-particulate matter suggest that in general, turbid waters are confined to waters less than 16 feet (5 meters) deep and do not extend seaward of the barrier islands. Turbidity is caused by fine-grained particles suspended in the water column. These particles come from rivers discharging into the marine environment, coastal erosion, and resuspension by wave action of particles deposited on the seafloor. Seafloor sediments in Foggy Island Bay include a heterogeneous mixture of fine sand-, silt-, and clay-size particles—particles less than 0.250 millimeter (0.01 inch) in diameter. The turbidity resulting from the floods, along with other factors, block the light and measurably reduce primary productivity of waters shallower than about 40 feet (12 meters).

In mid-June through early July, the shallow, inshore waters generally carry more suspended material, because runoff from the rivers produces very high turbidity adjacent to the river mouths. Deltas at the mouths of rivers indicate deposition of river-borne sediments. Total suspended solids in the Sagavanirktok River channels in 1985 (mid-July through mid-September) ranged from 0.2-30.0 milligrams per liter (U.S. Army Corps of Engineers, 1987). Maximum values corresponded to midseason river-discharge peaks following large rainfall events in the Brooks Range. The highest levels of suspended particles in the Sagavanirktok River discharge are found during breakup; values ranged from 63-314 milligrams per liter for 1971-1976 (U.S. Army Corps of Engineers, 1993).

III.A.5.a(3)(b) Winter - Ice Covered

In winter, the amount of suspended sediments under the sea ice ranged from 2.5-76.5 milligrams per liter in the southeastern portion of Stefansson Sound (Montgomery Watson, 1997, 1998). Total suspended solids in the water from beneath the ice in Gwydyr Bay ranged from 7,480-26,920 milligrams per liter and from off Stump Island ranged from nondetectable to 885 milligrams per liter (Montgomery Watson, 1996, as reported in U.S. Army Corps of Engineers, 1998). Gwydyr Bay is located west of the Sagavanirktok River.

In April 2000, as part of the ANIMIDA project, the concentrations of suspended-particulate matter at various depths in the water column under about 2 meters of ice were determined from water samples collected from stations in the vicinity of the Endicott development island, the Northstar island (development project), and in Foggy Island Bay (Boehm et al., 2001; Weingartner and Okkonen, 2001). The amounts of suspended sediments in the water samples were determined by the same laboratory methods. Total suspended-solids measurements ranged from 0.14-0.58 milligrams per liter; turbidity measurements ranged from 0.15-0.70 nephelometric turbidity units (Boehm et al., 2001). These concentration ranges were lower than the concentrations of suspended-particulate matter in the water column in August 1999.

The concentrations of particulate matter in ice cores were determined from seven stations located in the vicinity of the Endicott and Northstar developments. The total suspended-sediment concentrations in these ice cores ranged from 1.25-248 milligrams per liter (Boehm et al., 2001). In general, the concentrations of particulate matter decrease with depth in the ice core. Ice forms on the surface of the water and traps any suspended-particulate matter present in the water. The amount of suspended-particulate matter depends on the meteorological and oceanographic conditions at the time. Storms in late fall could result in higher concentrations of suspended-particulate matter than if conditions were calm during freezeup. When the surface freezes, the generation of waves and currents in response to winds decreases, and there is less energy in the water column. As the energy decreases, the capability of the water to retain particles in suspension lessens. Settling of particles decreases the concentration in the upper part of the water column. As the ice forms deeper in the water, the concentrations of suspended-particulate matter have decreased and there is less material to entrap in the ice.

III.A.5.b. Existing Regulatory Control of Discharges, Dredging, and Filling

The principal method for controlling pollutant discharges is through Section 402 (33 U.S.C. § 1342) of the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act of 1972), which establishes a National Pollution Discharge Elimination System (Laws, 1987). Under Section 402, the Environmental Protection Agency or authorized States can issue permits for pollutant discharges, or they can refuse to issue such permits if the discharge would create conditions that violate the water-quality standards developed under Section 303 (33 U.S.C. § 1313) of the Clean Water Act. The Clean Water Act, Section 403 (33 U.S.C. § 1343), states that no National Pollution Discharge Elimination System permit shall be issued for a discharge into marine waters except in compliance with established guidelines.

The guidelines require a determination that the permitted discharge will not cause unreasonable degradation to the marine environment (40 CFR 125.122). Unreasonable degradation of the marine environment means (1) significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities; (2) threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; or (3) loss of aesthetic, recreational, scientific, or economic values, which is unreasonable in relation to the benefit derived from the discharge.

The latest information on water-quality standards for the Environmental Protection Agency is available in the most recent edition of 40 CFR (paragraph 131) or at the agency's internet web site (www.epa.gov). State of Alaska water information is available in the most recent version of 18 AAC 70 or at the Alaska Department of Environmental Conservation web site (www.state.ak.us/dec/).

III.A.6. Air Quality

The existing air quality of the entire North Slope of Alaska is superior to that set by the National Ambient Air Quality Standards and Alaska air quality laws and regulations. Concentrations of regulated air pollutants are far less than the maxima allowed. The Environmental Protection Agency calls this an attainment area, because it meets the standards of the Clean Air Act. The Prevention of Significant Deterioration program of that Act places additional limitations on nitrogen dioxide, sulfur dioxide, and total suspended-particulate matter. Table III.A-5 lists the ambient air quality standards for the program area, and Table III.A-6 lists measured air pollutants at Prudhoe Bay.

III.A.6.a Local Industrial Emissions

Over most of the onshore area adjacent to the program area, there are only a few small, scattered emissions from widely scattered sources. The only major local sources of industrial emissions are in the Prudhoe Bay/Kuparuk/Endicott oil-production complex. This area was the subject of monitoring programs during 1986-1987 (ERT Company, 1987; Environmental Science and Engineering, Inc., 1987) and from 1990 through 1996 (ENSR, 1996, as cited in U.S. Army Corps of Engineers, 1999). Five monitoring sites were selected—three were considered subject to maximum air-pollutant concentrations and two were considered more representative of the air quality of the general Prudhoe Bay area. The more recent observations are summarized in Table III.A-6. All the values meet the State and Federal ambient air quality standards. The results appear to demonstrate that ambient pollutant concentrations, even for sites subject to maximum concentrations, meet the ambient air pollution standards. This is true even if we assume the baseline Prevention of Significant Deterioration program concentrations (determined on a site-specific basis) to be zero, limiting the allowable increase in concentrations.

III.A.6.b Arctic Haze

Although the measurements do indicate that the air quality standards are being met, some pollution nevertheless has occurred. Hattie Long stated: "We get a lot of yellow haze out of Prudhoe all year long…since the time that the haze started hovering over Nuiqsut" (U.S. Army Corps of Engineers, 1996). During the winter and spring, winds transport pollutants to arctic Alaska across the Arctic Ocean from industrial Europe and Asia (Rahn, 1982). These pollutants cause a phenomenon known as arctic haze. Pollutant sulfate due to arctic haze in the air in Barrow (that in excess of natural background) averages 1.5 micrograms per cubic meter. The concentration of vanadium, a combustion product of fossil fuels, averages up to 20 times the background levels in the air and snowpack. Recent observations of the chemistry of the snowpack in the Canadian Arctic also provide evidence of long-range transport of small concentrations of organochlorine pesticides (Gregor and Gummer, 1989). Concentrations of arctic haze during winter and spring at Barrow are similar to those over large portions of the continental United States, but they are considerably higher than levels south of the Brooks Range in Alaska. Any ground-level effects of arctic haze on the concentrations of regulated air pollutants in the Prudhoe Bay area are included in the monitoring data given in Table III.A-6. Model calculations indicate that less than 10% of the pollutants emitted in the major source regions is deposited in the Arctic (Pacyna, 1995). Maximum concentrations of some pollutants, sulfates and fine particles, were observed during the early 1980s; observers measured decreases at select stations at the end of the 1980's (Pacyna, 1995). Despite this seasonal, long-distance transport of pollutants into the Arctic, regional air quality still is far better than standards require.

III.B. Biological Resources

The following eight resource categories describe the existing biological environment:

- Lower Trophic-Level Organisms
- Fishes
- Essential Fish Habitat
- Endangered and Threatened Species (Bowhead Whales and Spectacled and Steller's Eiders)
- Marine and Coastal Birds
- Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales)

- Terrestrial Mammals (Caribou, Muskox, Grizzly Bear, and Arctic Fox)
- Vegetation and Wetlands

III.B.1. Lower Trophic-Level Organisms

Lower trophic-level organisms have been described in several Beaufort Sea EIS's; recent ones include the final EIS's for the Northstar Development Project (U.S. Army Corps of Engineers, 1999) and Sale 170 and Liberty (USDOI, MMS, 1998; USDOI, MMS, Alaska OCS Region, 2002a). The final EIS's for Sales 144 and 124 (USDOI, MMS, 1996a, 1990a) described the organisms along the entire Alaskan Beaufort Sea coast. Those documents should be consulted for background information. In this update for multiple sales over several years, information on species in the planktonic and epontic (on the undersurface of sea ice) communities will be summarized separately from information on benthic communities.

III.B.1.a. Planktonic and Epontic Communities

As explained in the Sale 170 final EIS (USDOI, MMS, 1998:Section III.B.1.a), most of the planktonic and epontic (on ice) species that occur in the sale area are distributed widely in the Arctic Ocean. Ongoing research on epontic organisms in Alaskan arctic seas indicates that those organisms might be more concentrated and productive than previously thought (Krembs, Deming, and Eichen, 2002). Other recent research illustrates the importance of plankton as prey for other animals. For example, fish and birds consume copepods, such as *Calanus*, *Neocalanus,* and *Pseudocalanus* (Shirley and Duesterloh, 2001); young ringed seals consume mostly euphausiids (Dehn et al., 2002); and bowhead whales consume copepods, euphausiids, and mysids (Lowry, 1993). The latter study showed that the same species were in the stomachs of bowhead whales that are harvested near Barter Island and near Point Barrow (Lowry, 1993), illustrating the wide distribution of zooplankton species. Plankton might be involved in the natural transfer of heavy metals in broad arctic regions. Dehn et al. (2002) show that several heavy metals possibly are transferred from water and sediments to pelagic and benthic invertebrates and then to predators. For example, they measured the concentration of total mercury in the livers (hepatic mercury) of seals from the Alaskan and Canadian arctic. They found higher mercury concentrations in ringed seals than in bearded seals, and the ringed seals from Canada had higher concentrations than those from Alaska. They concluded that the differences were probably due to the prey of the seals, because bearded seals tend to consume benthic and epibenthic prey (i.e., crustaceans and sea cucumbers) whereas ringed seals tend to consume pelagic prey (i.e., euphausiids when young and arctic cod when older).

The most productive area of the Alaskan Beaufort Sea is the coastal zone. Annual primary production along the coast to the east of Point Barrow exceeds 50 grams of carbon per year per square meter (USDOI, MMS, 1998). This high rate of production probably is due to relatively high nutrient concentrations and warm water along the coast. The coastal band of high production is illustrated in the satellite images of the distribution of phytoplankton (Figures III.B-1a and III.B-1b). The images show the concentration of cholophyll-a pigment per cubic meter, indicating the concentration of phytoplankton, or the "greenness" of the water. The red/orange colors in the figures show concentrations of pigment up to 10 milligrams per cubic meter, and the blue/purple colors in offshore waters show pigment concentrations down to 0.1 milligram per cubic meter—two orders of magnitude lower. The differences between the two figures indicate the wide range of both summer and interannual variability. The figures also show plumes of yellow/green colors that indicate moderate concentrations of phytoplankton in the western and eastern offshore portions of the Beaufort Sea. The plumes probably are due to additional nutrients from the Chukchi Sea and the MacKenzie River. The black areas show the locations of ice, clouds, and/or sediment-laden water. The narrow black band of sediment-laden water along the coast corresponds with the river deltas, estuaries, bays, lagoons, and brackish migratory corridor of anadromous fishes (Section III.B.2.c). The wider red/orange band along the coast would correspond approximately with the migratory corridor of bowhead whales [Section III.B.4.a(1)]. Together they would correspond with part of the "ring" of productive waters around the edge of the Arctic Ocean.

The region near Barter Island in the eastern Beaufort Sea was the focus of a special study of the zooplanktonic prey of bowhead whales (Richardson, 1986). As summarized in the Sale 170 final EIS (USDOI, MMS, 1998:Section III.B.1.a), the 1985-1986 field study found that the plankton was composed mostly of copepods, and the distribution was very patchy. Dense patches that bowhead whales typically feed on were found to be very extensive in the horizontal plane (for example, hundreds to thousands of meters across) but only 5-10 meters thick. Also, the patches were more abundant in nearshore and inner-shelf waters than in offshore waters. Three more years of fieldwork near Barter Island were conducted during 1998-2000 (LGL, 2002; Griffiths, Richardson, and Thomson, 2001). During a recent MMS Information Transfer Meeting, Griffiths explained that the scope and purpose of the additional fieldwork was similar to the previous study. The additional fieldwork also detected zooplankton patches with concentrations up to 700 milligrams per cubic meter, concentrations on which bowhead whales typically feed. Some of the patches were thin bands that extended for 10-15 kilometers horizontally.

Furthermore, the studies of the bowhead feeding area near Kaktovik provide information on the magnitude of natural variation, which is important for comparison with the magnitude of the probable effects of the proposed lease sale. The portion of the study by Griffiths and Thomson (2002) and Griffiths, Thomson and Bradstreet (2002) measured the abundance of zooplankton during 1985, 1986, and 1998-2000. The studies focused on large copepods—an important prey of bowhead whales—and are summarized also in bowhead whale Section III.B.4.a (1). The studies point out that predator zooplankton species were relatively abundant during the second period (1998-2000) and that the average biomass of large copepods was higher during the first 1985-1986 period than it was during the 1998-2000 period. Other studies summarize similar observations by subsistence whalers in the year-to-year variability in the feeding conditions for bowheads. The studies provide an estimate of the range of inter-annual variation in zooplankton biomass; specifically, the average biomass was about 10% less during the 1998-2000 period that it was during the 1985-1986 period (Griffiths and Thomson, 2002: Table 5.4).

The growth rates of planktonic and epontic organisms are relatively rapid, and the generation lengths are relatively short. For example, the body weight doubled every 2 weeks among immature stages of the common mysid, *Mysis litoralis*, during summer 1977-1978 field studies in Simpson Lagoon, and the generation length was 1-2 years (Griffiths and Dillinger, 1980). The rapid growth rates also were evident during formation of typical summer “blooms” during 1977 and 1978.

These studies indicate the seasonal and interannual regularity in arctic planktonic and epontic habitats. The regularity is indicated by the formation of plankton blooms during 1977 and 1978 in Simpson Lagoon. The regularity also is indicated by the formation of dense patches near Barter Island during studies conducted in 1985-1986 and 1998-2000.

III.B.1.b. Benthic Communities

Sea ice dominates the benthic and coastal habitats of the Beaufort Sea, as described by North Slope residents Norton and Weller (1984) and the Sale 170 final EIS (USDOI, MMS, 1998). The sea-ice cover is almost 100% for 9-10 months each year and freezes up to 2.5 meters thick during winter. Due to the ice cover, the shallow benthos and coastline are highly disturbed and support few large organisms. Typical organisms are the amphipods and small clams, which are the focus of the MMS-sponsored ANIMIDA study on hydrocarbon chemistry (Brown, Boehm, and Cook, 2001).

Most seafloor substrates on the Beaufort Sea OCS consist of silty sands that are gouged frequently by ice keels under ice ridges (USDOI, MMS, 1998). Grounded ice ridges and their depth distribution are illustrated in the Sale 144 and Northstar EIS’s (USDOI, MMS, 1996a:Figure III.A.4-1; U.S. Army Corps of Engineers, 1999:Figures 5.6-1, -4 and -5). Because of the disturbance from grounded ice, most of the benthic species in the proposed sale area are small and widely distributed, like small clams and mobile epibenthic amphipods.

Dunton and others have calculated the typical biomass of benthos on the Beaufort seafloor (www.utmsi.utexas.edu/staff/dunton.sbi/mywebs/data_maps.htm). The calculations include data collected during the past 3 decades of benthic studies for MMS/National Oceanic and Atmospheric Administration OCS Environmental Assessment Program and the Canadian Department of the Environment. The web site illustrates that about 30 grams per square meter of benthos grows on most of the OCS seafloor. The biomass is slightly lower in the eastern, deepwater portions of the Beaufort Sea and slightly higher in the western portion that is adjacent to the Chukchi Sea.

Dense kelp grows on a few areas of the seafloor. The distribution of kelp is limited by three main factors: ice gouging, sunlight, and hard substrate. Ice gouging restricts the growth of kelp to protected areas, such as behind barrier islands and shoals. Sunlight restricts the growth of kelp to the depth range where a sufficient amount penetrates to the seafloor, or water less than about 11 meters deep. Hard substrates, which are necessary for kelp holdfasts, also restrict kelp to areas with low sedimentation rates. These three factors have limited kelp to a few OCS areas. The best known kelp habitat is the Boulder Patch, which is located behind the barrier islands in Stefansson Sound (USDOI, MMS, Alaska OCS Region, 2002a). Kelp also grows sparsely in West Camden Bay (USDOI, MMS, Alaska OCS Region, 1998a). All likely kelp habitats have not yet been surveyed. Other kelp habitats may be discovered, as portions of the Beaufort Sea are further explored.

The Boulder Patch has been studied extensively. Its location, structure, and functioning are described extensively in the Environmental Report for the Liberty Development and Production Plan (Figure III.A-9; BPXA, 1998a:Section 4.6) and by Dunton and Schonberg (2000). The latter authors explain that the kelp grows on boulders that are gradually exposed by coastal erosion, resulting in a layer of boulders at the sediment surface (Dunton, Reimnitz, and Schonberg, 1982). The biological complexity and richness of the Boulder Patch is demonstrated by recent taxonomic studies; about 300 infaunal and epilithic species have been found (Dunton and Schonberg, 2000). The total biomass of organisms is about an order of magnitude higher than for most of the OCS seafloor; in contrast to the 30 grams per square meter of benthos on most of the OCS seafloor, about 300 grams per square meter of epilithic organisms inhabit the Boulder Patch (Dunton and Schonberg, 2000). The kelp community spreads very slowly, taking almost a decade to recolonize denuded boulders (Martin and Gallaway, 1994). The plants live a long time; Dunton observed some that probably were more than 40 years old (USDOI, MMS, Alaska OCS Region, 1998a:12).

During the MMS Arctic Kelp Workshop, Dunton explained that the growth of kelp in the Boulder Patch has varied considerably from year to year (USDOI, MMS, Alaska OCS Region, 1998a). He has records of kelp growth and light levels from 1984-1991. The data show that if the ice was clear of sediment and the plants received even a small amount of under-ice light during the spring, they grew a fair amount. For example, the growth during 1990 was exceptional, but 1988 was a really bad year for kelp growth. However, Dunton did not describe a long-term trend in the Boulder Patch, for example, from a health community to a threatened one.

The distribution and density of kelp in western Camden Bay is not as well known. During exploration of the Warthog Prospect in 1997, kelp was observed on a patch of boulders in a slight depression about 11 meters deep (Figures III.A-11 and III.A-12; USDOI, MMS, Alaska OCS Region, 1998a:Figure 3); however, the extent or density of the kelp is not well known. Kelp also has been observed shoreward in an area behind a shoal near Konganevik Point. For years, Natives have known about the rocky seafloor in this area (Jacobson and Wentworth, 1982:90), and rocks with kelp have been found on the shoreline. Overall, the kelp distribution in Camden Bay probably is limited to a few areas (1) with boulders or other hard substrate, (2) with shallow water that transmit sufficient light to the seafloor, and (3) with offshore shoals to block ice keels.

III.B.2. Fishes

Fishes inhabiting the Arctic (Figure III.B-2) must cope with harsh environmental conditions not required of their counterparts to the south. For example, during the 8-10-month winter period, freezing temperatures reduce their habitat by more than 95% (Craig, 1989). Food is very scarce during this time, and most of their yearly food supply must be acquired during the brief arctic summer (Craig, 1989). As a result, fishes inhabiting the Arctic grow slowly compared to those inhabiting warmer regions. Nevertheless, several types of fishes are year-round residents in the Arctic. They include:

- freshwater fishes that spend their entire life in freshwater (some also spend brief periods in brackish coastal waters);

- marine fishes that spend their entire life in marine waters (some also spend brief periods in brackish coastal waters); and
- migratory fishes that typically move between fresh, brackish, and marine waters for various purposes (some individual fishes do not migrate).

The freshwater environment of the Arctic Coastal Plain (from Barrow east to the Canadian border) consists of slow-moving rivers and streams in addition to lakes, ponds, and a maze of interconnecting channels. While some waterbodies are completely isolated, most are permanently, seasonally, or sporadically connected. Seasonally connected lakes are flooded during breakup, while sporadically connected lakes are flooded only during high-water years (Parametrix, Inc., 1996). Many of these waters support freshwater and migratory fish populations. At least 20 species of fishes have been collected in or near the Colville drainage system to the west (11 freshwater and 9 migratory species) (Moulton and Carpenter, 1986; Bendock, 1997). The distribution and abundance of freshwater and migratory fishes on the Arctic Coastal Plain depend on (1) adequate overwintering areas, (2) suitable feeding and spawning areas, and (3) access to these areas (typically provided by a network of interconnecting waterways) (Parametrix, Inc., 1996).

Studies on the Sagavanirktok River have shown that different fishes dominate at different times of the year:

- Summer: arctic grayling, round whitefish, Dolly Varden char (also called arctic char), broad whitefish, and slimy sculpin (Hemming, 1988; Woodward-Clyde Consultants, 1980)
- March: broad and humpback whitefish, arctic grayling, round whitefish, burbot, and slimy sculpin in the lower part of the river
- April: broad and humpback whitefish, arctic and least cisco, arctic grayling, round whitefish, burbot, and slimy sculpin
- May: broad whitefish, arctic and least cisco, arctic grayling, round whitefish, and burbot (Craig, 1989)

In winter, bodies of freshwater less than 6 feet deep are frozen to the bottom (Craig, 1989). In deeper waters that do not freeze to the bottom, the amount of dissolved oxygen is of critical importance. Flowing waters exceeding 7-10 feet in depth (depending on water velocity) generally are considered deep enough to support overwintering fishes. However, in standing waters the ice becomes thicker, and dissolved oxygen becomes less available as the winter progresses. In such cases, depths of up to 18 feet have been suggested as being the minimum required to support overwintering freshwater fishes (USDOI, BLM, 1990a).

The marine coastal environment of the Beaufort Sea consists of inlets, lagoons, bars, and numerous mudflats (USDOI, BLM, 1978a). During the open-water season, the nearshore zone of this area is dominated by a band of relatively warm, brackish water that extends across the entire Beaufort Sea coast. The summer distribution and abundance of coastal fishes (marine and migratory species) is strongly affected by this band of brackish water. The band typically extends 1-6 miles offshore and contains more abundant food resources than waters farther offshore. It is formed after breakup by freshwater input from rivers such as the Ikpikpuk, the Colville, the Sagavanirktok, and the Canning. It has its greatest extent off river-delta areas, with a plume sometimes extending 15 miles offshore.

During the open-water season, migratory fishes tend to concentrate in the nearshore area, which also is used by marine fishes and occasionally by some freshwater fishes. Migratory fishes acquire nearly all of their yearly food supplies during the brief open-water season. The areas of greatest species diversity within the nearshore zone are the river deltas (Bendock, 1997). Sixty-two species of fish have been collected from the coastal waters of the Alaskan Beaufort Sea (69% marine, 26% migratory, 5% freshwater). All (except salmon) are typical of fishes resident to arctic coastal waters from Siberia to Canada (Craig, 1984). Thirty-seven species were collected in the warmer nearshore brackish waters, and 40 species were collected in the colder marine waters farther offshore (some use both habitats). As the summer progresses, the amount of freshwater entering the nearshore zone decreases, and nearshore waters become colder and more saline. From late summer to fall, migratory fishes move back into rivers and lakes to overwinter and to spawn (if sexually mature). In winter, nearshore waters less than 6 feet deep freeze to the bottom. Before they freeze, marine fishes continue to use the nearshore area under the ice but eventually move into deeper offshore waters (Craig, 1984).

Subsistence fishermen harvest freshwater, marine, and anadromous fish in the area at differing times of the year, although the majority is harvested in summer. For example, summer fishing for whitefish happens all around the Shaviovik River Delta; and Tom cod, sculpin, ling cod, flounder, and other marine species are taken in the Foggy Island area (North Slope Borough, Commission on History and Culture, 1980). In spring, subsistence fishermen harvest arctic char as it migrates to sea and later in summer, as the char move about in nearshore waters. In fall, large migrations of whitefish and lake trout are fished along the Beaufort Sea shoreline in less than 3 feet of water. Changes in fish populations have been observed by Wilson Soplu, a subsistence fisherman, who noted that fish populations in the Shaviovik River have changed from many small fish to fewer large fish (North Slope Borough, Commission on History and Culture, 1980). For additional information concerning subsistence fishing and those harvesting fish, see Section III.C.2.

III.B.2.a. Freshwater Fishes

Freshwater fishes inhabit many of the rivers, streams, and lakes of the Arctic Coastal Plain. They include lake trout, arctic grayling, Alaska blackfish, northern pike, longnose sucker, round whitefish, burbot, ninespine stickleback, slimy sculpin, arctic lamprey, and threespine stickleback (rare). Freshwater fishes are found almost exclusively in freshwater (Moulton and Carpenter, 1986). Those with access to rivers, such as the Colville and Sagavanirktok (for example, arctic grayling), are sometimes found in the nearshore band of brackish coastal water described earlier. All of the freshwater species mentioned have been collected near the mouth of the Colville River during summer (USDOI, BLM, 1978a); however, their presence in the coastal environment is sporadic and brief, with a peak occurrence expected during or immediately following spring breakup.

Many of the streams on the Arctic Coastal Plain serve as interconnecting links to the many lakes in the area (Bendock, 1997). Some waters are used primarily as nursery areas, others for feeding, others for spawning and/or overwintering, and others as corridors linking these areas together. Juvenile fishes prefer the warmer shallow-water habitats that become available during the ice-out period (Hemming, Weber, and Winters, 1989). The most abundant freshwater fish is the ninespine stickleback (Hemming, 1996). The highest numbers are found in waters having emergent and submerged vegetation suitable for spawning and rearing, with overwintering sites nearby (Hemming, 1993). In streams, the most common freshwater fishes include arctic grayling, ninespine stickleback, and slimy sculpin (Netsch et al., 1977; Bendock and Burr, 1984). In lakes, the most common freshwater fishes include lake trout, arctic grayling, round whitefish, and burbot. Older lake fishes usually are dominant. In general, the larger, deeper, clearer lakes with outlets and suitable spawning areas are more likely to support fish. Smaller lakes that are more shallow and turbid, without outlets or suitable spawning areas, are not likely to support fish (Netsch et al., 1977; USDOI, BLM, 1978a). Bodies of freshwater less than 6 feet deep generally do not have resident fish populations, although some may be used during summer for feeding, rearing, or as access corridors to other waters.

Freshwater fishes feed on terrestrial and aquatic insects and their larvae, zooplankton, clams, snails, fish eggs, and small fishes (Bendock and Burr, 1984; USDOI, BLM, 1978a; Hemming, Weber, and Winters, 1989). Lake trout and burbot are reported to forage heavily on least cisco, round whitefish, grayling, and particularly on slimy sculpin and ninespine stickleback. Lake trout also have been reported to feed on voles (USDOI, BLM, 1978b) and burbot on Arctic lamprey (Bendock and Burr, 1984). Except for burbot, which spawns under ice in late winter, freshwater fishes spawn from early spring to early fall in suitable gravel or rubble. With the onset of winter, freshwater fishes move into the deeper areas of lakes, rivers, and streams. Smaller rivers such as the Kadleroshilik River support only small numbers of ninespine stickleback, Dolly Varden (a migratory species), and arctic grayling (Hemming, 1996).

III.B.2.b. Marine Fishes

Both marine and migratory fishes inhabit coastal waters. Marine fishes include arctic cod, saffron cod, twohorn (uncommon) and fourhorn sculpins, Canadian eelpout, arctic flounder, capelin, Pacific herring (uncommon), Pacific sand lance (uncommon), and snailfish (Craig, 1984; Moulton and Carpenter, 1986). Marine fishes prefer the colder, more saline coastal water seaward of the nearshore brackish-water zone described earlier. As summer progresses, the nearshore zone becomes more saline due to decreased freshwater input from rivers and streams. During this time, marine fishes often share this same nearshore environment with migratory fishes, primarily to feed on the abundant epibenthic fauna or to spawn (Craig, 1984). In the fall, when migratory fishes have moved out of the nearshore area and into freshwater systems to spawn and overwinter, marine fishes remain in the nearshore area to feed.

Common marine fishes in the nearshore area include fourhorn sculpin and capelin (Schmidt, McMillan, and Gallaway, 1989; Thorsteinson, Jarvela, and Hale, 1991). Saffron cod, arctic flounder, and snailfish also use the nearshore area; however, their occurrence is sporadic and variable and in much lower numbers. Common marine fishes in waters farther offshore include arctic cod and kelp snailfish (Craig, 1984; Schmidt, McMillan, and Gallaway, 1989; Thorsteinson, Jarvela, and Hale, 1991). Arctic cod are infrequent visitors to nearshore habitats during the first portion of the open-water season when waters are warmest and salinities are low (Craig et al. 1982). Arctic cod have been found to be more concentrated along the interface between the warmer nearshore water and colder marine water. The warmer nearshore zone with its more moderate salinity is thought to be an essential nursery area for juvenile arctic cod (Cannon, Glass, and Prewitt, 1991). Nevertheless, adults and juveniles are abundant in both nearshore and offshore waters and contribute significantly to productivity in arctic coastal waters. Because of the significant contribution they make to the diets of marine mammals, birds, and other fishes, arctic cod have been described as a "key species in the ecosystem of the Arctic Ocean" (Craig, 1984). They are believed to be the most significant consumer of secondary production in the Alaskan Beaufort Sea (Frost and Lowry, 1983) and even to influence the distribution and movements of marine mammals and seabirds (Craig, 1984, citing Finley and Gibb, 1982).

Marine fishes in the area primarily feed on marine invertebrates. They rely heavily on epibenthic and planktonic crustacea such as amphipods, mysids, isopods, and copepods. Flounders also feed heavily on bivalve mollusks, while fourhorn sculpins supplement their diets with juvenile arctic cod. Because the feeding habits of marine fishes are similar to those of migratory fishes (amphidromous and anadromous species), some marine fishes are believed to compete with migratory fishes for the same prey resources (Craig, 1984; Fechhelm et al., 1996). Competition is most likely to occur in the nearshore brackish-water zone, particularly in or near the larger river deltas, such as the Colville and the Sagavanirktok. As the nearshore ice thickens in winter, marine fishes continue to feed under the ice but eventually leave as the ice freezes to the bottom some 6 feet thick. Seaward of the bottomfast ice, marine fishes continue to feed and reproduce in nearshore waters all winter (Craig, 1984). Most spawn during the winter, some in shallow coastal waters, and others in offshore waters. Arctic cod spawn under the ice between November and February (Craig and Halderson, 1981). Snailfish spawn farther offshore by attaching their adhesive eggs to a rock or kelp substrate.

III.B.2.c. Migratory Fishes

The members of this group commonly are referred to as anadromous fishes. They are born and reared in freshwater, migrate to sea as juveniles, and return to freshwater as adults to spawn and die. Migratory fishes indigenous to the arctic environment (amphidromous species) differ substantially from migratory fishes inhabiting warmer waters to the south (anadromous species). Amphidromous fishes live much longer, grow much slower, and become sexually mature much later in life. Additionally, they do not make one far-ranging ocean migration and return years later to freshwater to spawn and die like anadromous fishes (for example, salmon). Instead, they make many migrations between freshwater and the sea for purposes other than just spawning. Unlike anadromous fishes, amphidromous fishes spend much more time in brackish coastal waters than they do in marine waters. Additionally, they return to freshwater to overwinter, not necessarily to spawn. In fact, amphidromous fishes typically return many times to freshwater before reaching spawning age. Even after reaching spawning age, spawning occurs only if their nutritional requirements were met during the brief arctic summer. When they do spawn, they do not necessarily die; some return years later to spawn again before dying. Despite these major differences, the term amphidromous is seldom used when referring to the indigenous migratory fishes of the arctic environment (Craig, 1989). For this reason and because the term anadromous is misleading, this review simply refers to this group of mostly amphidromous species as migratory fishes.

Migratory fishes inhabit many of the lakes, rivers, streams, interconnecting channels, and coastal waters of the North Slope. Common migratory fishes include arctic cisco, least cisco, Bering cisco, rainbow smelt, humpback whitefish, broad whitefish, Dolly Varden char (formerly known as arctic char), and inconnu.

The highest concentration and diversity of migratory fishes in the area occurs in river-delta areas, such as the Colville and the Sagavanirktok (Bendock, 1997). The most common migratory fishes in nearshore waters are arctic and least cisco (Craig, 1984). Lakes that are accessible to migratory fishes typically are inhabited by them in addition to the resident freshwater fishes. Least cisco is the most abundant migratory fishes found in these lakes.

Salmon (anadromous species) are uncommon in the North Slope region (see Table IV.C.1), are thought to be strays by most researchers, and typically contribute little (if anything) to annual subsistence and commercial harvests. Small runs of pink and chum salmon sometimes occur from the Colville River and in some drainages west of the Colville River. During the 1977-1978 sampling season, Bendock (1979) reported taking 35 chum salmon in the lower reaches of the Colville River. However, neither species has established populations anywhere in the area (Bendock and Burr, 1984). In recent years, chum smolts have been caught in the lower delta (Moulton 1999, 2001). Chum salmon accounts for a very small portion of the total fall subsistence catch (Pederson and Shishido 1988; Moulton and Field 1988, 1991, 1994, Moulton, Field, and Brotherton, 1986; Moulton et al, 1990, 1992, 1993; Moulton 1994, 1995, 1996, 1997).

Small runs also may occur in rivers closer to Barrow. Small numbers of chum are taken in the Chipp River and in Elson Lagoon, including adults in spawning condition (George, pers. commun., as cited in Fechhelm and Griffiths, 2001). Despite the presence noted, chum salmon are rare in the Beaufort Sea coastal waters, particularly east of the Colville River.

While the occurrence of salmon east of the Colville River is rare, small numbers of pink salmon occasionally have been taken in the Sagavanirktok River; however, spawning is not known to have occurred there (Wilson, 2002, pers. commun.; Fechhelm and Griffiths, 2001, citing Griffiths et al., 1983). Summer surveys along the coast of the Arctic National Wildlife Reserve by the Fish and Wildlife Service from 1988-1991 yielded 42 pink salmon in 1,788 net days of fyke-net fishing effort, and all were collected west of and including the Barter Island area (Underwood et al, 1995). Pink salmon occur in the Sagavanirktok River. During August 1982, 41 fish were collected in the lower river, 19 were caught at the mouth of the Sagavanirktok, and 8 more were caught upriver in the west channel near the Sagavanirktok Bridge where several spawned out adults also were observed (Griffiths et al., 1983). Between 1981 and 1997, only 276 individual fish were caught in Sagavanirktok River (Fechhelm and Griffiths, 2001). It is possible that random small schools of pink salmon from western stocks spawn in the Sagavanirktok River on a chance basis.

With the first signs of spring breakup (typically June 5-20), adult migratory fishes (and the juveniles of some species) move out of freshwater rivers and streams and into the brackish coastal waters nearshore. They disperse in waves parallel to shore, each wave lasting a few weeks or so. Some disperse widely from their streams of origin (for example, arctic cisco and some Dolly Varden char). Others, like broad and humpback whitefish and least cisco, do not; and they are seldom found anywhere but near the mainland shore (Craig, 1984). Most migratory fishes initiate relatively long and complex annual migrations to and from coastal waters (Bendock, 1997). However, some populations of Dolly Varden char, least cisco, and broad and humpback whitefish never leave freshwater (Craig, 1989). Many believe that arctic cisco in the Colville River area originated from spawning stocks of the Mackenzie River in Canada (Gallaway et al., 1983; Fechhelm and Fissel, 1988; Fechhelm and Griffiths, 1990). There are reports from fishermen that arctic cisco in spawning condition have been caught in at least the upper Colville and Chipp rivers (Moulton, Fawcett, and Carpenter, 1985, citing Matumeak, 1984, pers. commun.). However, the scientific evidence is overwhelming that the vast majority of the arctic cisco inhabiting the Alaskan Beaufort Sea were carried there from Canada by westerly currents.

During the 3-to-4-month open-water season that follows spring breakup, migratory fishes accumulate energy reserves for overwintering, and, if sexually mature, they spawn. They prefer the nearshore brackish-water zone, rather than the colder, more saline waters farther offshore. While their prey is concentrated in the nearshore zone, their preference for this area is believed to be more correlated with its warmer temperature (Craig, 1989; Fechhelm et al., 1993). Migratory fishes are more abundant along the mainland and island shorelines, but they also inhabit the central waters of bays and lagoons. Larger fishes of the same species are more tolerant of colder water (for example, Dolly Varden char and arctic and least ciscoes) and range farther offshore (Moulton, Fawcett, and Carpenter, 1985; Thorsteinson, Jarvela, and

Hale, 1991). Smaller fishes are more abundant in warmer, nearshore waters and the small, freshwater streams draining into the Beaufort Sea (Hemming, 1993).

Infaunal prey density in the nearshore substrate is very low and provides little to no food for migratory fishes. However, prey density in the nearshore water column is high, about five times that of freshwater habitats on the Arctic Coastal Plain. The nearshore feeding area also is much larger than that of freshwater habitats on the coastal plain (Craig, 1989). For these reasons, both marine and migratory fishes come to feed on the relatively abundant prey found in nearshore waters during summer. Migratory fishes feed on epibenthic mysids and amphipods (often greater than 90% of their diet) and on copepods, fishes, and insect larvae (Craig and Haldorson, 1981; Craig et al., 1984; Craig, 1989). In early to midsummer when migratory fishes are most abundant in nearshore waters, little dietary overlap is observed among them. However, in late summer when they are less abundant and their prey is more abundant, dietary overlap is common in nearshore waters (Moulton, Fawcett, and Carpenter, 1985). Marine birds also compete for the same food resources during this time. Migratory fishes do little to no feeding during their migration back to freshwater and when spawning, but some resume feeding during winter. Most migratory fishes return to freshwater habitats in the late summer or fall to overwinter and, if sexually mature, to spawn. Others, such as cisco and whitefish, return much earlier, arriving 6-10 weeks before spawning starts, thus forfeiting about half of the nearshore-feeding period (Craig, 1989). Char, ciscoes, and whitefish spawn in streambed gravels in fall in the Sagavanirktok River. Spawning in the arctic environment can take place only where there is an ample supply of oxygenated water during winter. Because of this and the fact that few potential spawning sites can meet this requirement, spawning often takes place in or near the same area where fishes overwinter (Craig, 1989).

III.B.3. Essential Fish Habitat

III.B.3.a. Regulations Enacting the Sustainable Fisheries Act

The 1996 Sustainable Fisheries Act enacted additional management measures to protect commercially harvested fish species from overfishing. Along with reauthorizing the Magnuson-Stevens Fishery Conservation and Management Act Reauthorization (16 U.S.C. 1801-1882), one of those added measures is to describe, identify, and minimize adverse effects to essential fish habitat. The regulations defining essential fish habitat are in 50 CFR 600.910. Essential fish habitat is defined as habitat necessary to the species for spawning, breeding, feeding, or growth to maturity.

Those habitats include:

- aquatic areas;
- their associated physical, chemical, and biological properties that are used by fish;
- sediment, hard bottom, and structures underlying the waters; and
- associated biological communities.

The Act also requires Federal Agencies to consult with the National Marine Fisheries Service on activities—in this case, offshore oil and gas leasing and development—that may adversely affect the essential fish habitat of managed harvested marine fish species. That consultation should be consolidated with environmental review required by other statutes, such as the National Environmental Policy Act (50 CFR 600.920(e)). Therefore, sections entitled essential fish habitat are included in this EIS. The essential fish habitat regulation (50 CFR 600.920(f)) enables the National Marine Fisheries Service to make a finding that an existing consultation or environmental review procedure can be used to satisfy the consultation requirements of the Magnuson-Stevens Act. A National Finding was agreed upon by MMS with the National Marine Fisheries Service on April 4, 2002, which allows that MMS may choose to use the National Environmental Policy Act process as a vehicle for the essential fish habitat consultation by submitting to the National Marine Fisheries Service, among other options, lease-sale EIS's rather than stand-alone essential fish habitat assessments.

The potentially impacting activities may have effects on essential fish habitats that are direct effects (for example, physical disruption) or indirect (for example, loss of prey species that are necessary for feeding). Those effects can be site-specific, habitatwide, individual, cumulative, and/or synergistic.

In the Alaskan offshore, essential fish habitats are designated in the fishery-management plans of the North Pacific Fisheries Management Council, the regulatory body for managing marine fisheries in Alaska. The only essential fish habitat designated in the Beaufort Sea is for salmon (Amendment 5 of the Fishery Management Plan for the Salmon Fisheries in the exclusive economic zone of the Coast of Alaska). Salmon includes all five species of Pacific salmon: chinook or king (*Oncorhynchus tshawytscha*), coho or silver (*O. kisutch*), pink or humpy (*O. gorbuscha*), sockeye or red (*O. nerka*), and chum or dog (*O. keta*) (North Pacific Fisheries Management Council, 1997).

Essential fish habitat is defined by whether it could ever be used, given climate change, seismic changes, etc and does not consider if it is currently used by salmon. Salmon essential fish habitat in freshwaters of Alaska is designated as virtually all the coastal streams to about 70° N. latitude. Salmon essential fish habitat in marine waters of Alaska formally is designated as the area within the 320 kilometer exclusive economic zone boundary of the United States down to a depth of 500 meters (North Pacific Fisheries Management Council, 1999). Salmon essential fish habitat is defined to the outer boundary of the exclusive economic zone and to a depth of 500 meters, while the written descriptions of salmon indicate that in the juvenile marine stage, they (all five species) head to the Bering Sea and south to the Gulf of Alaska for this stage (North Pacific Fisheries Management Council, 1999).

Habitat areas of particular concern (HAPC) include nearshore areas of intertidal and submerged vegetations, rock, and other substrates. Shallow nearshore estuarine and marine habitats including submerged aquatic vegetations and emergent vegetation are habitat areas of particular concern used by Pacific Salmon. Substrates of high-micro habitat diversity serving as cover from groundfish and other organisms such as areas rich in epifauna communities or substrate with large participle size such as the Boulder Patch. Streams and lakes and other freshwater areas used by Pacific salmon and other anadromous fish (such as smelt), especially located near urban areas or areas with intensive human-induced developmental activities also are habitat areas of particular concern (North Pacific Fisheries Management Council, 1999).

The salmon themselves also are to be evaluated (National Marine Fisheries Service, 2002). Generally, there is little evidence of viable self-sustaining salmon populations in the Beaufort Sea. Present salmon "populations" have a very difficult time establishing and persisting, most likely because of the marginal habitats (Craig, 1989; Fechhelm and Griffiths, 2001). Conclusions based on a survey of available information describing salmon stocks in the Beaufort Sea (Fechhelm and Griffiths, 2001) indicate only a few isolated spawning stocks of chum and pink salmon that might occur in the Beaufort Sea area, primarily the Sagavanirktok and Colville rivers. Their database shows only one to two chum per year on average caught in sampling gear in the last 30 years. These authors believe chum and pink taken in the Chipp River and Elson Lagoon near Point Barrow could be either individuals of small runs or an overshoot of spawning salmon from near Point Hope and along the Chukchi Sea coast. Sockeye, coho, and king salmon are even rarer than pink and chum salmon in the Beaufort Sea. For example, no sockeye or coho salmon and only a single chinook salmon were collected during 17 seasons of intensive sampling in Prudhoe Bay (Babaluk et al., 2000). Salmon generally make up less than 1% of the subsistence fish catch with spikes of 3-4% in a few years (State of Alaska, Dept. of Fish and Game, 1995b; North Slope Borough, 2000). Based on the above information, we conclude there are no self-sustaining salmon populations and that the small number of salmon caught are strays from the Chukchi or Bering Sea populations.

Recent occurrences raise the question of whether significant temperature increases in arctic areas caused by climate change indicate a significant change in salmon distribution in the future. Local residents have noticed increases in salmon occurrences over the past 10-20 years (Pedersen, 1995; Napageak, 1996). Several published journal notes of first records of salmon in the Canadian Beaufort Sea watershed that occurred in the past decade (Babaluk et al., 2000) also indicate the increasing but still rare incidence of salmon in the Beaufort Sea. Potential effects of global warming are further addressed in a subsequent section of this document.

Ecologically, the Beaufort Sea can be considered a population sink for salmon rather than a source, drawing excess salmon from other areas rather than producing a surplus that colonizes new areas. The scarcity of salmon documented in the Beaufort Sea and the fact that it is at the northern boundary of the geographic distribution support the population sink theory. Additionally, while still uncommon across the Beaufort Sea, more salmon have been documented more frequently in the west than the east. This seems to reflect locations nearer the sources of the larger and more concentrated salmon populations in the Bering and Chukchi seas.

Beyond the physical proximity to source populations, ocean currents tend to bring more nutrients to the western portion of the Beaufort Sea, making potential habitat better in the west than the east. Other physical differences such as temperature and salinities seem to differ little east to west (Okkonen and Stockwell, 2001). Thus, effects of the same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or the same size of deferral at the same distance from the shoreline can be expected to have a slightly greater effect in the western Beaufort than in the central and eastern Beaufort.

III.B.3.b. Salmon Essential Fish Habitat Components and Seasons in the Beaufort Sea

See Table III.B-1 for salmon essential fish habitat components, seasons, and areas of freshwater, estuary, and marine habitat in the Beaufort Sea multiple-sale area.

Freshwater overwintering habitat, including spawning gravel that does not freeze and kill eggs, is extremely limited in the Beaufort Sea coast area and probably is the largest controlling factor limiting the viability of Beaufort Sea salmon stocks (Craig, 1989; Fechhelm and Griffiths, 2001). Most benthic invertebrates, such as insects living on the stream bottom and insects and many zooplankton living in the water column (such as copepods), are freshwater prey for one or another species of salmon.

For salmon, these freshwater overwintering areas comprise primarily spawning habitat, which also is the egg and larvae habitat for up to 11 months after spawning. For this analysis, the egg-through-alevin stages of all five species of Pacific salmon are combined. Juveniles of pink and chum salmon, the most common and most adapted salmon to the Beaufort environment, do not require juvenile freshwater rearing habitat, because the young hatch in early spring and soon after migrate to saltwater. Coho, sockeye, and king salmon require year-round juvenile rearing habitat for 1-3 years. Sockeye require freshwater lake rearing habitat for 18 months to 2 years.

Habitat areas of particular concern are designated by regulation to be all freshwater anadromous streams and lakes. For purposes of analysis, anadromous freshwater habitat is calculated by summing the total length of State-identified anadromous streams and lakes from the northern coast south to present or potential onshore pipeline locations, approximately 687 kilometers of streams and rivers.

A 5-mile-wide region of brackish or less salty water, called the estuarine habitat, could theoretically support young salmon as they exit freshwater for life in the sea. In early summer (i.e., mid-June to mid-July) (Niedoroda and Colonell, 1988), significant inputs of freshwater from coastal runoff lowers the salinity in these waters to 28 physical salinity units (Weingartner and Okkonen, 2001) compared to 33.1 physical salinity units farther out from the coast (Lewbel and Gallaway, 1984; Okkonen and Stockwell, 2001; Pickart, 2001). Temperature and salinity differences within the estuarine belt are due primarily to winds. As freshwater discharge becomes low by late summer, brackish water becomes saltier. In October, landfast ice begins forming. From November to June, this 5-mile wide estuarine zone is frozen solidly to the ocean floor (Nukapigak, as cited in USDOI, MMS, 1995a). See Section III.A.3 Oceanography for more detail.

This estuarine zone is used primarily by juvenile salmon smolt during physiological adaptation to the saltwater environment from the freshwater. This outmigration takes place from the time the ice moves out through August. Feeding during this time, especially the first few days, is thought to be especially critical to survival. Salmon smolt must catch and eat prey within just a few days or die. Thus, prey and prey habitat are an important part of this particular habitat. Once they enter the ocean, pink and chum salmon smolt hug the shore. Pink salmon spend the first few weeks in water only a few centimeters deep; thus prey living in the gravel substrate (benthic insects and zooplankton) are their primary food source. Chum salmon use intertidal areas (i.e., estuarine waters in the Beaufort Sea) for months before migrating to the outside waters. They move offshore from July to September. Sockeye juveniles also tend to stay close to the shore during their first summer (North Pacific Fisheries Management Council, 1997). For purposes of analysis, we define the estuarine habitat as an approximately 5-mile wide zone adjacent to the Beaufort Sea coast, an area of approximately 715,000 hectares.

Salmon reportedly are caught in August in the Colville River subsistence fishery, but not in high numbers (George and Nageak, 1986). Strays attempting to spawn will transit the estuarine zone and may wait there while their osmoregulatory system adapts from saltwater back to freshwater for spawning. Otherwise, the salinity is not an important aspect for adults returning to spawn between June and September. Individual fish probably will take only a few days to a week to transit this estuarine area in the Beaufort Sea.

The marine juvenile stage is the principal growth period of salmon and can last from 1-6 years. During this lifestage, prey and prey habitat are the most critical components of the marine essential fish habitat. Prey commonly is animals near the water surface (epipelagic zooplankton), particularly copepods. Given their differences in size, this is a surprising overlap with the bowhead whale, which strains plankton through baleen. Chinook (king) salmon and larger sockeye coho and chum salmon also consume fish.

Marine essential fish habitat technically extends north to the exclusive economic zone from the estuarine zone. The marine salmon essential fish habitat associated with this lease sale extends from the estuarine band (to 5 miles from the coast) to the northern sale-area boundary, an area of approximately 4 million hectares.

However, according to the preliminary assessment report for essential fish habitat, this stage historically does not involve the Beaufort Sea. Pink salmon occupy marine waters south of 60º N. latitude, coho salmon south of 64º N. latitude, chinook salmon in the Bering Sea 70º N. latitude and south, pink salmon south of the Bering Straight (about 65º N. latitude), and sockeye salmon in the larger Gulf of Alaska and the Pacific Rim. Temperature may explain most of this difference, because the Beaufort Sea ranges between -1.7° and -1.3° Celsius in the top layers (Okkonen and Stockwell, 2001), whereas coho salmon, for instance, prefer 12-15° Celsius (North Pacific Fisheries Management Council, 1997).

III.B.4. Endangered and Threatened Species

III.B.4.a. Endangered and Threatened Species in or Near the Planning Area

The Endangered Species Act of 1973 defines an endangered species as any species that is in danger of extinction throughout all or a significant portion of its range. The act defines a threatened species as one that is likely to become endangered within the foreseeable future. Endangered bowhead whales and threatened spectacled and Steller’s eiders (birds) may occur near prospective oil and gas development sites in the Beaufort Sea.

III.B.4.a(1) Bowhead Whales

The bowhead whale was listed as endangered on June 2, 1970. No critical habitat has been designated for the species. The National Marine Fisheries Service received a petition on February 22, 2000, requesting that portions of the U.S. Beaufort and Chukchi seas be designated as critical habitat for the Western Arctic stock (Bering Sea stock) of bowhead whales. On August 30, 2002, the National Marine Fisheries Service made a determination not to designate critical habitat for this population of bowheads (67 *FR* 55767) because: (1) the population decline was due to overexploitation by commercial whaling, and habitat issues were not a factor in the decline; (2) the population is abundant and increasing; (3) there is no indication that habitat degradation is having any negative impact on the increasing population; and (4) existing laws and practices adequately protect the species and its habitat.

Regarding the listing status of bowhead whales, Shelden et al. (2001) propose that the bowhead whale species should be listed as five distinct population segments, based on the distinct population segment definition developed by the National Marine Fisheries Service and the Fish and Wildlife Service in 1996. The five separate stocks of bowhead whales are the Bering Sea stock (Western Arctic stock), the Spitsbergen stock, the Davis Strait stock, the Hudson Bay stock, and the Okhotsk stock. Shelden et al. (2001) evaluated each proposed distinct population segment to determine whether one or more should be reclassified. The authors used two alternative approaches to determine the status of bowhead whales, the classification system established by the IUCN (World Conservation Union, 1996, as referenced in Shelden et al., 2001) and the method developed by Gerber and DeMaster (1999, as referenced in Shelden et al., 2001) for Endangered Species Act classification of North Pacific humpback whales. Under each of these classification systems, the authors determined that the Bering Sea population of bowhead whales should be delisted, whereas the other four populations of bowheads should continue to be listed as endangered.

The Western Arctic stock of bowhead whales was estimated to be 8,000 individuals in 1993, with a 95% confidence interval from 6,900 and 9,200 individuals (Zeh, George, and Suydam, 1995; Hill and DeMaster, 1999). Zeh, Raftery, and Schaffner (1995) subsequently revised this population estimate by incorporating acoustic data that were not available when the earlier estimate was developed. The revised estimate of the population was estimated between 7,200 and 9,400 individuals in 1993, with 8,200 as the best population estimate, and the estimate recognized by the International Whaling Commission. This revised population estimate is also the population estimate used by the National Marine Fisheries Service in their stock assessments (Hill and DeMaster, 1999; Ferrero et al., 2000; Angliss, DeMaster, and Lopez, 2001). An alternative method produced an estimate of 7,800 individuals, with a 95% confidence interval of 6,800-8,900 individuals. Zeh, Raftery, and Schaffner (1995) estimate that the Western Arctic stock increased at a rate of 3.2% per year from 1978-1993. The increase in the estimated population size most likely is due to a combination of improved data and better censusing techniques along with an actual increase in the population. During the spring 2001 bowhead census, 3,295 bowhead whales were counted during the visual count (*The Arctic Sounder*, 2001). Following the census, the North Slope Borough Department of Wildlife Management estimated that the population of bowheads is increasing at the rate of about 4% per year. The current best bowhead whale population estimate for 2001 is 9,860 with a 95% confidence interval of 7,700-12,600 (George et al., 2002). This is a preliminary estimate and may be refined further by incorporating additional information on acoustic locations. The new preliminary estimate for 2001 results in an estimated rate of increase of the population of 3.3% (95% confidence interval of 2%, 4.7%) from 1978-2001(George et al., 2002). The number of calves counted in 2001 (121) is nearly twice the number counted in 1993 (66) and the highest ever recorded. Using the preliminary population estimate of 9,860, NOAA Fisheries estimates the minimum population of bowhead whales in the Western Arctic stock at 8,886 (Angliss and Lodge, 2002, draft). The most recent population census shows a substantial increase over the previous population count of 8,200 whales and shows the population is approaching the lower limits of the historical population. The historic population was estimated at 10,400-23,000 whales in 1848, before commercial whaling, compared to an estimate of between 1,000-3,000 animals in 1914, near the end of the commercial-whaling period (Woody and Botkin, 1993).

The Western Arctic stock (Bering Sea stock) of bowhead whales migrates through the Alaskan Beaufort Sea semiannually between wintering areas in the Bering Sea and summer feeding grounds in the Canadian Beaufort Sea.

Bowhead whales have an affinity for ice and are associated with relatively heavy ice cover and shallow continental shelf waters for much of the year. Throughout the winter, bowheads frequent the marginal ice zone, regardless of where the zone is, and polynyas (irregular areas of open water). Polynyas in the Bering Sea along the northern Gulf of Anadyr, south of St. Matthew Island, and near St. Lawrence Island, are important wintering areas for bowheads. Bowheads also congregate in these polynyas before starting their spring migration (Moore and Reeves, 1993).

The bowheads' northward spring migration appears to coincide with ice breakup. They pass through the Bering Strait and eastern Chukchi Sea from late March to mid-June through newly opened leads in the shear zone between the shorefast ice and the offshore pack ice. The migration takes place in pulses, or aggregations of whales swimming together, with the first pulse passing Point Barrow in late April or early May, the second pulse in mid-May, and a less-well-defined pulse in late May to mid-June (Moore and Reeves, 1993). Several studies of acoustical and visual comparisons of the bowhead's spring migration off Barrow indicate that bowheads also may migrate under ice within several kilometers of the leads. Data from several observers indicate that bowheads migrate underneath ice and can break through ice 14-18 centimeters (5.5-7 inches) thick to breathe (George et al., 1989; Clark, Ellison, and Beeman, 1986). Bowheads may use cues from ambient light and echoes from their calls to navigate under ice and to distinguish thin ice from multiyear floes (thick ice). After passing Barrow from April through mid-June, they move easterly through or near offshore leads. East of Point Barrow, the lead systems divide into many branches that vary in location and extent from year to year. Andrew Oenga, who hunted bowhead whales as a crew member out of Barrow from 1943-1960 stated: “I believe from my experience that bowhead whales would reach the leads offshore from Prudhoe Bay by early May” (Oenga, as cited in U.S. Army Corps of Engineers, 1999). The spring-migration route is far offshore of the barrier islands in the central Alaskan Beaufort Sea. Bowheads arrive on their summer feeding grounds near Banks Island from mid-May through June and remain in the Canadian Beaufort Sea and Amundsen Gulf until late August or early September (Moore and Reeves, 1993).

Some biologists conclude that almost the entire Bering Sea bowhead population migrates to the Beaufort Sea each spring and that few whales, if any, summer in the Chukchi Sea. However, some scientists maintain that a few bowheads swim northwest along the Chukotka coast in late spring and summer in the Chukchi Sea. Incidental sightings suggest that bowhead whales may occupy the northeastern Chukchi Sea in late summer more regularly than commonly believed (Moore, 1992). Records of bowhead sightings from 1975-1991 suggest that bowheads may occur regularly along Alaska’s northwestern coast in late summer; however, no one has yet established if these are “early-autumn” migrants or whales that have summered nearby (Moore et al., 1995). Harry Brower, Jr., stated that he has seen whales in the Barrow area in the middle of the summer while the hunters are out hunting bearded seals on the ice edge (Brower, as cited in USDOI, MMS, 1995b). The monitoring program conducted while towing the SDC to the McCovey location in 2002 recorded five bowhead whales off Point Barrow on July 21. Bowheads found in the Bering and Chukchi seas in the summer may be part of the expanding Western Arctic stock (DeMaster, et al., 2000, as referenced in Angliss, DeMaster, and Lopez, 2001).

After summer feeding in the Canadian Beaufort Sea, bowheads begin moving westward into Alaskan waters in August and September. Generally, few bowheads are seen in Alaskan waters until the major portion of the migration takes place, typically between mid-September and mid-October. In some years bowheads are present in substantial numbers in early September. Greene and McLennan (2001) reported detecting substantial rates of bowhead whale calls on September 2-3 while conducting acoustic monitoring studies around the Northstar Project. In 1997, Treacy (1998) reported sighting 170 bowheads, including 6 calves, between Cross Island and Kaktovik on September 3, during the first flight of the survey that year. There is some indication that the fall migration, just as the spring migration, takes place in pulses or aggregations of whales (Moore and Reeves, 1993). Braham et al. (1984, as reported in Moore and Reeves, 1993) reiterated the contention of Eskimo whalers that bowheads are segregated roughly by age class, with smaller whales preceding large adults and cow-calf pairs on the fall migration. Inupiat whalers estimate that bowheads take about 2 days to travel from Kaktovik to Cross Island, reaching the Prudhoe Bay area in the central Beaufort Sea by late September, and 5 days to travel from Cross Island to Point Barrow (T. Napageak, 1996, as cited in National Marine Fisheries Service, 1999).

Wartzog et al. (1989) placed radio tags on bowheads and tracked the tagged whales in 1988. One tagged whale was tracked for 915 kilometers as it migrated west at an average speed of 2.9 kilometers per hour in ice-free waters. It traveled at an average speed of 3.7 kilometers per hour in relative ice-free waters and at an average speed of 2.7 kilometers per hour through eight-tenths ice cover and greater. Another whale traveled 1,291 kilometers at an average speed of 5.13 kilometers in ice-free waters but showed no directed migratory movement, staying within 81 kilometers of the tagging site. Additional tagged whales in 1989 migrated 954-1,347 kilometers at average speeds of 1.5-2.5 kilometers per hour (Wartzog et al., 1990). Mate, Krutzikowsky, and Winsor (2000) tagged 12 juvenile bowhead whales with satellite-monitored radio tags in the Canadian Beaufort Sea. Individual movements and average speeds (1.1-5.8 kilometers per hour) varied widely. The whale with the longest record traveled about 3,886 kilometers from Canada across the Alaskan Beaufort Sea to the Chukchi Sea off Russia and averaged 5.0 kilometers per hour. This whale’s speed was faster, though not significantly, in heavy ice than in open water.

Oceanographic conditions can vary during the fall migration from open water to more than nine-tenths ice coverage. The extent of ice cover may influence the timing or duration of the fall migration. Miller, Elliot, and Richardson (1996) observed that whales within the Northstar region (long. 147°-150° W.) migrate closer to shore in light and moderate ice years and farther offshore in heavy ice years, with median distances offshore of 30-40 kilometers (19-25 miles) in both light and moderate ice years and 60-70 kilometers (37-43 miles) in heavy ice years. Moore (2000) looked at bowhead distribution and habitat selection in heavy, moderate, and light ice conditions in data collected during the autumn from 1982-1991. This study concluded that bowhead whales select shallow inner-shelf waters during moderate and light ice conditions and deeper slope habitat in heavy ice conditions. During the summer, bowheads selected continental slope waters and moderate ice conditions (Moore, DeMaster, and Dayton, 2000). Interseasonal depth and ice-cover habitats were significantly different for bowhead whales. Ljungblad et al. (1987) observed during the years from 1979-1986 that the fall migration extended over a longer period, that higher whale densities were estimated, and that daily sighting rates were higher and peaked later in the season in light ice years as compared to heavy ice years.

Fall aerial surveys of bowhead whales in the Alaskan Beaufort Sea have been conducted since 1979 by the Bureau of Land Management and the MMS (Ljungblad et al., 1987; Treacy, 1988-1998; Treacy, 2000). Over a 19-year period (1982-2000), there were 15 years with some level of offshore seismic exploration and/or drilling activity and three blank years (1994, 1995, 1999, and 2000) in which neither offshore activity took place during September or October. The parametric Tukey HSD test was applied to MMS fall aerial-transect data (1982-2000) to compare the distances of bowhead whales north of a normalized coastline in two analysis regions of the Alaskan Beaufort Sea from 140-156° W. longitude (Map 7). While the Tukey HSD indicates significant differences between individual years, it does not compare actual levels of human activity in those years nor does it test for potential effects of sea ice and other oceanographic conditions on bowhead migrations (Treacy, 2000). Treacy (2000) showed in a year-to-year comparison that the mean migration regionwide in fall 1998 was significantly closer to shore in both the East and West Regions than in 1999, a year with no offshore seismic or drilling activity during the fall season in the Alaskan Beaufort Sea.

Treacy (2001) used a Geographic Information System to depict bowhead whale sighting rates by ice severity (Map 8) for the central Alaskan Beaufort Sea (142-155° W. longitudes). During light-ice years, the highest sighting rates of central-area bowhead whales were generally in shallower, nearshore water reflecting coastal contours. During moderate-ice years, central-area whales occurred in mid-range waters, although with some overlap of both light- and heavy-ice categories. During heavy-ice years, central-area whales occupied deeper, offshore waters, with little overlap of whale densities for light-ice years. While other factors may have dominating effects on site-specific distributions, such as prey concentrations, seismic activities, and localized vessel traffic, broad-area fall distributions of bowhead whale sightings in the central Alaskan Beaufort Sea appear to be driven by overall sea-ice severity (Treacy, 2001).

Further evidence that bowhead whales migrate at varying distances from shore in different years is provided by recent site-specific studies monitoring whale distribution relative to local seismic exploration in nearshore waters of the central Beaufort Sea (Miller et al., 1997; Miller, Elliot, and Richardson, 1998; Miller et al., 1999). In 1996, bowhead sightings were fairly broadly distributed between the 10-meter and 50-meter depth contours. In 1997, bowhead sightings were fairly broadly distributed between the 10-meter and 40-meter depth contours, unusually close to shore. In 1998, the bowhead migration corridor generally was farther offshore than in either 1996 or 1997, between the 10-meter and 100-meter depth contours and approximately 10-60 kilometers from shore.

Aerial surveys near the proposed Liberty development project in 1997 (BPXA, 1998a) showed that the primary fall-migration route was offshore of the barrier islands, outside the development area. However, a few bowheads were observed in lagoon entrances between the barrier islands and in the lagoons immediately inside the barrier islands, as shown in Figures 4-4 and 4-5 of the Environmental Report submitted by BPXA for the Liberty development project (BPXA, 1998a). Because survey coverage in the nearshore areas was more intensive than in offshore areas, maps and tabulations of raw sightings overestimate the importance of nearshore areas relative to offshore areas. Transects generally did not extend south of the middle of Stefansson Sound. Nevertheless, these data provide information on the presence of bowhead whales near the proposed Liberty development area during the fall migration. Probably only a small number of bowheads, if any, came within 10 kilometers (6 miles) of the Liberty area.

Some bowheads may swim inside the barrier islands during the fall migration. Frank Long, Jr., reported that whales are seen inside the barrier islands near Cross Island nearly every year and are sometimes seen between Seal Island and West Dock (U.S. Army Corps of Engineers, 1999). Thomas Brower, Sr., from

Barrow, participated in the last commercial whale hunt in 1919. He said that when he went along with the commercial-whale hunts, he saw crews from the whaling ships look for the whales near the barrier islands in the Beaufort Sea and in the lagoons inside the barrier islands (Brower, 1980). Brower also said that whales have been known to migrate south of Cross Island, Reindeer Island, and Argo Island during years when fall storms push ice against the barrier islands. Inupiat whaling crews from Nuiqsut also have noticed that the whale migration appears to be influenced by wind, with whales stopping when the winds are light and, when the wind starts blowing, the whales started moving through Captain Bay towards Cross Island (Tuckle, as cited in USDOI, MMS, 1986b). Some bowhead whales have been observed swimming about 25 yards from the beach shoreline near Point Barrow during the fall migration (Rexford, as cited in USDOI, MMS, 1996c). A comment received from the Alaska Eskimo Whaling Commission on the Liberty draft EIS indicated that Inupiat workers at Endicott have, on occasion, sighted bowheads on the north side of Tern Island, but no source for the reference was provided nor was any specific information provided regarding the location of the whale.

Data are limited on the bowhead fall migration through the Chukchi Sea before the whales move south into the Bering Sea. Bowhead whales commonly are seen from the coast to about 150 kilometers (93 miles) offshore between Point Barrow and Icy Cape, suggesting that most bowheads disperse southwest after passing Point Barrow and cross the central Chukchi Sea near Herald Shoal to the northern coast of the Chukotsk Peninsula. However, scattered sightings north of 72° N. latitude suggest that at least some whales migrate across the Chukchi Sea farther to the north. After moving south through the Chukchi Sea, bowheads pass through the Bering Strait in late October through early November on their way to overwintering areas in the Bering Sea.

Bowheads are filter feeders, filtering prey from the water through baleen fibers in their mouth. Bowheads apparently feed throughout the water column, including bottom or nearbottom feeding as well as surface feeding. Food items most commonly found in the stomachs of harvested bowheads are zooplankton, including euphausiids, copepods, mysids, and amphipods. Euphausiids and copepods are the primary prey species.

The importance of the Alaskan Beaufort Sea as a feeding area for bowheads is an issue of concern to Inupiat whalers. It is likely that bowheads continue to feed opportunistically where food is available as they migrate across the Alaskan Beaufort Sea, similar to what they are thought to do during the spring migration. Some bowheads apparently take their time returning westward during the fall migration, sometimes barely moving at all, with some localities being used as staging areas due to abundant food resources or social reasons (Bodfish, 1981; Akootchook, 1995, as reported in National Marine Fisheries Service, 2001). The Inupiat believe that whales follow the ocean currents carrying food organisms. If the currents go close to Cross Island, whales migrate near there (Napageak, 1996, as reported in National Marine Fisheries Service, 2001). Bowheads have been observed feeding not more than 1,500 feet offshore in about 15-20 feet of water (Brower, 1979; Rexford, 1979, as reported in National Marine Fisheries Service, 2001). Nuiqsut Mayor Nukapigak testified at the Nuiqsut Public Hearing on March 19, 2001, that he harvested a bowhead whale 2 miles from Northstar Island in 1997. He also testified that he and others saw a hundred or so bowhead whales and gray whales feeding near Northstar Island (USDOI, MMS, 2001). Although numerous observations have been made of bowheads feeding during both the spring migration north to the Beaufort Sea and the fall migration west across the Alaskan Beaufort Sea, quantitative data showing how food consumed in the Alaskan Beaufort Sea contributes to the bowhead whale population's overall annual energy needs is fairly limited.

Carroll et al. (1987) and Shelden and Rugh (1995; 2002) report that stomach contents collected from bowheads harvested between St. Lawrence Island and Point Barrow during April into June, indicate some whales feed opportunistically during the spring migration. Carroll et al. (1987) report that the region west of Point Barrow seems to be of particular importance for feeding, at least in some years, but whales may feed opportunistically at other locations in the lead system where oceanographic conditions produce locally abundant food. Shelden and Rugh also suggest the lead system near Point Barrow may serve as an important feeding area in the spring in years when oceanographic conditions are favorable. Lowry (1993) reported that the stomachs of 13 out of 36 spring-migrating bowheads harvested near Point Barrow between 1979 through 1988 contained food. Lowry estimated total volumes of contents in stomachs ranged from less than 1 to 60 liters, with an average of 12.2 liters in eight specimens. The extent or importance of the area to bowheads for feeding is not known, because no estimate of total stomach volume for the whales was provided.

Over the years, bowheads have been reported feeding in the eastern Beaufort Sea and Amundsen Gulf region in Canada and have been observed feeding in various places in the Alaskan Beaufort Sea. Some bowheads appear to feed east of Barter Island as they migrate westward (Thomson and Richardson, 1987). Lowry (1993) reports that stomachs of 13 out of 15 whales harvested off Kaktovik during 1979-1988 contained food, suggesting that nearly all bowheads taken at Kaktovik had been feeding before capture. Lowry estimated total volumes of contents in stomachs ranged from 3-48 liters, with an average of 25.9 liters in eight specimens. One whale was noted as having a full stomach, but no stomach volume was reported. The report did not distinguish between feeding whales with a full stomach and whales with as little as 3 liters of material in the stomach. Stomachs of five out of six whales taken at Point Barrow during 1976-1988 contained food (Lowry, 1993). The total volume of contents of the stomach of one whale was estimated at 109 liters, and three others were estimated at 8 liters. No estimate of total stomach volume for the whales was provided. All whales with food materials in the stomach, regardless of volume, apparently were considered feeding whales.

Lowry and Sheffield (2002) analyzed stomach contents of whales taken at Kaktovik, Cross Island, and Barrow during the fall migration. The standard for a whale being designated as a feeding whale for this study was as little as 10 or more prey items in the stomach. In many instances no information was available about the volume of the stomach contents, but collected samples were available for laboratory analysis.

Twenty-four out of 32 whales taken during the fall at Kaktovik from 1979-2000 and included in this analysis were considered to have been feeding (Lowry and Sheffield, 2002). The status of three other whales was uncertain. Of these 24 known feeding whales, there were estimates of stomach contents for 18 whales. Eleven of the 18 whales had less than 20 liters of material in their stomach, and 7 whales had more than 20 liters of material in their stomach. Several feeding whales had as little as 2-3 liters in the stomach. Two whales had estimated stomach volumes of 136 and 150 liters. Copepods were the dominant prey species by volume.

Four out of five whales taken during the fall at Cross Island from 1976-2000 were considered to have been feeding. Copepods were the main prey in three of the stomachs sampled. The report provided little or no information on volume or stomach content of these whales other than types of prey species.

Seventy-seven out of 106 whales harvested during the fall near Barrow from 1987-2000 and included in this analysis were considered to have been feeding. The status of two other whales was uncertain. There was no estimate of stomach contents for 61 whales. Of the 77 known feeding whales, there were estimates of stomach contents for 16 whales. Seven of the 16 whales had less than 20 liters of material in their stomach, and nine whales had more than 20 liters of material in their stomach. Estimated stomach volumes ranging from 1-189 liters were reported for the 16 whales with stomach contents, with five whales having stomach volumes greater than 100 liters. Euphausiids were the dominant prey species by volume. The extent or importance of the area to bowheads for feeding is not clear from the Lowry and Sheffield 2002 report, because the standard for determining a feeding whale was set so low. As pointed out by Thomson, Koski, and Richardson (2002), there is a large difference between a stomach with that small amount of prey (10 prey items) and one that is full.

Bowheads occasionally have been observed feeding north of Flaxman Island and, in some years, fairly large groups of them have been seen feeding east of Point Barrow between Smith Bay and Point Barrow. Ljungblad et al. (1986) reported that feeding bowheads comprised approximately 25% of the total bowheads observed during aerial surveys conducted in the Beaufort Sea from 1979 through 1985. Miller, Elliott, and Richardson (1998) reported observing many aggregations of feeding whales in nearshore waters near or just offshore of the 10-meter depth contour during late summer/autumn 1997.

Treacy (2002) used a Geographic Information System to identify temporal or spatial patterns in feeding or milling behavior of bowhead whales in a given year or multiple years. Because whales exhibiting milling behavior also may be feeding whales, whales with milling behavior were included with whales with apparent feeding behavior, even though some milling whales were probably engaged in other forms of social behavior. Feeding and milling whales observed per unit effort for each fall season (1982-2001) were mapped for visual comparison of relative occurrence of these behaviors in the Alaskan Beaufort Sea. Treacy (2002) observed a greater relative occurrence of feeding and/or milling behavior of whales on transect in six of the 20 years (1984, 1989, 1997, 1998, 1999, and 2000) near the mouth of Dease Inlet. Greater relative occurrence of feeding and/or milling behavior of bowheads was observed on transect in 4 of those years (1989, 1997, 1998, and 1999) near Cape Halkett. There were 9 other years when feeding and/or milling behaviors were noted on transect at locations other than near Dease Inlet or Cape Halkett (1982, 1983, 1985, 1986, 1988, 1990, 1993, 1995, and 1996). Feeding/milling behaviors during these 9 years were typically spottier, less recurrent between years, and/or involved fewer whales per unit effort. In 5 other years (1987, 1991, 1992, 1994, and 2001), neither feeding nor milling behaviors were observed on transect anywhere in the study area. Interannual and geographic variation in prey availability likely accounts for opportunistic feeding aggregations in particular years and locations (Treacy, 2002).

A study by Richardson (1987) concluded that food consumed in the eastern Beaufort Sea contributed little to the bowhead whale population's annual energy needs, although the area may be important to some individual whales. The conclusion was controversial. The North Slope Borough's Science Advisory Committee (1987) believed there were problems in the study's design and length. The main concerns expressed by the Committee were the short duration of the study (two field seasons, one of which was limited by ice cover), suboptimal sampling designs, and difficulties in estimating food availability and consumption. Two years is too short a period in which to fully characterize the use of an area by bowheads. The Committee also said the overall conclusion of nonimportance seems marginally reasonable only for the whale stock as a whole and only in the context of the sampling period within the 1985-1986 feeding seasons. The Committee did not accept the conclusion that the study area is unimportant as a feeding area for bowhead whales. To respond to these concerns and to better understand the importance of the eastern Alaska Beaufort Sea to bowhead whales, the MMS funded a second study on bowhead whale feeding, entitled *Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information* (USDOI, MMS, Alaska OCS Region, 1997). The study emphasized cooperation among local government, subsistence-whale hunters, scientists, and MMS in its planning and execution. This bowhead whale-feeding study was an extension of the feeding study conducted in the same area of the eastern Beaufort Sea during 1985 and 1986. The purpose of the project was to compile and integrate existing traditional and scientific knowledge about the importance of the eastern Alaskan Beaufort Sea for feeding by bowhead whales. The study area extended from Flaxman Island to the Alaska/Canada border and from shore to the 200-meter depth contour.

A later study by Koski (2000) summarized that the most common activity of bowheads in the eastern Alaskan Beaufort Sea during late summer and autumn was feeding. Bowhead use of the eastern Alaskan Beaufort Sea during late summer and autumn can be highly variable from year to year, with substantial differences in the numbers, size classes, residence times, and distributions of bowheads recorded there during 1985, 1986, 1998, and 1999.

Following the first year of fieldwork on this study, Griffiths (1999) noted that the average zooplankton biomass in the study area was higher in 1986 than in 1998. Habitat suitable for feeding appears to have been less common in the eastern Alaskan Beaufort Sea in 1998 than it was in 1986. In 1998, the principal feeding area within the eastern study area appeared to have been near Kaktovik.

Griffiths, Thomson, and Bradstreet (2002) discussed zooplankton biomass samples collected in the Canadian Beaufort Sea during the 1980's and in the Alaskan Beaufort Sea in 1986, 1998, and 1999, where bowhead whales were either observed feeding or where whales had been observed feeding the previous day. Bowhead whales feed in areas with a higher than average concentration of zooplankton. The lowest biomass in any of the plankton tows conducted at 17 whale-feeding stations was 545 milligrams per cubic meter. For 4 of the 17 stations the highest biomass measured was 771-807 milligrams per cubic meter, and for 12 of 17 stations the highest value was greater than or equal to 1,000 milligrams per cubic meter. Mean wet-weight biomass in the water column near actively feeding whales was 529 milligrams per cubic meter, a value considerably higher than the mean biomass in the water column elsewhere in the eastern Alaskan and Canadian parts of the Beaufort Sea (230 milligrams per cubic meter). The distribution of biomass values at locations with feeding bowheads indicates that the feeding threshold for bowheads may be a wet biomass of ~800 milligrams per cubic meter.

Bowhead whales moved quickly through the area in 1998 and did not stop to feed for any great period of time. In contrast, during 1986, some individual whales stopped to feed in the study area for periods of at least several days. In 1999, the main bowhead feeding areas were 20-60 kilometers offshore in waters 40-100 meters deep in the central part of the study area east and northeast of Kaktovik, between Kaktovik and Demarcation Bay (Koski, Miller, and Gazey, 2000). In 1999, one bowhead remained in the study area for at least 9 days, and 10 others remained for 1-6 days. Their mean rate of movement was about one-eighth of the rate observed in 1998.

Although various types of evidence (with the exception of isotope ratios) indicate that the eastern Beaufort Sea as a whole, including the Canadian Beaufort, is important to bowhead whales for feeding, the eastern Alaskan Beaufort Sea is only a small fraction of that area (Richardson and Thomson, 2002). The average bowhead does not spend much time in the eastern Alaskan Beaufort Sea and, thus, does not feed there extensively. Koski, et al. (2002) used six calculation methods to estimate residence time for whales in the eastern Alaska Beaufort Sea area, from Flaxman Island to Herschel Island. The annual residence time varied from 2.1-8.3 days and averaged 5.1 days. Richardson and Thomson (2002) estimated that an average bowhead spends ~3.8 days in the area from Flaxman Island to the Alaska/Canada border during late summer/early autumn, or ~1.4 days longer than expected for a whale that swims steadily across that area. Of the individual bowheads that travel through this portion of the eastern Alaskan Beaufort Sea, some spend at least 7 days.

Carbon-isotope analysis of bowhead baleen has indicated that a significant amount of feeding may occur in wintering areas (Schell, Saupe, and Haubenstock, 1987). Baleen from bowhead whales provides a multiyear record of isotope ratios in prey species consumed during different seasons, including information about the occurrence of feeding in the Bering Sea and Chukchi Sea system. Carbon-isotope analysis of zooplankton, bowhead tissues, and bowhead baleen indicates that a significant amount of feeding may occur in areas west of the eastern Alaskan Beaufort Sea, at least by subadult whales (Schell, Saupe, and Haubenstock, 1987). The isotopic composition of the whale is compared with the isotope ratios of its prey from various geographic locations to make estimates of the importance of the habitat as a feeding area. Subadult whales show marked changes in the carbon isotope over the seasons, indicating that carbon in the body tissues is replaced to a large extent from feeding in summer and feeding in the autumn-winter months. In contrast, adult animals sampled show very little seasonal change in the carbon isotope and have an isotopic composition best matched by prey from the western and southern regions of their range, implying that little feeding occurs in summer (Schell and Saupe, 1993).

The isotopic data also indicate that primary productivity in the Bering and southern Chukchi seas is declining. Schell (1999a) looked at baleen from 35 bowheads that were archived, in addition to whales from the recent harvest, and constructed an isotopic record that extends from 1947-1997. He inferred from this record that seasonal primary productivity in the North Pacific was higher over the period from 1947-1966, and then began a decline that continues to the most recent samples from 1997. Isotope ratios in 1997 are the lowest in 50 years and indicate a decline in the Bering Sea productivity of 35-40% from the carrying capacity that existed 30 years ago. If the decline in productivity continues, the relative importance of the eastern Beaufort Sea to feeding bowheads may increase (Schell, 1999b).

Lee and Schell (2002) analyzed carbon isotope ratios in bowhead whale muscle, baleen, and fat, and in bowhead food organisms. The isotopic signatures in zooplankton from Bering and Chukchi waters, which sometimes extend into the western Beaufort Sea, are similar and cannot be differentiated from one another. Zooplankton from the eastern Beaufort Sea (summer and early autumn range) has an isotopic signature that is distinct from that in Bering/Chukchi zooplankton. Lee and Schell compared these isotopic signatures in zooplankton to isotopic signatures in bowhead tissues.

Lee and Schell (2002) found that carbon isotopes in the muscle sampled in the fall were not significantly different from those in muscle sampled in the spring. Carbon isotopes in the muscle during both seasons closely matched the isotope ratios of zooplankton from the Bering and Chukchi waters, indicating most of the annual food requirements of adults and subadults are met from that portion of their range. Based on the comparison of carbon isotopes in the zooplankton and in bowhead tissues, they estimate that 10-26% of the annual bowhead feeding activity was in the eastern and central Beaufort Sea waters, roughly east of Prudhoe Bay.

Isotope data from baleen showed different feeding strategies by adult and subadult whales. Subadults acquired sufficient food in the eastern Beaufort Sea to alter the carbon isotope ratios in baleen relative to baleen representing feeding in Bering and Chukchi waters. Baleen plates from subadults showed a wider range in isotope ratios than those from adults, suggesting active feeding over all parts of their range.

A study by Hoekstra et al. (2002) concluded that seasonal fluctuations in carbon isotope values was consistent for all age classes of bowhead whales and suggests that the Bering and Beaufort Seas are both important regions for feeding. Hoekstra et al. (2002) included data on isotope ratios in tissue subsamples from some of the same individual bowheads from Kaktovik and Barrow that were analyzed by Lee and Schell. There was an apparent discrepancy in the data from these two studies and somewhat different conclusions. The source of the discrepancy related to differences in the results from the Kaktovik whale muscle samples. Hoekstra et al. (2002) suggest the percentage of annual feeding activity in the eastern Beaufort Sea could be on the order of 37-45% (compared to 10-26%). This discrepancy was considered critical in assessing the importance of feeding in the eastern Beaufort Sea. Lee and Schell subsequently repeated their isotopic analyses on additional subsamples from the same Kaktovik whales and obtained the same results they obtained initially (Lee and Schell, 2002). These re-analyses confirm the accuracy of the measurements reported by Lee and Schell in their draft report. Hoekstra et al. have not repeated their isotopic analyses at this time; therefore, the reason for the discrepancy between the two sets of data remains uncertain.

Estimated food consumption by bowheads in the eastern Alaskan study area (Flaxman Island to Alaska/Canada border) was expressed as a percentage of total annual consumption by the population (Thomson, Koski, and Richardson, 2002). This was done separately for each year of the study and averaged for the 5 years of the study. Based on this approach, in an average year the population of bowhead whales is estimated to consume about 2.4% of its annual energetic requirements in the study area. In 1 of the 5 years (1999), the population of bowheads may have derived about 7.5% of annual energetic requirements in the study area. In all other years, estimated consumption in the study area was less than 2%.

Thomson, Koski, and Richardson (2002) tried to reconcile the low estimates of summer feeding, as evident from the isotope data of Lee and Schell, with other data: behavioral observations showing frequent feeding in the eastern Beaufort Sea during the summer and early autumn; zooplankton sampling near bowheads feeding in those areas shows that whales concentrate their feeding at locations with much higher than average biomasses of zooplankton; frequent occurrence of food in the stomachs of bowheads harvested in the Alaskan Beaufort Sea during late summer and autumn; and length-girth relationships show that subadult bowheads, and possibly adults, gain weight while in the Beaufort Sea in summer and lose weight while elsewhere and lipid content of blubber, at least in subadults, is higher when they leave the Beaufort in fall than when they return in spring. Although some of this evidence suggests the importance of feeding in the Beaufort Sea during summer and early autumn, those types of data on summer and early fall feeding in the Beaufort Sea do not specifically show what fraction of the annual feeding occurs in the eastern and central Beaufort Sea. No comparable data on feeding, girth, or energy content have been obtained during and after the whales feed in the Chukchi sea in mid- to late fall. Perhaps, more feeding and energy accumulation occurs there in fall than in the Beaufort Sea in summer. If so, the observations of feeding in the Beaufort Sea might not be inconsistent with the strong Bering/Chukchi isotope signature in bowhead tissues.

Thomson, Koski, and Richardson (2002) offered a feeding scenario that might be consistent with all these data: feeding occurs commonly in the Beaufort Sea in summer and early autumn, and bowheads gain energy stores while feeding there. However, zooplankton availability is not as high in the Beaufort Sea during summer as in the Chukchi and northern Bering seas during autumn. Also, feeding in the western Beaufort in autumn effectively may be on Chukchi prey advected to that area. Thus, bowheads might acquire more energy from Bering/Chukchi prey in autumn than from eastern and central Beaufort prey in summer/early autumn. Given this, plus an assumed low turnover rate of body components, the overall body composition of bowheads may be dominated by components from the Bering/Chukchi system, even at the end of the summer when leaving the Beaufort. Energy gained in the Beaufort and Chukchi seas during summer and fall presumably is used during winter when food availability is low, resulting in reduced girth and energy stores when returning to the Beaufort Sea in spring than when leaving in autumn. Several aspects of this scenario are speculative.

Richardson and Thomson (2002) summarized the information from the bowhead whale feeding study:

- A comparison of carbon isotope ratios in bowhead muscle and baleen with those in the main food organisms suggests that bowhead whales consume only a minority of their food in the eastern and central Beaufort Sea, including the Canadian and the eastern Alaskan Beaufort Sea. Based on stable-isotope evidence, bowhead whales likely consume only 10-26% of their food in the eastern and central Beaufort Sea. Subadult bowheads appear to derive greater than 10% of annual food requirements there, although the 95% confidence interval extends below 10%. It also is probable that adults gain greater than10% of their food in that area but, for adults, the isotope evidence considered in isolation would support an answer of less than 10%.
- An average bowhead spends ~3.8 days in the area from Flaxman Island to the Alaska/Canada border during the late summer/autumn period, or ~1.4 days longer than expected for a whale that swims steadily across that area. Averages in various years ranged from ~2.5-6.3 days. Although the average was less than 7 days in all years studied, it might exceed 7 days in a small minority of the years, based on the calculated upper 95% confidence bounds. Of the individual bowheads that travel through the eastern Alaskan Beaufort Sea, some spend at least 7 days between the Alaska/Canada border and Flaxman Island during late summer and autumn.
- The percentage of the study area suitable as feeding habitat, i.e., with 800 milligrams per cubic meter zooplankton at some depth, averaged 25% over 4 years with effective echosounder sampling, and varied from 7-43% in individual years.
- Based on stomach content data supplemented by behavioral evidence, far more than 10% of the bowheads that pass through the eastern Alaskan Beaufort Sea during late summer and autumn feed there. Of the whales harvested at Kaktovik, 24 out of 32 whales had been feeding. The status of three other whales was uncertain. Of the 24 feeding whales, there were estimates of stomach contents for 18 whales. Eleven of these 18 whales had less than 20 liters of stomach contents and 7 whales out of the 18 had 20 liters or more of stomach contents.
- Bowheads fed for an average of 47% of their time in the eastern Alaskan Beaufort Sea during late summer and autumn. A substantial minority of the feeding occurred during travel. Among traveling whales, feeding as well as travel was occurring during a substantial percentage of the time, on the order of 43%.
- In an average year, the population of bowhead whales derives an estimated 2.4% of annual energetic requirements in the eastern Alaskan Beaufort Sea. In 1 of 5 years of study, the population may have derived as much as 7.5% of annual energetic requirements from the area. Use of the study area varies widely in time and space, depending on zooplankton availability and other factors.

Information regarding age at sexual maturity or mating behavior and timing for bowhead whales is not known with certainty. Most bowheads mate and calve from April through mid-June, coinciding with the spring migration. Mating may start as early as January and February, when most of the population is in the Bering Sea, but mating also has been reported as late as September and early October (Koski et al., 1993). Calving occurs from March to early August, with the peak probably occurring during the spring migration between early April and the end of May (Koski et al., 1993). Females give birth to a single calf probably every 3-4 years.

Reese et al. (2001) developed a nonlinear model for fetal growth in bowhead whales to estimate the length of gestation, with the model indicating an average length of gestation of 13.9 months. By comparison, the length of gestation for bowhead whales was estimated to be between 13 and 14 months by Nerini et al. (1984, as reported in Reese et al., 2001) and between 12 and 16 months by Koski et al. (1993). The model by Reese et al. (2001) also indicated that conception likely occurs in early March to early April, suggesting that breeding occurs in the Bering Sea. The conception date and length of gestation suggests that parturition is likely to occur in mid-May to mid-June, when most whales are between the Bering Strait and Point Barrow. Reese et al. (2001) said this is consistent with other observations in the region, including: (a) relatively few neonate-cow pairs are reported by whalers at St. Lawrence Island; (b) many neonates are seen during the whale census in late May; (c) relatively few term females have been taken at Barrow; (d) females with term pregnancies appeared close to parturition; and (e) most of the herd is believed to have migrated past Barrow by late May.

Several researchers have explored techniques for aging bowheads, including tympanic bullae lamina, carbon isotopes in baleen, photographic recapture, and aspartic-acid racemization of the eye lens. The various approaches at aging bowhead whales and estimating survival rates all suggest slow growth, great longevity, and high survival rates. Schell and Saupe (1993) looked at baleen plates as a means to determine the age of bowhead whales and concluded that bowheads are slow-growing, taking about 20 years to reach breeding size. Zeh et al. (1993), while looking at population structure and dynamics, also concluded that the bowhead is a late-maturing, long-lived animal with fairly low mortality. Photographic recaptures by Koski et al. (1993) also suggested advanced age at sexual maturity of late teens to mid-twenties. Most female bowheads become sexually mature when they are 12.5-14.0 meters long, probably at an age exceeding 15 years. The discovery of traditional whaling tools recovered from five bowheads landed since 1981 also suggest advanced longevity (George et al., 1995), in some instances exceeding 100 years. George et al. (1999), using the aspartic-acid racemization techniques, estimated the age of 42 whales. The results indicated that four animals exceeded 100 years of age.

There is little information regarding natural mortality for bowhead whales in the Bering, Chukchi, and Beaufort seas. Bowhead whales have no known predators except, perhaps, killer whales and subsistence whalers. Attacks by killer whales have occurred, but the frequency probably is low. George et al. (1994) concluded that the relatively low frequency of bite marks likely reflects a relatively low frequency of killer whale attacks and predation pressure. Likewise, the scarcity of observations of vessel-inflicted injuries suggests that the incidence of ship collisions with bowhead whales also is quite low. There also are some reports of bowheads becoming entangled in ropes from crab pots, harpoon lines, or fishing nets; however, the frequency of occurrence is not known. Some whales likely die as a result of entrapment in ice, but the number is thought to be relatively small (Philo et al., 1993). Little is known about the effects of microbial or viral agents on natural mortality.

III.B.4.a(2) Spectacled and Steller's Eiders

III.B.4.a(2)(a) Population Status and Spring Migration

An estimated 7,370 spectacled eiders occupied the Arctic Coastal Plain of Alaska in June 2001 (Larned et al., 2001), about 2% of the estimated 363,000 world population (USDOI, Fish and Wildlife Service, 1999). Nonbreeders, assumed to remain at sea in summer, are not included in the Alaska estimate. The arctic Alaska population has shown a nonsignificant decreasing trend from 1993-2000 (Larned et al., 2001). Details of population status and annual cycle may be found in the final EIS's for Liberty and Sale 170 (USDOI, MMS, Alaska OCS Region, 2002a; USDOI, MMS, 1998); the National Petroleum Reserve-Alaska Integrated Activity Plan EIS (USDOI, Bureau of Land Management and MMS, 1998); Petersen, Grand, and Dau (2000); Troy Ecological Research Assocs. (1999); and USDOI, Fish and Wildlife Service (1999). The spectacled eider was listed as a threatened species under the Endangered Species Act in May 1993.

The only known wintering area lies south of St. Lawrence Island in the Bering Sea. Because few eiders are observed in marine areas along the Beaufort coast in spring, a majority may migrate to the nesting areas overland from the Chukchi Sea (Troy Ecological Research Assocs., 1999).

III.B.4.a(2)(b) Nesting and Postnesting Periods

Spectacled eider nests are widely separated, nesting mainly from the Sagavanirktok River to the Chukchi Sea, and only sparsely to the east (Larned et al., 2001). The highest densities determined from Fish and Wildlife Service aerial surveys for eiders in 1998-2001 on the Arctic Coastal Plain east to the Arctic National Wildlife Refuge were found south of Barrow, with smaller areas east of Teshekpuk Lake, on the Colville River Delta, and near western Simpson Lagoon (Map 9a). Overall density was determined as 0.24 birds per square kilometer (304 birds observed) in 2001 (Larned, et al., 2001).

Following their early (June) departure from the nesting areas, males apparently make relatively little use of the Beaufort before migrating to the Chukchi Sea. A few satellite-tagged males have been located in western Simpson Lagoon and Harrison Bay (Map 9b). Females that have not nested, or had nest failure, may occur in Beaufort Sea waters from late June through August. Females with broods are present from late August. The use of Beaufort coastal waters by females is more widespread than males, but Harrison

Bay also is used frequently, as suggested by locations of birds by satellite telemetry (Map 9b). Apparently, there is considerable variation in the speed of movement from east to west across the Beaufort Sea by individual birds, as indicated by successive locations of specific satellite transmitters (numbers near map symbols). From the Prudhoe Bay area, where birds were equipped with transmitters that broadcast a location every 3 days, some birds left the Beaufort Sea before the next location was broadcast (for example, males 7347, 7353). Others were recorded at intermediate points for 1-3 three-day intervals before departing the map area (males 7352, 7354; females 4453, 4457, 4500, 7339, 7341, 7356, 7362). It does not appear that any birds remained in the Beaufort more than 9 days after receiving a transmitter, and most departed more quickly.

Aerial surveys in the central Beaufort Sea area from Harrison Bay/Cape Halkett to Mikkelsen Bay/Brownlow Point in 1999 and 2000 by the Fish and Wildlife Service located 148 individuals in offshore waters; 147 of these were in deeper waters (greater than 10 meters) of Harrison Bay, including one large flock of 100 birds (Fischer, Tiplady, and Larned, 2002; Map 9a). A Fish and Wildlife Service survey from Point Barrow to Demarcation Point in 2001 located 15 individuals off western Simpson Lagoon, in outer Smith Bay, and off the Plover Islands east of Point Barrow (Fischer, 2001; Map 9a). It should be noted that aerial flight lines along which birds were counted during 1999 and 2000 surveys were separated by only 5.4 kilometers and confined to the area between Harrison Bay/Cape Halkett to Mikkelsen Bay/Brownlow Point, compared to 10 kilometers in the 2001 survey, which covered the entire Alaskan Beaufort Sea coast from Point Barrow to Demarcation Point and, thus, lines along which birds are plotted are closer together and almost twice as numerous in the central area as to the east and west.

III.B.4.a(2)(c) Steller's Eider

Recent surveys have found very low densities (0.01 birds per square kilometer, Larned, et al., 2001) of this species on the western Arctic Coastal Plain as far east as the Colville River Delta (Map 9b). It is rare in this latter area and extremely rare farther east (Larned, et al., 2001; Mallek, 2001; Mallek, Platte, and Stehn, 2002). The estimated coastal plain population is about 1,000 individuals; its center of abundance and nesting is the Barrow area (USDOI, Fish and Wildlife Service, 1999), with a high density of 0.08 birds per square kilometer (44-112 birds observed in 1999-2001) determined by intensive surveys in this area (Ritchie and King, 2001). Nesting does not occur every year in this area, possibly related to predator presence (Quakenbush and Suydam, 1999). Although Dau and Anderson (2001) did not observe Steller's eiders during their Beaufort Sea nearshore-barrier island aerial survey in late June-early July 2001, Fischer (2001) observed three near Cape Simpson in Smith Bay during transects flown in late July 2001. The Alaska population of the Steller's eider was listed as threatened under the Endangered Species Act in June 1997.

III.B.4.a(2)(d) Critical Habitat

Critical habitat for these eiders was designated in February 2001. Spectacled eider areas include Ledyard Bay in the southeast Chukchi Sea, the wintering area south of St. Lawrence Island, Norton Sound, and the Yukon-Kuskokwim Delta. Critical habitat for the Steller's eider includes the Yukon-Kuskokwim Delta and four areas of southwest Alaska.

III.B.5. Marine and Coastal Birds

Several million birds of about 70 species occur regularly in Arctic Coastal Plain and Beaufort Sea habitats in or adjacent to the multiple-sale area (BPXA, 1995, 1998a; Johnson and Herter, 1989; USDOI, MMS, 1996a, 1998; Troy Ecological Research Assocs., 1993, 1995b). Nearly all are migratory, present for all or part of the period May to early November. A majority of species found in coastal areas are waterfowl or shorebirds; other groups represented by one or more species that also are fairly common to abundant include loons, seabirds, hawks/eagles, ptarmigan, and songbirds. Aerial surveys in the Beaufort Sea have documented that birds are widespread in substantial numbers in both nearshore and offshore waters of this area (Fischer, 2001; Fischer, Tiplady, and Larned, 2002; Larned, Platte, and Stehn, 2001; Stehn and Platte, 2000; USDOI, Fish and Wildlife Service, 2002) and it is likely that approximately this distribution prevails along most or all of the Beaufort coastline and into the northern Chukchi Sea during the open-water season.

Birds occur out to at least 70 kilometers offshore where open water is available. Important features of various species' annual cycle events, habitats, abundance, and population status are summarized below; details of these topics may be found in the final EIS's for Liberty and Sale 170 (USDOI, MMS, Alaska OCS Region, 2002a; USDOI, MMS, 1998) and the Northwest National Petroleum Reserve-Alaska Integrated Activity Plan EIS (USDOI, Bureau of Land Management and MMS, 2002).

III.B.5.a. Annual Cycle

III.B.5.a(1) Spring Migration

Waterfowl species such as the **long-tailed duck**, **king eider**, **common eider**, and **brant** migrate eastward along a broad front, which may include inland, coastal, and offshore routes, from about early May to mid-June (Johnson and Herter, 1989; Johnson and Richardson, 1982; Richardson and Johnson, 1981). A substantial proportion of several species' Pacific breeding population passes through or adjacent to the multiple-sale area during spring migration. The availability of open water off river deltas and in leads determines migratory routes and distribution of loons, waterfowl, and seabirds at this time. These areas are occupied until local nesting areas are free of snow in June (Bergman et al., 1977; Johnson and Herter, 1989). Most **shorebirds** and other **waterfowl** concentrate in snow-free coastal or inland areas until nest sites are available. For example, in early to mid-June prebreeding shorebirds such as sanderlings, Baird's sandpiper, and semi-palmated plover occur on early-opening gravel and mud areas on some beaches and pools. Arrival dates for various species range from late April to early June.

III.B.5.a(2) Nesting Period

Islands in river deltas and barrier islands provide the principal nesting habitat for several waterfowl and marine bird species in the Beaufort Sea region. In particular, **lesser snow geese** and **brant** nest on Howe and Duck islands in the Sagavanirktok River Delta (Johnson, 1994a,b; Stickney and Ritchie, 1996); snow geese also nest on the Ikpikpuk River delta at Smith Bay (Ritchie, Lovely, and Knoche, 2002), apparently increasing from about 100 nesting pairs in 1998 (Ritchie, Burgess, and Suydam, 2000) to more than 800 pairs in 2002 (Suydam, 2002, pers. commun., as cited in North Slope Borough, 2002:letter comment on Beaufort Sea Planning Area EIS). Up to 7,500 snow geese nest on the Kendall Island Bird Sanctuary on the Mackenzie River delta. Large numbers of **brant** and other goose species often occur in the Teshekpuk Lake Special Area , especially on lakes between Teshekpuk and the coast. Scattered colonies of brant occur through northwest Alaska, particularly from Smith Bay west to the Chukchi coast, and low numbers southward to Kasegaluk Lagoon (Ritchie, Lovely, and Knoche, 2002). **Common eiders**, **glaucous gulls,** and **arctic terns** nest on barrier islands in the east-central Beaufort Sea in addition to on other islands and causeways (Flint, et al., 2000; Johnson, Wiggins, and Rodrigues, 1993; Johnson and Herter, 1989; Schamel, 1978; Maps 10a, 11a). Terns also nest at high density inland across much of the Arctic Coastal Plain, and **common eiders** have been documented nesting on the mainland near Point Thomson (U.S. Geological Survey, Biological Resources Div., 2002, pers. commun.). **Common eider** young may occur in creches of varying size, particularly where eiders nest in colonies (Flint, et al., 2000; Johnson and Herter, 1989). **Black guillemots** nest mainly on barrier islands in the western Beaufort, particularly Cooper Island (Divoky, Watson, and Bartonek, 1974).

Pacific loons; tundra swans; greater white-fronted geese; several **duck species** including the abundant **northern pintail; shorebirds (**Map 10a**), jaegers; glaucous gulls;** and **arctic terns** nest across most of the Arctic Coastal Plain, generally at higher densities west of the Prudhoe Bay area; but they also extend into northern Canada in smaller numbers. **Sabine's gull** occurs mainly from the Deadhorse area west; it is an uncommon breeder in the Arctic National Wildlife Refuge. **Shorebirds** are numerically dominant in most coastal plain bird communities (Map 10a), occurring across northern Alaska, including the Arctic National Wildlife Refuge, and Canada, including Kendall Island Bird Sanctuary, using a range of habitats from dry gravelly to wet tundra and littoral. Members of this group, including dunlin, semi-palmated sandpiper, and American golden-plover, also nest on barrier islands which have tundra habitats, as do several passerine species including Lapland longspur, redpoll, and snow bunting (U.S. Geological Survey, Biological Resources Div. 2002, pers. commun.). Shorebirds likely to nest in these habitats also include semi-palmated plover, pectoral sandpiper, red-necked phalarope, and red phalarope. Concentrations of **Canada**

geese occur in the Teshekpuk Lake area and at lower density in the Prudhoe Bay region. **Long-tailed ducks** are widespread in northern Alaska, including the Arctic National Wildlife Refuge, and Canada (Map 10b). Probably three-quarters of Beaufort Sea **king eiders** occupy western Canada and northeastern Alaska during the breeding season (Dickson et al., 1997; Suydam, 2000). Other areas of relatively moderate density occur on the coastal plain from west of Prudhoe Bay to south of Barrow (Larned, Platte, and Stehn, 2001; Map 11a). **Yellow-billed** and **red-throated loons** (Gotthardt, 2001) nest mainly south and west of Smith Bay.

III.B.5.a(3) Postnesting Period

Most broodrearing and/or molting **loons, swans**, and **geese** occur in large lakes. B**rant** molt on lakes in the Teshekpuk Lake area or lakes near their nesting colonies elsewhere. In addition, postmolting and broodrearing **brant** use various coastal habitats such as sloughs and tidal flats (Derksen, Bollinger, and Esler, 1992; Johnson and Herter, 1989; Ritchie, Lovely, and Knoche, 2002) from early July through August. Major concentrations of molting waterfowl occur in several areas along the Beaufort and Chukchi sea coasts including Simpson Lagoon, the Teshekpuk Lake Special Area, Peard Bay, Kasegaluk Lagoon, and Ledyard Bay from late June through August. Teshekpuk Lake is the most important molting location for **brant**, especially failed breeders and nonbreeders from western Alaska and the Yukon-Kuskokwim Delta, Canada, and Siberia beginning in late June; substantial numbers **of greater white-fronted** and **Canada geese** also molt in this area. Numbers occupying the area during the molt period vary considerably, from low thousands to tens of thousands of individuals, in part depending on greater or lesser nest success by the various species (Mallek, 2001; Mallek, Platte, and Stehn, 2002). **Snow goose** broodrearing occurs in Foggy Island Bay and surrounding river deltas (Johnson, 1998).

Large numbers of **long-tailed ducks** molt in Simpson and other Beaufort lagoons and bays beginning in mid-July (Johnson, 1984; Johnson and Gazey, 1992; Lanctot et al., 2001; Map 10b). (Note that the apparently higher offshore bird densities recorded during aerial surveys confined to the central Beaufort Sea region from Harrison Bay/Cape Halkett to Mikkelsen Bay/Brownlow Point in 2000, compared to those recorded in areas farther east or west during aerial surveys that covered the entire Alaskan Beaufort coast from Point Barrow to Demarcation Point, may be partly an artifact of sampling intensity. This is because aerial survey flight lines along which birds were counted were separated by only 5.4 kilometers in the central survey area, compared to 10 kilometers in areas farther east or west and, thus, lines along which birds are plotted are closer together and almost twice as numerous in the central area as in the eastern or western areas). Most birds are located along barrier islands or in lagoons rather than seaward from lagoons or along mainland shores (Flint et al., 2000). To a considerable extent, molting and staging individuals remain in the same area of a particular lagoon during their stay in the Beaufort region (Flint et al., 2000). Males and nonbreeders/failed breeders are joined later by females with young.

Males and nonbreeding or failed breeding female **common eiders** migrate to coastal molting areas in Chukchi Sea lagoons and bays beginning in late June and early July (Johnson and Herter, 1989; Map 11b). Some females with young may molt in local coastal lagoons (Barry, 1968; Johnson and Herter, 1989) before moving south to wintering areas beginning in late August and continuing into early November. Male **king eiders** undertake a molt migration to Chukchi and Bering sea areas from early July through August (Dickson, Suydam, and Balogh, 2000; Maps 11a and 11b). Apparently, some molt in the Beaufort Sea (Suydam et al., 1997). Females migrate from mid-August into September, and young leave the breeding areas in September and October. These species, together with the long-tailed duck, are common migrants along the coast of the Arctic National Wildlife Refuge.

Along the Beaufort coastline, nonincubating members of **shorebird** pairs concentrate in coastal habitats as early as mid-June. In late June to early July, individuals and flocks of nonbreeding and postbreeding adults of several species move to habitats surrounding small coastal lagoons and nearby brackish pools. In late July and early August, adults relieved of parental duties flock in shoreline areas prior to migration. In August and September, juvenile semi-palmated sandpipers and red phalaropes feed along inner lagoon margins in preparation for migration. Shoreline use by red phalaropes in particular is extensive, with concentrations exceeding 500 per kilometer of gravel beach reported on the Barrow spit and in the Simpson Lagoon area (U.S. Geological Survey, Biological Resources Div., 2002, pers. commun.). Parents with fledged young follow in several weeks, and juveniles form large flocks in mid- to late August (Johnson and Richardson, 1981). Most have departed the area by mid-September.

III.B.5.b. Habitat Use and Abundance

In the Beaufort Sea region, most loons, waterfowl, and seabirds are found within 50 kilometers of the coast (Map 10a). (Note that the apparently higher offshore bird densities recorded during aerial surveys confined to the central Beaufort Sea region, from Harrison Bay/Cape Halkett to Mikkelsen Bay/Brownlow Point in 2000, compared to those recorded in areas farther east or west during aerial surveys that covered the entire Alaskan Beaufort coast from Point Barrow to Demarcation Point, may be partly an artifact of sampling intensity. This is because aerial survey flight lines along which birds were counted were separated by only 5.4 kilometers in the central survey area, compared to 10 kilometers in areas farther east or west and, thus, lines along which birds are plotted are closer together and almost twice as numerous in the central area as in the eastern or western areas). Bird densities generally are lower in offshore areas. In nearshore marine areas, barrier islands provide important nesting habitat for **common eiders**, **glaucous gulls**, **arctic terns**, and **black guillemots**. Many species may return to the same areas for nesting in successive years (for example, **common eider**, Map 11b). The Teshekpuk Lake Special Area and the Colville River; Sagavanirktok, Canning, and Hulahula river deltas; and the Arctic National Wildlife Refuge provide important nesting habitat for **loons**, **waterfowl**, and **shorebirds** (Map 10a). Large numbers of several goose populations from Canada, Russia, and elsewhere in Alaska molt in the Teshekpuk Lake Special Area, which apparently is preferred because of the presence of large lake basins that provide extensive meadows of high-quality forage conveniently located in a coastal area.

Shorebirds prefer wet-tundra habitats (**sandpipers, phalaropes**) or well-drained gravelly areas (**plovers**) for nesting, whereas **loons** use lakes, and geese prefer deeper ponds (**brant**) or wet tundra near lakes (**greater white-fronted goose**). **Long-tailed ducks** (Map 10b) nest on small ponds with some deeper water and **king eiders** (Map 11a) prefer ponds with extensive deeper areas. The highest nesting densities generally occur in areas of mixed wet and dry habitats, whereas birds often move to wetter areas for broodrearing. Lagoons formed by barrier islands, bays, and river deltas provide important broodrearing and staging habitat for waterfowl, particularly molting **long-tailed ducks,** and staging habitat for this species; **eiders;** other waterfowl species (Maps 10a, 10b, 11b); and **plovers, sandpipers,** and **phalaropes**. Flocks of nonbreeding and postbreeding adults of several shorebird species move from wet tundra to habitats surrounding small coastal lagoons and nearby brackish pools. Later on, adults relieved of parental duties flock in shoreline areas, and juvenile semi-palmated sandpipers and red phalaropes feed along inner lagoon margins prior to migration. Gravel beach and other shoreline types are used extensively by red phalaropes at this time. Use of lagoons and other coastal habitats by migrants peaks in August to late September. From late September to mid-October, a majority of the world **Ross' gull** population occurs offshore of Point Barrow and eastward to the Plover Islands (Divoky, Hatch, and Haney, 1988).

Aerial surveys over the Arctic Coastal Plain have shown that most waterfowl and other waterbird species have exhibited nonsignificant population trends since 1986 or 1992 (Larned and Balogh, 1997; Larned et al., 1999; Larned, Platte, and Stehn, 2001; Mallek and King, 2000; Mallek, Platte, and Stehn, 2002), although there is conflicting evidence for some species. For example, during a recent spring migration an estimated 373,000 **king eiders** (see the following estimates derived from offshore aerial surveys) and 71,000 **common eiders** passed Point Barrow (Suydam et al., 1997, 2000); these numbers represent declines of 53% and 56%, respectively, from the 1970's. However, recent aerial breeding-pair surveys show a slightly increasing trend for **king eiders** on the coastal plain (Larned et al., 2001), and these surveys do not include some areas with highest nesting densities (for example, northwest Canada). Even though their populations are reduced from prior decades, these eiders still occur in flocks of substantial size during spring and fall migration periods. **Pacific loons**, **glaucous gulls**, **northern pintails**, **greater scaup**, **white-winged scoters**, **brant**, **snow geese**, and **tundra swans** have exhibited overall non-significant increasing trends since 1992, while **yellow-billed loons**, **Canada goose**, and **snowy owls** show decreases (Larned, et al., 2001; Mallek, Platte, and Stehn, 2002). **Greater white-fronted geese** and **arctic terns** increased significantly. The results of the two surveys cited, flown about mid-June and late June, indicate opposite trends for several species over the past 10-15 years: the earlier survey (Larned) shows **red-throated loons** decreasing significantly, **Sabines's gulls** decreasing, and **long-tailed ducks** and **jaegers** increasing; while the later survey (Mallek) indicates the reverse. Such differences probably are explained by a combination of variation in bird detection (for example, different observers used between years and change to more secretive behavior as the season progresses for some species) and real timing differences in bird presence during sampling periods separated by up to 2 weeks.

Recent Fish and Wildlife Service estimates of **long-tailed ducks** occupying the central Beaufort Sea area (Harrison Bay/Cape Halkett to Mikkelsen Bay/Brownlow Point) during surveys up to 60 kilometers offshore ranged from 20,994 in June/July to 37,792 in August, with densities ranging from 58.1-73.8 birds per square kilometer (Fischer, Tiplady, and Larned, 2002; Stehn and Platte, 2000). Numbers of **king eider** were 19,842 (June/July) and 6,698 (August), with densities from 3.6 (June/July) to 10.0 (August) birds per square kilometer; **common eider** numbers were 3,300 (June/July) and 1,477 (August), with densities from 4.6 (June/July) to 56.4 (August) birds per square kilometer. Generally, fewer than 1,000 **Pacific loons**, 200 **red-throated loons**, and 100 **yellow-billed loons** were present in this area at very low densities. Offshore aerial surveys by the Fish and Wildlife Service in late July 2001, spanning the Beaufort from Point Barrow to Demarcation Point (Fischer, 2001), suggest that offshore bird distributions across this broad area generally are similar to those found in the more extensively surveyed central area. An exception from 1999 and 2000 central Beaufort aerial survey results was noted for **king eiders**, which were found farther offshore and almost exclusively west of Harrison Bay (Map 11a). Neither survey recorded this species over a broad area from east of Mikkelsen Bay to the Canadian border. Possible explanations for this include that the survey timing missed the bulk of migrants (unlikely, because they were abundant to the west); or that eiders migrating from Canadian islands follow a route that takes them farther offshore than the northernmost extent of the aerial survey transects until they reach the central Beaufort region and so they were not observed.

The highest breeding-season densities for 34 species in an area east of Prudhoe Bay ranged from 251.7 birds per square kilometer in the second week of June to 167.0 in mid-July, and 131.7 in mid-August. Most abundant were **Lapland longspurs** and several shorebird species (Troy Ecological Research Assocs., 1995b).

III.B.6. Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales)

This discussion emphasizes species of marine mammals other than endangered whales commonly occurring in the Alaskan Beaufort Sea habitats that may be affected by the proposed sale. Species covered include the ringed, bearded, and spotted seal and the walrus, polar bear, and beluga and gray whales. Other species that are uncommon or rare in the sale area but that occasionally occur in small numbers (fewer than 100 to fewer than 10) include the harbor porpoise, killer whale, narwhal, and hooded seal. Because of the relative numerical insignificance of the latter species in the Beaufort Sea Planning Area (fewer than 100 to fewer than 10 individuals of any of these species have been recorded in the Beaufort Sea), their populations are not expected to be exposed to or be affected by any activities associated with the Proposal and, therefore, are not discussed further.

All marine mammals in U.S. waters are protected under the Marine Mammal Protection Act of 1972. In the act, it was the declared intent of Congress that marine mammals "be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management, and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem."

III.B.6.a. Ringed Seal

Widely distributed throughout the Arctic, this species is the most abundant seal in the Beaufort Sea. The estimated population in the Alaskan Beaufort Sea was 80,000 during the summer and 40,000 during the winter (Frost and Lowry, 1981). There currently is no reliable estimate for the Alaskan stock of ringed seals, but there is no reason to believe that the minimum abundance is below 50,000 animals (Ferrero et al., 2000). Ringed seal densities within the Beaufort Sea depend on food availability, water depth, ice stability, and distance from human disturbance. Seal densities reflect changes in the ecosystem's overall productivity in different areas (Stirling and Oritsland, 1995). In the zone of floating shorefast ice of the Beaufort Sea, ringed seals range from 1.5-2.4 seals per square nautical mile (Map 6 shows the floating shorefast-ice [Frost, Lowry, and Burns, 1988a]). Surveys in May 1996 through 1999 recorded densities of about 0.81 seals per square kilometer in the Beaufort Sea fast-ice habitat (Frost and Lowry, 1999). The overall density from 1997 surveys was 0.90 seal/square kilometer, with a 95% confidence interval that the density ranged from 0.77-1.05 seals per square kilometer (Frost, Pendleton, and Hessinger, 2001). Ringed seals probably are a polygamous species. When sexually mature, they establish territories during the fall and maintain them during the pupping season. Pups are born in late March and April in lairs that seals excavate in snowdrifts and pressure ridges. During the breeding and pupping season, adults on shorefast ice (floating fast-ice zone) usually move less than individuals in other habitats; they depend on a relatively small number of holes and cracks in the ice for breathing and foraging. During nursing (4-6 weeks), pups usually stay in the birth lair. Alternate snow lairs provide physical and thermal protection when the pups are being pursued by polar bears and arctic foxes (Smith, Hammill, and Taugbol, 1991). The primary prey of ringed seals is arctic cod, saffron cod, shrimps, amphipods, and euphausiids (Kelly 1988; Reeves, Stewart, and Leatherwood, 1992). This species is a major resource that subsistence hunters harvest in Alaska (see Section III.C.2 Subsistence-Harvest Patterns).

Figure III.B-3a shows recorded ringed seal sightings in the Beaufort Sea Planning Area from 1987-1999 during the Bowhead Whale Aerial Surveys conducted by MMS. Most of the sightings were recorded during the fall (September through October).

III.B.6.b. Bearded Seal

This species is found throughout the Arctic and usually prefers areas of less-stable or broken sea ice, where breakup occurs early (Cleator and Stirling, 1990). Most of the bearded seals in Alaskan OCS areas are found in the Bering and Chukchi seas. Estimates on the abundance of bearded seals in the Beaufort Sea and in Alaskan waters currently are unavailable; however, the minimum population in Alaskan waters is expected to be at least 50,000 animals (Ferrero et al., 2000). Bearded seals stay on moving-ice habitat in the Beaufort Sea. Their densities in the western Beaufort Sea are greatest during the summer and lowest during the winter. Their most important habitat in winter and spring is active ice or offshore leads.

Pupping takes place on top of the ice less than 1 meter from open water (Kovacs, Lyderson, and Gjertz, 1996) from late March through May mainly in the Bering and Chukchi seas, although some takes place in the Beaufort Sea. These seals do not form herds but sometimes do form loose groups. Bearded seals feed on a variety of primarily benthic prey, decapod crustaceans (crabs and shrimp) and mollusks (clams), and other food organisms, including arctic and saffron cod, flounders, sculpins, and octopuses (Kelly 1988; Reeves, Stewart, and Leatherwood, 1992). Bearded seals (ugruk) are a main subsistence resource and a favorite food of subsistence hunters (residents of Barrow, as cited in S.R. Braund and Assocs. and University of Alaska, Anchorage [UAA], Institute for Social and Economic Research [ISER], 1993).

Figure III.B-3b shows bearded seal sightings in the Beaufort Sea Planning Area from 1979-1999 during the Bowhead Whale Aerial Surveys conducted by MMS and the Naval Ocean Systems Center. Most of the sightings were recorded during the fall (September through October). Their distribution is widely disbursed across the planning area. More bearded seals were observed in the eastern half of the Beaufort Sea than to the west.

III.B.6.c. Spotted Seal

The suggested minimum and maximum population estimate of spotted seals occurring along the western Alaskan coast is about 7,000 and 55,000 animals, respectively (Rugh, Shelden, and Withrow, 1997). Ferrero et al. (2000) estimated the population at about 59,000 animals. This species is a seasonal visitor to the Beaufort Sea from populations in the Bering/Chukchi seas, as indicated from satellite-tagged animals (Lowry et al., 2000). Spotted seals appear along the coast in July-August in low numbers (about 1,000 total for the Alaskan Beaufort Sea coast) hauling out on beaches, barrier islands, and remote sandbars on the river deltas. Beaufort Sea coastal haulout and concentration areas include the Colville River Delta, Peard Bay, and Oarlock Island in Dease Inlet/Admiralty Bay (Figure III.B-3c). Recently, these seals also have frequented Smith Bay at the mouth of the Piasuk River. Spotted seals frequently enter estuaries and sometimes ascend rivers, presumably to feed on anadromous fishes. In the Arctic, their diet is similar to that of ringed seals including a variety of fishes including arctic and saffron cod, and also shrimp, and euphausiids (Kato, 1982; Quakenbush, 1988; Reeves, Stewart, and Leatherwood,1992). Spotted seals migrate out of the Beaufort Sea in the fall (September to mid-October) as the shorefast ice re-forms and the pack ice advances southward. They spend the winter and spring periods offshore north of the 200-meter isobath along the ice front throughout the Bering Sea, where pupping, breeding, and molting occur (Lowry et al., 2000).

III.B.6.d. Walrus

The North Pacific walrus population was estimated at about 201,000 animals in 1990 (Seagars, 1992; Gilbert et al., 1992; USDOI, Fish and Wildlife Service, 1995), comprising about 80% of the world population. In general, most of this population is associated with the moving pack ice year-round. Walruses spend the winter in the Bering Sea; and the majority of the population summers throughout the Chukchi Sea, including the westernmost part of the Beaufort Sea. Although a few walruses may move east throughout the Alaskan portion of the Beaufort Sea to Canadian waters during the open-water season, the majority of the Pacific population is found west of 155° W. longitude north and west of Barrow, with the highest seasonal abundance along the pack-ice front (Figure III.B-3d).

Nearly all the adult females with dependent young migrate into the Chukchi Sea during the summer, while a substantial number of adult males remain in the Bering Sea. Spring migration usually begins in April, and most of the walruses move north through the Bering Strait by late June. Females with calves comprise most of the early spring migrants. During the summer, two large Arctic areas are occupied: from the Bering Strait west to Wrangell Island and along the northwest coast of Alaska from about Point Hope to north of Point Barrow. With the southern advance of the pack ice in the Chukchi Sea during the fall (October-December), most of the walrus population migrates south of the Bering Strait. Solitary animals occasionally may overwinter in the Chukchi Sea and in the eastern Beaufort Sea.

Walrus calves are born from mid-April to mid-June during the northward migration; mating takes place from January to March. The gross reproductive rate of walruses is considerably lower than that of seals. Prime reproductive females produce one calf every 2 years rather than one every year, as do other pinnipeds. Although bivalve mollusks-clams are the primary food of walruses, seals also are eaten by some walruses (Sease and Chapman, 1988; Lowry and Fay, 1984; Herman Rexford, as cited in UAA, ISER, 1982). In Barrow, walruses are a very important cultural and subsistence resource comprising the third most important species by weight of harvestable meat (Residents of Barrow, as cited in S.R. Braund and Assocs. and UAA, ISER, 1993).

Figure III. B-3d shows recorded walrus sightings in the Beaufort Sea Planning Area from 1979-1999 during the Bowhead Whale Aerial Surveys conducted by MMS and the Naval Ocean Systems Center. Most of the observations of walruses were in the far western part of the planning area. Few walruses were seen to the east.

III.B.6.e. Polar Bear

The Southern Beaufort Sea's population (from Icy Cape to Cape Bathurst, Northwest Territories, Canada) is about 1,800 bears (Gorbics, Garlich-Miller, and Schliebe, 1998). The current stock assessment is 2,272 and a minimum estimate of 1,971 bears (*Federal Register* March 28, 2002). This population has increased over the past 20-30 years at 2% or more per year and is believed to be increasing slightly or stabilizing near its carrying capacity (Amstrup, 1995; USDOI, Fish and Wildlife Service, 1995). Their seasonal distribution and local abundance vary widely in the Alaskan Beaufort Sea. Amstrup, Durner, and McDonald (2000) assumed a bear density of one bear per 25 square kilometers occurs in seasonal concentration areas. Much lower densities occur beyond 100 miles offshore and higher densities near ice leads, where seals concentrate during the winter. Another study estimated their overall density from Point Barrow to Cape Bathurst as one bear every 141-269 square kilometers (54-103 square miles) (Amstrup, Stirling, and Lentfer, 1986). Sea ice and food are the two most important natural influences on their distributions. Polar bears in the Alaskan arctic prey primarily on ringed seals and, to a lesser extent, bearded seals; walruses, and beluga whales are taken opportunistically (Amstrup and DeMaster, 1988).

Drifting pack ice off the coast of the Alaskan Beaufort Sea probably supports more polar bears than either shorefast ice or polar pack ice, probably because young seals are abundant in this habitat. Polar bears prefer rough sea ice, floe-edge ice, and moving ice over smooth ice for hunting and resting (Martin and Jonkel, 1983; Stirling, Andriashek, and Calvert, 1993). Polar bears sometimes concentrate along Alaska's coast when pack ice drifts close to the shoreline, at whale-carcass locations, and when shorefast ice forms early in the fall. Polar bears can swim great distances and are very curious animals (Adams, 1986, pers. commun.).

Pregnant and lactating females with newborn cubs are the only polar bears that occupy winter dens for extended periods. Typically, dens are more sparsely distributed in the Alaskan coastal zone than in areas receiving consistent use, areas such as Wrangell Island, Russia, and in Hudson Bay and James Bay, Canada. Pregnant females come to coastal areas in late October or early November to build maternity dens. Most onshore dens are close to the seacoast, usually not more than 8-10 kilometers inland (Figure III.B-3e). Offspring are born from early December to late January, and females and cubs break out from dens in late March or early April.

Polar bear dens have been located on river banks in northeast Alaska and on shorefast ice close to islands east of the mouth of the Colville River. Dens have been found recently in the proposed Liberty area. A greater number of dens have been recorded on the Arctic National Wildlife Refuge where topographic relief (hills, banks, and other terrain features) provides conditions where enough snow accumulates for bears to build dens. Polar bear hunters from Nuiqsut and Kaktovik identified several of the coastal den areas (USDOI, Fish and Wildlife Service, 1995; Kalxdorff, 1997). Female polar bears usually do not use the same den sites each year (Ramsay and Stirling, 1990; Amstrup, Garner, and Durner, 1992), but they often do use the same geographic areas (Amstrup, Garner, and Durner, 1992). Shifts in the distribution of den locations in Canada may be related to changes in sea-ice conditions (Ramsay and Stirling, 1990).

In addition to being protected by the Marine Mammal Protection Act of 1972, polar bears and their habitats are covered by the International Agreement on the Conservation of Polar Bears. This 1976 agreement among Canada, Denmark, Norway, the Union of Soviet Socialist Republics, and the United States addresses protecting "habitat components such as denning and feeding sites and migration patterns." Additionally, a bilateral agreement between the United States and Russia to conserve polar bears in the Chukchi/Bering seas was signed in October 2000.

The North Slope Borough/Inuvialuit Game Council's management of polar bears for the southern Beaufort Sea includes sustainable harvest quotas based on estimated population size, sustainable harvest rates for female polar bears, and information regarding the sex ratio of the subsistence harvest.

Figure III. B-3e shows recorded polar bear sightings in the Beaufort Sea Planning Area from 1979-1999 during the Bowhead Whale Aerial Surveys conducted by MMS and the Naval Ocean Systems Center. Polar bear sightings were widely distributed across the Beaufort Sea Planning Area. Concentrations were observed along the coast of the planning area.

III.B.6.f. Beluga Whale

The beluga whale, a subarctic and arctic species, is a summer seasonal visitor throughout offshore habitats of the Alaskan portion of the Beaufort Sea. The Beaufort population was currently estimated to be in excess of 32,000 whales (Ferrero et al., 2000). Most of this population migrates from the Bering Sea into the Beaufort Sea in April or May. However, some whales may pass Point Barrow as early as late March and as late as July (Frost, 1985, pers. commun.). The spring-migration routes through ice leads are similar to those of the bowhead whale. A major portion of the Beaufort Sea population concentrates in the Mackenzie River estuary during July and August. An estimated 2,500-3,000 belugas summer in the northwestern Beaufort and Chukchi seas, with some using coastal areas such as Peard Bay and Kasegaluk Lagoon (Frost, Lowry, and Burns, 1988b; Frost, Lowry, and Carroll, 1993). This eastern Chukchi Sea stock was estimated at a minimum of about 3,700 whales (Ferrero et al., 2000). Satellite tracking of 23 belugas from this stock indicate that these whales inhabit the eastern Beaufort Sea during the summer season (Suydam et al., 2001). In the Arctic, belugas feed primarily on arctic and saffron cod, whitefish, char, and benthic invertebrates (Hazard, 1988).

Fall migration through the western Beaufort Sea and the Sale 170 area is in September or October. Although small numbers of whales have been observed migrating along the coast (Johnson, 1979), surveys of fall distribution strongly indicate that most belugas migrate offshore along the pack-ice front (Frost, Lowry and Burns, 1988b; Treacy, 1988-1998, 2000). Beluga whales are an important subsistence resource of Inuit Natives in Canada and also to Inupiat Natives in Alaska (see Section III.C.2 Subsistence-Harvest Patterns).

Figure III. B-3f shows recorded beluga whale sightings in the Beaufort Sea Planning Area from 1979-1999 during the Bowhead Whale Aerial Surveys conducted by MMS and the Naval Ocean Systems Center. The majority of the beluga sightings were recorded offshore along the shelf break or further offshore during spring and fall migrations. Much smaller numbers of whales were seen in coastal waters in the planning area.

III.B.6.g. Gray Whale

Since receiving protection by the International Whaling Commission in 1946, the eastern Pacific gray whale population has increased from a few thousand individuals that survived commercial harvest to more than 21,000 (Breiwick et al., 1989; Withrow, 1989; National Marine Fisheries Service, 1991; Buckland et al., 1993). Evidence that the population had approached and exceeded pre-exploitation levels (Rice, Wolman, and Braham, 1984) prompted the National Marine Fisheries Service to issue a determination that the eastern North Pacific stock be removed from the List of Endangered and Threatened Wildlife (59 *FR* 31094-31095). The current minimum gray whale estimate is 26,635 with an estimated annual increase rate from 1967/1968-1995/1996 at 2.4% (Ferrero et al., 2000).

Most gray whales calve and breed from late December to early February in protected waters along the western coast of Baja California. Recent observations suggest that some calving occurs as far north as Washington prior to arrival on the calving grounds (Dohl et al., 1983; Jones and Swartz, 1987).

Northward migration, primarily of individuals without calves, begins in February; some cow/calf pairs delay their departure from the calving area until well into April (Jones and Swartz, 1984). Most whales occur within 15 kilometers of land but have been observed up to 200 kilometers offshore (Bonnell and Dailey, 1990). Much of the migration route north of Point Conception to and from summer feeding grounds in the northern Bering and southern Chukchi seas lies within a few kilometers of the coast or adjacent islands. Gray whales occur in the Gulf of Alaska in late March, April, May, and June and again in November and December (Rice and Wolman, 1971; Consiglieri et al., 1982).

A portion of the gray whale population summers along the west coast of North America south of the Bering Sea/Unimak Pass (56 *FR* 58870). Gray whales migrate into the northern Bering and Chukchi seas starting in late April through the summer open-water months and feed there until October-November (Miller, Johnson, and Doroshenko, 1985; Moore and DeMaster, 1997). They migrate out of the Chukchi and Beaufort seas with freezeup and migrate out of the Bering Sea during November-December (Rugh and Braham, 1979).

The majority of the eastern Pacific gray whale population feeds primarily on benthic amphipods in the northern feeding grounds of the Bering and Chukchi seas (Moore and DeMaster, 1997). Shallow coastal areas and offshore shoals in the Chukchi and western Beaufort seas provide rich benthic feeding habitat for gray whales during these months (Rugh et al., 1999). Gray whale feeding areas offshore of northern Alaska are characterized with low species diversity, high biomass, and the highest secondary production rates reported for any extensive benthic community (Rugh et al., 2000). Gray whales suck infauna amphipods from the fine sand on the ocean bottom, producing an extensive record of feeding craters 2-20 square meters in size (Kim and Oliver, 1988; Moore and DeMaster, 1997).
Figure III.B-3g shows recorded gray whale sightings in the Beaufort Sea Planning Area from 1979-1999 during the Bowhead Whale Aerial Surveys conducted by MMS and the Naval Ocean Systems Center. Most of the observations were west of Point Barrow, and few gray whales were seen east of Barrow.

III.B.7. Terrestrial Mammals

Among the terrestrial mammals that occur in the Beaufort Sea area, the caribou, muskox, grizzly bear, and arctic fox are the species most likely to be affected by development. Other species, such as moose, are too sparse in the project area to be affected by Beaufort Sea development.

III.B.7.a. Caribou

Among the terrestrial mammals that occur along the coast of the Beaufort Sea, barren-ground caribou is the species that could be affected most by proposed OCS oil and gas activities in the Beaufort Sea multiple-sale area. Two large and two smaller caribou herds use coastal habitats adjacent to the Beaufort Sea area: the Western Arctic, the Porcupine, the Central Arctic, and the Teshekpuk Lake herds.

III.B.7.a(1) Population Status and Range

The Western Arctic Herd was estimated at 430,000 animals (Bente, 2000). The herd ranges over territory in northwestern Alaska from the Chukchi coast east to the Colville River, and from the Beaufort coast south to the Kobuk River. In winter, the range extends south as far as the Seward Peninsula and Nulato Hills, and east as far as the Sagavanirktok River north of the Brooks Range and the Koyukuk River south of the Brooks Range. The Teshekpuk Lake Herd was estimated to number more than 28,000 animals in 1999 (Bente, 2000). The Teshekpuk Lake Herd has increased at a rate of 14% per year during between 1989 and 1993 and since then has stabilized or increased slightly (Bente, 2000). The Teshekpuk Lake Herd is found primarily within the National Petroleum Reserve-Alaska, with its summer range extending between Barrow and the Colville River. In some years, most of the Teshekpuk Lake Herd remains in the Teshekpuk Lake area all winter. In other years, some or all of the herd winters in the Brooks Range or within the range of the Western Arctic Herd.

The Central Arctic Herd was estimated at 27,000 (Lawhead and Prichard, 2001). Its range extends from the Itkillik River east to the Canning River, and from the Beaufort coast south into of the Brooks Range.

The Porcupine Caribou Herd was estimated to be about 178,000-180,000 animals in 1989 and then declined to 160,000 animals in 1992 and to 152,000 animals in 1994 (Whitten, 1992; Whitten, 1995, pers. commun.). The herd probably declined in response to lower yearling recruitment after harsh winters, and the herd continued to decline to an estimate of 129,000 animals in 1998 (Stephenson, 1999). The Porcupine Caribou Herd ranges south from the Beaufort Sea coast, from the Canning River of Alaska in the west, eastward through the northern Yukon and portions of the Northwest Territories in Canada, and south to the Brooks Range.

III.B.7.a(2) Migration

Caribou migrate seasonally between their calving areas, summer range, and winter range to take advantage of seasonally available forage resources. If movements are greatly restricted, caribou are likely to overgraze their habitat, leading to perhaps a drastic, long-term population decline. The caribou diet shifts from season to season and depends on the availability of forage. In general, the winter diet of caribou has been characterized as consisting predominantly of lichens and mosses, with a shift to vascular plants during the spring (Thompson and McCourt, 1981). However, when Teshekpuk Lake Herd caribou winter near Teshekpuk Lake, where relatively few lichens are present, this herd may consume more sedges and vascular plants.

Spring migration of parturient female caribou from the overwintering areas to the calving grounds starts in late March (Hemming, 1971). Often the most direct routes are used; however, certain drainages and routes probably are used during calving migrations, because they tend to be corridors free of snow or with shallow snow (Lent, 1980). Bulls and nonparturient females generally migrate at a very leisurely pace, with some remaining on winter ranges until June. Severe weather and deep snow can delay spring migration, with some calving occurring en route. Cows calving en route usually proceed to their traditional calving grounds (Hemming, 1971).

The spring migration to traditional calving grounds consistently provides high nutritional forage to lactating females during calving and nursing periods, which is critical for the growth and survival of newborn calves. *Eriophorum*-tussock-sedge buds (tussock cotton grass) appear to be very important in the diet of lactating caribou cows during the calving season (Lent, 1966; Thompson and McCourt, 1981; Eastland, Bowyer, and Fancy, 1989), while orthophyll shrubs (especially willows) are the predominant forage during the postcalving period (Thompson and McCourt, 1981). The availability of sedges during spring, which apparently depends on temperature and snow cover, probably affects specific calving locations and calving success.

The evolutionary significance of the establishment of the calving grounds, however, may relate directly to the avoidance of predation on the caribou calves, particularly predation by wolves (Bergerud, 1974, 1987). Caribou calves are very vulnerable to wolf predation, as indicated by the documented account of surplus predation by wolves on newborn calves (Miller, Gunn, and Broughton, 1985). By migrating north of the tree line, caribou leave the range of the wolf packs, which generally remain on the caribou winter range or in the mountain foothills or along the tree line during the wolf-pupping season (Heard and Williams, 1991; Bergerud, 1987). By calving on the open tundra, the cow caribou also avoid ambush by predators. The selection of snow-free patches of tundra on the calving grounds also helps to camouflage the newborn calf from other predators such as golden eagles (Bergerud, 1987). However, the sequential spring migration, first by cows and later by bulls and the rest of the herd, is believed to be a strategy for optimizing the quality of forage as it becomes available with snowmelt on the arctic tundra (Whitten and Cameron, 1980). The earlier migration of parturient cow caribou to the calving grounds also could reduce forage competition with the rest of the herd during the calving season.

III.B.7.a(3) Calving Grounds

Calving takes place in the spring, generally from late May to late June (Hemming, 1971). Calving areas for the Western Arctic, Teshekpuk Lake, and Central Arctic caribou herds are shown in Figure III.B-4. The Western Arctic Herd calving area is inland on the National Petroleum Reserve-Alaska, west of the planning area. The Teshekpuk Lake Herd’s central calving area generally is located on the east side of Teshekpuk Lake and near Cape Halkett, adjacent to Harrison Bay. The Central Arctic Herd generally calves within 30 kilometers of the Beaufort coast between the Itkillik and Canning rivers. The herd separates into two segments based on the locations of the calving concentration areas, one on each side of the Sagavanirktok River.

The Porcupine Caribou Herd’s calving range encompasses an area along the Beaufort Sea coast from the Canning River in Alaska to the Babbage River in Canada and south to the northern foothills of the Brooks Range (Figure III.B-4). Major concentrations of calving cows of the Porcupine Caribou Herd occur within this range between the Canning and Sadlerochit rivers on the west and east, respectively, and between Camden Bay on the north and the Sadlerochit Mountains on the south.

During the postcalving period in July through August, caribou generally attain their highest degree of aggregation with continuous masses of animals in herds, such as the Porcupine Caribou Herd, in excess of tens of thousands. Cow/calf groups are most sensitive to human disturbance during this period. During the summer months, caribou use various coastal habitats of the Beaufort Sea in Alaska, such as sandbars, spits, river deltas, and some barrier islands, for relief from insect pests.

III.B.7.a(4) Summer Distribution and Insect-Relief Areas

During calving and postcalving periods, cow/calf groups are most sensitive to human disturbance. They join into increasingly larger groups, foraging primarily on the emerging buds and leaves of willow shrubs and dwarf birch (Thompson and McCourt, 1981). In the postcalving period (July through August), caribou attain their highest degree of aggregation. Members of the Western Arctic Herd may be found in continuous herds numbering in excess of tens of thousands of individuals, and portions of the Western Arctic Herd may be found throughout their summer range.

Insect-relief areas become important during late June to mid-August during the insect season (Lawhead, 1997). Insect harassment reduces foraging efficiency and increases physiological stress (Reimers, 1980). For insect relief, caribou use various coastal and upland habitats such as sandbars, spits, river deltas, some barrier islands, mountain foothills, snow patches, and sand dunes, where stiff breezes prevent insects from concentrating and alighting on the caribou. In the planning area, members of the Teshekpuk Lake Herd generally aggregate close to the coast for insect relief. Some small groups, however, gather in other cool, windy areas such as the Pik Dunes located about 30 kilometers south of Teshekpuk Lake (Hemming, 1971; Philo, Carroll, and Yokel, 1993). Caribou aggregations move frequently from insect-relief areas along the arctic coast (the Central Arctic, Western Arctic, and especially the Teshekpuk Lake herds) and in the mountain foothills (some aggregations of the Western Arctic Herd) to and from green foraging areas.

III.B.7.a(5) Winter-Range Use and Distribution

Western Arctic Herd caribou generally reach their winter ranges in early to late November and remain on the range through March (Hemming, 1971; Henshaw, 1968). The primary winter range of the Western Arctic Herd is located south of the Brooks Range along the northern fringe of the boreal forest. During winters of heavy snowfall or severe ice crusting, caribou may overwinter within the mountains or on the Arctic Slope (Hemming, 1971). Even during normal winters, some caribou of the Western Arctic Herd overwinter on the Arctic Coastal Plain. The Teshekpuk Lake Herd was believed to reside year-round in the Teshekpuk Lake area (Davis, Valkenburg, and Boertje, 1982); however, satellite-collar data from Teshekpuk Lake caribou indicate that some animals travel great distances to the south, as far as the Seward Peninsula (Carroll, 1992). The Central Arctic Herd overwinters primarily in the northern foothills of the Brooks Range (Roby, 1980).

The movement and distribution of caribou over the winter ranges reflect their need to avoid predators and their response to wind (storm) and snow conditions (depth and snow density), which greatly influence the availability of winter forage (Henshaw, 1968; Bergerud, 1974; Bergerud and Elliot, 1986). The numbers of caribou using a particular portion of the winter range are highly variable from year to year (Davis, Valkenburg, and Boertje, 1982; Fancy et al., 1990, as cited in Whitten, 1990). Range condition, distribution of preferred winter forage (particularly lichens), and predation pressure all affect winter distribution and movements (Roby, 1980; Miller, 1974; Bergerud, 1974).

III.B.7.b. Muskoxen

Indigenous populations of muskoxen were extirpated in the 1800's in northern Alaska (Smith, 1989). Muskoxen were reintroduced east of the National Petroleum Reserve-Alaska on the Arctic National Wildlife Refuge in 1969 and in the Kavik River area (between Prudhoe Bay and the Refuge) in 1970; they were reintroduced west of the National Petroleum Reserve-Alaska near Cape Thompson in 1970 and 1977 (Smith, 1989). The reintroductions to the east established the Arctic National Wildlife Refuge population, which grew rapidly and expanded both east and west of the Refuge (Garner and Reynolds, 1986). An estimated 270 muskoxen were counted between the Colville River and the Refuge, 91 animals were recorded west of the Trans-Alaska Pipeline near the Colville River (Whitten, 1997, pers. commun.), and a breeding population has become established in the Itkillik-Colville rivers area (Johnson et al., 1996). The latter is the closest known breeding population to the planning area. The number of muskoxen that occur within the planning area is unknown. A total of about 800 muskoxen were observed in the 500-kilometer area between the Itkillik River west of Prudhoe Bay and the Babbage River in northwestern Canada (Reynolds, 1998). Probably a transitory number of lone bulls frequent the planning area, coming from populations that breed east of the Colville River. Muskoxen are expected to repopulate their former home-range habitats in the National Petroleum Reserve-Alaska in the near future (McCabe, 1977, pers. commun.). The most important habitats for muskoxen in the Colville River Delta are riparian, upland shrub and moist sedge-shrub meadows (Johnson et al., 1996).

Muskoxen generally do not migrate but will move in response to seasonal changes in snow cover and vegetation. They use riparian habitats along the major river drainages on the Arctic Slope year-round. Calving takes place from about April to early June (Garner and Reynolds, 1987). Distribution of muskoxen during the calving season, summer, and winter are similar, with little movement during winter (Reynolds, 1992). Only 14 muskoxen were sighted in the project area (LGL, Woodward-Clyde, and Applied Sociocultural Research, 1998) mostly along the Kadleroshilik River.

III.B.7.c. Grizzly Bears

The grizzly bear population on the western North Slope was considered stable or slowly increasing in 1991. Densities were highest in the foothills of the Brooks Range and lowest on the Arctic North Slope (Carroll, 1991). On the North Slope, grizzly bear densities vary from about 0.3-5.9 bears per 100 square miles, with a mean density of 1 bear per 100 square miles. The number of grizzly bears using the Prudhoe Bay and Kuparuk oil fields adjacent to the central Beaufort Sea area has increased in recent years. An estimated 60-70 bears or approximately 4 per 1,000 square kilometers currently inhabit the oil-field area (Shideler and Hechtel, 2000). The State of Alaska, Department of Fish and Game captured and marked 27 bears while studying the bears' use of the oil fields (Shideler and Hechtel, 1995). These bears have very large home ranges (2,600-5,200 square kilometers) and travel up to 50 kilometers a day (Shideler and Hechtel, 1995). Since 1991, 17 grizzly bears were recorded in the Beaufort Sea area (LGL, Woodward-Clyde, and Applied Sociocultural Research, 1998). On the North Slope, grizzly dens occur in pingos, banks of rivers and lakes, sand dunes, and steep gullies in uplands (Harding, 1976; Shideler and Hechtel, 1995). Bears enter dens primarily in the last 2 weeks of October and emerge from the dens in early May (McLoughlin, Cluff, and Messier, 2002). The grass meadows on the bluffs along the Colville River are used by foraging bears during the spring (Swem, 1997, pers. commun.).

Densities were highest in the foothills of the Brooks Range and lowest in the northern portion of the National Petroleum Reserve-Alaska (Carroll, 1991). On the North Slope, grizzly bear densities vary from about 0.3-5.9 bears per 100 square miles, with a mean density of 1 bear per 100 square miles. In 1989, the population of the western North Slope (Game Management Unit 26A) was estimated at between 500 and 720 bears (Trent, 1986; Carroll, 1991). The number of grizzly bears using the Prudhoe Bay and Kuparuk oil fields east of the Petroleum Reserve has increased in recent years: 27 bears were captured and marked by the Alaska Department of Fish and Game in studies of bear use of the oil fields (Shideler and Hechtel, 1995). These bears have very large home ranges (2,600-5,200 square kilometers) and travel up to 50 kilometers a day (Shideler and Hechtel, 1995).

III.B.7.d. Arctic Foxes

The arctic fox population on the North Slope has increased since 1929, as the values and harvest rates of white fox pelts declined (Chesemore, 1967). Fox populations peak whenever lemmings (their main prey) are abundant. Other food sources include ringed seal pups and the carcasses of other marine mammals and caribou, which are important throughout the year (Chesemore, 1967; Hammill and Smith, 1991). Tundra-nesting birds also are a large part of their diet during the summer (Chesemore, 1967; Fay and Follmann, 1982; Quinlan and Lehnhausen, 1982; Raveling, 1989). The availability of winter food sources directly affects the foxes' abundance and productivity (Angerbjorn et al., 1991). Arctic foxes on the Prudhoe Bay oil field readily use development sites for feeding, resting, and denning; their densities are greater in the oil fields than in surrounding undeveloped areas (Eberhardt et al., 1982; Burgess et al., 1993). Development on the Prudhoe Bay oil fields probably has led to increases in fox abundance and productivity (Burgess, 2000). However, arctic foxes are particularly subject to outbreaks of rabies, and their populations tend to fluctuate with the occurrence of the disease and with changes in the availability of food. Marine mammals are an important part of the diet of arctic foxes that occur along the coast of western Alaska (Anthony, Barten, and Seiser, 2000).

III.B.8. Vegetation and Wetlands

Detailed information on vegetation of the central Arctic Coastal Plain, including the Prudhoe Bay oil fields and the Beaufort Sea planning area, is available in Walker and Acevedo (1987) (U. S. Geological Survey Beechey Point Quadrangle, vegetation and land cover series L-0211). The authors produced comprehensive vegetation maps and reports that not only describe the area's vegetation but also provide techniques to show the changes over time resulting from oil-field development.

Sedge, grasses, and shrubs dominate the vegetation classes. Water sedge (*Carex aquatilis*) is the dominant species in the wet tundra class, in both of the flooded tundra classes, and in the one aquatic class that bears its name. Pendant grass, *Arctophila fulva*, dominates the other aquatic class. *Eriophorum vaginatum*, commonly called tussock cotton grass, dominates the tussock tundra class. Common shrub species include mountain alder (*Alnus crispa*), dwarf birch (*Betula nana*), four-angled mountain heather (*Cassiope tetragona*), crowberry (*Empetrum nigrum*), *Ledum palustre*, cloudberry (*Rubus chamaemorus*), bog blueberry (*Vaccinium uliginosum*), lingonberry (*Vaccinium vitis-idaea*), and species of the genera *Andromeda*, *Arctostaphylos*, *Dryas*, and willow (*Salix*). *Salix* and *Alnus* (to a much lesser extent) are the dominant species of the low and tall shrub classes. Except for *Betula*, all are dwarf shrubs.

The four dominant types of plant cover area typical of the North Slope (Beechey Point Quadrangle, Walker and Acevedo, 1987) are:

- Open-water and pond complexes having more than about 40% open water with aquatic grass tundra (about 70% of the land cover).
- Wet herbaceous tundra dominated by wet-sedge (*Carex*) and cotton-grass species (*Eriophorum*). It has little permanent water or up to 40% water-covered ground or 30% moist herbaceous tundra that includes wet coastal areas periodically flooded with saltwater (about 13% of the total land cover).
- Moist or dry tundra dominated by dwarf shrubs such as willow (*Salix*), lichens, and forbs.
- Barren areas along major streams composed of 60% barren peat, mineral soil, or gravel. These areas may have patches with sparse cover of forbs and dwarf shrubs.

The Beaufort planning area's coast includes eroding bluffs, sandy beaches alternating with lower tundra areas having some saltwater intrusions, sand dunes, sandy spits, and estuarine areas at the mouths of streams. Deltas of the Colville, Sagavanirktok, Kadleroshilik, and Shaviovik rivers support a complex mix of wet arctic saltmarsh, dry coastal barrens, salt-killed tundra, typical moist and wet tundra, and dry, partially vegetated gravel bars. In freshwater wetlands, high abundances of invertebrate populations correlate strongly with the presence of emerging water sedge (*Carex*) and pendant grass (*Arctophila*) (Bergman et al., 1977).

The Arctic Coastal Plain on the National petroleum Reserve-Alaska is dominated by many lakes and is very poorly drained. About 20% of the Petroleum Reserve coastal plain is open water, while another 18% has standing water with varying proportions of plant cover. The single most common cover type is the cotton grass tussock. Tussock-tundra represents about 45% of the plant cover (USDOI, Bureau of Land Management and MMS 1998).

Water sedge *(Carex aquatilis)* is the dominant species in the wet tundra vegetation class. Pendant grass (*Arctophila fulva)* is dominant in the aquatic class. Other common grass/sedge species occurring in the moist tundra classes are tussock-cotton-grass species (*Eriophorum angustifolium, Eriophorum russeolum*, and *Eriophorum vaginatum*), *Arctagrostis latifolia, Deschampsia ceaspitosa, Cochlearia officianalis, Poa lanata,* and *Puccinellia phryganodes*. *Eriophorum vaginatum*, commonly referred to as tussock cotton grass, is the dominant species of the tussock tundra class.

Some of the commonly occurring herbaceous species are *Caltha palustris, Epilobium latifolium, Petasites frigidus, Potentilla palustre*, and species of the genera *Draba, Papaver, Pedicularis, Polygonum, Ranunculus, Rumex, Saxifraga, Senecio*, and *Stellaria*.

Common shrub species include alder (*Alnus crispa*), dwarf birch (*Betula nana*), mountain heath (*Cassiope tetragona)*, crowberry (*Empetrum nigrum*), cloudberry (*Rubus chamaemorus*), bog blueberry (*Vaccinium uliginosum*), lingonberry (*Vaccinium vitis-idaea*), and species of the genera *Andromeda, Arctostaphylos, Dryas*, and willow (*Salix)*. *Salix* and, to a much lesser extent, *Alnus*, are the dominant species of the low and tall shrub classes. With the exception of Betula, the remainder are dwarf shrubs.

There are seven species of rare vascular plants known to occur on the North Slope (Lipkin, 1997). *Mertensia drummondii* has been found on sand dune habitats along the Kogosukruk River and west of the planning area along the Meade River. *Potentilla stipularis* has been found at Umiat. This species occurs in sandy substrates, such as sandy meadows, and riverbank silts and sands other than dunes. *Pleuropogon sabinei* is an aquatic grass that rarely occurs between the *Arctophila* and *Carex* vegetation zones in lakes and ponds. This species is known from a few locations north and northeast of Teshekpuk Lake. Because relatively little plant-survey work has been done on Alaska's North Slope, these species might be found at additional sites. *Draba adamsii* has been found near Barrow in eroding, turfy polygons by the ocean or streams. This species may be precluded from areas farther south by its adaptation to low temperatures. *Poa hartzii* is a grass known from sites on the Meade River and within the Arctic National Wildlife Refuge. It is found on the dry sands of some active floodplains. *Erigeron muirii* might be found on some drier soils, such as ridges in the foothills region. *Aster pygmaeus* is known from sites east of the Petroleum Reserve on mudflats and saline soil.

III.C. Social Systems

The following six resource categories describe the social systems environment:

- Economy
- Subsistence-Harvest Patterns
- Sociocultural Systems
- Archaeological Resources
- Land Use Plans and Coastal Management Program

Environmental Justice

III.C.1. Economy

III.C.1.a. Revenues

III.C.1.a(1) North Slope Borough Revenues

The North Slope Borough received no OCS revenues for the period 1995-2000.

The tax base in the North Slope Borough since the 1980's has consisted mainly of high-value property owned or leased by the oil industry in the Prudhoe Bay area. In Fiscal Year 1995, more than 95% of revenues came from property taxes, according to the final EIS for Sale 144 (USDOI, MMS, 1996a:Section III.C.1).

North Slope Borough revenues (exclusive of The North Slope Borough School District) were $224-$235 million between 1992 and 1997. Revenues were $285, $266, and $245 million in 1998, 1999, and 2000, respectively (Abbott, 2001, pers. commun.). In 1997, the assessed value of all property was $11.7 billion; in 1998, 1999, and 2000, assessed values were $11.4, $10.8, and $10.8 billion, respectively. The North Slope Borough projects total assessed value will decline steadily from $10 billion in 2002 to $5 billion in 2013 (Wright, 2001, pers. commun.).

In Fiscal Year 1994, the North Slope Borough applied a rate of 18.5 mills to assessed property: 4.78 mills for operations and 13.72 mills for debt service. Although the mill rate for operations is at the limit allowed by State statutes, the North Slope Borough's mill rate to repay bonded indebtedness is unlimited. Therefore, the North Slope Borough can raise the mill rate to repay bonds without legal restraints, and limits on short-term revenues do not drive current capital expenditures. The State perceives a limit of 20 mills on the rate for oil and gas property; thus, self-limitation at an 18.5-mill rate leaves the North Slope Borough a buffer to increase revenues, if assessed values fall unexpectedly (Nageak, 1998).

Between 1966 and 1995 the State of Alaska allocated $66,000 for two projects under the Land and Water Conservation program. Under the Federal coastal impact assistance program, the State allocated $1.9 million on a one-time basis to the North Slope Borough (www.gov.state.ak.us/dgc/CIAP September 2001).

III.C.1.a(2) State Revenues

The Federal Government distributed OCS revenues from Beaufort Sea Lease Sales to the State of Alaska for rents, bonuses, royalties, escrow funds, and settlement payments as follows:

- 1995, $9.4 million
- 1996, $9.5 million
- 1997, $17.3 million
- 1998, $13.6 million
- 1999, $14.7 million
- 2000, $13.7 million

The OCS revenues the Federal Government distributed to the State are greater than those collected in the 1995-2000 period enumerated in the next subsection, because the revenues distributed to the State include funds held in escrow from previous years and distributed after 1994. From 1986-2000, the Federal Government distributed $505 million in OCS revenues to the State of Alaska. State income tax and state spill and conservation tax related to the Beaufort Sea OCS from 1995-1998 is zero.

The Federal Government has allocated $20 million of OCS revenues through the Federal Land and Water Conservation Fund to the State of Alaska between 1966 and 1995. The State, in turn, allocated these funds to local jurisdictions for eligible projects.

Congress amended the OCS Lands Act to enable the coastal impact assistance program. This program makes a one-time allocation of $12 million to the State of Alaska. Of this, the State retains $8 million and allocates the balance to coastal political subdivisions according to a formula specified by the amended act (www.gov.state.ak.us/dgc/CIAP September 2001).

The State of Alaska revenues budgeted for expenditure varied between $3.7 billion in 1998 and $4.3 billion in 2001 (www.legfin.state.ak.us/BudgetReports/Operating/).

III.C.1.a(3) Federal Revenues

Total Federal OCS revenues for the Beaufort Sea, which include bonuses, royalties, and rents, are:

- 1995, $1.1 million
- 1996, $16.1 million
- 1997, $1.1 million
- 1998, $7.4 million
- 1999, $1.4 million
- 2000, $1.4 million

Of these revenues, bonuses in the 1995-2000 period were $14.4 million for Sale 144 in 1996 and $5.3 million for Sale 170 in 1998. Total revenues from the Alaska OCS from 1976-2000 were $6.4 billion.

Federal income tax collected from OCS workers is estimated to be $1.1 million for drilling and related activity on Warthog and Liberty islands in 1997. There was no income tax in 1995, 1996, or 1998-2000, because there was no worker activity on the OCS.

Total Federal receipts of all types, including personal income tax, corporation tax, and other types of revenue varied from $1.7 trillion in 1998 to $2.0 trillion in 2001 (www.whitehouse.gov/omb/budget/index.html).

III.C.1.b. Employment and Personal Income

III.C.1.b(1) History of Employment in the North Slope Borough

Approximately 70% of the oil and gas industry workers on the North Slope commute to permanent residences in Alaska but outside the North Slope Borough, primarily in Southcentral Alaska and Fairbanks. Approximately 30% reside outside Alaska (Hadland and Landry, 2002; Hadland, 2002, pers. commun.).

The number of those who work and reside on the North Slope Borough is so small as to be statistically negligible (see Section III.C.1.b(4)).

Table III.C-1 shows North Slope Borough employment data, as a whole and by sector, including the oil-industry workers at Prudhoe Bay between 1990 and 1998. While the table lists "mining," the data for this industry is completely oil and gas employment at Prudhoe Bay and nearby facilities. The total North Slope Borough employment, less mining, reflects workers who reside permanently in the borough. The Borough reports:

> Since its incorporation, the North Slope Borough has expended millions of dollars for construction projects on work-force development programs to improve the living conditions, employment rates, and skills of its residents. [Since 1972,] the number of Inupiat who have skills and experience on construction projects, from training programs and most recently from educational opportunities available through Ilisagvik College, has slowly risen (North Slope Borough, 1999).

For a summary description of the North Slope Borough employment, see Table III.C-2, 1998 Employment by Employer, North Slope Borough, Nuiqsut, Kaktovik, and Barrow; Table III.C-3, 1998 Employment by Employer: Employees by Ethnicity, North Slope Borough; and Table III.C-4, 1998 Labor Force Summary North Slope Borough, Nuiqsut, Kaktovik, and Barrow. For further details on employment, see the Final EIS for Sale 170 (USDOI, MMS, 1998:Section III.C.1), which is incorporated here by reference.

III.C.1.b(2) The North Slope Borough is the Largest Employer of Permanent Residents in the Borough

The North Slope Borough's government employs many people directly and finances construction projects under its Capital Improvement Program. For details, see the description in the previous paragraphs and in the final EIS for Sale 170 (USDOI, MMS, 1998:Section III.C.1).

III.C.1.b(3) Unemployment in the North Slope Borough

According to State figures, unemployment in the North Slope Borough was 3.5-9.4% from 1975-2001 (www.labor.state.ak.us/research). However, according to the 1993 North Slope Borough Census, 22% of the North Slope Borough's resident labor force believed themselves to be underemployed, and 24% worked less than 40 weeks in 1993 (North Slope Borough, 1995). According to the State Department of Labor, the North Slope Borough had 16% unemployment in 1998. According to the 1998 North Slope Borough Census, 13% of the North Slope Borough's resident labor force perceived themselves to be under employed, and 27% worked less than 40 weeks in 1998 (North Slope Borough, 1999). For these data for the North Slope Borough, Nuiqsut, Kaktovik, and Barrow see Table III.C-5, 1998 Unemployment and Underemployment. For further discussion and details, see North Slope Borough (1995: NSB-28 through NSB-42, 1999: NSB-41 through NSB-54) and USDOI, MMS (1998:Section III.C.1).

III.C.1.b(4) North Slope Oil-Industry Employment of North Slope Borough Resident Natives

Very few North Slope Natives have been employed in the oil-production facilities and associated work in and near Prudhoe Bay since production started in the late 1970's. Also, North Slope Natives are not motivated to move because of employment. This historical information is relevant to assessing potential economic effects of proposed oil and gas exploration and development and development on the North Slope Native population. A study contracted by MMS shows that 34 North Slope Natives interviewed comprised half of all North Slope Natives who worked at Prudhoe Bay in 1992, and that the North Slope Natives employed at Prudhoe Bay comprised less than 1% of the 6,000 North Slope oil-industry workers (USDOI, MMS, 1993). This pattern is confirmed by 1998 data showing only 10 North Slope Borough Inupiat residents as employed in the oil industry (see Table III.C-3).

One of the North Slope Borough's main goals has been to create employment for Native residents. It has been successful in hiring many Native people for the North Slope Borough's construction projects and operations. Only a few permanent residents hold jobs at the industrial enclaves at Prudhoe Bay.

The North Slope Borough has tried to facilitate employment of Native people in the oil industry at Prudhoe Bay. They are concerned that the oil industry has not done enough to train unskilled laborers or to allow them to participate in subsistence hunting. The North Slope Borough also is concerned that the oil industry recruits using methods common to western industry. The North Slope Borough would like to see serious efforts by industry to hire the North Slope Borough's residents (Nageak, 1998). For further information, see USDOI, MMS (1998:Section III.C.1).

The purpose of BPXA's Itqanaiyagvik Program is to increase North Slope Borough Native employment. It is a joint venture with the Arctic Slope Regional Corporation and its oil-field subsidiaries and is being coordinated with the North Slope Borough and the North Slope Borough's School District (BPXA, 1998b). Nanook Incorporated, a subsidiary of Kuukpik Corporation, based in Nuiqsut, has a training program that could be used to train Natives for positions in the oil industry, such as technicians and other long-term jobs. Nanook Incorporated could work with other village corporations on the North Slope (Helms, as cited in USDOI, MMS, Alaska OCS Region, 2002c)

Some Natives residing in the North Slope Borough have worked in the North Slope oil industry. The account of one Native provides an example of a Native who has found work in the oil industry in the past. Mr. Long found work as early as 1969, at first as a roustabout, then later as a floor hand on a drill rig, and then as a chain thrower. Mr. Long indicates that in recent years, operations are so automated the industry needs fewer workers and, thus, workers have more difficulty finding jobs, especially Natives Long, as cited in USDOI, MMS, Alaska OCS Region, 2002c)

III.C.1.b(5) Most North Slope Oil-Industry Workers Reside in Southcentral Alaska and Fairbanks

In the past, most workers at oil operations centered at Prudhoe Bay commuted between worker enclaves on the North Slope and permanent residences in other parts of the State and outside the State. See Section III.C.1.b(1) for more information on this point.

Employment in the Anchorage-MatSu Region, the Kenai Peninsula Borough, and Fairbanks North Star Borough is shown in Table III-C-6.

III.C.1.b(6) U.S. Employment

The total employment in the U.S. was 137 million workers in 1999 (www.bea.doc.gov/bea/regional/). This employment figure is comparable to the employment figures in Tables III.C-1 and III.C-6 for the North Slope Borough, and Southcentral Alaska and Fairbanks.

III.C.1.b(7) Personal Income

Aggregate personal income in 1999 was:

- North Slope Borough, $0.2 billion.
- South Central Alaska (Municipality of Anchorage, Matanuska-Susitna Borough, and Kenai Peninsula Borough) and Fairbanks Northstar Borough, $13.2 billion.
- U.S., $7,739.4 billion (www.bea.doc.gov/bea/regional/)

Per capita personal income, rounded to the nearest thousand dollars, in 1999 was:

- North Slope Borough, $29,000.
- Municipality of Anchorage, $34,000
- Matanuska-Susitna Borough, $19,000
- Kenai Peninsula Borough, $25,000
- Fairbanks Northstar Borough, $26,000
- U.S., $28,000 (www.bea.doc.gov/bea/regional/)

III.C.1.c. Subsistence as a Part of the North Slope Borough's Economy

The predominately Inupiat residents of the North Slope Borough traditionally have relied on subsistence activities. Although not fully part of the cash economy, subsistence hunting is important to the North Slope Borough's whole economy and even more important to the culture (see Sections III.C.2 and III.C.3). Households do need to expend cash to purchase equipment used in the subsistence harvest, such as boats, rifles, all-terrain vehicles, snowmobiles, etc. Inupiat are the prevailing ethnic group making expenditures for subsistence-harvest equipment. See Table III.C-7 for 1998 Annual Household Subsistence Expenditures by Ethnicity.

III.C.2. Subsistence-Harvest Patterns

Characteristics of Harvest Patterns: This section describes the subsistence-harvest patterns of the Inupiat (Eskimo) communities adjacent to the Beaufort Sea multiple-sale area: Barrow, Nuiqsut, and Kaktovik. This community-by-community description provides general information on subsistence-harvest patterns, harvest information by resource and community, timing of the subsistence-harvest cycles, and harvest-area concentrations by resource and by community. Further information regarding the harvest areas, species harvested, and quantities harvested can be found in the final EIS's for Beaufort Sea Sales 144 and 170 (USDOI, MMS, 1996a, 1998). The following summary description is augmented by information from current studies, including State of Alaska, Department of Fish and Game (1995), S.R. Braund and Assocs. (1996), Kruse et al. (1983), Alaska Natives Commission (1994), City of Nuiqsut (1995), and USDOI, MMS (1996b, 1996c), in addition to the National Petroleum Reserve-Alaska Final Integrated Activity Plan EIS (USDOI, Bureau of Land Management and MMS, 1998) and the Liberty Development and Production Plan final EIS (USDOI, MMS, Alaska OCS Region, 2002a). A study titled *Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow: Past and Present Comparison* is ongoing and will map geographic patterns of subsistence use near important North Slope communities. The MMS will use this comparative time-series information to assess cumulative sociocultural effects in the Beaufort Sea region.

III.C.2.a. Definition of Subsistence

Generally, subsistence is considered hunting, fishing, and gathering for the primary purpose of acquiring traditional food. The Alaska National Interest Land Conservation Act defines subsistence as the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade (16 U.S.C. § 3113). The North Slope Borough Municipal Code defines subsistence as an activity performed in support of the basic beliefs and nutritional needs of the residents of the borough and includes hunting, whaling, fishing, trapping, camping, food gathering, and other traditional and cultural activities (North Slope Borough Municipal Code 19.20.020 (67)). As a lifeway for Native Alaskans, subsistence is more than the harvesting, processing, sharing, and trading of marine and land mammals, fish, and plants. Subsistence should be understood to embody cultural, social, and spiritual values that are the essence of Alaskan Native cultures (Bryner, 1995; State of Alaska, Dept. of Natural Resources, 1997).

The community residents adjacent to the Beaufort Sea multiple-sale area participate in a subsistence way of life. While new elements have been added to the way people live, this way of life is a continuation of centuries-old Inupiat traditional patterns. Until January 1990, Alaska statutes defined "subsistence uses" as "the non-commercial, customary and traditional uses of wild, renewable resources by a resident domiciled in a rural area of the state for personal or family consumption" (AS § l6.05.940); and subsistence uses were given priority over other uses. In January 1990, as a result of *McDowell vs. State of Alaska*, this law was declared unconstitutional by the Alaska Supreme Court. However, Federal law (Title VIII of the Alaska National Interest Land Conservation Act) continues to define Alaskan subsistence and grants it priority over other uses. The new ruling means Alaska cannot legally (according to State law) establish rural preference for subsistence. The effect of the Alaska Supreme Court's decision was stayed until July 1, 1990. The State had until then to devise a solution to the issues raised in the *McDowell* decision. The Alaska State Legislature has not been able to pass any subsistence legislation despite special sessions called for that purpose and other efforts initiated more recently by Governor Tony Knowles. On Federal lands and navigable waters in Alaska, Federal laws grant subsistence priority over other uses, and Federal Agencies are now managing these subsistence hunts and will continue to do so until State legislation can be enacted (USDOI, Fish and Wildlife Service, 1992). Spurred by a number of recent court decisions and the

State of Alaska's failure to enact a subsistence plan that guarantees some type of rural preference, the management of subsistence fisheries on Federal lands is now under the auspices of the Fish and Wildlife Service *(Anchorage Daily News*, 1996).

III.C.2.b. The Cultural Importance of Subsistence

Subsistence activities are assigned the highest cultural values by the Inupiat and provide a sense of identity in addition to being an important economic pursuit. Many species are important for the role they play in the annual cycle of subsistence-resource harvests, yet effects on subsistence can be serious, even if the net quantity of available food does not decline. Subsistence resources provide more than dietary benefits. They also provide materials for personal and family use, and the sharing of resources helps maintain traditional Inupiat family organization. Subsistence resources also provide special foods for religious and social occasions; the most important ceremony, Nalukataq, celebrates the bowhead whale harvest. The sharing, trading, and bartering of subsistence foods structures relationships among communities, while at the same time the giving of such foods helps maintain ties with family members elsewhere in Alaska.

III.C.2.c. Community Subsistence-Harvest Patterns

Two major subsistence-resource categories occur on the North Slope: the coastal/marine and the terrestrial/aquatic. In the coastal/marine group, the food resources harvested are whales, seals, walruses, waterfowl, and fish. In the terrestrial/aquatic group, the resources sought are caribou, freshwater fishes, moose, Dall sheep, edible roots and berries, and furbearers. Generally, communities harvest resources most available to them, and harvests tend to be concentrated near communities, along rivers and coastlines, and at particularly productive sites. The distribution, migration, and the seasonal and more extended cyclical variation of animal populations make determining what, where, and when a subsistence resource will be harvested a complex choice. Many areas might be used infrequently, but they can be quite important harvest areas when they are used (USDOI, Bureau of Land Management, 1978c). Under certain conditions, harvest activities may occur anywhere in the sale area; but they tend to be concentrated along rivers and coastlines, near communities, and at particularly productive sites.

Use by a village of any particular species can vary greatly over time, and data from short-term harvest surveys often can lead to a misinterpretation of use/harvest trends. For example, if a particular village did not harvest any bowhead whales in one year, the volume of whale in their diet would decrease. Consequently, consumption and use of caribou and other species likely would go up, in absolute and percent terms. If caribou were not available one winter, other terrestrial species could be hunted with greater intensity. The harvest of faunal resources, such as marine and terrestrial mammals and fish, is heavily emphasized, and the subsistence harvest of vegetation by communities adjacent to the project area is limited. When compared with more southerly regions, the total spectrum of available resources in the arctic region is limited.

While subsistence-resource harvests differ from community to community, the resource combination of caribou, bowhead whales, and fish has been identified as the primary grouping of resources harvested. Caribou is the most important overall subsistence resource in terms of effort spent hunting, quantity of meat harvested, and quantity of meat consumed. The bowhead whale is the subsistence resource of primary importance, because it provides a unique and powerful cultural basis for sharing and community cooperation (Stoker, 1984, as cited by Alaska Consultants, Inc. [ACI], Courtnage, and Braund, 1984). In fact, the bowhead could be said to be the foundation of the sociocultural system. Depending on the community, fish is the next most important resource after caribou and bowhead whales. Bearded seals and various types of birds also are considered primary subsistence species. Waterfowl are particularly important during the spring, when they provide variety to the subsistence diet and the first fresh meat of the season. In the late 1970's, when bowhead whale quotas were low and the Western Arctic caribou herd crashed (and the Alaska Board of Game put bag limits in place), hunters turned to bearded seals (ugruk), ducks, geese, and fish to supplant the subsistence diet. Seal oil from bearded seals is an important staple and a necessary complement to other subsistence foods.

The subsistence pursuit of bowhead whales has major importance to the communities of Barrow, Nuiqsut, and Kaktovik and continues today to be the most valued activity in the subsistence economy of these communities. This is true even in light of harvest constraints imposed by quotas of the International Whaling Commission; relatively plentiful supplies of other resources such as caribou, fish, and other subsistence foods; and supplies of retail grocery foods. Whaling traditions include kinship-based crews, use of skin boats (only in Barrow for their spring whale-hunting season), distribution of the meat, and total community participation and sharing. In spite of the rising cash income, these traditions remain as central values and activities for all Inupiat on the North Slope. Bowhead whale hunting strengthens family and community ties and the sense of a common Inupiaq heritage, culture, and way of life. In this way, whale-hunting activities provide strength, purpose, and unity in the face of rapid change. In terms of the whale harvest, Barrow is the only community within the planning area that harvests whales in both the spring and the fall. Nuiqsut and Kaktovik residents hunt bowheads only during the fall whaling season.

An important shift in subsistence-harvest patterns occurred in the late 1960's, when the substitution of snowmachines for dogsleds decreased the importance of ringed seals and walruses as key sources of dog food and increased the relative importance of waterfowl. This shift illustrates how technological and/or social change can lead to modified subsistence practices. Because of technological and harvest-pattern changes, the dietary importance of waterfowl also may continue to increase; however, these changes would not affect the central and specialized dietary roles that bowhead whales, caribou, and fish—the three most important subsistence-food resources to North Slope communities—play in the subsistence harvests of Alaska's Inupiat, and for which there are no practical substitutes.

Subsistence resources used by Barrow, Nuiqsut, and Kaktovik are listed in Table III.C-8 by common species name, Inupiaq name, and scientific name. For a comparison of the proportion of Inupiaq household foods obtained from subsistence in the years 1977, 1988, and 1993, see Table III.C-9. Table III.C-10 shows the percentage of households that participated in successful harvests of subsistence resources in the three communities being discussed, and Table III.C-11 shows individual species' percentages of the total subsistence harvest for each community.

Many species are important for the role they play in the annual cycle of subsistence-resource harvests, yet effects on subsistence can be serious even if the net quantity of available food does not decline. The consumption of harvestable subsistence resources provides more than dietary benefits, it also provides materials for personal and family use, and the sharing of resources helps maintain traditional Inupiat family organization. Subsistence resources provide special foods for religious and social occasions; the most important ceremony, Nalukataq, celebrates the bowhead whale harvest. The sharing, trading, and bartering of harvestable subsistence foods structures relationships among communities while, at the same time, the giving of such foods helps maintain ties with family members elsewhere in Alaska. Additionally, subsistence provides a link to the cash economy; many households within the communities earn cash from crafting whale baleen and walrus ivory and from harvesting furbearing mammals.

Full-time wage employment has positively affected the subsistence hunt on the one hand by providing cash for snowmachines, boats, motors, and fuel—important tools for the hunt. Yet, on the other hand, full-time employment limits the time a subsistence hunter can spend hunting to after work hours. During midwinter, this time is further limited by waning daylight. In summer, extensive hunting and fishing activities can be pursued after work without any daylight limitations.

Inupiat concerns regarding oil development for the Beaufort Sea multiple sales that have been identified during scoping can be divided into six categories: (1) disruption of subsistence species' migrations; (2) direct damage to subsistence resources and habitats; (3) disruption of access to subsistence areas; (4) loss of subsistence food sources; (5) concerns over cumulative oil-development impacts; and (6) insufficient recognition of Inupiat indigenous knowledge concerning subsistence resources, subsistence-harvest areas, and subsistence practices. One study of Inupiat concerns about oil development was based on a compilation of approximately 10 years of recorded testimony at North Slope public hearings for State and Federal energy-development projects. Most concerns confirmed those raised in scoping, centering on the subsistence use of resources, including damage to subsistence species, loss of access to subsistence areas, loss of Native foods, or interruption of subsistence-species migration. These four concerns represent 83% of all the concerns heard in the testimony taken on the North Slope for this period (S.R. Braund and

Assocs., In prep.; Kruse et al., 1983:Table 35; USDOI, MMS, 1994; Human Relations Area Files, Inc., 1992).

III.C.2.d. Annual Cycle of Harvest Activities

This section provides general information regarding subsistence-harvest patterns in all of the communities close to the Beaufort Sea multiple-sale area. The primary subsistence-harvest areas for Barrow, Nuiqsut, and Kaktovik are depicted in Figure III.C-1 Subsistence-Harvest Areas for Beaufort Sea Communities. The entire marine subsistence-harvest areas of Nuiqsut and Kaktovik and most of Barrow's marine-subsistence-harvest area lie within or near the boundary of the Beaufort Sea multiple-sale area; portions of Barrow's marine-subsistence-harvest area in the Chukchi Sea lie to the west and outside the boundary of the Beaufort Sea multiple-sale area. Onshore, the caribou-hunting areas of Barrow, Nuiqsut, and Kaktovik would be most directly affected by potential pipelines and other onshore facilities associated with the proposed action. Figures III.C.3-2 through III.C.3-7a in the Beaufort Sea Sale 144 final EIS depict subsistence-harvest-concentration areas for bowhead whales, beluga whales, caribou, seals, walrus, fish, and waterfowl, respectively and are incorporated here by reference. The annual subsistence cycles for Barrow, Nuiqsut, and Kaktovik are described in the following.

III.C.2.d(1) Barrow

As with other communities adjacent to the planning area, Barrow residents (population 3,469 in 1990, 3,908 in 1993, 4,641 in 1998, and 4,581 in 2000 [USDOC, Bureau of the Census, 1991 and 2001; North Slope Borough, Dept. of Planning and Community Services, 1994, 1999) enjoy a diverse resource base that includes both marine and terrestrial animals. Barrow's location is unique among the communities in the sale area: the community is a few miles southwest of Point Barrow, the demarcation point between the Chukchi and Beaufort seas. This location offers superb opportunities for hunting a diversity of marine and terrestrial mammals and fishes. Barrow's subsistence-harvest area can be seen in Figure III.C-1. Subsistence resources used by Barrow are listed in Table III.C-8 by common species name, Inupiaq name, and scientific name. Specific subsistence-harvest areas for major subsistence resources for Barrow are shown in Figure III.C-2. Figure III.C-3 shows Barrow harvest sites recorded by Braund from 1987 through 1990 (S.R. Braund and Assocs. and UAA, ISER, 1993), and Figure III.C-4 depicts known Barrow hunting and fishing camps.

III.C.2.d.(1)(a) Bowhead Whale

Unlike residents of Nuiqsut and Kaktovik, Barrow residents hunt the bowhead whale during both spring and fall; however, more whales are harvested during the spring whale hunt, which is the major whaling season (Figure III.C-5). In 1977, the International Whaling Commission established an overall quota for subsistence hunting of the bowhead whale by the Alaskan Inupiat. The quota currently is regulated by the Alaska Eskimo Whaling Commission, which annually decides how many bowheads each whaling community may take. Barrow whalers continue to hunt in the fall to meet their quota and to seek strikes that can be transferred to the community from other villages from the previous spring hunt. During the spring hunt, there are approximately 30 whaling camps along the edge of the landfast ice. The locations of these camps depend on ice conditions and currents. Most whaling camps are located south of Barrow, some as far south as Walakpa Bay. Typically, Atqasuk whalers participate in the subsistence bowhead hunt by joining Barrow whaling crews.

Depending on the season, the bowhead is hunted in two different areas. In the spring (from early April until the first week of June), the bowheads are hunted from leads that open when pack-ice conditions deteriorate. At this time, bowhead whales are harvested along the coast from Point Barrow to the Skull Cliff area, and the distance of the leads from shore varies from year to year. The leads generally are parallel and quite close to shore, but occasionally they break directly from Point Barrow to Point Franklin and force Barrow whalers to travel over the ice as much as 10 miles offshore to the open leads. Typically, the lead is open from Point Barrow to the coast; and hunters whale only 1-3 miles from shore. A stricken whale can be chased in either direction in the lead. Spring whaling in Barrow is conducted almost entirely with skin boats because the narrow leads prohibit the use of aluminum skiffs, which are more difficult to maneuver than the traditional skin boats (ACI, Courtnage, and Braund, 1984; S.R. Braund and Assocs. and UAA, ISER, 1993). Fall whaling occurs east of Point Barrow from the Barrow vicinity to Cape Simpson. Hunters use aluminum skiffs with outboard motors to chase the whales during the fall migration, which takes place in open water up to 30 miles offshore.

No other marine mammal is harvested with the intensity and concentration of effort that is expended on the bowhead whale. Bowheads are very important in the subsistence economy; from 1962-1982, they accounted for 21.3% (an average of 10.10 whales/year) of the annual subsistence harvest (ACI, Courtnage, and Braund, 1984). From 1987 through 1990, Braund (S.R. Braund and Assocs. and UAA, ISER, 1993) conducted a 3-year subsistence study in Barrow. Table III.C-12 shows the number of various subsistence species harvested by year and the 3-year average reported in the study. During the last year of the study, harvest data indicated that 58.2% of the total harvest was marine mammals, and 43.3% of the total harvest was bowhead whales (State of Alaska, Dept. of Fish and Game, 1995b; Table III.C-12). As with all species, the harvest of bowheads varies from year to year; over the past 30 years (see Figures III.C-5 and III.C-6), the number taken each year has varied from zero to 23. In the memory of community residents, 1982 is the only year in which a bowhead whale was not harvested (ACI, Courtnage, and Braund, 1984; S.R. Braund and Assocs. and UAA, ISER, 1993).

III.C.2.d(1)(b) Beluga Whale

Beluga whales are available from the beginning of the spring whaling season through June and occasionally in July and August in ice-free waters (Figure III.C-5). Barrow hunters do not like to hunt beluga whales during the bowhead hunt, preferring to harvest them after the spring bowhead season ends, which depends on when the bowhead quota is met. Belugas are harvested in the leads between Point Barrow and Skull Cliff. Later in summer, belugas occasionally are harvested on both sides of the barrier islands of Elson Lagoon. The annual average beluga harvest over the 20-year period from 1962-1982 is estimated at 5 whales, or 5% of the total annual subsistence harvest (ACI, Courtnage, and Braund, 1984). In Braund's (1993) study, there were no harvests of beluga whales in the 3-year period of data collection (S.R. Braund and Assocs. and UAA, ISER, 1993; State of Alaska, Dept. of Fish and Game, 1995b; Table III.C-12). During the period 1982-1996, belugas were taken very rarely at Barrow, with an annual average of about one per year. In 1997, five belugas had been taken as of August (Suydam, 1997, pers. commun.).

III.C.2.d(1)(c) Caribou

Caribou, the primary terrestrial source of meat for Barrow residents, are available throughout the year, with peak-harvest periods from February through early April and from late June through late October (Figure III.C-5). The approximate boundary for Barrow's primary subsistence-harvest area for caribou, as reflected in research conducted in the late 1980's and early 1990's, extends southwest from Barrow along the Chukchi coast for roughly 35 miles, then runs south and eastward toward the drainage of the upper Meade River; it swings easterly crossing the Usuktuk River and then trends north and east crossing the Topagoruk and Oumalik rivers until it reaches Teshekpuk Lake; from here the boundary generally traces the coastline back to Barrow. (The area described here is a boundary that circumscribes reported harvest sites and does not represent a reported harvest area as such [S.R. Braund and Assocs. and UAA, ISER, 1993].) Over the 20-year period from 1962-1982, residents harvested an annual average of 3,500 caribou, which accounted for 58.2% of the total annual subsistence harvest (ACI, Courtnage, and Braund, 1984). In the last year of Braund's 3-year Barrow subsistence study, caribou provided 22.2% of the total edible pounds harvested (S.R. Braund and Assocs. and UAA, ISER, 1993; State of Alaska, Dept. of Fish and Game, 1995b; Table III.C-12).

II.C.2.d(1)(d) Seals

Hair seals are available from October through June; however, because of the availability of bowheads, bearded seals, and caribou during various times of the year, seals are harvested primarily during the winter months, especially from February through March (Figure III.C-5). Ringed seals are the most common hair seal species harvested, and spotted seals are harvested only in the ice-free summer months. Ringed seal hunting is concentrated in the Chukchi Sea, although some hunting occurs off Point Barrow and along the barrier islands that form Elson Lagoon. During the winter, leads in the area immediately adjacent to Barrow and north toward the point make this area an advantageous spot for sealing. Spotted seals also are harvested occasionally off Point Barrow and the barrier islands of Elson Lagoon. Oarlock Island in Admiralty Bay is a favorite place for hunting spotted seals. From 1962-1982, the hair seal harvest ranged between 31 and 2,100 seals a year, with the average annual harvest estimated at 955 seals, or 4.3% of the total annual subsistence harvest (ACI, Courtnage, and Braund, 1984). In the last year of Braund's 3-year Barrow subsistence study, ringed seals provided 2.1% of the total edible pounds harvested (S.R. Braund and Assocs. and UAA, ISER, 1993; State of Alaska, Dept. of Fish and Game, 1995b; Table III.C-12).

The hunting of bearded seals (ugruk) is an important subsistence activity in Barrow, because the bearded seal is a preferred food and because bearded seal skins are the preferred covering material for the skin boats used in whaling. Six to nine skins are needed to cover a boat. For these reasons, bearded seals are harvested more than the smaller hair seals. Most bearded seals are harvested during the spring and summer months and from open water during the pursuit of other marine mammals in both the Chukchi and Beaufort seas (North Slope Borough, 1998). Occasionally, they are available in Dease Inlet and Admiralty Bay. No early harvest data were available for the number of bearded seals harvested annually; thus, the annual subsistence harvest averaged over 20 years from 1962-1982 was only 150 seals, or about 2.9% of the total annual subsistence harvest (ACI, Courtnage, and Braund, 1984). Harvests from 1988-1989 were documented at 213 seals, providing 6.0% of the total edible pounds harvested (S.R. Braund and Assocs. and UAA, ISER, 1993; Table III.C-13).

III.C.2.d(1)(e) Fishes

Barrow residents harvest marine and riverine fishes, but their dependency on fish varies according to the availability of other resources. Capelin, char, cod, grayling, salmon, sculpin, trout, and whitefish are harvested (ACI, Courtnage, and Braund, 1984). Fishing occurs primarily in the summer and fall months and peaks in September and October (Figure III.C-5). Fishing also occurs concurrently with caribou hunting in the fall. Tom cod are harvested during the fall and early winter when there is still daylight (North Slope Borough, 1998). The subsistence-harvest area for fish is extensive, primarily because Barrow residents supplement their camp food with fish whenever they are hunting.

Most fishing occurs at inland fish camps, particularly in lakes and rivers that flow into the southern end of Dease Inlet (Craig, 1987). Inland fish camps are found in the Inaru, Meade, Topagoruk, Chipp, Alaktak, and Ikpikpuk river drainages and as far as Teshekpuk Lake. Inland fisheries within or adjacent to the planning area are those on the Alaktak and Ikpikpuk drainages and on Teshekpuk Lake. At established fish camps, hunters place set nets for whitefish, char, and salmon. These camps provide good fishing opportunities as well as access to inland caribou and birds. When whitefish and grayling begin to migrate out of the lakes into the major rivers in August, inland fishing intensifies. This also is the period of peak collection of berries and greens (Schneider, Pedersen, and Libbey, 1980; ACI, Courtnage, and Braund, 1984). During 1969-1973, the average annual harvest of fish was about 80,000 pounds (Craig, 1987); from 1962-1982, the estimated annual average was 60,000 pounds, which account for 6.6% of the total annual subsistence harvest (ACI, Courtnage, and Braund, 1984). In a 1986 partial estimate of fish harvests for the Barrow fall fishery in the Inaru River, the catch composition was least cisco (45%), broad whitefish (36%), humpback whitefish (16%), Arctic cisco (1%), fourhorn sculpin (1%), and burbot (0.5%) (Craig, 1987). In Braund's (1993) study, 1989-1990 fish harvests provided 13.5% of the total edible subsistence harvest (S.R. Braund and Assocs. and UAA, ISER, 1993; Table III.C-12).

III.C.2.d(1)(f) Walrus

Walruses are harvested during the summer marine-mammal hunt west of Point Barrow and southwest to Peard Bay. Most hunters will travel no more than 15-20 miles to hunt walruses. The major walrus-hunting effort occurs from late June through mid-September, with the peak season in August (Figure III.C-5). The annual average harvest over 20 years from 1962-1982 was estimated at 55 walruses, or 4.6% of the total annual subsistence harvest (ACI, Courtnage, and Braund, 1984). Braund's 1987-1990 study (S.R. Braund and Assocs. and UAA, ISER, 1993; Table III.C-12) indicated an increased walrus harvest, with a harvest of 88 walruses providing 10.9% of the total edible pounds of meat harvested during this period. From 1989-1995, 109 walruses were harvested, from a low of 1 in 1989 to a high of 30 in 1993 (Stephensen, Cramer, and Burn, 1994; Cramer, 1996, pers. commun.).

III.C.2.d(1)(g) Waterfowl

Migratory birds, particularly eider ducks and geese, provide an important food source for Barrow residents. This is not because of the quantity of meat harvested or the time spent hunting them, but because of the dietary importance of birds as the first source of fresh meat in the spring. In May, geese are hunted and hunters travel great distances along major inland rivers and lakes to harvest them; most eider and other ducks are harvested along the coast (Schneider, Pedersen, and Libbey, 1980). Once harvested extensively, snowy owls are no longer taken regularly. Eggs from a variety of species still are gathered occasionally, especially on the offshore islands where foxes and other predators are less common. Waterfowl, hunted during the whaling season (beginning in late April or early May) when their flights follow the open leads, provide a source of fresh meat for whaling camps. Later in the spring, Barrow residents harvest many geese and ducks, with the harvest peaking in May and early June but continuing until the end of June (Figure III.C-5). Birds may be harvested throughout the summer, but only incidentally to other subsistence activities. In late August and early September, with peak movement in the first 2 weeks of September, ducks and geese migrate south and are again hunted by Barrow residents. Birds, primarily eiders and other ducks, are hunted along the coast from Point Franklin to Admiralty Bay and Dease Inlet. Concentrated hunting areas also are located along the shores of the major barrier islands of Elson Lagoon. During spring whaling, families not involved with whaling may go geese hunting; successful whaling crews also may be hunting geese while other crews are still whaling (North Slope Borough, 1998).

A favorite spot for hunting birds is the “shooting station” at the narrowest point of the barrier spit that forms Point Barrow and separates the Chukchi Sea from Elson Lagoon. This area, a highly successful hunting spot during spring and fall bird migrations, is easily accessible to Barrow residents. Barrow residents harvested an estimated annual average from 1962-1982 of 8,000 pounds of birds, which accounted for about 0.9% of the total annual subsistence harvest (ACI, Courtnage, and Braund, 1984). From 1989-1990, 29,215 pounds were harvested, accounting for 3.3% of the total edible pounds harvested (S.R. Braund and Assocs. and UAA, ISER, 1993; State of Alaska, Dept. of Fish and Game, 1995b; Table III.C-12).

III.C.2.d(1)(h) Polar Bear

Barrow residents hunt polar bears from October to June (Figure III.C-5). Polar bears comprise a small portion of the Barrow subsistence harvest, with an annual average of 7.8 bears harvested from 1962-1983, or only 0.3% of the annual subsistence harvest (Schliebe, 1983; ACI, Courtnage, and Braund, 1984). From 1989-1990, 39 polar bears were harvested, providing 2.2% of the total edible pounds harvested (S.R. Braund and Assocs. and UAA, ISER, 1993; State of Alaska, Dept. of Fish and Game, 1995b; Table III.C-13). Table III.C-14 shows polar bear harvests from 1983-1995 for Barrow, Nuiqsut, and Kaktovik.

Figures III.C-7 and III.C-8 are derived from a North Slope Borough subsistence study conducted in 1993 and indicate the level of household consumption of subsistence foods and expenditures on subsistence activities (Harcharek, 1995).

III.C.2.d(2) Nuiqsut

Specific harvest areas for wildfowl, caribou, moose, fish, whales, and seals for Nuiqsut are shown on Map 9. The Inupiat community of Nuiqsut has subsistence-harvest areas in and adjacent to the sale area, and Nuiqsut’s entire marine subsistence-harvest area lies within proposed boundary of the Beaufort Sea multiple-sale area. Cross Island and vicinity is a crucially important region for Nuiqsut’s subsistence bowhead whale hunting. Before oil development at Prudhoe Bay, the onshore area from the Colville River Delta in the west to Flaxman Island in the east and inland to the foothills of the Brooks Range (especially up the drainages of the Colville, Itkillik, and Kuparuk rivers) was historically important to Nuiqsut for the subsistence harvests of caribou, waterfowl, furbearers, fish, and polar bears. Offshore, in addition to bowhead whale hunting, seals historically were hunted as far east as Flaxman Island. Also, commercial whaling near and within the barrier islands during the late 1800’s has been documented (Thomas P. Brower, as cited in North Slope Borough, Commission on History and Culture, 1980). Bowheads also have been observed inshore of the barrier islands, and recent mention has been made of the area being used as a whale feeding area (V. Nauwigewauk, as cited in Shapiro, Metzner, and Toovak, 1979; Isaac Akootchook, as cited in USDOI, MMS, 1979a; Thomas P. Brower, as cited in North Slope Borough, Commission on

History and Culture, 1980; Frank Long, Jr., as cited in Dames and Moore, 1996b; Burton Rexford, as cited in USDOI, MMS, 1996d; and Isaac Nukapigak, as cited in USDOI, MMS, Alaska OCS Region, 1998b).

Nuiqsut Subsistence-Harvest Seasons and Harvest Success Profile: Nuiqsut's population stood at 354 in 1990, 418 in 1993, 420 in 1998, and 433 in 2000 [USDOC, Bureau of the Census, 1991, 2001; North Slope Borough, Dept. of Planning and Community Services, 1994, 1999). Nuiqsut is located near the mouth of the Colville River, which drains into the Beaufort Sea. For Nuiqsut, important subsistence resources include bowhead whales, caribou, fish, waterfowl, ptarmigan and, to a lesser extent, seals, muskoxen, and Dall sheep. Polar bears, beluga whales, and walruses are seldom hunted but can be taken opportunistically while in pursuit of other subsistence species. A 1993 Department of Fish and Game subsistence study showed that nearly two-thirds of all Nuiqsut households received more than half of their meat, fish, and birds from local subsistence activity (Pedersen et al., 1995, as cited in Fall and Utermohle, 1995). Nuiqsut's marine and terrestrial subsistence-harvest areas can be seen in Figure III.C-1 and Map 9. The preferred harvest periods for Nuiqsut are indicated in Figure III.C-9. A summary of subsistence resources harvested in the 1993 and 1994-1995 seasons can be seen in Tables III.C-15 and III.C-16, respectively. A map of Nuiqsut's terrestrial harvest areas can be seen in Figure III.C-10.

III.C.2.d(2)(a) Bowhead Whale

Even though Nuiqsut is not located on the coast but approximately 25 miles inland with river access to the Beaufort Sea, bowhead whales are a major subsistence resource. Bowhead whale hunting usually occurs between late August and early October, with the exact timing depending on ice and weather conditions. Ice conditions can dramatically extend the season up to 2 months or contract it to less than 2 weeks. Unlike the Barrow spring whale hunt, staged from the edge of ice leads using skin boats, Nuiqsut whalers use aluminum skiffs with outboard motors to hunt bowheads in open water in the fall. Generally, bowhead whales are harvested by Nuiqsut residents within 10 miles of Cross Island, but hunters may at times travel 20 miles or more from the island. Historically, the entire coastal area from Nuiqsut east to Flaxman Island and the Canning River Delta has been used, but whale hunting to the west of Cross Island has never been as productive and whale hunting too far to the east requires long tows of the whales back to Cross Island for butchering, creating the potential for meat spoilage (Impact Assessment, Inc., 1990a).

In the past, Nuiqsut has not harvested many bowhead whales (20 whales from 1972-1995); however, their success has improved over the past few years. Unsuccessful harvests were more common in the 1980s, with no whales taken in 1983, 1984, 1985, and 1988; however, in the 1990s, the only unsuccessful years have been 1990 and 1994 (USDOI, MMS, 1996a; U.S. Army Corps of Engineers, 1998) (see Figures III.C-6 and III.C-14). A 1993 Alaska Department of Fish and Game subsistence survey in Nuiqsut indicated that 31.8% of the total subsistence harvest was marine mammals, and 28.7% of the total harvest was bowhead whales (State of Alaska, Dept. of Fish and Game, 1995a; Tables III.C-15 and III.C-16). The harvest of bowhead whales at Nuiqsut greatly affects the percentage of total harvest estimates because in years when whales are taken, other important subsistence species are underrepresented due to the great mass of the total pounds of whale harvested.

Although in Nuiqsut bowheads are not the main subsistence resource in terms of edible pounds harvested per capita, they remain, as in other North Slope communities, the most culturally prominent to the Inupiat. The bowhead is shared extensively with other North Slope communities and often with Inupiat residents in communities as far away as Fairbanks and Anchorage. Nuiqsut Whaling Captains Association President, Frank Long, Jr., presented a history of Nuiqsut bowhead whaling and summarized major issues of concern in the Proceedings of the 1995 Arctic Synthesis Meeting (USDOI, MMS 1996d).

III.C.2.d(2)(b) Caribou

Nuiqsut harvests several large land mammals, including caribou and moose; of these, caribou is the most important subsistence resource. Caribou may be the most preferred mammal in Nuiqsut's diet and, during periods of high availability, it provides a source of fresh meat throughout the year. Caribou-harvest statistics for 1976 show that 400 caribou provided approximately 47,000 pounds of meat, an estimated 90.2% of the total subsistence harvest (Stoker, 1983, as cited in ACI, Courtnage, and Braund, 1984; S.R. Braund and Assocs. and UAA, ISER, 1993; see Tables III.C-15 and III.C-16). In 1985, an estimated 513 caribou were harvested, providing an estimated 60,000 edible pounds of meat (37.5% of the total subsistence harvest; State of Alaska, Dept. of Fish and Game, 1993). A 1993 Alaska Department of Fish and Game subsistence study estimated a harvest of 674 caribou, providing about 82,000 edible pounds of meat (30.6% of the total subsistence harvest). In 1993, 74% of Nuiqsut households harvested caribou, 98% used caribou, 79% shared caribou with other households, and 79% received caribou shares (State of Alaska, Dept. of Fish and Game, 1995a). Harvests occurred at 16 locations with the highest harvest, 111 caribou, at Fish Creek (Pedersen et al., 1995, as cited in Fall and Utermohle, 1995). A subsistence-harvest survey conducted by the North Slope Borough, Division of Wildlife Management covering the period from July 1994 to June 1995 reported 249 caribou harvested by Nuiqsut hunters, or 58% of the subsistence harvest in edible pounds. The report noted this as quite a low number of caribou when compared to reported harvests for earlier years (see Table III.C-16). Explanations offered by local hunters were: (1) the need to travel longer distances to harvest caribou than in the past; (2) the increasing numbers of muskoxen (that hunters believe keep caribou away from traditional hunting areas); and (3) restricted access to traditional subsistence-hunting areas due to oil exploration and development in these areas (Brower and Opie, 1997; Brower and Hepa, 1998).

Because of the unpredictable movements of the Central Arctic and Teshekpuk Lake caribou herds, and because of ice conditions and hunting techniques that depend on the weather, Nuiqsut's annual caribou harvest can fluctuate markedly; but when herds are available and when weather permits, caribou are harvested year-round. Elders Samuel and Sarah Kunaknana related that caribou hunters in the past had to go inland to hunt caribou, because they never came down to the coast as they do now (Shapiro, Metzner, and Toovak, 1979).

III.C.2.d(2)(c) Fishes

Fish provides the most edible pounds per capita of any subsistence resource harvested by Nuiqsut (see Tables III.C-15 and III.C-16; State of Alaska, Dept. of Fish and Game, 1993, 1995a). The harvests of most subsistence resources, such as caribou, can fluctuate widely from year to year because of variable migration patterns and because harvesting techniques depend on ice and weather conditions, much the same as the conditions surrounding the bowhead whale hunt. Even though fish-harvest rates (and total catch) vary from year to year, the harvest of fish is perhaps more consistent than the harvest of land animals. The harvesting of fish is not subject to seasonal limitations, a situation that adds to their importance in the community's subsistence round. Nuiqsut has been shown to have the largest documented subsistence fish harvest on the Beaufort Sea coast (Moulton, 1997; Moulton, Field, and Brotherton, 1986). Moreover, in October and November, fish may provide the only source of fresh subsistence foods.

Fishing is an important activity for Nuiqsut residents because of the community's location on the Nechelik Channel of the Colville River, which has large resident fish populations on the North Slope. The river supports 20 species of fish, and approximately half of these are taken by Nuiqsut residents (George and Nageak, 1986). Local residents generally harvest fish during the summer and fall, but the fishing season basically runs from January through May and from late July through mid-December. The summer, open-water harvest lasts from breakup to freezeup (early June to mid-September). The summer harvest covers a greater area, is longer than the fall/winter harvest, and a greater number of species are caught. Broad whitefish is the primary anadromous species harvested during the summer. Thomas Napageak relates that

> …in the summer when it is time to fish for large, round-nosed whitefish the place called Tirragruag gets filled with them as well as the entrance to Itqiliq. Nigliq River gets filled with nets all the way to the point where it begins. We do not go to Kuukpiluk in the summer months. Then we enter Fish Creek...another place where they fish for whitefish is Nuiqsagruaq (Thomas Napageak [USDOI, BLM, 1998]).

In July, lake trout, northern pike, broad whitefish, and humpback whitefish also are harvested south of Nuiqsut. Traditionally, coastal areas were fished in June and July, when rotting ice created enough open water for seining. Nuiqsut elder Sarah Kunaknana, interviewed in 1979, said: "...in the little bays along the coast we start seining for fish (iqalukpik). After just seining 1 or 2 times, there would be so many fish we would have a hard time putting them all away" (Shapiro, Metzner, and Toovak, 1979). Salmon species reportedly have been caught in August but not in large numbers. Pink and chum are the most commonly caught salmon, although there reportedly has not been a great interest in harvesting them (George and Nageak, 1986). Arctic char is found in the main channel of the Colville River but does not appear to be a major subsistence species because, although apparently liked, it is not abundantly caught (George and Nageak, 1986; George and Kovalsky, 1986; State of Alaska, Dept. of Fish and Game, 1993, 1995a).

The fall/winter under-ice harvest of fish begins after freezeup, when the ice is safe for snowmachine travel. Local families begin fishing approximately 1 month after freezeup. The Kuukpigruaq Channel is the most important fall fishing area in the Colville region, and the primary species harvested are arctic and least cisco. Even after freezeup, people continue to fish for whitefish (Thomas Napageak [USDOI, BLM, 1998]). Nuiqsut resident Ruth Nukapigak recounts a recent winter fishing trip in December 1997: "I, myself, took my net out in December right before Christmas Day. I was catching whitefish in my net." (USDOI, BLM, 1998). Arctic and least cisco amounted to 88 and 99% of the harvest in 1984 and 1985, respectively; however, this percentage varied greatly depending on the net-mesh size. Humpback and broad whitefish, sculpin, and some large rainbow smelt also are harvested, but only in low numbers (George and Kovalsky, 1986; George and Nageak, 1986). A fish identified as "spotted least cisco" also has been harvested. This fish is not identified by Morrow (1980) but could be a resident form of least cisco (George and Kovalsky, 1986). Additionally, weekend fishing for burbot and grayling occurs at Itkillikpaat, 6 miles from Nuiqsut (George and Nageak, 1986; State of Alaska, Dept. of Fish and Game, 1995a).

A study conducted in 1985 estimated the summer catch that season totaled about 19,000 pounds of mostly broad whitefish; in the fall, approximately 50,000 pounds of fish were caught, for an annual per capita catch of 244 pounds; some of this catch was shipped to Barrow (Craig, 1987). A 1985 Alaska Department of Fish and Game subsistence survey estimated a smaller per capita catch with the edible pounds of all fish harvested at 176.13 pounds per capita (44.1% of the total subsistence harvest; State of Alaska, Department of Fish and Game, 1993). In 1986, there was a reduced fishing effort in Nuiqsut, and the fall harvest was only 59% of that taken in 1985 (Craig, 1987). In 1992, 34% of the edible pounds of the total subsistence harvest was fish and, by 1993, the estimate for edible pounds of all fish harvested had risen to 250.62 pounds per capita (33.7% of the total subsistence harvest [George and Fuller, 1997; State of Alaska, Dept. of Fish and Game, 1995a]). A subsistence-harvest survey conducted by the North Slope Borough, Division of Wildlife Management covering the period from July 1994 to June 1995 reported that the subsistence fishing provided 30% of the total subsistence harvest (see Table III.C-16; Brower and Opie, 1997; Brower and Hepa, 1998). A recent survey shows that 80% of all Nuiqsut households participate in some fishing activity (State of Alaska, Dept. of Fish and Game, 1995a).

Fish are eaten fresh or frozen. Because of their important role as an abundant and stable food source, and as a fresh-food source during the midwinter months, fish are shared at Thanksgiving and Christmas feasts and given to relatives, friends, and community elders. Fish also appear in traditional sharing and bartering networks that exist among North Slope communities. Because it often involves the entire family, fishing serves as a strong social function in the community, and most Nuiqsut families (out of a total 91 households in 1993) participate in some fishing activity (State of Alaska, Dept. of Fish and Game, 1995b).

III.C.2.d(2)(d) Seals

Seals are hunted year-round, but the bulk of the seal harvest takes place during the open-water season, with breakup usually occurring in June. In the spring, seals can be hunted once the landfast ice goes out. Present-day sealing is most commonly done at the mouth of the Colville when it begins flooding in June. According to Thomas Napageak:

> …when the river floods, it starts flowing out into the ocean in front of our village affecting the seals that include the bearded seals in the spring month of June…. When the river floods, near the mouth of Nigliq River it becomes filled with a hole or thin spot in [the] sea ice that has melted as the river breaks up. When it reaches the sea, that is the time that they begin to hunt for seals, through the thin spot in the sea ice that has melted. They hunt for bearded seals and other types of seals (USDOI, BLM, 1998).

Nuiqsut resident Ruth Nukapigak recounts past trips to this same sealing area: "I love to follow my son Jonah every year just when the ice begins moving down there and it takes us one hour travel time to get there. That is where we go to hunt for seals" (USDOI, BLM, 1998). Nuiqsut elder Samuel Kunaknana, when interviewed in 1979, noted that when the ice is nearshore in the summer, it is considered to be good for seal hunting (S. Kunaknana, as cited in Shapiro, Metzner, and Toovak, 1979). While seal meat is eaten, the dietary significance of seals primarily comes from seal oil, served with almost every meal that includes subsistence foods. Seal oil also is used as a preservative for meats, greens, and berries. Also, sealskins are important in the manufacture of clothing and, because of their beauty, spotted seal skins often are preferred for making boots, slippers, mitts, and parka trim. In practice, however, ringed seal skins are used more often in the making of clothing, because the harvest of this species is more abundant. A 1993 Department of Fish and Game subsistence survey in Nuiqsut indicates that 31.8% of the total subsistence harvest was marine mammals, and 3.1% of the total harvest was seals (State of Alaska, Dept. of Fish and Game, 1995a). George and Fuller (1997) estimated 24 ringed seals, 6 spotted seals, and 16 bearded seals were harvested in 1992, and the overall marine mammal contribution (including bowhead whales) to the total subsistence harvest was estimated at 36%. A subsistence-harvest survey conducted by the North Slope Borough, Division of Wildlife Management covering the period from July 1994-June 1995 reported a harvest of 23 ringed seals and a contribution of marine mammals of only 2% to the total subsistence harvest, primarily because no bowhead whales were harvested that season (Brower and Opie, 1997; Brower and Hepa 1998).

III.C.2.d(2)(e) Polar Bear

The harvest of polar bears by Nuiqsut hunters begins in mid-September and extends into late winter. Polar bear meat is sometimes eaten although little harvest data are available. One documented bear was harvested in the 1962-1982 period; for the period 1983-1995 Nuiqsut harvested 20 polar bears (Schliebe, 1995; State of Alaska, Dept. of Fish and Game, 1993, 1995a; Brower and Opie, 1997; Brower and Hepa, 1998). According to whaling captain Thomas Napageak's statement at the Beaufort Sea Sale 144 Public Hearings in Nuiqsut, the taking of polar bear is not very important now because Federal regulations prevent the selling of the hide: "...as valuable as it is, [it] goes to waste when we kill a polar bear" (USDOI, MMS, 1995a). Table III.C-14 shows polar bear harvests from 1983-1995 for Barrow, Nuiqsut, and Kaktovik.

III.C.2.d(2)(f) Beluga Whale

Some sources have mentioned beluga whales being taken incidentally during the bowhead harvest; however, Thomas Napageak, resident of Nuiqsut and Chairman of the Alaska Eskimo Whaling Commission, in recent testimony stressed that the village of Nuiqsut has never hunted beluga whales: "I don't recall a time when I went hunting for beluga whales. I've never seen a beluga whale here" (USDOI, BLM, 1998).

III.C.2.d(2)(g) Walrus

The Alaska Department of Fish and Game subsistence-survey data indicate that two walruses were harvested in the 1985/1986 harvest season, but no new walrus data for the community have been gathered since then (State of Alaska, Department of Fish and Game, 1993, 1995a). Walruses probably are incidentally taken during seal hunting.

III.C.2.d(2)(h) Moose

Moose normally are harvested from August-October by boat on the Colville (upriver from Nuiqsut), Chandler, and Itkillik rivers, but the timing for the harvest varies, depending on the current hunting regulations. Harvest data show that moose have been harvested during the winter months by snowmachine (Brower and Opie, 1997). In 1985, hunters from 40 households out of a total of 76 surveyed reported a harvest of seven moose (State of Alaska, Dept. of Fish and Game, 1993). In 1993, 62 households out of a total of 91 surveyed managed to harvest nine moose (State of Alaska, Dept. of Fish and Game, 1995a). A subsistence-harvest survey conducted by the North Slope Borough Division of Wildlife Management covering the period from July 1994 to June 1995 reported five moose harvested, or 5% of the total edible pounds harvested that season (Brower and Opie, 1997; Brower and Hepa, 1998). In 1992, caribou and moose accounted for 27% of the total subsistence harvest (George and Fuller, 1997); in 1993, moose and caribou accounted for 33% (Pedersen, 1996); and in the period covered by the North Slope Borough subsistence survey (July 1994 to June 1995), caribou and moose accounted for 63% of the edible pounds of subsistence resources harvested by Nuiqsut hunters (Brower and Opie, 1997; Brower and Hepa, 1998). This jump to a much higher percentage for terrestrial mammals is likely explained by an unsuccessful bowhead whale harvest during the study period (Suydam et al., 1994).

III.C.2.d(2)(i) Waterfowl

Waterfowl and coastal birds are a subsistence resource that has been growing in importance since the mid-1960's. Birds are harvested year-round, with peak harvests in May-June and September-October. The most important species for Nuiqsut hunters are the Canada and white-fronted goose and brant; eiders are harvested in low numbers. Ruth Nukapigak relates that "...when the white-fronted goose come, they do hunt them. When the thin ice near the mouth of the river breaks up, that is when they start duck hunting. We, the residents of Nuiqsut, go there to hunt for ducks when they arrive" (USDOI, BLM, 1998). The only upland bird hunted extensively is the ptarmigan (State of Alaska, Dept. of Fish and Game, 1993, 1995a; Brower and Opie, 1997). Recent data indicate that the subsistence bird harvest has provided 5% of the total harvest (Brower and Opie, 1997; Brower and Hepa, 1998). Waterfowl hunting occurs mostly in the spring, beginning in May, and continues throughout the summer. In the summer and early fall, such hunting usually occurs as an adjunct to other subsistence activities, such as checking fishnets.

Figures III.C-11 and III.C-12 indicate important trends in Nuiqsut household consumption of subsistence foods and expenditures on subsistence activities (Harcharek, 1995).

III.C.2.d(3) Kaktovik

Kaktovik is situated on Barter Island off the Beaufort Sea coast (population 224 in 1990, 230 in 1993, 256 in 1998, and 293 in 2000 [USDOC, Bureau of the Census, 1991, 2001; North Slope Borough, Dept. of Planning and Community Services, 1994, 1999]). For Kaktovik, the subsistence resources that could be affected by the Beaufort Sea sales are bowhead and beluga whales, seals, polar bears, caribou, fishes, and marine and coastal birds. The intensity of effort and preferred harvest periods are indicated in Figure III.C-14. A summary of subsistence resources harvested in 1992 can be seen in Table III.C-17. The North Slope Borough, Division of Wildlife Management, conducted a subsistence-harvest survey in Kaktovik covering the period from December 1994-November 1995. The survey recorded the subsistence-harvest effort for 73 households and the species types and numbers harvest for each month (see Tables III.C-18 and III.C-19; Brower, Olemaun, and Hepa, 2000). Like Nuiqsut, much of Kaktovik's marine subsistence-harvest area is within the proposed Beaufort Sea multiple-sale area, and the western edge of the community's terrestrial mammal, fish, and bird subsistence-harvest areas overlap a possible landfall location at Point Thompson.

III.C.2.d(3)(a) Bowhead Whale

Bowhead whaling occurs between late August and early October (Figure III.C-13), with the exact timing depending on ice and weather conditions. The whaling season can range anywhere from longer than 1 month to less than 2 weeks, depending on these conditions. As in Nuiqsut, Kaktovik whalers hunt the bowhead in the fall in aluminum skiffs in open water rather than in skin boats from the edge of ice leads. Whaling crews generally hunt bowheads within 10 miles of shore but occasionally may range as much as 20 miles from the coast (see Figures III.C-1 and III.C-14). Bowhead whales provide a large proportion of Kaktovik's subsistence harvest, but the number landed can vary and has ranged from zero to as many as four each year since 1962, with the exception of 1979 when five were landed (see Figure III.C-14 and 15). In the Department of Fish and Game 1992 subsistence harvest survey, bowhead whales amounted to 63% of the total subsistence harvest for the community, or 560.35 pounds per person (State of Alaska, Dept. of Fish and Game, 1993b; see Table III.C-17). Bowheads are an important meat resource and the source for maktak, an especially preferred food. The sharing of the bowhead is a central aspect of Kaktovik's Thanksgiving and Christmas feasts and the focus of the community's whale feast, Nalukataq. As in other North Slope communities, the bowhead is shared extensively. Its baleen is bartered in traditional networks and is used in the manufacture of traditional arts and crafts.

III.C.2.d(3)(b) Beluga Whale

Beluga whales usually are harvested in August through November (Figure III.C-14), incidental to the bowhead harvest. However, belugas sometimes are taken earlier in the open-water season when boating and camping groups are concentrating on the harvest of seals, caribou, or fish (Table III.C-17).

III.C.2.d(3)(c) Seals

Seals are hunted year-round, but the bulk of the seal harvest occurs during the open-water season from July to September (Figure III.C-13). Elder Elija Kakinya, when interviewed in 1979, stated that “when polar ice is not far from the barrier islands, is a good chance of catching seals when ice is close to shore” (in Shapiro and Metzner, 1979). During the winter, these harvests consist almost exclusively of ringed seals taken along open leads in the ocean ice many miles offshore. Summer harvests are made by boat crews and consist of ringed, bearded, and spotted seals (see Table III.C-19). Summer sealing typically occurs 5-10 miles offshore but may range up to 20 miles offshore (Figure III.C-1). Elder Bruce Nukapigak related how his father-in-law Uqumailaq taught him about hunting seals at Barter Island: “He took me on hunts as far as Cross Island and east of Barter Island to in front of the Jago River” (in Shapiro and Metzner, 1979).

Seal meat is eaten, and bearded seal meat is most preferred. However, the primary dietary significance of seals comes from seal oil, which is served with every meal that includes subsistence foods; seal oil is used, as well, as a preservative for meats, greens, and berries. Sealskins are important in the manufacture of clothing. Because of their beauty, spotted seal skins often are preferred for making boots, slippers, mitts, and parka trim, but ringed seal skins also are important in the manufacture of these same items. Bearded seal hides are necessary for the manufacture of boot soles. Sealskin products such as boots, slippers, mitts, and parkas are sold, bartered, and given as gifts to relatives and friends.

III.C.2.d(3)(d) Walrus

Walruses are harvested much less frequently than are seals in Kaktovik, because the community lies east of the mammal’s optimum range. They are harvested only opportunistically by boat crews hunting other species in July and August (Figures III.C-1 and III.C-13). Harvests occur in open water along the coast in conjunction with seal hunting. Jacobson and Wentworth (1982) stated that in 1982, only five or six walruses had been harvested in the last two decades (see Table III.C-17). If harvested, walrus meat is eaten and its ivory used in the manufacture of traditional arts and crafts.

III.C.2.d(3)(e) Polar Bear

Polar bears are harvested during the winter months (Figure III.C-13) on ocean ice and along ocean leads. When discovered, these bears may be pursued seaward of the barrier islands for 10 miles or more. The meat often is consumed (see Table III.C-17). Since the passage of the Marine Mammal Protection Act in 1972, there has been less incentive for hunting polar bears, because the act made the sale of the unprocessed hides illegal (Jacobson and Wentworth, 1982). However, polar bear fur is still used to manufacture cold-weather gear such as boots, mitts, and coats. These sewn items are bartered, sold, and given as gifts to relatives and friends. Table III.C-14 shows polar bear harvests from 1983 to 1995 for Barrow, Nuiqsut, and Kaktovik.

III.C.2.d(3)(f) Caribou

Kaktovik harvests several large land mammals including caribou, Dall sheep, moose, and brown bear. Kaktovik’s annual caribou harvest fluctuates widely because of the unpredictable movements of the Porcupine and Central Arctic herds, weather-dependent hunting technology, and ice conditions (see Figure III.C-1). Limited only by availability and unfavorable weather conditions, caribou can be harvested almost year-round (Figure III.C-13). With open water comes a period of intense caribou harvest that usually occurs in July. Kaktovik residents hunt caribou by boat along the coast, with hunting usually lasting until mid-August when the caribou move inland and are no longer abundant. Approximately 70% of all caribou harvests take place on the coastal plain. By late October, snow buildup allows hunters access to inland caribou. From then on, until the onset of breakup, which usually occurs sometime in May, Kaktovik hunters take caribou by snowmachine in inland mountains and valleys and, to a lesser extent, on the coastal plain. A subsistence-harvest survey conducted by the North Slope Borough Division of Wildlife Management covering the period from December 1994-November 1995 mapped terrestrial harvest locations for this seasonal round and are shown in Figure III.C-16 (Brower, Olemaun, and Hepa, 2000).

Caribou is eaten fresh, frozen, and dried and is the most preferred land mammal in Kaktovik’s diet. During periods of high availability, caribou can be a source of fresh meat throughout the year. The meat often is shared with kin, friends, and elders within the community. Outside the community, caribou meat is sent to relatives as far away as Anchorage, and it occasionally is bartered. Caribou plays an important part in holiday feasts. Traditionally, the skins of caribou taken in July and August have been used to manufacture parkas, boot soles, mitts, and mukluk tops; blankets and sleeping pads are made from the skins of caribou taken in October and November.

In Pedersen and Coffing's (1985) 3-year study (1981-1983) of Kaktovik's caribou hunting, they found that the general caribou-hunting range covered about 7,600 square miles and that the intensely used area covered about 2,900 square miles. The latter figure is only a short-term measure of use intensity because the distribution and availability of caribou fluctuate over a period of years, and the size and location of the intensely used area also change. As expected from earlier research (North Slope Borough Contract Staff, 1979), harvest levels were highly variable. During the 1981-1982 season, 43 caribou were taken; during the 1982-1983 season, 110 were taken. The annual average harvest was 71.5, or approximately .4 caribou per capita. These figures indicated that the earlier State Department estimate of 100-300 caribou harvested per year by Kaktovik hunters might have been high (U.S. Department of State, 1980), until the 1992 the State of Alaska's subsistence harvest survey that recorded a take of 158 caribou that season (State of Alaska, Dept. of Fish and Game, 1993b). ACI and S.R. Braund and Assocs. (1984) estimated that an annual average of 75 caribou were taken by Kaktovik hunters between 1962 and 1983; and Jacobson and Wentworth (1982) estimated that 80 were taken in 1980. While Jacobson and Wentworth (1982) found high-yield areas in both coastal and inland habitats, 70% of all caribou harvests were found to take place on the coastal plain and near the coast. Most of these caribou were harvested by boat crews. For the most recent subsistence caribou harvest data, see Table III.C-19.

It should be noted that these figures cannot be extrapolated to apply to other North Slope communities, because species availability and use varies from settlement to settlement (North Slope Borough Contract Staff, 1979). For example, Kaktovik hunts the muskox, a big-game species unavailable to other North Slope communities. Kaktovik also is heavily dependent on fish (Jacobson and Wentworth, 1982). Moreover, these figures cannot be assumed to reflect the long-term per capita harvests made by Kaktovik hunters. Pederson and Coffing conducted their work in the early 1980's, a period of intense Capital Improvement Project construction, and reports from other North Slope communities during this time indicated that subsistence hunting may have dropped because of Capital Improvement Project wage employment; more recent data tends to indicate an increase in subsistence hunting since the drop in availability of wage work. Additionally, it was discovered that, even in the early 1980's, Kaktovik's hunting patterns already may have been affected by industrialization. Pedersen and Coffing (1985) wrote:

> A sizable portion of the general caribou hunting range, as well as a portion of the intensively used area, has been identified as lying within a rapidly industrializing portion of the east-central North Slope. However, very little caribou hunting activity has been conducted in the area recently by Kaktovik residents.

It was suggested that unclear harvesting regulations in addition to industrialization may have led to avoidance of this region by Kaktovik caribou hunters.

III.C.2.d(3)(g) Dall Sheep

Although not a major subsistence resource in terms of pounds harvested, Dall sheep are the most preferred subsistence resource by Kaktovik hunters. With difficulties the availability of musk ox-permits and the variability of caribou as a summer subsistence meat source, sheep might be one of the more stable meat sources available to the community. Sheep are hunted by snowmachine from late October through November and in the spring from March through April. The preferred hunting period is in the fall when the sheep have more fat. See Table III.C-19 for recent subsistence-harvest numbers for sheep (Impact Assessment, Inc., 1990d; State of Alaska, Dept. of Fish and Game 1993b).

III.C.2.d(3)(h) Muskox

In 1969, the Department of Fish and Game, with the assistance of the Fish and Wildlife Service, reintroduced muskoxen into the Kaktovik area. Originally indigenous, the muskox was extinct by the late 1800s, probably hunted out by non-Native hunters. Not until 1983 was a hunt permitted, and then only by a limited permit drawing and the payment of a large permit fee. From 1986-1989, permitting problems prevailed. Seven permits presently are reserved for a sport-hunt drawing in Fairbanks, and seven are allocated for local Kaktovik hunters. Muskoxen are hunted in March and April when the days are long and travel by snowmachine still good. The hunt is conducted in the Camden Bay area and in the Sadlerochit River drainage. See Table III.C-19 for muskox-harvest numbers.

III.C.2.d(3)(i) Fishes

Fish is an important subsistence resource for Kaktovik. The community's harvest of most other subsistence resources can fluctuate widely from year to year because of variable migration patterns of game and because harvesting technologies are extremely dependent on ice conditions and weather, but the harvest of fish is not subject to these conditions, and this adds to their importance in Kaktovik's subsistence system. Moreover, in January and February, fish may provide the only source of fresh subsistence foods (see Figure III.C-13). In the summer, Kaktovik residents primarily harvest arctic char. Sea-run char are caught all along the coast, around the barrier islands, and up the navigable portions of the river deltas. Char are the first fish to appear after the ice is gone in early July and are caught until late August. Arctic cisco are harvested in the ocean after the arctic char run peaks, beginning about the first of August through early September. Grayling is a major subsistence fish taken in the Hulahula River and in many other area rivers and river deltas. Late summer, after freezeup, and again in the spring, are the most likely times to catch grayling. Least cisco is taken in the lagoons, river deltas, and particularly the small lakes and streams of the river drainages. Broad whitefish is harvested in the deeper lakes and channels of the Canning River Delta from July through September. Less commonly harvested are round whitefish, also harvested in the Canning River, and pink and chum salmon are occasionally taken in July and August near Barter Island (Jacobsen and Wentworth, 1982). See Table III.C-17 for more recent data on Kaktovik's subsistence harvests of fishes.

Arctic flounder and fourhorn sculpin occasionally are taken during summer ocean fishing off Manning Point, Drum Island, Arey Spit, and in Kaktovik Lagoon between Manning Point and the mainland; but sculpin often is not eaten because it is too bony. Called Paigluk in Inupiaq, pike (not yet positively identified) is caught in the Hulahula River and occasionally in other rivers. Arctic cod or Tom cod and smelt are caught in the summer along the Beaufort Sea coast, sometimes near the spits off Barter Island. Blackfish is harvested in the spring in the Canning, Hulahula, Kongakut, and, especially, the Aichilik rivers (Jacobsen and Wentworth, 1982).

During the fall/winter fish harvest, freshwater arctic char is taken inland on the rivers by fishing through holes in the ice. Broad whitefish occasionally is taken in the winter at fishing holes farther inland on the Canning River. Small numbers of ling cod are sometimes taken inland on the Canning River during the snow season. They are harvested only on the inland portions of rivers, at least 10 miles from the coast. During winter, lake trout are caught in the Neruokpuk Lakes of the Brooks Range. Tom cod and smelt are sometimes caught by jigging in October and November north of Barter Island and at Iglukpaluk. Blackfish is harvested in the winter in the Canning, Hulahula, and Kongakut rivers, with harvests in the Aichilik River the most productive (Jacobsen and Wentworth, 1982).

Because of the important role of fish as an abundant and stable source of fresh food during midwinter months, it is shared at Thanksgiving and Christmas feasts, as well as given to relatives, friends, and village elders. Subsistence uses in Kaktovik are similar to those found elsewhere on the North Slope, where fish figures in existing traditional sharing and bartering networks of the communities.

III.C.2.d(3)(j) Waterfowl

Since the mid-1960's, waterfowl and coastal birds as a subsistence resource have been growing in importance. The most important subsistence species of birds for Kaktovik are the black brant, long-tailed duck, eiders, snow goose, Canada goose, and pintail duck. Other birds, such as loons, occasionally are harvested. Waterfowl hunting occurs mostly in the spring, from May through early July (Figure III.C-13); normally, a less-intensive harvest continues throughout the summer and into September. During spring, birds are harvested by groups of hunters that camp along the coast, with spits and points of land providing the best hunting locations. Kaktovik's primary subsistence-harvest areas for waterfowl are shown in Figure III.C-1. In summer and early fall, bird hunting occurs as an adjunct to other subsistence activities, such as checking fishing nets.

Virtually the entire community of Kaktovik participates in the spring bird hunt. The hunt occurs at the end of the school year and has become a major family activity. Because waterfowl is a highly preferred food, it is shared extensively within the community, and birds are given to relatives, friends, and village elders. While most birds are eaten fresh, usually in soup, some are stored for the winter. Waterfowl is served for special occasions and holiday feasts such as Nalukataq and Thanksgiving, and occasionally birds are bartered. Table III.C-19 shows subsistence bird-harvest data for household subsistence surveys conducted in 1987 and 1992 by the State of Alaska, Dept. of Fish and Game (1993a,b).

Figures III.C-17 and III.C-18 indicate important trends in Kaktovik household consumption of subsistence foods and expenditures on subsistence activities (Harcharek, 1995).

III.C.3. Sociocultural Systems

The topic of sociocultural systems encompasses the social organization and cultural values of a society. This section provides a profile of the sociocultural systems that characterize the North Slope communities of Barrow, Nuiqsut, and Kaktovik, whose ethnic, sociocultural, and socioeconomic makeup is primarily Inupiaq.

The communities of Barrow, Nuiqsut, and Kaktovik potentially could be affected by exploration and development in the project area. Their populations and current socioeconomic conditions are discussed before the important variables in a sociocultural analysis—social organization, cultural values, institutional organization, and other ongoing issues—are considered.

The following summarizes and incorporates by reference detailed descriptions of sociocultural systems found in the Beaufort Sea Sale 144 final EIS (USDOI, MMS, 1996a), the Northeast National Petroleum Reserve-Alaska Draft Integrated Activity Plan/EIS (USDOI, Bureau of Land Management and MMS, 1998), the Beaufort Sea Sale 170 final EIS (USDOI, MMS, 1998), and the Beaufort Sea Oil and Gas Development Project/ Northstar draft EIS (U.S. Army Corps of Engineers, 1998). This summary is augmented by additional material, as cited. Sociocultural systems of the North Slope Inupiat also are described and discussed in the Beaufort Sea Sale 97 final EIS (USDOI, MMS, 1987), the Chukchi Sea Sale 109 final EIS (USDOI, MMS, Alaska OCS Region, 1987), and the Beaufort Sea Sale 124 final EIS (USDOI, MMS, 1990a). The following description is augmented by information from current studies, including State of Alaska, Department of Fish and Game (1996, 2002); State of Alaska, Department of Community and Regional Affairs/Community and Borough Map (1996); Fall and Utermohle (1995); S.R. Braund and Assocs. and UAA, ISER (1993); S.R. Braund and Assocs. (In prep.); Alaska Natives Commission (1994); City of Nuiqsut (1995); Human Relations Area Files, Inc. (1994); USDOI, MMS (1996b,c); Hoffman, Libbey, and Spearman (1988); Schneider, Pedersen, and Libbey (1980); and the USDOI, Bureau of Land Management's National Petroleum Reserve-Alaska 105(c) studies and other pertinent documents that accompanied the 105(c) analysis (USDOI, Bureau of Land Management, 1978a,b,c; 1979b,c,d; 1981; 1982a,b,c; 1983a,b,c; 1990; and 1991).

III.C.3.a. Characteristics of the Population

The North Slope has a fairly homogeneous population of Inupiat, approximately 72% in 1990 and 68.38% in 2000, although Indians and Alaskan Natives were not differentiated in the 2000 count. These percentages are approximations, because the 1990 and 2000 censuses did not distinguish between Inupiat and other Alaskan Natives and American Indians. The percentage in 1990 ranged from 92.7% Inupiat in Nuiqsut to 61.8% Inupiat in Barrow (USDOC, Bureau of the Census, 1991). The percentage in 2000 ranged from 89.1% Inupiat in Nuiqsut to 64.0% Inupiat in Barrow (USDOC, Bureau of the Census, 2001). In 2000, population counts were 4,581 for Barrow, 433 for Nuiqsut, and 293 for Kaktovik (USDOC, Bureau of the Census, 2001).

North Slope society responded to early contacts with outsiders by successfully changing and adjusting to new demands and opportunities (Burch, 1975a,b; Worl, 1978; North Slope Borough Contract Staff, 1979). Since the 1960's, the North Slope has witnessed a period of "super change," a pace of change quickened by the area's oil developments (Lowenstein, 1981). In the Prudhoe Bay/Kuparuk industrial complex, oil-related work camps have altered the seascape and landscape, making some areas off limits to traditional subsistence hunting. In addition, large North Slope Borough Capital Improvement Projects have dramatically changed the physical appearance of North Slope Borough communities.

Social services have increased dramatically since 1970, with increased Borough budgets and grants acquired early on by the Inupiat Community of the Arctic Slope, and later by the Arctic Slope Native Association and other borough nonprofits. In 1970 and 1977, residents of North Slope villages were asked about their state of well-being in a survey conducted by the University of Alaska, Anchorage, Institute of Social and Economic Research (Kruse et al., 1983). The survey noted significant increases in complaints about alcohol and drug use in all villages between 1970 and 1977. Health and social-services programs have attempted to address these problems with treatment programs and shelters for wives and families of abusive spouses, as well as putting greater emphasis on recreational programs and services. More recently, a lack of adequate financing for individual North Slope Borough city governments has hampered the development of these programs, and declining revenues from the State of Alaska have seriously impaired the overall function of these city governments. In the last decade, all communities in the North Slope Borough have struggled with banning the sale, use, and possession of alcohol, and the issue of whether a community will become “dry” or stay “wet” is constantly being brought before local voters.

The introduction of modern technology has tied the Inupiat subsistence economy increasingly to a cash economy (Kruse, 1982). Nevertheless, oil-supported revenues have been able to support a lifestyle that still is distinctly Inupiaq and outside pressures and opportunities have sparked what may be viewed as a cultural revival (Lantis, 1973). What exists in the communities of the North Slope is “a unique lifestyle in which a modern cash economy and traditional subsistence are interwoven and interdependent” (USDOI, Bureau of Land Management, 1979). People continue to hunt and fish, but aluminum boats, outboards, snowmachines, and all-terrain vehicles now blend these pursuits with wage work. Inupiat whale hunting remains a proud tradition that involves ceremonies, dancing, singing, visiting, cooperation between communities and, most important, the sharing of foods.

North Slope residents exhibit an increasing commitment to areawide political representation, local and regional tribal governments, and the cultural preservation of such institutions as whaling crews and dancing organizations, and the revival of traditional seasonal celebrations. The North Slope Borough has a Commission on Inupiat History, Language and Culture, an important body for preserving Inupiat heritage, for conducting elders’ conferences and other cultural activities to preserve oral histories, and to actively pursue the repatriation of cultural artifacts and remains under the Native American Graves Protection and Repatriation Act. Effects from ongoing and proposed oil exploration and development on subsistence and, hence, on the overall sociocultural system, have been, are, and will continue to be a major concern for residents of North Slope communities (Kruse et al., 1983; ACI and S.R. Braund and Assocs., 1984; USDOI, MMS, 1994, 1995b, 1996a; S.R. Braund and Assocs., In prep.; USDOI, Bureau of Land Management, 1997c; USDOI, MMS, 1998).

III.C.3.b. Social Characteristics of the Communities

The following describes the Alaskan North Slope communities that may be affected directly by exploration and development in the planning area. These community-specific descriptions discuss factors relevant to the sociocultural analysis of the community in relation to industrial activities, population, and current socioeconomic conditions. Following these descriptions, social organization, cultural values, and other issues of all the communities are discussed. MMS’ ongoing *Quantitative Description of Potential Effects of OCS Activities on Bowhead Whale Hunting Subsistence Activities in the Beaufort Sea* study was developed in response to concerns raised by the Alaska Eskimo Whaling Commission and the North Slope Borough. This study will involve a systematic analysis of residents’ observations and perceptions about how their lives, and especially subsistence whale hunting activities, have been and might in the future be affected by oil-industry activities and other forces of modernity.

III.C.3.b(1) Socioeconomic Conditions in Barrow

On the North Slope, Barrow is the largest community and the regional center. Barrow’s population in 2000 was 4,581 (USDOC, Bureau of the Census, 2001). Barrow already has experienced dramatic population changes as a result of increased revenues from onshore oil development and production at Prudhoe Bay and in other smaller oil fields; these revenues early on served to stimulate the North Slope Borough Capital Improvement Projects. In 1970, the Inupiat population of Barrow represented 91% of the total population (USDOC, Bureau of the Census, 1971). In 1985, non-Natives outnumbered Natives between the ages of 26 and 59 (North Slope Borough, Dept. of Planning and Community Services, 1989). By 1990, Inupiat representation had dropped to 63.9%, but in the 2000 Census, Barrow's Inupiat population remained undiminished at 64.0% (USDOC, Bureau of the Census, 1991, 2001; Harcharek, 1992). Most of Barrow's terrestrial and marine subsistence-harvest area lies in or adjacent to the Beaufort Sea multiple-sale area.

From 1975-1985, Barrow experienced extensive social and economic transformations. The North Slope Borough Capital Improvement Projects stimulated a boom in the Barrow economy and an influx of non-Natives to the community; between 1980 and 1985, Barrow's population grew by 35.6% (Kevin Waring Assocs., 1989). Inupiat women entered the labor force in the largest numbers ever and achieved positions of political leadership in newly formed institutions. The proportion of Inupiat women raising families without husbands also increased during this period, a noticeable alteration in a culture where the extended family, operating through interrelated households, is salient in community social organization (Worl and Smythe, 1986). During this same period, the social organization of the community became increasingly diversified with the proliferation of formal institutions and the large increase in the number of different ethnic groups, although socioeconomic differentiation is not new in Barrow. During the periods of commercial whaling and reindeer herding, there were influxes of outsiders and significant shifts in the economy. Other fluctuations have occurred during different economic cycles: fur trapping, U.S. Navy and arctic contractors' employment, the Capital Improvement Projects' boom, and periods of downturn (Worl and Smythe, 1986). As a consequence of the changes it already has sustained, Barrow may be more capable of absorbing additional changes as a result of oil exploration and development than would smaller, homogenous Inupiat communities such as Nuiqsut and Kaktovik.

III.C.3.b(2) Socioeconomic Conditions in Nuiqsut

Nuiqsut is located on the west bank of the Nechelik Channel of the Colville River Delta, about 25 miles from the Arctic Ocean and approximately 150 miles southeast of Barrow. The population was 354 (92.7% Inupiat) in 1990 and 433 (89.1% Inupiat) in 2000 (USDOC, Bureau of the Census, 1991, 2001). Nuiqsut, one of three abandoned Inupiat villages in the North Slope region identified in the Alaska Native Claims Settlement Act, was resettled in 1973 by 27 families from Barrow. Today, Nuiqsut is experiencing rapid social and economic change with a new hotel, the influx of non-Inupiat oil workers at the Alpine field adjacent to the community, and the potential development of oil in the National Petroleum Reserve-Alaska.

Most of Nuiqsut's marine subsistence-harvest area lies adjacent to the Beaufort Sea multiple-sale area. Nuiqsut's important bowhead whale hunting area at Cross Island is nearshore of the sale-area boundary, but hunters from the island would pursue whales well within the multiple-sale area. Nuiqsut's terrestrial, fish, and bird subsistence-harvest areas are in the vicinity of possible new landfalls. Any pipelines from these landfalls potentially would cross Nuiqsut's land subsistence-harvest area.

III.C.3.b(3) Socioeconomic Conditions in Kaktovik

Kaktovik, incorporated in 1971, is the easternmost village in the North Slope Borough. In 1990, it had a population of 224 (83% Inupiat) and in 2000 it had a population of 293 (84.0% Inupiat) (USDOC, Bureau of the Census, 1991, 2001). Kaktovik is located on the north shore of Barter Island, situated between the Okpilak and Jago rivers on the Beaufort Sea coast. Barter Island is one of the largest of a series of barrier islands along the north coast and is about 300 miles east of Barrow. Kaktovik's coastal and marine subsistence-harvest areas are in and adjacent to the Beaufort Sea multiple-sale area. Its terrestrial mammal, fish, and bird subsistence-harvest areas lie adjacent to the sale area. Kaktovik has been an important "place of barter" for centuries. Canadian and Barrow Inupiat stopped on Barter Island to trade. In 1923, the white trader, Tom Gordon, established a store at Barter Island that provided a permanent location for resident trappers for trading furs and gaining supplies. With the introduction of reindeer to the area in the 1920's, the settlement slowly grew into a permanent village (Kevin Waring Assocs., 1989).

III.C.3.c. Social Organization

The social organization of these Inupiat communities is strongly kinship oriented. Kinship forms "the axis on which the whole social world turn[s]" (Burch, 1975a,b). Historically, households were composed of large, extended families, and communities were kinship units. Today, there is a trend away from the extended-family household because of increases in mobility, availability of housing, and changes in traditional kinship patterns. However, kinship ties in Inupiat society continue to be important and remain a central focus of social organization.

The social organization of North Slope Inupiat encompasses not only households and families but also wider networks of kinspeople and friends. These various types of networks are related through various overlapping memberships and also are embedded in those groups that are responsible for hunting, distributing, and consuming subsistence resources (Burch, 1970). An Inupiat household on the North Slope may contain a single individual or group of individuals who are related by marriage or ancestry. The interdependencies that exist among Inupiat households differ markedly from those found in the United States as a whole. In the larger, non-Inupiat society, the demands of wage work emphasize a mobile and prompt workforce. While modern transportation and communication technologies allow for contact among parents, children, brothers, sisters, and other extended-family members, more often than not, independent nuclear households (father, mother, and children) or conjugal pairs (childless couples) form independent "production" units that do not depend on extended-family members for the day-to-day support of food, labor, or income. A key contrast between non-Native and Inupiat cultures occurs in their differing expectations of families—the Inupiat expect and need support from extended-family members on a day-to-day basis.

Associated with these differences, the Inupiat hold unique norms and expectations about sharing. Households are not necessarily viewed as independent economic units; and giving, especially by successful hunters in the community, is regarded as an end in itself although community status and esteem accrue to the generous. Kinship ties are strengthened through the sharing and exchanging of subsistence resources (Nelson, 1969; Burch, 1971; Worl, 1979; ACI, Courtnage, and Braund, 1984; Luton, 1985; Chance, 1990).

III.C.3.d. Cultural Values

Traditionally, Inupiat values focused on their close relationship with natural resources, specifically game animals. The Inupiat also had a close relationship to the supernatural with specific beliefs in animal souls and beings who control the movements of animals. Other values included an emphasis on the community, its needs, and its support of other individuals. The Inupiat respect persons who are generous, cooperative, hospitable, humorous, patient, modest, and industrious (Lantis, 1959; Milan, 1964; Chance, 1966, 1990). Although there have been substantial social, economic, and technological changes in Inupiat lifestyle, subsistence continues to be the central organizing value of Inupiat sociocultural systems. The Inupiat remain socially, economically, and ideologically loyal to their subsistence heritage. Indeed, "most Inupiat still consider themselves primarily hunters and fishermen" (Nelson, 1969). This refrain is voiced repeatedly by the residents of the North Slope (Kruse et al., 1983; ACI, Courtnage, and Braund, 1984; Impact Assessment, Inc., 1990a,b; USDOI, MMS, 1994). Task groups still are organized to hunt, gather, and process subsistence foods. Cooperation in hunting and fishing activities also remains an integral part of Inupiat life, and who one cooperates with is a major component of the definition of significant kin ties (Heinrich, 1963). Large amounts of subsistence foods are shared within the community, and who one gives to and receives from also are major components of what makes up significant kin ties (Heinrich, 1963; ACI, Courtnage, and Braund, 1984).

On the North Slope, "subsistence" is much more than an economic system. The hunt, the sharing of the products of the hunt, and the beliefs surrounding the hunt tie families and communities together, connect people to their social and ecological surroundings, link them to their past, and provide meaning for the present. Generous hunters are considered good men, and good hunters often are respected leaders. Good health comes from a diet derived from the subsistence hunt. Young hunters still give their first game to the community elders, and to be generous brings future success. These are some of the essential ways that subsistence and beliefs about subsistence join with sociocultural systems.

The cultural value placed on kinship and family relationships is apparent in the sharing, cooperation, and subsistence activities that occur in Inupiat society; however, cultural value also is apparent in the patterns of residence, reciprocal activities, social interaction, adoption, political affiliations (some families will dominate one type of government administration, for example, the village corporation), employment, sports activities, and membership in voluntary organizations (Mother's Club, Search and Rescue, etc.) (ACI, Courtnage, and Braund, 1984).

Bowhead whale hunting remains at the center of Inupiat spiritual and emotional life; it embodies the values of sharing, association, leadership, kinship, arctic survival, and hunting prowess (see Bockstoce et al., 1979; ACI, Courtnage, and Braund, 1984). Barrow resident Beverly Hugo, testifying at public hearings for MMS' Beaufort Sea Sale 124, summed up Inupiaq cultural values this way:

> …these are values that are real important to us, to me; this is what makes me who I am…the knowledge of the language, our Inupiat language, is a real high one; sharing with others, respect for others…and cooperation; and respect for elders; love for children; hard work; knowledge of our family tree; avoiding conflict; respect for nature; spirituality; humor; our family roles. Hunter success is a big one, and domestic skills, responsibility to our tribe, humility…these are some of the values…that we have…that make us who we are, and these values have coexisted for thousands of years, and they are good values…(USDOI, MMS, 1990b).

The importance of the whale hunt is more than emotional and spiritual. The organization of the crews does much to delineate important social and kin ties within communities and also to define community leadership patterns. The structured sharing of the whale helps determine social relations both within and between communities (Worl, 1979; ACI, Courtnage, and Braund, 1984; Impact Assessment, Inc., 1990a). Structured sharing also holds true for caribou hunting, fishing, and other subsistence pursuits. In these communities, the giving of meat to elders does more than feed old people; it bonds giver and receiver, joins them to a living tradition, and draws the community together.

Today, this close relationship between the spirit of a people, their social organization, and the cultural value of subsistence hunting may be unparalleled when compared with other areas in America where energy-development is taking place. The Inupiat's continuing strong dependence on subsistence foods, particularly marine mammals and caribou, creates a unique set of potential effects from onshore and offshore oil exploration and development on the social and cultural system. Barrow resident Daniel Leavitt articulated these concerns during a 1990 public hearing for Beaufort Sea Sale 124: "…as I have lived in my Inupiat way of livelihood, that's the only…thing that drives me on is to get something for my family to fill up their stomachs from what I catch" (USDOI, MMS, 1990b).

One analysis of Inupiat concerns about oil development was based on a compilation of approximately 10 years of recorded testimony at North Slope public hearings for State and Federal energy-development projects. The most concerns centered on the subsistence use of resources, including damage to subsistence species, loss of access to subsistence areas, loss of Native foods, or interruption of subsistence-species migration. These four concerns represented the concerns expressed in 83% of all the testimony taken on the North Slope (Kruse et al., 1983:Table 35; USDOI, MMS, 1994; Human Relations Area Files, Inc., 1992).

Another great concern that North Slope Borough Inupiat communities express is the lack of traditional knowledge and testimony appearing in government documents, particularly MMS's oil lease-sale EIS's. Mayor George N. Ahmaogak, Sr., of the North Slope Borough said in a 1990 letter to MMS: "The elders who spoke particularly deserve a response to their concerns. You should respect the fact that no one knows this environment better than Inupiat residents" (Ahmaogak, 1990, pers. commun.). In public testimony in 1993 concerning a Letter of Authorization for bowhead whale monitoring at the Kuvlum Prospect, the late Burton Rexford, then Chairman of the Alaska Eskimo Whaling Commission, stated that the most important environmental information would come from whaling captains, crew members, and whaling captains' wives. "We know our environment—our land and resources—at a deep level" (National Marine Fisheries Service, 1993). These same concerns were unanimously echoed by those testifying for Barrow, Kaktovik, and Nuiqsut in hearings and scoping meetings for Beaufort Sea Sales 144 and 170, for the National Petroleum Reserve-Alaska Management Plan, for the Northstar and Liberty projects, and for the Beaufort Sea multiple sales (Public Hearing Transcripts, Beaufort Sea Sale 144 [USDOI, MMS, 1995a,b,c], Beaufort Sea Sale 170 [USDOI, MMS, 1997], National Petroleum Reserve-Alaska Integrated Activity Plan Draft

EIS [USDOI, Bureau of Land Management and MMS, 1997], Beaufort Sea Oil and Gas Development Project/Northstar [U.S. Army Corps of Engineers, 1996], and the Liberty Project Scoping Meeting [USDOI, MMS, Alaska OCS Region, 1998b]).

At scoping meetings for all six of these projects, the need to address cumulative impacts was stressed repeatedly, mainly because impacts from development already have reduced subsistence access to and use of the area around Prudhoe Bay. The point was made at each meeting that incremental development in and around Prudhoe Bay has created cumulative impacts. Development impacts can be assessed only through a viable monitoring regime—something that has never been established by the industry or the Federal and State agencies involved. One suggestion that was made repeatedly and reiterated again at the National Petroleum Reserve-Alaska Symposium (USDOI, Bureau of Land Management and MMS, 1997) was a need for an ongoing subsistence-oversight panel composed of Federal, State, Native, and oil-industry interests that would address these concerns and the need for instituting an ongoing subsistence-monitoring program.

III.C.3.e. Institutional Organization of the Communities

The North Slope Borough provides most government services for the communities of Barrow, Nuiqsut, Kaktovik, and other communities in the Borough. These services include public safety, public utilities, fire protection, and some public-health services. Future fiscal and institutional growth is expected to slow because of economic constraints on direct Inupiat participation in oil-industry employment and growing constraints on the Statewide budget. Although the North Slope Borough's own permanent fund account continues to grow as does its role as primary employer in the region, Borough tax revenues are decreasing (Kruse et al., 1983; Harcharek, 1992, 1995). The Arctic Slope Regional Corporation, formed under the Alaska Native Claims Settlement Act, runs several subsidiary corporations. Most of the communities also have a village corporation, a Traditional Village or Indian Reorganization Act Village Council, and a city government. The Indian Reorganization Act and village governments have not provided much in the way of services, but village corporations have made many service contributions. The Inupiat Community of the Arctic Slope, the regional tribal government, recently has taken on a more active and visible role in regional governance.

III.C.3.f. Other Ongoing Issues

Other issues important to an analysis of sociocultural systems are those that will affect or already are affecting Inupiat society (i.e., cumulative impacts). The EIS's for MMS Sales 97, 124, 144, 170; the Northstar and Liberty projects; and the National Petroleum Reserve-Alaska detail issues about changes in employment, increases in income, decreases in Inupiaq fluency, rising crime rates, and substance abuse (USDOI, MMS, 1987, 1990a, 1996a, 1998; USDOI, MMS, Alaska OCS Region, 2002a; USDOI, Bureau of Land Management and MMS, 1998; U.S. Army Corps of Engineers, 1996) and also discuss the fiscal and institutional growth of the North Slope Borough. These discussions are incorporated by reference and summarized briefly below. In addition, Smythe and Worl (1985) and Impact Assessment, Inc. (1990a) detail the growth and responsibilities of local governments.

Recent statistics on homicides, rapes, and wife and child abuse present a sobering picture of some aspects of life in North Slope Borough communities. Violent deaths account for more than one-third of all deaths on the North Slope. The Alaska Native Health Board notes the "overwhelming involvement of alcohol (and drug) abuse in domestic violence, suicide, child abuse, birth defects, accidents, sexual assaults, homicide and mental illness" (Alaska Native Health Board, 1985). The lack of comparable data makes it impossible to compare levels of abuse and violence between aboriginal (prior to contact with Caucasians), traditional (from the time of commercial whaling through the fur trade), and modern (since World War II) Inupiat populations. Nonetheless, it is apparent from reading earlier accounts of Inupiat society that there has been a drastic increase in these social problems, although a study conducted in the early 1980's on the North Slope indicates that no direct relationship was found between energy development and "accelerated social disorganization" (Kruse, Kleinfeld, and Travis, 1982, cited in Impact Assessment, Inc., 1990b).

Studies done in Barrow (Worl and Smythe, 1986) detail the important changes in Inupiat society that have occurred during the last decade in response to these problems. Services provided by outside institutions and programs recently have begun to assume a greater responsibility for functions formerly provided by extended families. Today, there is an array of social services available in Barrow that is more extensive for a community of this size than anywhere in the U.S. (Worl and Smythe, 1986).

The baseline of the present sociocultural system includes change and strain. The very livelihood and culture of North Slope residents come under increasingly close scrutiny, regulation, and incremental alteration. Increased stresses on social well-being and on cultural integrity and cohesion come at a time of relative economic well-being. The expected challenges on the culture by the decline in Capital Improvement Project funding from the State of Alaska have not been as significant as once expected. The buffer effect has come mostly through the dramatic growth of the Borough's own permanent fund, the North Slope Borough taking on more of the burden of its own capital improvement, and its emergence as the largest employer of local residents. However, North Slope Borough revenues from oil development at Prudhoe Bay are on the decline, and funding challenges (and subsequent challenges to the culture) continue as the Alaska State Legislature alters accepted formulas for Borough bonding and for funding rural school districts.

III.C.4. Archaeological Resources

Archaeological Resource means "any material remains of human life or activities that are at least 50 years of age and that are of archaeological interest." Archaeological Interest means "capable of providing scientific or humanistic understanding of past human behavior, cultural adaptation, and related topics through the application of scientific or scholarly techniques, such as controlled observation, contextual measurement, controlled collection, analysis, interpretation and explanation. These resources provide information pertaining to history or prehistory. It is the policy of the MMS to consider the effects on archaeological resources in all aspects of planning, leasing, permitting, operations, and regulatory decisions. To do this, an assessment of archaeological resource potential within the area to be affected by a proposed action must take place (MMS Manual Part 620.1.1).

The National Register of Historic Places is a national inventory of sites that meet specific criteria of significance. Most archaeological sites listed on or eligible for the Register meet Criterion D, Information Potential: "Properties may be eligible for the National Register if they have yielded, or may be likely to yield, information important in prehistory or history. With rare exception, properties must be 50 or more years old to be considered eligible for the National Register" (USDOI, National Register Bulletin No. 15).

In the case of the Federal OCS, most of the Beaufort Sea Planning Area has never been surveyed for archaeological sites; and no sites on the OCS have been listed on the National Register. Therefore, archaeological resources or potential resources within the planning area must be identified using regional baseline studies that are predictive models, geophysical/geological data, historic accounts of shipwreck disasters, and marine remote-sensing data compiled from required shallow-hazards surveys.

The following analyses represent the Prehistoric Resource Analysis and Shipwreck Update Analysis required in the MMS Handbook for Archaeological Resource Protection (620.1-H). We incorporate by reference the archaeological analyses prepared for previous Beaufort Sea lease sales and previous works concerning the geologic processes that affect the survivability of potential prehistoric sites. Wherever appropriate, these sources have been updated with current reports, surveys, and information.

III.C.4.a. Prehistoric Resources

Prehistoric resources "pertain to that period of time before written history. In North America, 'prehistoric' usually refers to the period before European contact" (MMS Manual 620.1-H).

III.C.4.a(1) Onshore

A review of the Alaska Heritage Resources Survey site files indicates that 18 sites with prehistoric components have been recorded in the Beaufort Sea Planning Area (see Table III.C-20). They are comprised of habitation sites, lithic scatters, and isolated finds.

III.C.4.a(2) Offshore

The potential for submerged prehistoric sites in the Beaufort Sea Planning Area was determined by an evaluation of the available geophysical/geological and archaeological data. This analysis was prepared to aid in the identification of lease blocks with prehistoric-site potential. The geologic processes that have acted on the ocean floor of the sale area are summarized in Section III.A.1 and have been evaluated with regard to the distribution, survivability, and detectability of potential archaeological resources sites. The current multiple-sale area includes lease blocks previously offered in the following Beaufort Sea lease sales: the Joint Federal/State Beaufort Sale, Diapir Field Sale 71, Sale 87, Sale 97, Sale 124, Sale 144, and Sale 170.

Archaeological analyses were prepared for previous Beaufort Sea lease sales and are cited by reference in this report. However, the baseline study of Friedman and Schneider (1987) concerning the geomorphological processes that pertain to the survivability of potential prehistoric resource sites in the sale area is updated with current reports, surveys, and information pertinent to this analysis. The Friedman and Schneider report (USDOI, MMS, 1987) recommended that all blocks in the Beaufort Sea sale area be exempted from prehistoric resource requirements. Those conclusions are modified in the present report.

The last two EIS's published (Sales 144 and 170) found that there is only low potential for archaeological resources in the Beaufort Sea Planning area. Since then, it has come to our attention during the analysis of site conditions of several wells in the shallow-water inner shelf (Warthog #1, Liberty #1, the proposed Liberty Development area, and the McCovey exploration site) that there are several potential conditions that, in combination with other features, properties, or environments, might cause the archaeological potential for an area to increase (USDOI, MMS, Alaska OCS Region, 2002a:Section VI.B.3).

These conditions are found in the following:

- Areas of no ice gouging, which allows the potential preservation of terrestrial sediments and landforms. These areas have been found inside barrier islands and in other areas where there is stable, floating shorefast ice.
- The presence of in situ Quaternary terrestrial sediments such as peat, soil horizons, and river-bar and -bank deposits.
- The presence of submerged and buried terrestrial landforms.

In previous EIS evaluations, we assumed that ice gouging and coastal and marine erosional processes had destroyed or severely disturbed drowned late Pleistocene to Holocene landforms and terrestrial sediments, virtually eliminating the possibility of in situ archaeological resources. We now believe that in areas with little or no ice gouging, the possibility exists for undisturbed, potential prehistoric archaeological resources. These areas of little or no ice gouging correspond to the areas of stable, shorefast floating ice, shoreward of the stamukhi zone, and areas shoreward of the barrier islands.

The following individual blocks have been identified as having the potential for prehistoric archaeological resources:

- OPD: NR 05-01, Dease Inlet; Blocks: 6604-6606, 6654-6657, 6704-6709, 6754-6761, 6804-6812, 6856-6864, 6909-6915, 6960-6969, 7011-7023, 7062-7073, 7113-7123
- OPD: NR 05-02, Harrison Bay North; Blocks: 7001-7007, 7051-7059, 7101-7112
- OPD: NR 05-03, Teshekpuk; Blocks: 6015-6024, 6067-6072
- OPD: NR 05-04, Harrison Bay; Blocks: 6001-6015, 6052-6066, 6106-6115, 6157-6168, 6208-6223, 6258-6274, 6309-6324, 6360-6374, 6410-6424, 6461-6471, 6513-6519, 6565-6566
- OPD: NR 06-03, Beechy Point; Blocks: 6202-6207, 6251-6257, 6301-6308, 6351-6361, 6401-6417, 6456-6469, 6509-6520, 6561-6570, 6612-6614, 6616, 6618-6623, 6664-6674, 6717-6724, 6768-6771, 6819-6822, 6870-6871
- OPD: NR 06-04, Flaxman Island; Blocks: 6651, 6701-6702, 6751-6754, 6802-6808, 6860, 6910-6912, 6920-6924, 6961-6974, 7013-7022, 7066-7070, 7118-7119

- OPD: NR 07-03, Barter Island; Blocks: 6853-6855, 6901-6909, 6958-6960, 7010-7011, 7061-7063, 7113-7114
- OPD: NR 0705, Demarcation Point; Blocks: 6016-6017, 6067-6069, 6118-6120, 6169-6170, 6222-6223, 6273-6275, 6324-6325

We evaluated geophysical/geological and archaeological data and determined that the area shoreward of the stamukhi zone and areas inside the barrier islands may have preserved, submerged prehistoric sites. The prehistoric archaeological site potential was analyzed with respect to the distribution and survivability of potential preserved terrestrial sediments and submerged landforms.

III.C.4.a(3) Review of the Baseline Study

No new baseline studies exist for archaeological resources in the Beaufort Sea. The EIS analysis for the Liberty Development and Production Plan is the most current and was referred to while we prepared this report.

III.C.4.a(4) Review of Reports on Geology and Cultural Resources

We reviewed the following geohazards and geotechnical reports to prepare this analysis:

- The Liberty Cultural Resources Report (Watson Company [1999]).
- The Liberty High Resolution Geophysical Survey, Foggy Island Bay in Stefansson Sound, Alaska (Watson Company [1998a]).
- Liberty Pipeline Route Survey, Foggy Island Bay in Stefansson Sound (Watson Company [1998b]).
- Geotechnical Exploration Liberty Development Project, Foggy Island Bay, Alaska (Duane Miller & Assocs. [1997]).
- Geotechnical Exploration Liberty Development North Slope, Alaska (Duane Miller & Assocs. [1998]).
- Beaufort Sea Shallow Hazards Synthesis Liberty #1 Well (Arctic Geoscience, Inc. [1997]).
- Geophysical and Geotechnical Site Evaluation, Karluk Prospect, Beaufort Sea Alaska (Harding Lawson Assocs. [1988]), in support of Chevron USA’s Karluk OCS-Y 0194 Well #1.
- Geotechnical Investigation Tract 42 Well Site, Beaufort Sea, Alaska, (Harding-Lawson Assocs. [1981b]), for Shell Oil Company’s Tern Prospect.
- Geologic Hazards Report for Shell Oil Company’s Tern Prospect (Harding-Lawson Assocs. [1981]).
- The Warthog No. 1 Camden Bay, Beaufort Sea, Shallow Hazards Survey Results (Fairweather E&P Services Inc. [1997a]). (This was reviewed because of its relevance to potential archaeological resources in the shallow Beaufort Sea).
- Archaeological Assessment Report for the Arco Warthog Prospect, Camden Bay, Beaufort Sea, Alaska 1997, MMS, in-house report.
- Pre-Historic Archaeological Assessment of Phillips Alaska Inc.’s McCovey Prospect, Beaufort Sea, Alaska, (Arctic Geoscience Inc. [2000]).
- Geohazards Survey, Phillips Alaska Inc.’s McCovey Prospect, Beaufort Sea, Alaska, (Arctic Geoscience Inc. 2000]).

III.C.4.a(5) Review of Sea-Level History

Any area within the Beaufort Sea shallower than 200 feet (60 meters) would have been exposed as dry land and available for people to live on until the sea level rose and flooded the project area sometime around 5,000-6,000 years Before Present. Relative sea level in the Beaufort Sea was approximately 165 feet (50 meters) below its present level at 13,000 years Before Present (Hopkins, 1967), which is just before the general timeframe for the arrival of people in the Arctic. Blocks in water deeper than the 165-foot (50-meter) isobath would not have archaeological resource potential and have been removed from further consideration in this report.

III.C.4.a(6) Review of Geological/Geophysical Data to Determine the Potential for Survival of Archaeological Sites

The geohazards and geotechnical reports and surveys collected in the areas of the Warthog #1, Liberty #1, and proposed McCovey exploration well and Liberty Project area suggest there may be the potential for archaeological resources to have survived the destructive erosional processes that operated on the coast as sea level rose and sculpted the seafloor. Sediment core(s) collected in Camden Bay and in Foggy Island Bay, Stefansson Sound contained peat layers in the upper Quaternary section. Peat does not prove the existence of archaeological resources but shows that there is the potential for the preservation of Quaternary-age sedimentary sequences, including possible archaeological sequences, in these nearshore areas. It also shows that erosion from ice gouging, thermokarst erosion, etc., was not significant enough to thoroughly rework the entire upper Quaternary section.

The subbottom profiler data show the presence of well-preserved Quaternary-age fluvial channels within these areas (Figure III.A-10a; see also USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-10). The subbottom profiler data from the proposed Liberty pipeline route also show a buried lake or lagoon with underlying peat beds approximately 12 feet (3.5 meters) below the seafloor (USDOI, MMS, Alaska OCS Region, 2002a:Figure VI.C-11). The age of the peat is unknown. Adjacent to this buried depression is a seafloor shoal that may represent a drowned island. The buried edge of this island terminates in a possible buried paleo-terrace at the edge of the paleo-lagoon or paleo-lake. The banks, terraces, and point bars of these channels and lagoons, and areas on paleo-islands, are areas where, according to terrestrial site analogues, prehistoric people would have located their campsites and focused their subsistence activities. Because these channel features appear to be well preserved, any archaeological sites that are present also could be preserved. Also, because the channels and lagoon terraces are buried by only a few meters of Holocene sediments, any sites would be detectable with physical sampling techniques such as sediment coring.

In general we do not have any exact age correlation for sediment or buried and drowned landforms that can determine whether they are early to middle Pleistocene or whether they are younger late Pleistocene to Holocene. Age dating on organic sediments has been conducted on only two samples from nearshore Camden Bay. These samples, one on a piece of woody material and the other on a shell fragment, gave dates of nearly 20,000 years Before Present. However, these fragments may have been from older sediments that were redeposited in the Holocene sequence.

The analysis of prehistoric resources for previous Beaufort Sea sales concluded that destructive geologic processes such as ice gouging, thermokarst erosion, and storm surges had strongly reworked the near-surface shelf sediments in the Beaufort Sea Planning Area. Therefore, it was previously concluded that prehistoric archaeological sites had a very low potential for survival. The geophysical data from the nearshore areas, such as Warthog in Camden Bay and the Liberty Project area, contradict this previous conclusion. Information from the side-scan sonar and underwater video images of the seafloor show that ice gouging is sparse to nonexistent at these two locations. Evidence shows that locations beneath/near floating shorefast ice and landward of the barrier islands get more protection from ice gouging and other destructive geologic processes that operate on the open shelf and, perhaps, were sheltered from some of the erosional effects of rising sea level.

Thus, after reviewing geophysical high-resolution data and geotechnical core data from the Warthog, Liberty Project, and McCovey areas, we conclude that prehistoric archaeological sites may exist and may have survived the destructive geologic processes of the Holocene sea transgression and those that operate at the modern seafloor.

III.C.4.b. Historic Resources

Historic resources pertain "to the period of time for which written history exists" (MMS Manual 620.1-H) including, but not limited to, shipwrecks.

III.C.4.b(1) Onshore

A review of the Alaska Heritage Resources Survey site files shows sites with historic components in the Beaufort Sea Planning Area. They consist of a Distant Early Warning line station and its research equipment and habitation, cemetery, military debris, camp, hunting, reindeer herding, trapping, ice cellar, and lookout-tower site types (see Table III.C-20) (Dale, 1996, pers. commun.; Alaska Heritage Resources Survey Database, 2002).

III.C.4.b(2) Offshore

Our computerized list of shipwrecks for the sale area shows 20 known shipwrecks. They range from the whaler *St. George* lost in 1876 between Point Barrow and Point Tangent to Inupiaq whaling craft lost as recently as 1992. Along with the *St. George*, nine other Yankee whalers were lost in 1876. All nine vessels were caught in the ice and abandoned 20-30 miles north of Cape Simpson. Other vessels lost from Barrow and eastward, and potentially within the proposed lease-sale area, are the *Young Phoenix* lost in 1888 east of Barrow; the *Reindeer*, a 340-ton whaling bark wrecked near Reindeer Island in the Midway Islands in 1894; the *Duchess of Bedford*, a 60-ton expedition schooner wrecked near Flaxman Island in 1907; the *Elvira* lost east of Barter Island in 1913; the *Duxbury* lost near Cape Halkett in 1925; the *Baychimo* last seen off Barrow in 1931; and modern-day Inupiat whaling craft lost off Point Barrow in 1988, off Kaktovik in 1988, and two lost off Cross Island in 1992 (Burwell, 2002, pers. commun.; Tornfelt and Burwell, 1992; see Table III.C-21and Map 15, Archaeological Blocks and Location of Shipwrecks in the Multiple-Sale Area).

The final distribution of a shipwreck on the seafloor depends on such factors as water depth; the composition and thickness of unconsolidated sediments at the seafloor; ice gouging, sea currents, and other geologic processes active at the seafloor; and the size and type of ship. To date, no surveys have been done to find these wrecks, and the information we have is not enough to assign them to specific locations.

Rates of sedimentation sufficient to bury shipwrecks within recent history have not been identified for the sale area. Therefore, any shipwrecks present within the sale area should be locatable with sonar survey instruments.

III.C.5. Land Use Plans and Coastal Management Program

III.C.5.a. Land Status and Use

Most land in the North Slope Borough is held by a few major landowners. The predominant landowner within the Borough is the Federal Government. Of the approximately 20 million hectares in the region north of 68° N. latitude, more than one-half are contained in the National Petroleum Reserve-Alaska and the Arctic National Wildlife Refuge. Other major landholders include the State of Alaska (1.4 million hectares) and the eight Native village corporations and the Arctic Slope Regional Corporation (1.9 million hectares). Complexity in land-ownership patterns is a result of the Alaska Native Claims Settlement Act provisions that only surface-estate rights are to be conveyed to Native village corporations; subsurface-estate rights can be conveyed to Native regional corporations. Moreover, in selected Federal holdings, such as the Arctic National Wildlife Refuge and the National Petroleum Reserve-Alaska, selection was restricted to surface estate for village corporations. The subsurface estate was reserved for the Federal Government; the Arctic Slope Regional Corporation was required to select its subsurface estate outside these boundaries.

Major land uses on the North Slope are divided between traditional subsistence uses of the land and hydrocarbon-development operations. The traditional settlement patterns and subsistence uses of land are discussed in Section III.C.3. The extent and location of hydrocarbon exploration and development and production operations on the North Slope and offshore areas are discussed in the description of projects included for the cumulative case, Section V.A.

III.C.5.b. Land Use Planning Documents

Documents addressing land use in the North Slope Borough include the North Slope Borough Comprehensive Plan and Land Management Regulations, and the North Slope Borough Coastal Management Program (CMP). The North Slope Borough CMP and the Statewide Standards of the Alaska Coastal Management Program (ACMP) are described in the following section.

North Slope Borough Comprehensive Plan and Land Management Regulations: The North Slope Borough Comprehensive Plan and Land Management Regulations were adopted initially in December 1982, and they were revised on April 12, 1990. The following description is based on the new regulations. The revisions simplified the regulatory process but did not alter the basic premise of the comprehensive plan—to preserve and protect the land and water habitat essential to subsistence living and the Inupiat character of life.

The new Land Management Regulations have five zoning districts—Village, Barrow, Conservation, Resource Development, and Transportation Corridor. All areas within the Borough are in the Conservation District unless specifically designated as within the limited boundaries of the villages or Barrow, as a unitized oil field within the Resource Development District, or along the Trans-Alaska Pipeline corridor within the Transportation Corridor. Therefore, any new large-scale development occurring outside an existing Resource Development District will require a Master Plan for the development to be submitted to the North Slope Borough and adopted by the Borough Assembly as an amendment to the Comprehensive Plan, and the land must be rezoned from Conservation District to Resource Development District.

In the regulations, uses are categorized as (1) uses that can be administratively approved without public review, (2) uses that require a development permit and must have public review before they can be administratively approved, and (3) uses that are considered conditional development that must be approved by the Planning Commission.

Policy revisions in the Land Management Regulations incorporated the North Slope Borough CMP's and supplemented these with several additional policy categories—Village Policies, Economic Development Policies, Offshore Development Policies, and Transportation Corridor Policies. Offshore policies are specifically limited to development and uses in the portion of the Beaufort Sea that is within the boundary of the North Slope Borough. All the policies address offshore drilling.

III.C.5.c. Coastal Management

The Federal Coastal Zone Management Act and the Alaska Coastal Management Act were enacted in 1972 and 1977, respectively. Through these acts, development and land use in coastal areas are managed to provide a balance between the use of coastal areas and the protection of valuable coastal resources. The provisions and policies of both the Federal and State CMP's are described in MMS Reference Paper 83-1 (McCrea, 1983), which is summarized in the following paragraphs and incorporated by reference in this EIS. Statewide standards of the ACMP may be refined through local coastal programs prepared by coastal districts. Coastal districts are encouraged to prepare local CMP's to supplement the Statewide standards in their district. District programs must be approved by the Alaska Coastal Policy Council and the Secretary of the U.S. Department of Commerce through the Office of Ocean and Coastal Resource Management before they are fully incorporated into the ACMP. The NSB is the only coastal district in proximity to the sale area; its CMP has been fully incorporated into the ACMP. A description of the North Slope Borough CMP follows that of the Statewide standards of the ACMP.

III.C.5.c(1) Statewide Coastal Management Standards

The ACMP, as initially approved by the Office of Ocean and Coastal Resource Management, includes the Alaska Coastal Management Act, guidelines and standards developed by the Coastal Policy Council, a series of maps depicting the interim boundaries of the State coastal zone, and an EIS prepared by the Office of Ocean and Coastal Resource Management. The Statewide standards that may be relevant to activities hypothesized in this EIS are summarized in the following paragraphs under three headings: coastal habitats, coastal resources, and uses and activities.

III.C.5.c(1)(a) Coastal Habitats

Eight coastal habitats were identified in the standards (offshore; estuaries; wetlands and tidelands; rocky islands and sea cliffs; barrier islands and lagoons; exposed high-energy coasts; rivers, streams, and lakes; and important uplands). Each habitat has a policy specific to maintaining or enhancing the attributes that contribute to its capacity to support living resources (6 AAC 80.130[b] and [c]).

Activities and uses that do not conform to the standards may be permitted if there is a significant public need, no feasible prudent alternatives to meet that need, and all feasible and prudent mitigation measures are incorporated to maximize conformance. Habitat policies frequently are cited in State consistency review

III.C.5.c(1)(b) Coastal Resources

Two policy areas come under the heading of coastal resources: (1) air, land, and water quality and (2) historic, prehistoric, and archaeological resources. In the first instance, the ACMP defers to the mandates and expertise of the State of Alaska, Department of Environmental Conservation. The standards incorporate by reference all the statutes, regulations, and procedures of the Department of Environmental Conservation that pertain to protecting air, land, and water quality (6 AAC 80.140). Concerns for air and water quality are cited frequently during State reviews for consistency.

The policy addressing historic, prehistoric, and archaeological resources requires only identification of the "areas of the coast which are important to the study, understanding, or illustration of national, state, or local history or prehistory" (6 AAC 80.150).

III.C.5.c(1)(c) Uses and Activities

Nine topics are addressed under this heading: coastal development, geophysical-hazard areas, recreation, energy-facility siting, transportation and utilities, fish and seafood processing, timber harvesting and processing, mining and mineral processing, and subsistence. Uses and activities of particular relevance to the activities hypothesized for this OCS lease sale include coastal development, energy-facility siting, transportation and utilities, and subsistence.

Both the Federal Coastal Zone Management Act and the ACMP require that uses of State and Federal concern be addressed (Coastal Zone Management Act § 303[2][C], AS 46.40.060, and AS 46.40.070). The Alaska Coastal Management Act further stipulates that local districts may not arbitrarily or unreasonably restrict or exclude such uses in their CMP's. Among the uses of State concern is the siting of major energy facilities.

III.C.5.c(2) North Slope Borough District Coastal Management Plan

The North Slope Borough CMP was adopted by the Borough in 1984. Following several revisions, the Borough's CMP was approved by the Alaska Coastal Policy Council in April 1985 and Office of Ocean and Coastal Resource Management in May 1988. The coastal management boundary adopted for the North Slope Borough CMP varies slightly from the interim boundary of the ACMP. In the mid-Beaufort sector, the boundary was extended inland on several waterways to include anadromous-fish-spawning and -overwintering habitats. Along the Chukchi Sea coast, it was extended inland to include the Kukpuk River and a 1.6-kilometer corridor along each bank.

The North Slope Borough CMP was developed to balance exploration, development, and extraction of nonliving natural resources and maintenance of and access to the living resources on which the Inupiat traditional cultural values and way of life are based. The North Slope Borough CMP contains four categories of policies: (1) standards for development, (2) required features for applicable development, (3) best-efforts policies that include both allowable developments and required features, and (4) minimization-of-negative-impacts policies.

Standards for development prohibit severe harm to subsistence resources or activities or disturb cultural and historic sites. Required features address reasonable use of vehicles, vessels, and aircraft; engineering criteria for offshore structures; drilling plans; oil-spill-control and -cleanup plans; pipelines; causeways;

residential development associated with resource development; and air quality, water quality, and solid-waste disposal.

Best-efforts policies allow for exceptions if (1) there is "a significant public need for the proposed use and activity" and (2) developers have "rigorously explored and objectively evaluated all feasible and prudent alternatives" and briefly documented why the alternatives have been eliminated from consideration. If an exception to a best-efforts policy is granted, the developer must take "all feasible and prudent steps to avoid the adverse impacts the policy was intended to prevent."

Best-efforts policies allow development if all feasible and prudent steps are taken "to avoid the adverse impacts the policy was intended to prevent." Policies in this category address developments that could cause significantly decreased productivity of subsistence resources or ecosystems, displace beluga whales in Kasegaluk Lagoon, or restrict access of subsistence users to a subsistence resource. They also create restrictions on various modes of transportation, mining of beaches, or construction in certain floodplains and geologic-hazard areas.

Best-efforts policies also address features that are required by "applicable development except where the development has met the [two criteria identified above] and the developer has taken all feasible and prudent steps to maximize conformance with the policy." Developments and activities regulated under these policies include coastal mining, support facilities, gravel extraction in floodplains, new subdivisions, and transportation facilities. Siting policies include the State habitat policies and noninterference with important cultural sites or essential routes for transportation to subsistence resources.

All applicable developments must minimize "negative impacts." Regulated developments include recreational uses, transportation and utility facilities, and seismic exploration. Protected features include permafrost, subsistence activities, important habitat, migrating fish, and wildlife. Geologic hazards must be considered in site selection, design, and construction.

Two "areas meriting special attention" were identified in the CMP—Point Thomson and Kasegaluk Lagoon. Upon further examination, Point Thomson was dropped and the Colville River Delta was added. Planning for the Kasegaluk Lagoon area meriting special attention and the Colville River Delta area meriting special attention is proceeding.

The North Slope Borough has adopted administrative procedures for implementing these policies based on the permit process established under Title 19 of the Borough's Land Use Regulations and the consistency-review process of Title 46 of the Alaska Statutes.

III.C.6. Environmental Justice

Alaska Inupiat Natives, a recognized minority, are the predominant residents of the North Slope Borough, the area potentially most affected by the Beaufort Sea multiple sales. Effects on Inupiat Natives could occur because of their reliance on subsistence foods, and exploration and development may affect subsistence resources and harvest practices.

Environmental justice is an initiative that culminated with President Clinton's February 11, 1994, Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," and an accompanying Presidential memorandum. The Executive Order requires each Federal Agency to make the consideration of environmental justice part of its mission. Its intent is to promote fair treatment of people of all races, so no person or group of people shoulders a disproportionate share of the negative environmental effects from this country's domestic and foreign programs. It focuses on minority and low-income people, but the Environmental Protection Agency defines environmental justice as the "equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status from environmental hazards" (U.S. Department of Energy, 1997; Envirosense, 1997). Specifically, the Executive Order requires an evaluation in the EIS as to whether the proposed project would have "disproportionately high adverse human health and environmental effects…on minority populations and low income populations."

Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," requires MMS to be in consultation with Inupiat tribal governments on the North Slope on Federal matters that significantly or uniquely affect their communities. The Environmental Protection Agency's own Environmental Justice guidance of July 1999 stresses the importance of government-to-government consultation. In acknowledgement of its importance, the MMS has invited tribal governments to participate in the EIS planning process. In January 2001, MMS's community liaison Albert Barros was instrumental in getting a USDOI Alaska Regional Government-to-Government policy signed by all the USDOI Alaska Regional Directors. The MMS has come to appreciate the potential overload to stakeholder institutions that can occur from too many planning and public meetings. The Inupiat People of the North Slope have made the MMS aware of this potential meeting "burnout," and MMS has been sensitive to this in planning the number and timing of meetings with North Slope tribal groups and local governments.

Since 1999, all MMS public meetings have been conducted under the auspices of Environmental Justice, and presentations on the Executive Order and how MMS is addressing it have been made in Barrow, Nuiqsut, Kaktovik, and Point Hope. At these meetings, Inupiat translators were provided. The Environmental Justice process followed for the Beaufort Sea multiple sales included: (1) initial scoping, (2) notices in local newspaper notices and on local cable TV, and (3) followup meetings that included meetings specific to Environmental Justice concerns. Some meetings were broadcast over local radio. From this process, the MMS received limited interest and feedback on specific Environmental Justice concerns. Nevertheless, the MMS documented various concerns of Inupiat residents, and discussions about mitigation were conducted. Environmental Justice concerns were taken back to MMS management and incorporated into environmental study designs and new mitigating measures. New mitigating measures/stipulations being evaluated include one for no siting of permanent facilities in the vicinity of Cross Island and one for noise abatement in areas near bowhead whale subsistence-hunting areas.

Environmental Justice concerns were solicited from meetings on the North Slope with the communities of Nuiqsut on October 16, 2001, with Barrow on October 18, 2001, and with Kaktovik on October 19, 2001. A Slopewide Government-to-Government teleconference arranged through the Inupiat Community of the Arctic Slope was held on December 6, 2001, and involved the tribal governments of Point Hope, Point Lay, Wainwright, Atqasuk, Nuiqsut, and Anaktuvuk Pass. Kaktovik chose not to participate in the teleconference, and a separate meeting with the Native Village of Barrow had already been held in Barrow on October 18, 2001. MMS maintains a dialogue on Environmental Justice with these communities; follow-up meetings to address Environmental Justice issues were held with the Inupiat Community of the Arctic Slope and the Alaska Eskimo Whaling Commission on November 15, 2001.

Major concerns expressed at these meetings included:

- the need for continued participation by the North Slope Borough in the multiple-sale planning process;
- the multiple-sale process will diminish local input into the planning process;
- the need for a 10-mile deferral around Cross Island;
- support for a Barter Island deferral;
- more concrete guidelines for the consultation process;
- agencies need to help fund the Kuukpik Subsistence Advisory Panel;
- take local traditional knowledge seriously in decisionmaking;
- the need for oil-spill response training in the villages;
- the need for impact assistance;
- better employment opportunities from oil industry;
- the need for conflict resolution agreements with subsistence seal hunters and fishermen;
- the need for establishing a Slopewide subsistence advisory panel;
- the need to provide natural gas to local communities;
- the need for better assessment of cumulative impacts;
- continued fears about ice gouging damaging undersea pipelines;
- ice damage to gravel drilling islands;
- oil-spill cleanup in broken ice;
- problems with netting fish in the Colville River;

- noise effects on bowhead whales; and
- air pollution from development at Prudhoe Bay.

The Executive Summary for the draft EIS was translated into the Inupiat Language and distributed to the Native Village of Nuiqsut, Native Village of Kaktovik, Native Village of Barrow, Inupiat Community of the Arctic Slope, Alaska Eskimo Whaling Commission, Inupiat Heritage Center, Ilisagvik College, North Slope Borough, City of Nuiqsut, and the City of Kaktovik. MMS plans to translate the Executive Summary of the Final EIS and distribute it to the same entities.

SECTION IV

ENVIRONMENTAL CONSEQUENCES

Contents Section IV

IV. Environmental Consequences

Section IV analyzes effects on resources in or migrating through the proposed lease-sale area. Based on a three-tier process, Section IV.A defines basic assumptions made in assessing the alternatives in this EIS (excluding Alternative II). Section IV.B discusses Alternative II (No Lease Sale). Section IV.C analyzes effects on the 16 different resource categories in three areas by alternative and by sale. Sections IV.D through IV.I are general topics common to all resources.

IV.A. Basic Assumptions for Effects Assessment

Certain basic assumptions are common to the effects assessments for all the alternatives, except Alternative II - No Lease Sale. A general overview of the Proposal (offering the entire sale area) shows that certain properties are common for the entire sale area, no matter where the action takes place or which alternative is chosen. The alternatives are analyzed on the basis of a field-development time profile called a scenario. The MMS traditionally bases the EIS scenarios on both geologic possibilities and on what is expected to be leased, discovered, developed, and produced in the sale area under consideration. This subsection details the scientific, economic, geologic, and other assumptions on which the exploration and development scenarios in this EIS are based. These topics include discussions of basic scenarios for exploration, development, production, and transportation. The location of any oil deposits is purely hypothetical, until oil is proven to be there by drilling (see Appendix B). While these scenarios are reasonable and provide a basis for analyzing the effects, considerable uncertainty exists about where and when activities may take place, if they take place at all. In addition to uncertainty about the size and location of geologic resources, many other factors would influence where leasing, exploration, and development might take place. Such factors as the price of oil, the availability of high-grade onshore oil and gas leases, and company goals and perspectives about Alaska and offshore development would have tremendous effects on the level of participation in offshore oil and gas exploration and development in the Beaufort Sea.

While reading the effects assessment, please note that the MMS has developed scenarios to aid in the development of a complete and comprehensive analysis of the various possibilities that might arise from leasing, exploration, and development. The alternatives in this EIS evaluate leasing from Barrow to the Canadian border and from shore to about 60 miles offshore. The scenarios developed by the MMS indicate a logical progression from the nearshore central Beaufort Sea to locations in deeper water or farther east or west. The three zones (Near, Midrange, and Far) mentioned are developed and defined in Section II.A.1 (also see Map 4). The scenarios developed by the MMS indicate our analytical assumption, based on professional judgment, that most leasing, exploration, and development that might result from Sales 186 and 195 would take place in the Near and Midrange zones offshore of current development. Although the scenarios prepared for this EIS do not assume development in the Far Zone until after Sale 202, companies could bid on and be awarded leases in any of the zones in any of the three sales. Because this EIS evaluates the effects of leasing in all three zones, the effects attributed to any zone could occur as a result of any lease sale, if they occur at all.

The remainder of this section evaluates the potential effects of the Proposal and all the alternatives. The information in this section is presented by resource and evaluates the effects common to all alternatives, followed by an analysis for each alternative. In addition to the Proposal (Alternative I) and the No Lease Sale Alternative (Alternative II), four other alternatives for the three proposed lease sales (Sales 186, 195, and 202) create 18 potential options. In many cases, the estimated effects of a specific alternative for a particular sale are identical or similar to those effects of the alternative for another sale and/or another alternative for another sale. In such cases, rather than repeat the analysis, we reference the effect already described for another alternative and sale combination that would have the same effect. This narrative will include the appropriate rationale and information developed supporting the grouping.

To help focus, we provide only the information that will help the reader and decisionmaker focus on the differences among the alternatives. Table Summary compares the effects by alternative and sale.

Each analysis of effects in this EIS evaluates the following key resource topics that were identified during scoping:

- Water Quality
- Lower Trophic-Level Organisms
- Fishes
- Essential Fish Habitat
- Endangered and Threatened Species: Bowhead Whale and Spectacled and Steller's Eiders
- Marine and Coastal Birds
- Marine Mammals: Pinnipeds, Polar Bear, and Beluga and Gray Whales
- Terrestrial Mammals: Caribou, Muskoxen, Grizzly Bear, and Arctic Fox
- Vegetation and Wetlands
- Economy of the North Slope Borough
- Subsistence-Harvest Patterns
- Sociocultural Systems
- Archaeological Resources
- Land Use Plans and Coastal Management Programs
- Air Quality
- Environmental Justice

If leasing takes place, we can project that impacts likely would occur from the following:

- noise from seismic surveys, aircraft, and marine support boats and
- traffic from seismic-survey vessels and aircraft.

If exploration does take place, the following impacts, in addition to the aforementioned seismic activities, could result:

- noise from construction or installation of ice roads, exploration drilling island, or platform;
- traffic for crew, fuel, and supply vessels;
- discharge of well-drilling fluids, produced water, and domestic wastewater generated from the exploration facility;
- solid-waste disposal from exploration wells (drilling muds and cuttings) and trash and debris from the human activities supporting exploration;
- gaseous emissions from offshore and onshore facilities and transportation vessels and aircraft; and
- physical emplacement, presence, and removal of exploration facilities.

If exploration leads to development, impacts likely could occur from the following:

- noise from construction of ice roads, development of production islands or facilities, pipelines, and production facilities;
- routine and recurring traffic associated with crew and supply activities;
- liquid-waste disposal from well-drilling fluids, produced waters, and domestic wastewaters generated at the offshore facility;
- solid-waste disposal from development wells (muds and cuttings) and trash and debris from production activities;

- gaseous emissions from production facilities, both onshore and offshore, and from transportation vessels and aircraft; and
- physical placement, presence, and removal of offshore production facilities, including islands or platforms, storage and production facilities, and pipelines to onshore common carrier pipelines.

Other accidental activities could, but are not expected to, occur. Oil-spill accidents (blowouts, production accidents, pipeline leaks, and fuel spills) also could occur. The reader and decisionmaker(s) should consider the low probability that an oil spill might occur when considering the spill and cleanup effects. Even though the analysis assumes that an oil spill occurs and provides information about the potential that an oil spill would contact a specific area or resource, the reader should remember that the estimate of an oil spill greater than or equal to 1,000 barrels occurring from any of the three proposed lease sales and contacting any resource is 8-10%. Also, when reading our estimate of the effects of an oil spill, the reader should note that the EIS does not assume any reduction in effects that would result from required oil-spill-response activities. All exploration and production activities require an approved oil-spill-response plan and, if an oil spill occurred, oil-containment and -cleanup activities would begin within hours or minutes of the detection of a spill.

Sections IV.D through IV.I are common to all alternatives for Sales 186, 195, and 202, and are analyzed by resource category. These include the following topics:

- Comparison of the Effects of the Alternatives and the Cumulative Effects
- Unavoidable Adverse Effects;
- Relationship Between Local-Short-Term Uses and Maintenance and Enhancement of Long-Term Productivity;
- Irreversible and Irretrievable Commitment of Resources;
- Effects on Natural Gas Development and Production;
- Effects of a Low-Probability, High Effects, Very Large Oil-Spill Event.

IV.A.1. Significance Thresholds

The Council on Environmental Quality National Environmental Policy Act (NEPA) regulations (40 CFR 1508.27) define the term "significantly" in terms of both context and intensity. "Context" considers the setting of the Proposed Action, what the affected resource might be, and whether the effect on this resource would be local or more regional in extent. "Intensity" considers the severity of the impact, taking into account such factors as whether the impact is beneficial or adverse; the uniqueness of the resource (for example, threatened or endangered species); the cumulative aspects of the impact; and whether Federal, State, or local laws may be violated. The analysis in this document uses terminology that is consistent with that definition. Impacts may be beneficial or adverse. Impacts are described in terms of frequency, duration, general scope, and/or size and intensity. The analysis in this EIS also considers whether the mitigation that is proposed as part of the project can reduce or eliminate all or part of the potential adverse effects.

As directed by the Council on Environmental Quality NEPA regulations (40 CFR 1502.16), we discuss direct and indirect impacts (effects) and their significance on the previously listed physical, biological, and human social resources.

Our EIS impact analyses address the significance of the impacts on the aforementioned resources considering such factors as the nature of the impact (for example, habitat disturbance or mortality), the spatial extent (local and regional), temporal and recovery times (years, generations), and the effects of mitigation (for example, implementation of the oil-spill-response plan). Bowhead whales, for example, are an endangered species, and the analysis considers the possible effects of a large oil spill in terms of the following:

- lethal and nonlethal effects;
- habitat affected;
- seasonality and spatial extent of the effect;
- what part of the population may be affected;

- oil-spill-cleanup mitigation;
- the likelihood of such a spill; and
- if such a spill occurred, the likelihood of the oil contacting whales.

For impacts on water quality from construction disturbance, the analysis considers the following:

- the increases in suspended particles and turbidity relative to acute (toxic) criteria;
- the seasonal, temporal, and spatial extent of the effect; and
- the contribution of this relative to naturally occurring turbidity.

Some impacts may be measurable, but their effects may be minimal and/or short-term in duration; therefore, they may not require avoidance or mitigation.

Adverse impacts that are reduced by mitigation below the "significance thresholds" that are incorporated into the project, or that are demonstrated to be acceptable because the risk of the impact occurring is small, are considered "nonsignificant."

For this EIS, we have defined a "significance threshold" for each resource as the level of effect that equals or exceeds the adverse changes indicated in the following impact situations:

- **Threatened and Endangered Species** (bowhead whale, spectacled and Steller's eiders): An adverse impact that results in a decline in abundance and/or change in distribution requiring one or more generation for the indicated population to recover to its former status.

- **Biological Resources** (seals, walrus, beluga whale, polar bear, marine and coastal birds, terrestrial mammals, lower trophic-level organisms, fishes, essential fish habitat, and vegetation and wetlands): An adverse impact that results in a decline in abundance and/or change in distribution requiring three or more generations for the indicated population to recover to its former status and one or more generations for polar bears.

- **Subsistence-Harvest Patterns:** One or more important subsistence resources would become unavailable, undesirable for use, or available only in greatly reduced numbers for a period of 1-2 years.

- **Sociocultural Systems:** Chronic disruption of sociocultural systems occurs for a period of 2-5 years, with a tendency toward the displacement of existing social patterns.

- **Archaeological Resources:** An interaction between an archaeological site and an effect-producing factor occurs and results in the loss of unique, archaeological information.

- **Economy:** Economic effects that would cause important and sweeping changes in the economic well-being of the residents or the area or region. Local employment is increased by 20% or more for at least 5 years.

- **Water Quality:** A regulated contaminant is discharged into the water column, and the resulting concentration outside a specified mixing zone is above the acute (toxic) State standard or Environmental Protection Agency criterion more than once in a 1-year period and averages more than the chronic State Standard or Environmental Protection Agency criterion for a month. Turbidity exceeds 7,500 parts per million suspended-solid concentration outside the mixing zone specified for regulated discharges more than once in a 3-year period and averages more than chronic State standards or Environmental Protection Agency criteria for a month. The accidental discharge of crude or refined oil in which the total aqueous hydrocarbons in the water column exceeds 1,500 micrograms per liter (1.5 parts per million), the assumed acute (toxic) criteria, for more than 1 day and 15 micrograms per liter (0.015 parts per million), the assumed chronic criteria and the State of Alaska ambient-water-quality standard, for more than 5 days.

- Violations would be caused by exceeding an effluent limit or creating an oil sheen. The accidental discharge of a small volume of crude or refined oil also might cause an adverse impact and could result in concentrations of hydrocarbons that are greater than the acute criteria in a local area (less than 1 square mile) for less than a day and concentrations that are greater than the chronic criteria in a larger area (less than 100 square miles) for fewer than 5 days. However, an action of violation or accidental discharge of a small volume crude or refined oil would not necessarily constitute a significant environmental impact as defined in 40 CFR 1508.27.

- **Air Quality:** Emissions cause an increase in pollutants over an area of at least a few tens of square kilometers that exceeds half the increase permitted under the Prevention of Significant Deterioration criteria or the National Ambient Air Quality Standards for nitrogen dioxide, sulfur dioxide, or particulate matter less than 10 microns in diameter; or exceeds half the increase permitted under the National Ambient Air Quality Standards for carbon monoxide or ozone.
- **Environmental Justice**: The significance threshold for Environmental Justice would be disproportionate, high adverse human health or environmental effects on minority or low-income populations. This threshold would be reached if one or more important subsistence resource becomes unavailable, undesirable for use, or available only in greatly reduced numbers for a period of 1-2 years; or chronic disruption of sociocultural systems occurs for a period of 2-5 years, with a tendency toward the displacement of existing social patterns. Tainting of subsistence foods from oil spills and contamination of subsistence foods from pollutants would contribute to potential adverse human health effects.

IV.A.2. Exploration, Development and Production, Timing of Activities, Transportation Assumptions, and Abandonment

IV.A.2.a. Assumed Resources

All hydrocarbon resources estimated to be produced as a result of proposed Lease Sales 186, 195, and 202 should be crude oil. The production of gas is not considered feasible at this time, because there is no gas-transportation system from the North Slope to outside markets (see Section IV.H). Available oil-resource estimates for the entire program area range between 1.68 billion barrels and 2.87 billion barrels when correlated to market prices of $18 and $30 per barrel (in 2000$). We assume that higher prices would be required to develop the more remote and/or difficult oil reservoirs. Resource estimates assumed to be discovered and developed for each of the proposed sales vary between 340 and 570 million barrels of oil, assuming market prices ranging between $18 and $30 per barrel (in 2000$). For purposes of analysis, the MMS has assumed that each sale would have the potential to produce 460 million barrels of oil over the lifetime of its field production.

An expanded discussion of the resource estimates of the proposed action is found in Sections II.A and II.B and Appendix B. Tables IV.A-1 through IV.A-4 show the levels of infrastructure and resources estimated for the proposed action. These assumptions may overestimate effects, because the MMS has held seven sales on the Beaufort Sea OCS and, to date, the only production is the relatively small amount from the Federal portion of the Northstar facility, which started producing October 31, 2001.

IV.A.2.b. Timing of Activities

The level of exploration- and development-related activities and the timing of events for the proposed action are shown on Tables IV.A-1 through IV.A-4 and in Appendix B. For purposes of analysis, we have created the following scenarios.

Sale 186 would be held in 2003. Exploratory drilling would begin in 2004 and continue until 2009, with delineation wells drilled through 2010. No more than two drilling rigs would operate at any time, with a total of six exploration and six delineation wells expected to be drilled over the 7-year exploration period. A maximum of two exploration platforms would be in service during any year, assuming one exploration rig per platform. If the first commercial discovery is made in 2005, 2 years after the sale date, production from Sale186 would begin by 2010. Between 2009 and 2014, three production platforms are expected to be installed. Two platforms would be in the Near Zone, and one would be in the Far Zone. Drilling production and injection wells would begin in 2009 and conclude in 2017, with a total of 102 wells drilled. Offshore pipeline construction would begin in 2009 and finish in 2015, with 40 miles of new offshore pipeline installed. The offshore pipeline would connect to existing onshore pipelines and, therefore, construction of new onshore pipelines would be minimal. Oil production from Sale 186 would end by 2033.

Sale 195 would be held in 2005. Exploratory drilling would begin in 2007 and continue until 2013, with delineation wells drilled through 2014. A maximum of two drilling rigs would operate at any time, with a total of six exploration and six delineation wells expected to be drilled over the 8-year exploration period. The first commercial discovery is assumed to be made in 2008, 3 years after the sale date, and production from Sale195 would begin by 2013. Between 2012 and 2017, two production platforms are assumed to be installed. One platform would be in the Near Zone, and one would be in the Midrange Zone. Drilling of production and injection wells would begin in 2012 and finish in 2019, with a total of 102 wells drilled. Offshore pipeline construction would begin in 2012 and finish in 2016, with 40 miles of new offshore pipeline installed. The offshore pipeline would connect to existing onshore pipelines and, therefore, construction of new onshore pipelines would be minimal. Oil production from Sale 195 would end by 2036.

Sale 202 would be held in 2007. Exploratory drilling would begin in 2010 and continue until 2018. Only one drilling rig would operate at any time, with a total of six exploration and five delineation wells assumed to be drilled over the 9-year exploration period. Only one exploration platform in the Far Zone with a single drill rig would be in service during any year. If a commercial discovery is made in 2012, 5 years after the sale date, production from Sale 202 would begin by 2019. Between 2018 and 2019, two production platforms are assumed to be installed. Drilling production and injection wells would begin in 2018 and finish in 2022, with a total of 102 wells drilled. Offshore pipeline construction would begin and finish in 2018, with 35 miles of new offshore pipeline installed. Oil production from Sale 202 would end by 2038.

Many of these estimates are based on a 45-day open-water season, which historically has been highly variable. Ice conditions, regulatory effects, and general weather patterns can either lengthen or shorten the estimated open-water season. In the Beaufort Sea, this season generally ranges from mid-August to early October.

IV.A.2.b(1) Activities Associated With Exploration Drilling

As noted, exploration activities could begin in 2004 and continue through 2018. Because of the short open-water drilling season in the Beaufort Sea, it is likely that a single drilling rig would drill a single well at any drilling site in any one year. However, in the event of a discovery, two delineation wells could be drilled by the same exploration rig in the same season. The type of units that might be used in exploration drilling would depend on water depth, sea-ice conditions, ice-resistance of the units, and availability of drilling units. Artificial ice islands grounded on the seabed and supported by ice roads constructed on landfast ice would be used in shallower water depths of 15-30 feet (5-10 meters). It is less likely that gravel islands would be constructed for exploratory drilling. Older artificial islands or natural shoals could be used as a base for temporary gravel or ice islands. Some leases could be drilled from existing gravel islands using extended-reach drilling. However, should the lease operators consider that a gravel island is necessary, it likely would be constructed in water depths less than 40 feet (12 meters); it could be built from barges in summer but likely would be built in winter. Gravel used to construct the island would be hauled over ice roads from onshore sources. About 60% of gravel is estimated to be needed for a production island in similar water depths. Personnel and material would be carried to and from the various shallow-water platforms over ice roads (in winter) and by boats and barges (in summer). In water 33-66 feet (10-20 meters) deep, movable platforms resting on the seafloor likely would be used for exploration. These platforms are designed to withstand winter ice forces, and drilling could be conducted year-round. In water deeper than 66 feet (20 meters), drillships or other types of floating platforms would be used. These floating systems can operate only in open-water and broken-ice conditions and not in midwinter pack-ice conditions. They would be supported by icebreakers and supply boats during the summer months and stored in protected inshore areas when not in use.

Based on geologic studies, the MMS assumes that exploration and delineation wells generally would test prospects from 3,000-15,000 feet (914-4,572 meters), and we assume a representative exploration-well depth of 7,000 feet (2,133 meters). At this depth, each exploratory or delineation well would require 425 short tons of drilling muds (dry weight) and produce approximately 525 short tons of dry rock cuttings. We assume that 80% of the drilling muds would be recycled, leaving 85 tons of "spent mud" to be discharged along with all the drill cuttings at the exploration site or disposed of onshore. We estimate 935-1,040 short tons (dry weight) of drilling muds and 5,775-6,300 short tons (dry weight) of bore cuttings would need to be disposed for the exploration and delineation activities for each sale. The lower figure is estimated for Sale 202 and higher number for Sales 186 and 195. These materials would be disposed of primarily at the drill site under conditions prescribed by the Environmental Protection Agency's National Pollution Discharge Elimination System (Clean Water Act of 1977, as amended [33 U.S.C. 1251 et seq.).

On completion of the exploration-drilling program the operator, depending on the type of platform used, may do the following: allow the ice island to melt, remove the protective berm from the gravel island and allow it to disperse from wave action, or mine the gravel island for other construction projects. Should economically recoverable oil resources be discovered, the gravel island could be enhanced for production activities. At the end of the exploration phase, a deepwater steel and/or concrete exploration platform would be either floated out and used in another field or be reinforced and used as a production platform should that be required.

IV.A.2.b(1)(a) Seismic-Survey Activity

Before exploration and production activities, the MMS requires the lessee/operator to conduct surveys to define any shallow hazards or archaeological resources that may be present. If geological/geophysical evidence shows that specific lease blocks might have the potential for archaeological resources, either prehistoric or historic, a site clearance is required. These surveys usually incorporate seismic profiling. The projected level of seismic activity varies by the number of wells that may be drilled. Site-specific surveys of the exploration- and delineation-well sites would be conducted during the ice-free seasons of the years of the exploratory phase. We estimate each survey would cover roughly six OCS blocks (9 square miles or 23 square kilometers) for each exploration well. For Sales 186, 195, and 202, the total area covered by these surveys would equal 54 square miles (approximately 138 square kilometers). The average time needed to survey each site should range between 2 and 5 days, allowing for down time for bad weather and equipment failure. Other factors affecting seismic surveys are climate, oceanography, and geology.

IV.A.2.b(1)(b) Support and Logistic Activities

Offshore exploration-drilling operations in the Beaufort Sea multiple-sale area would require onshore support facilities. Where possible, existing facilities within the Prudhoe Bay or Kuparuk unit areas would be used or upgraded. These onshore facilities would have to provide the following:

- a staging area for construction equipment, drilling equipment, and supplies;
- a transfer point for drilling and construction personnel;
- a harbor to serve as a base for vessels required to support offshore operations; and
- an airfield for fixed-wing aircraft and helicopters.

Existing systems would be used to transport equipment, material, supplies, and personnel. The descriptions of North Slope transportation systems as contained in Section III.C of the Northeast National Petroleum Reserve-Alaska final EIS (USDOI, Bureau of Land Management and MMS, 1998) and Sections 3.2 and 3.3 of the Beaufort Sea Oil and Gas Development/Northstar Project, final EIS, (U.S. Army Corps of Engineers, 1999) are incorporated by reference and updated where appropriate.

Existing surface-transportation routes, including both pipelines and roads, traverse about a quarter of the North Slope. They extend from the Endicott field facilities located on the Beaufort Sea coast to just west of the Kuparuk field. Gravel roads, which parallel existing pipelines, connect existing oil-production facilities between the Kuparuk and Endicott fields. One gravel road, east of the Colville River, connects the main Alpine pad with its airstrip. Most exploration activities are supported by ice roads that must be reconstructed each year. The Prudhoe-Kuparuk region is linked to interior Alaska by the Dalton Highway. The majority of the vehicles traveling the Dalton Highway are commercial freight vehicles associated with oil-field activities, although privately owned vehicles and commercial-tour operators also travel the Dalton Highway. Summer-traffic levels for the Dalton (June-August) are substantially higher than traffic levels for the rest of the year.

Air transportation is the primary means of passenger travel to the North Slope Borough and Prudhoe Bay/Kuparuk area. All public airstrips, except those at Barrow and Deadhorse, are gravel. The North Slope Borough continually upgrades local roads and airports. A private airfield capable of handling jet aircraft also is located at the Kuparuk Unit base camp.

Barges transport most heavy and bulky cargo to the North Slope Borough. Prudhoe Bay has barge-docking facilities at both the East Dock and the West Dock; however, the West Dock facility is larger and more active. Crowley Maritime operates several heavy-lift cranes, barges, and barge docks in addition to support vessels from the West Dock. Oliktok Dock was constructed in 1982 to expedite shipping to the Kuparuk Field. Barge traffic in support of continued development on the North Slope of Alaska typically has, over time, ranged from 10-15 barges per year. During the initial development of the Prudhoe Bay Unit in 1970, 48 barges were used; however, newer barges are larger and more efficient and would sharply reduce that number. Barges supporting exploration activities would travel directly to the drill site to offload any cargo. Typically, a mobile drilling platform used for exploration drilling would enter its area of operation fully supplied for the drilling season.

The number of required support vessels for each bottom-founded drilling unit would depend, at least in part, on the type and characteristics of the unit and the sea-ice conditions. If drilling operations occur during the open-water season, the MMS requires an emergency-standby vessel within the immediate vicinity (5 miles or a 20-minute steaming distance, whichever is less) of the drilling unit to ensure emergency evacuation of personnel. This vessel also could assist in deploying the oil boom in the event of an oil spill. If operations are planned during broken-ice conditions, two or more icebreaking vessels may be required to perform ice-management tasks for the floating units. One to two potential drilling units might be operating during the open-water period.

During the open-water season (again, assuming a 45-day season), a supply boat would make one trip per rig per week. We estimate the total number of supply boat trips per open-water season could be as high as 14 for Sales 186 and 195 and 7 for Sale 202. The level of support-boat traffic would vary by distance from shore and/or support base and whether the facility can be supported by vehicles using ice roads in the winter.

The estimated numbers of vessel, helicopter, or vehicle trips are calculated as round trips. Estimates of vehicle trips do not include operations that may be necessary for rig demobilization or for emergencies.

Ice roads are assumed to be the principal route for transporting routine supplies and materials to ice islands and/or nearshore gravel islands. For drilling platforms farther offshore in the broken-ice zone, material and supplies would be transported by support/supply boats (with icebreaking capacity, if necessary) during the open-water season and by helicopter at all other times. For both types of drilling structures, it is probable that most personnel would be transported by helicopters. The number of helicopter trips flown in support of exploration- and delineation-well drilling is assumed to range from about 90-270 each year, depending on the number of wells (1-3) that are drilled. For each drilling operation, we assume there would be one flight per day of drilling. The time required to drill and test a well is about 90 days. For Sales 186, 195, and 202, the annual number of helicopter trips to the drill sites should average between 140 and 155.

If exploratory drilling occurs in water close to existing infrastructure and within driving distance of an existing airstrip, operators may choose to transport crews by ice road when reasonable, especially during periods of inclement weather.

IV.A.2.b(2) Activities Associated with Development and Production

Assumptions associated with development and production strategies are highly speculative. This scenario is characteristic of the type of development that could accompany production. Work on offshore and onshore production and transportation facilities would not begin until the engineering and economic assessments of the potential reservoirs was completed and the conditions of all the permits were evaluated. As noted in Section IV.A.2.b, delineation wells are assumed in 2006 for Sale 186, 2009 for Sale 195, and 2013 for Sale 202. Production is assumed to begin in 2010, 2013, and 2019, respectively. Production for

Sale 186 would peak in 2019 and end in 2033; for Sale 195, it would peak in 2018 and end in 2036; and for Sale 202, production would peak at 38.6 million barrels annually between 2020 and 2024 and end in 2038.

IV.A.2.b(2)(a) Seismic-Survey Activity

A three-dimensional, multichannel, prospect-defining, seismic-reflection survey would be conducted for each of the production platforms. The survey would cover approximately 35 square miles (92 square kilometers) for each production platform. The platform sites might be surveyed several years before the installation of the platform; surveys would be conducted during open-water, ice-free periods. High-resolution seismic-reflection data for shallow hazards would be collected before laying the offshore pipeline. The total trackline distance, estimated to be four times the length of the offshore trunk pipelines assumed for each sales scenario, would equal approximately 160 miles each for Sales 186 and 195 and 140 miles for Sale 202. Seismic activities and assumptions for development are similar to those described for exploration activities (see Section IV.A.2.b(1)(a)).

IV.A.2.b(2)(b) Production Platforms and Production Drilling

Assumed hydrocarbon production and development information is given in Tables IV.A-1, IV.A-2, and IV.A-3, should commercial discoveries result from the above exploration activities. For Sales 186 and 195, we assume 69 production wells and 33 injection wells would be drilled from three production platforms. For Sale 202, 68 production wells and 34 injection wells would be drilled from two platforms. Drilling of each production and service well would require 650 short tons (dry weight) of drilling mud per well and 825 tons of rock cuttings. We assume that 80% of the mud is recycled and 130 tons per well be disposed of in the subsurface by service/injection wells on the production platform. The disposal of muds and cuttings and any produced water would be in accordance with approved National Pollution Discharge Elimination System permits for development-well drilling. The amount of disposed drilling muds would be about 13,300 tons for all wells drilled for each sale. The total amount of disposed cuttings for each sale would amount to 84,000 short tons (dry weight). These calculations are based on a production well with a representative depth of 10,000 feet (3,050 meters).

Depending on the water depth, seafloor conditions, ice conditions, and size of the reservoir, several types of platforms could be used. In water depths less than or equal to 30 feet (10 meters), artificial (gravel) and or caisson-retained islands may be used as production platforms. For water depths between 30 and 100 feet (10 and 30 meters), bottom-founded structures designed with ice-management systems are likely. Icebreaking support ships may be required onsite. For waters deeper than 100 feet (30 meters), a combination of extended-reach wells and/or subsea well tied back to the main production platform in shallower water is most likely.

A variety of steel and concrete structures of various designs can be built and used for a production platform that resists seawater, ice, and freeze-thaw cycles and operates safely in low-temperature, offshore environments such as the Beaufort Sea. Bottom-founded production platforms would be constructed and outfitted in ice-free harbors and moved to the production site. Modular units would be transported during the open-water season and assembled and installed in less than 45 days. In addition to the vessels (8-10 tugboats) used to tow the platform components to the site, installation also might require a large-capacity derrick barge and a vessel to accommodate the workers. Each platform could use two rigs to maximize development drilling and shorten startup times.

Gravel needs and transportation requirements for island construction would vary according to water depths. The BPXA proposal for the Liberty Project, estimated 800,000 cubic yards of gravel would be needed to construct a production Island in 22 feet (7 meters) of water (USDOI, MMS, Alaska OCS Region, 2002a). For Northstar Island, an estimated 700,000-800,000 cubic yards of gravel was hauled to the site of a relic exploration island. At the former exploration island site, about 400-500,000 cubic yards of gravel remained. Consequently, Northstar Island, which lies in 39 feet of water (12 meters), required approximately 1.2 million cubic yards of gravel. For both islands, construction material was carried on ice roads, with needed additional gravel excavated from onshore sites (U.S. Army Corps of Engineers, 1999).

At the end of production and the abandonment of the production platform, the following might occur. The gravel island's protective concrete or sandbag berm would be removed and allowed to disperse from wave action. The island's gravel resources may be removed and used for other construction projects. A far-offshore steel-production platform could be floated out and scrapped, or the structure could be sunk and allowed to become an artificial reef. This last option has proved effective in enhancing fish and benthic habitat offshore in the Gulf of Mexico. In all cases, the pipelines would be flushed and any remaining oil removed.

IV.A.2.b(2)(c) Support and Logistics Activities

For this scenario, it is assumed that the infrastructure at Prudhoe Bay would provide the major support for construction and operation activities associated with the development, production, and transportation of crude oil. However, as the development of the proposed sale area progresses into tracts farther from Prudhoe Bay and/or into deeper waters, new shore-base locations may be required. One new shore base is assumed for the development of Sale 202 resources (see Table IV.A-3) and is assumed to be located at Point Thomson in the west or Smith Bay in the east. It could be located anywhere in the eastern or western Beaufort Sea.

Support and logistics operations after discovery can be divided broadly into three phases: construction, development drilling, and production. Transportation needs for each project are initially and briefly intense and then decline over time. For the now-deferred Liberty Project, forecast construction-phase transport requirements for helicopter round trips ranged from 10-20 flights per day during the construction phase to 3-7 trips per week during the operation/production phase. Marine-support trips to the Northstar structures during the construction phase were estimated at 125-150 trips during the open-water season. This figure also includes sealift barges. Marine transport estimates declined to 4-6 trips per season during the operations/production phase. For surface transport during the construction phase, estimates for Northstar and Liberty were roughly 36,000 round trips (400 per day), assuming a 90-day season. Surface transport estimates are expected to decline to 100-200 per season during the operations/production phase.

As construction/development operations move farther from existing infrastructure and into deeper water, beyond the landfast-ice zone, the burden of transport would shift increasingly to helicopter and, more importantly, marine transport. Personnel, perishable goods, and emergency material would be transported by helicopter during all but the open-water season. During the construction phase, dredges would prepare the seafloor for bottom-founded structures; any fill or gravel required would be barged to site from shore or dredged from offshore sites. The open-water season would be the focus of activity as barges from outside the sale area and local support vessels fulfill the platforms' yearly construction and operating requirements. Icebreaking vessels would be on standby to extend the open-water season and to support ships in case of emergency activities.

Marine transport requirements during construction for far/deepwater facilities most likely would range between 150 and 250 vessel trips during the open-water season. This number would include barges carrying construction supplies from outside ports, dredges, survey vessels, pipelaying barges, and local support vessels. Should subsea completions be used to produce deepwater finds, gathering lines would transport production to platforms that could be located in shallower waters. In this event, air and marine transport requirements would be reduced. During the period of developmental drilling (8 years for Sale 186, 7 years for Sale 195, and 5 years for Sale 202), helicopter trips for far/deepwater platforms would range from 7-14 per week per platform. During the production phase, average weekly helicopter operations could range between 3 and 7 trips per platform.

Table IV.A-4 summarizes the exploration, development, production, and transportation assumptions for all Alternatives for each of the three sales. Transportation information presented in this table is based on the assumption that all three production platforms constructed as a result of Sale 186 would be in the shallow-water landfast-ice zone; that one of the three production platforms assumed for Sale 195 would be in the shallow-water zone and the other two would be in the Midrange or Far Zone; and that both production platforms for Sale 202 would be beyond the landfast-ice zone and located in the Midrange or Far Zone.

IV.A.2.b(3) Activities Associated with Oil Transportation

IV.A.2.b(3)(a) Pipelines

For Sales 186 and 195, installation of offshore pipelines between production platforms and onshore facilities would take 1-2 years. Trenching and pipeline laying would take place during the relatively short open-water season or during mid- to late winter, when the landfast ice has stabilized. New onshore-pipeline sections would take 1-2 years to complete, with construction activities taking place simultaneously with the offshore-pipeline installation. For Sale 202, installation of offshore pipelines between production platforms and onshore facilities would take 2-4 years, considering that route surveys, trenching, and pipeline laying would take place in the relatively short open-water season. New onshore pipeline sections would take 2-4 years to complete, with construction activities taking place simultaneously with the offshore pipeline installation. We assume that for all sales, offshore pipelines would be trenched as a protective measure against damage by ice in all water depths less than 165 feet (50 meters). At coastal landfalls, pipelines would be elevated on short gravel causeways to protect them against shoreline-erosion. Booster stations at the landfalls would be required to maintain pressure in the long pipeline segments. Onshore, pipelines would be elevated on vertical support members. The onshore pipeline and shore facility would be constructed simultaneously with the installation of the offshore platforms.

For economic and logistical reasons, future offshore developments would attempt to use the existing onshore infrastructure (processing facilities and pipeline networks) whenever possible. This would be especially true for Sale 186, given the sale's assumed small field sizes. Produced oil would be gathered by existing pipeline systems within the Prudhoe Bay/Kuparuk field areas and transported to Pump Station 1 of the Trans-Alaska Pipeline System. Landfalls are assumed at Oliktok Point (using the Kuparuk field infrastructure), Northstar pipeline landfall, West Dock area (using the Prudhoe Bay infrastructure), and the Badami field. For Sale 195, we assume that new offshore projects would tie into existing onshore pipeline-gathering systems at the nearest possible points. Produced oil would be gathered by existing pipeline systems to Pump Station 1 of the Trans-Alaska Pipeline. We assume that landfalls would be Oliktok Point, Northstar pipeline, West Dock, and Bullen Point (a new facility to support development in the Point Thompson unit). Because Sale 202 may feature projects that are developed in remote locations, new onshore pipelines would be required to reach the existing North Slope gathering system connecting to Pump Station No. 1 of the Trans-Alaska Pipeline. Depending on the location of the field, a new landfall would be constructed in Smith Bay (discovery in the western Beaufort) and traverse south of Teshekpuk Lake through the National Petroleum Reserve-Alaska to the Kuparuk field infrastructure, a distance of approximately 50 miles (80 kilometers). Existing field infrastructure in the central Beaufort (Oliktok, Northstar, Endicott, Badami) could be used for oil production from deepwater areas offshore from the central Beaufort coastline. If the new field is found in the eastern Beaufort, a new landfall and facility expansion in the Point Thomson area would be constructed. The pipeline would pass along the coast and join the Badami pipeline, a distance of approximately 12 miles (19 kilometers). As only one new, remote field is expected, there would be only one landfall and one new processing facility.

IV.B.2.b(3)(b) Tankers

Crude oil produced from Sales 186, 195, and 202 leases would be transported by pipeline to the oil terminal at Valdez, where it would be commingled with crude produced from other North Slope sources. Once at Valdez, the oil would be loaded into tankers for transport primarily to the U.S. West Coast, with smaller quantities traveling to the Kenai Peninsula, Hawaii, the Gulf of Mexico, the Far East, or refineries in the Virgin Islands. Tankers loaded with oil produced from Sale 186 are expected to depart Valdez during 2010. Sale 195 tanker departure should begin sometime in 2013, and Sale 202 departures should begin at some point during 2019. Valdez tanker-transport traffic generated by the Proposal is approximated in Table IV.A-4. Assuming the use of 100,000 deadweight-ton tankers, we estimate that at the peak of production, Sales 186, 195, and 202 would generate 63 tanker loadings and departures in 2016, 56 in 2018, and 55 in 2020-2024, respectively.

IV.A.3. Disturbance Effects

Activities such as oil and gas exploration, development, and production could disturb the ecosystems in which they are taking place. Unlike oil spills, which are probabilistic in nature and unlikely to occur, disturbances are likely to occur if there are any postsale activities. In general, disturbance effects would result from industrial activities, noise, and habitat alteration.

IV.A.3.a. Disturbance Caused by Industrial Activities

If a lease sale occurs and exploration and/or development occur, the industrial activities associated with oil and gas exploration and development would generate disturbances to the environment. These disturbances would occur from both exploration and, if an economic field is discovered, development and production activities. Exploration disturbances include seismic activities (Section IV.A.2.b(1)(a)) and support and logistic activities (Section IV.A.2.b(1)(b)). If exploration is successful, disturbances would occur from seismic activity (Section IV.A.2.b(2)(a)), production platform and production drilling activities (Section IV.A.2.b(2)(b)), support and logistic activity (Section IV.A.2.b(2)(c)), and oil-transportation operations, in both construction and operation phases (Section IV.A.2.b(3)).

Some of the disturbances, such as exploration and construction of production and transportation facilities would occur primarily during the winter and would be completed in one or two winter seasons. Once construction is completed, disturbances from the operation of the production facilities would occur over a 15-20 year period and would occur year-round. The analyses in Section IV.C describe and evaluate the effects of disturbances first.

Some of the aforementioned disturbances generate noise (seismic and drilling activities), habitat alterations (construction of islands and pipelines), and discharges to both the air and water.

IV.A.3.b. Disturbance Caused By Noise

Noise generated by industrial activities can come from a variety of sources, such as transportation, general machinery use, construction, gravel mining, pile drivers, seismic surveys, and human activity. Noise, whether carried through the air or under water, may cause some species to alter their feeding routines, movement, and reproductive cycles. Most specifically, concerns about noise have been raised regarding marine and terrestrial mammals, marine birds, and related subsistence activities. See Section IV.C for a discussion of the effects of noise on resources in the multiple-sale area.

IV.A.3.c. Disturbance Caused By Habitat Alteration

Habitat alteration can be viewed as a change or changes in the environment in which plants, animals, and humans exist. Habitat alteration can be caused by construction, new types of infrastructure, alteration of stream flow, influx of different cultural groups, an increase in available jobs, oil spills, etc. All of the resources discussed in this EIS would be affected through habitat alteration. An alteration to the habitat of the bowhead whale, marine mammals, and birds could significantly alter the cultural resources and quality of life of the Inupiat people. See Section IV.C for a discussion of habitat alteration on resources in the multiple-sale area.

IV.A.3.d. Discharges to the Marine Environment

Should there be a discovery and development of oil resources for Sales 186, 195, and/or 202, the related construction of infrastructure locally would disturb the water quality of some of the affected area. Constructing gravel islands, building on- and offshore ice roads, trenching for pipelines, and other activities would create and require mining of onshore (and possible offshore) gravel deposits. Increased sedimentation, the removal of gravel, the use of freshwater to create onshore ice roads, and changes in stream flow due to gravel removal or new road and pad locations could have effects on some benthic and fish populations. See Section IV.C.1 for a discussion of discharges to water quality and possible disturbance to the rivers and lakes.

IV.A.3.e. Discharges to the Air

Effects on air quality would come from industrial emissions related to vessel traffic, construction machinery, compressors, generators, and various types of engines. Other effects on air quality would come from evaporation of spilled oil into the atmosphere or in situ burning of hydrocarbons, in the unlikely event of an oil spill. See Section IV.C.15 for a discussion of disturbance to air quality.

IV.A.4. Oil Spills

A major concern we heard during scoping was the potential effects of oil spills. The EIS oil-spill analysis considers three spill-size categories: (1) large spills, those greater than or equal to 1,000 barrels; (2) small spills, those less than 1,000 barrels; and (3) very large spills, those greater than or equal to 150,000 barrels. The oil-spill-trajectory model addresses the movement of spills greater than or equal to 1,000 barrels. The oil-spill-trajectory model results are appropriate only for "large" spills greater than or equal to 1,000 barrels. Small spills are analyzed without the use of the oil-spill-trajectory model.

IV.A.4.a. Large Oil Spills

We define large oil spills as greater than or equal to 1,000 barrels. This introduction summarizes the assumptions we use to analyze large oil spills for each alternative. The section locations for the analysis of small and very large spills are shown under IV.A.4.c - Locations of Oil-Spill Analyses.

The assumptions about large oil spills are a mixture of project-specific information, modeling results, statistical analysis, and professional judgment. For details on any of these points, please read Appendix A. We believe this is the basis for understanding the discussions about the effects of large oil spills on resources of concern in Section IV.C.

We estimate that a large spill is unlikely to occur based on a mean spill number ranging from 0.08-0.11 for Alternative I for Sales 186, 195 and 202 and their alternatives. For purposes of analysis, we assume one large spill occurs anywhere from Alternative I for Sales 186, 195, and 202 or their alternatives. This "what if" analysis of oil spills addresses whether such spills could cause serious environmental impact.

The analysis of a large spill represents the range of effects that might occur from a range of likely offshore or onshore spill sizes from the Alternative I for Sales 186, 195, and 202 or their alternatives. Table IV.A-5 shows the large spill sizes we assume for purposes of analysis range from 1,500-4,600 barrels for crude and diesel oil. The spills are broken out as follows:

Crude oil

- production facility (includes storage tanks), 1,500 barrels
- offshore pipeline, 4,600 barrels

For further information on how we derive the information in Table IV.A-5, please read Appendix A.

In terms of timing, a large spill from the Alternative I for Sales 186, 195, and 202 or their alternatives could happen at any time during the year. We assume that the production facility would not retain any oil. We assume that, depending on the time of year, a spill reaches the following environments:

- production facility and then the water or ice
- open water
- broken ice
- on top of or under solid ice
- shoreline
- tundra or snow

The analysis of a large spill examines the weathering of the assumed spills. We assume the oil will be similar to Alaska North Slope crude oil. The spill sizes are 1,500 and 4,600 barrels. We simulate two general scenarios, one in which the oil spills into open water and one in which the oil freezes into the ice and melts out into 50% ice cover. We assume open water is July through September, and a winter spill melts out in July. For open water, we model the weathering of the 1,500- and 4,200-barrel spills as if they are instantaneous spills. For the meltout spill scenario, we model the entire spill volume as an instantaneous spill. Although different amounts of oil could melt out at different times, the MMS took the conservative approach, which was to assume all the oil was released at the same time. We report the results at the end of 1, 3, 10, and 30 days.

In our analysis, we assume the following fate of the crude oil without cleanup. Tables IV.A-6a and IV.A-6b summarize the results we assume for the fate and behavior of Alaska North Slope crude oil and diesel oil in our analysis of the effects of oil on environmental and social resources. After 30 days in open water or broken ice:

- 27-29% evaporates,
- 4-32% disperses, and
- 28-65% remains.

After 30 days under landfast ice:

- nearly 100% of the oil remains in place and unweathered.

We base the analysis of effects from large oil spills on the following assumptions:

- One large spill occurs.
- The spill size is one of the sizes we show in Table IV.A-5.
- All the oil reaches the environment; the production facility absorbs no oil.
- The spill starts at the production facility or along the offshore pipeline.
- There is no cleanup or containment.
- The spill could occur at any time of the year.
- The spill weathering is as we show in Tables IV.A-6a and b.
- A spill under the landfast ice from the production facility or its pipeline does not move significantly until the ice breaks up (Appendix A).
- The spill area varies over time as we show in Tables IV.A-6a and b and is calculated from Ford (1985).
- The time and chance of contact from an oil spill are calculated from an oil-spill-trajectory model (Appendix A, Tables A.2-1 through A.2-54).
- The chance of contact is analyzed from the location where it is highest when determining effects.
- The overall chance of an oil spill occurring and contacting is calculated from an oil-spill-risk analysis model (Appendix A. Tables A.2-55 through A.2-72).

IV.A.4.a(1) The Chance of a Large Spill Occurring

After we analyze the effects of a large oil spill, we consider the chance of a large oil spill occurring. Even though the chance of one or more spills occurring and entering offshore waters is low (8-10%), we analyze the consequences of an oil spill because it is a significant concern to all stakeholders. The MMS uses the term “low” to characterize the relative chance of a large spill occurring, and it is based on our familiarity with oil-spill rates and sizes. We recognize that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. For some stakeholders, a 10% chance of a large spill over the life of the field may be high. For purposes of analysis, we use the term “low” to mean on the order of 8-10% over the life of the Alternative I for Sales 186, 195 and 202 or their alternatives.

IV.A.4.a(2) The Chance of a Large Spill Occurring and Contacting Resources of Concern

We also estimate the chance of one or more large spills occurring and contacting resources of concern over the lifetime of the project. After 30 days, the chance of one or more large spills occurring and contacting environmental resource areas, land segments, or boundary segments ranges from less than 0.5-2%.

IV.A.4.b. Small Spills

Small spills, though accidental, generally are routine and expected. We estimate small spills are likely to occur based on a mean spill number ranging from 299-387 for Alternative I for Sales 186, 195, and 202 and their alternatives. Most small spills occur into containment and do not reach the environment. The analysis of onshore Alaska North Slope crude oil spills is performed collectively for all facilities, pipelines, and flowlines. For purposes of analysis, this EIS assumes an average crude oil-spill size of 3 barrels (State of Alaska, Dept. of Environmental Conservation, 2001). Following is the estimated number and volume of small crude oil spills:

Alternative	Estimated Number of Spills	Estimated Total Spill Volume (barrels)
I	82	246
II	0	0
III	81	243
IV	78	234
V	80	240
VI	79	237

The causes of onshore Alaska North Slope crude oil spills, in decreasing order of occurrence by frequency, are leaks, faulty valve/gauges, vent discharges, faulty connections, ruptured lines, seal failures, human error, and explosions. The cause of approximately 30% of the spills is unknown (State of Alaska, Dept. of Environmental Conservation, 2001).

The typical refined products spilled are aviation fuel, diesel fuel, engine lube, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil (State of Alaska, Dept. of Environmental Conservation, 2001). Diesel spills are 58% of refined oil spills by frequency and 83% by volume. Engine-lube oil spills are 10% by frequency and 3% by volume. Hydraulic oil is 26% by frequency and 10% by volume. All other categories are less than 1% by frequency and volume. For purposes of analysis, this EIS assumes an average refined-spill size of 0.7 barrels. Following is the estimated number and volume of refined spills:

Alternative	Estimated Number of Spills	Estimated Total Spill Volume (barrels)
I	202	141
II	0	0
III	201	141
IV	192	134
V	197	138
VI	197	138

IV.A.4.c. Locations of Oil-Spill Analyses

Following are section locations for the analysis of oil spills and their effects throughout this document:

- Section IV.B - Alternative II, No Lease Sale assumes no spill occurs, because no action occurs.
- Sections IV.C - Analysis of the effects of large and small oil spills from the Alternative I for Sales 186, 195, and 202 and their alternatives.
- Section IV.I - Analysis of the effects of very low probability, very large oil spills.
- Appendix A - supporting documentation for the assumptions we use in the oil-spill analysis in this EIS.

For more information on the analysis of oil spills, see Appendix A of this EIS and Johnson et al. (2002*) Oil Spill Risk Analysis: Beaufort Multisale.*

IV.A.5. Spill Prevention and Response

Each permittee operating offshore in the Beaufort Sea is required to have an Oil-Spill-Response Plan with trained personnel and cleanup equipment and supplies at each activity site to meet Federal and State regulations. An activity site would be the exploration site, drilling site, or production site, each with its ancillary facilities. Federal regulations governing these operations for the MMS are found in 30 CFR 250.300 and 254, respectively. These regulations deal with the prevention and control of oil spills and releases. Regulations 40 CFR 110, 112, and 300 deal with responses to spills or releases of oil and gas. Spill-response requirements would be thoroughly addressed when and if parcels are leased. For example, an Application for Permit to Drill would be evaluated for spill response regarding blowout-prevention equipment required and for the size of the containment and recovery equipment in relation to the potential blowout volume. These conditions are all very site specific. State regulations that may apply are covered in 18 AAC 75 and are administered by the Alaska Department of Environmental Conservation.

Leak detection of chronic small leaks over an extended period of time from buried subsea pipelines under the ice has been a concern. One of the requirements placed on the approval of the Northstar pipeline was the requirement to develop a prototype leak-detection system to be used in addition to the two proposed state-of-the-art systems. BPXA met this requirement by installing a German leak detection system, Leck Erkennurgs Ortungs Sytems (LEOS), which was developed 20 years ago for a pipeline project in Bavaria, Germany (*Oil and Gas Journal*, 2002). As stated in the article, the LEOS system detects a leak by collecting vapor through a liquid impermeable acetate layer within a perforated tube. The system is tested every 24 hours, and the sensitivity of the system depends on the type of the hydrocarbon being detected, proximity to the leak and, to a lesser extent, on the type of soil surrounding the sensor tube. The LEOS system was installed as part of the bundled-pipeline systems for the Northstar Project. Prior to transporting oil through the pipeline, the LEOS system was checked to ensure it was functioning properly (*Oil and Gas Journal*, 2002). As noted in the article, “After a year of operation the LEOS systems has been field calibrated to account for increasing background methane due to soil warming” (*Oil and Gas Journal*, 2002). The ability to detect hydrogen from all the anodes demonstrates the system is working. The article notes the leak-detection thresholds for fluids is less than 1 liter per hour and less than 1 cubic meter per hour for gas. This type of technology will help prevent large undetected oil spills from small chronic leaks under the ice.

The response plan includes response action plans, identifies worst-case spill volumes, provides a list of contacts for State and Federal agencies that require notification in the event of a spill, identifies oil-spill-response organizations that provide response support in the event of a spill, other private companies that can be called on for further information or assistance, and inventories of spill-response equipment. The environmental obligations of operators on a Federal offshore lease are described in MMS regulations contained in 30 CFR 254, *Oil Spill Response Requirements for Facilities Located Seaward of the Coast Line*.

By congressional action, the MMS is delegated the authority to ensure that wells drilled on Federal offshore lands are done so in a controlled manner. The MMS has the authority to cite the operator and bring civil and/or criminal charges to bear for failure to comply with Federal regulations. If there is a spill or release of petroleum fluids or chemicals used in the petroleum industry on the lease, unit, or participating area, the MMS has the authority to cite the operator. Cleanup of the site will occur under the direction of the Federal and State On-Scene Coordinators. The Federal On-Scene Coordinator is the U.S. Coast Guard for coastal zone spills, the U.S. Environmental Protection Agency for land-based spills. The State of Alaska, Department of Environmental Conservation is the State On-Scene Coordinator for spills impacting State lands and waters.

The MMS requires that oil spills greater than 1 barrel be reported to their authorized officer within 24 hours of the event. The MMS monitors the work of the lessee or operator to ensure that all personnel and equipment cited in the spill plan are available for response efforts and spills are appropriately cleaned up in accordance with all applicable laws and regulations.

In Alaska, the *Unified Plan for Preparedness to Oil Discharges and Hazardous Substance Release* developed by the Environmental Protection Agency and U.S. Coast Guard with the Alaska Department of Environmental Conservation identifies the governmental response network within the State of Alaska. The

Unified Plan is further augmented with regional subarea contingency plans that are specific to the areas of operation, such as the North Slope. The plans identify response resources located within the area and identify environmentally sensitive areas in the geographic region. The Department of the Interior is a member of the Alaska Regional Response Team and has adopted the Unified Plan. The intent of the applicable laws and regulations is to prevent, as much as possible, hazardous materials and oil from entering the water and to ensure the rapid removal of these substances from areas where there is a danger of contaminating water. The Federal and State On-Scene Coordinators monitor and document the operator's actions and determine when the cleanup is satisfactory, in coordination with the surface-land managers. On average, spill-response efforts result in recovery of approximately 10-20% of the oil released to the ocean environment.

Where a spill occurs determines how much of the spill will be recovered. For the 3-barrel crude oil spills that contact land or solid ice, the cleanup rate can be nearly 100%. Free product can be removed with skimmers and sorbent materials, and any contaminated soil or ice can be excavated and removed from the environment for disposal. For the same small spills contacting open water, recovery rates drop to about 10-20%. To effectively remove a spilled product from the ocean surface, the responder must be able to use boomers or ice to concentrate enough of the spilled material to allow for recovery. Small spills are difficult to concentrate in sufficient quantity for efficient skimmer collection

Again, effective recovery of small refined-product spills (0.7 barrel) depends on where the spill occurs. Spills occurring on land or solid ice will be cleaned up almost completely. The spills can be wiped or skimmed up and contaminated soil or ice excavated and disposed of properly. These same spills occurring in an open-water environment most likely would not be cleaned up. Because of their small size, it would be extremely difficult to collect a sufficient concentration of the spill to permit recovery by skimmers or sorbent materials.

IV.A.6. Constraints and Technology

IV.A.6.a. Spill Response, Containment, and Collection Equipment

Offshore operators in the Beaufort Sea currently maintain spill response, containment, and collection equipment to respond to releases the entire year. During winter solid-ice conditions, land-based spill-response tactics and equipment are used. The North Slope operators maintain sufficient equipment such as bulldozers, dump trucks, front-end loaders, snow blowers, trenching equipment, ditch witches, pumps, and skimmers to mount a response on top of the ice and under it (see Alaska Clean Seas tactics R-1 -R-31 [Alaska Clean Seas, 1998]). During the transitional periods of spring broken ice, fall freezeup, and open water, water-based response tactics and equipment are used as conditions allow. North Slope operators, through Alaska Clean Seas, maintain an ice-strengthened barge, an oil-storage barge, Point Class tugs to maneuver the barges, and numerous smaller response boats to mount a response effort in the varying ocean conditions.

In 2000, Alaska Clean Seas conducted a series of trials of the R-19A barge-based response tactic in spring broken ice-conditions and again in fall during freezeup conditions. The R-19A tactic involves using a response barge as a collection platform with smaller skimming systems deployed on either side of the barge during broken-ice conditions. These trials were key in establishing realistic operating conditions for all the components of the R-19A tactic, to include the barge, tugs, containment boom, skimmers, towboats, mini-barges and other workboats required to collect oil from the ocean surface. These demonstrations set an effective level of about 30% ice coverage of the ocean surface before the skimming system became ineffective because of ice intrusion into the boom.

During fall freezeup conditions, once ice crystals were present in the water, the R-19A skimming system was effectively shut down. The containment boom served to concentrate the ice crystals into a large mass that surrounded the skimming devices and choked them off from any oil that would be present in a spill. To get any flow of "oil" into the skimmer, the operator had to drastically increase the amount of water taken into the skimmer. Recovering more water relative to oil increases the amount of on-water storage and the number of decants that must be conducted to pump the water out of the storage barges once it has separated from the oil.

It should be noted that these trials were of one tactic. During the trials it was noted that the small-vessel skimming systems were more efficient in maneuvering in and around ice with fewer effects on the system. The North Slope operators are revising their response tactics to capitalize on this observation and incorporating tactics used by spill responders in Cook Inlet. In the Cook Inlet, spill responders also contest with broken ice mixed with swift currents and drastic tides. Cook Inlet responders effectively use free-skimming techniques with both barges and small vessels to access oil on or among the icefloes. Free skimming is conducted without a containment boom, and the response team relies on the ice to contain and concentrate oil to a sufficient thickness for recovery.

IV.A.6.b. In Situ Burning

Other response tactics not tested during the 2000 trials include in situ burning of oil and allowing oil to freeze in place for removal once ice conditions can support heavy equipment. In situ burning involves burning oil on whatever surface it is on–ice, water, or soil. The burning can remove in excess of 90% of oil from the aquatic environment. The residual material is then collected from the ocean surface and returned to the shore for appropriate disposal. Preapproval for in situ burning has been granted for the marine environment by the MMS. The Federal On-Scene Coordinator will make the decision, in coordination with the State On-Scene Coordinator, on whether to initiate an in situ burn. Burning can be conducted only when wind conditions are such that the smoke plume is carried away from villages or encampments.

To conduct an in situ burn, the oil must be collected and concentrated to a sufficient thickness to permit ignition and sustain burning. For in situ burning to be the most successful, burning operations need to be initiated as soon as possible, usually within the first 2-3 days of the spill. Once the crude oil begins to weather and lose the light volatile fractions, it becomes more difficult to ignite. Also, as the oil sits on the ocean surface, more water is incorporated into the oil forming an emulsion and further reducing the ability to initiate and sustain a burn. Emulsions containing more than 70% water generally will not burn. The application of emulsion breakers can reduce water content of the oil/water emulsion and increase the amount of oil that can be removed by burning.

Oil that has collected under the ice surface from a pipeline leak also is an excellent candidate for in situ burning. The ice and cold water prevent the oil from weathering. As the oil begins to surface as the ice breaks up, it essentially is fresh crude and can be ignited the same as oil released during open-water conditions.

IV.A.6.c. Allowing Oil to Freeze in Place

For spills occurring late in the season, a more appropriate response tactic may be to allow the oil to be frozen into place and freezing tracking buoys in with the oil so it can be located at a later date. Once ice conditions are stable enough to support land-based removal equipment, the response effort would begin. The contaminated ice and oil would be mined from the pack ice and taken back to shore for disposal. Once spring returns, the contaminated area would be monitored for any oil surfacing through brine channels in the ice sheet. When oil surfaces in the melt pools, Alaska Clean Seas would return and conduct in situ burning operations or skim the oil from the surface to complete removal of the oil from the environment.

IV.A.6.d. Further Research in Spill Response

The North Slope operators also have been actively engaged in research to improve spill-response equipment and tactics in the arctic environment. Along with the MMS, they have participated in the development of a prototypical skimmer for use in ice-infested water, the MORICE project. The MMS has sponsored considerable research in areas such as detection and tracking of oil in and under ice, behavior of oil in ice, in situ burning and fire boom research and development, use of ice booms, viscous oil pumping, and optimum timing for decanting storage barges to maximize on-water storage.

IV.A.6.e. Leak-Detection Systems

The Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a:Section II.A.I.b(3)(b)) discusses various leak-detection systems. The primary system used on Alaska's North Slope is the pressure-point analysis and mass-balance line-pack compensation system. This system is considered as part of the best available and safest technology. The LEOS system, an external pipeline leak-detection system that identifies hydrocarbons in the water column through a permeable membrane, has been incorporated into the pipeline design for Northstar and is being used in operations at the Northstar site (see Section IV.A.5). The LEOS leak-detection system also is incorporated into the pipeline design for the Liberty Project.

Solid- and broken-ice conditions also serve to limit the ability to detect releases from subsea pipelines for the majority of the year. During solid-ice conditions, the operator has no visual means to determine if a release has occurred and must rely solely on the pipeline leak-detection systems. While these systems have detection levels of a few barrels, leaks could develop below the detection level and continue to discharge until breakup occurs and the oil begins to surface. Broken ice also can make it difficult to determine if a leak has occurred by obscuring the oil from sight.

One method to determine whether a leak has occurred during solid-ice conditions is to drill holes through the ice surface at various intervals throughout the solid-ice season. The MMS and others continue research to develop new technology to detect leaks in both solid-ice and broken-ice environments. Methods to date include satellite imagery, forward-looking infrared radar, acoustic-detection systems, and external pipeline leak-detection systems that identify hydrocarbons in the water column through a permeable membrane.

IV.A.6.f. Extended-Reach Drilling

A discussion of extended-reach drilling experience and technology is found in the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a:Appendix D-3). Although an extended-reach drilling well with a 6.67-mile horizontal departure has been drilled at the Wytch Farm field in Great Britain, it is unreasonable to assume that an exclusive extended-reach drilling development project (let alone an exploration well) could achieve the same success rate and cost-benefit ratio as a conventional drilling program for North Slope projects. This is based in part on (1) the lack of an adequate drilling history for the project, which can be obtained only through drilling experience and (2) the lack of comparable extended-reach drilling experience on the North Slope. When planning extended-reach drilling wells, a combination of several factors needs to be considered. These include rig capacity and capability, well design, geological conditions, and production capabilities. The extended-reach drilling records have been set in mature development areas and are based on an accumulation of drilling experience and geologic knowledge. Extended-reach drilling has not been used, or proposed, for a new startup exploratory drilling program or development project.

IV.A.6.g. Platform Types Related to Water Depth

A discussion of platform types in relation to water depth is discussed in the Northstar final EIS (U.S. Army Corps of Engineers, 1999:Volume II, Chapter III.4.2). Oil and gas exploration and development/production options are discussed for the breadth of the Beaufort Sea; options are based on available technology, both of the drilling platform to withstand environmental conditions and of the relationship of the surface expression of the platform in relation to the downhole drilling location. Water depth plays a prominent part in the selection of the platform type, as platform performance limitations and economic considerations are determining factors in choosing a compatible platform type. Tables 3-4 and 3-5 in the Northstar EIS (U.S. Army Corps of Engineers, 1999) include various technical options to consider in choosing platform types. Figure 3-6 provides a flow chart and decision tree in dealing with location and structure type.

IV.B. ALTERNATIVE II - No Lease Sale

We evaluate the effects of the No Lease Sale Alternative here rather than by resource-by-resource in Section IV.C. In this way, readers can consider and evaluate the potential impacts and environmental protection offered by this alternative, as they read the effects analysis for the other deferral alternatives.

There are tradeoffs to environmental protection and the selection of Alternative II - No Lease Sale.

Under this alternative, the leasing actions proposed in the Beaufort Sea multiple-sale EIS would not be approved. Should this occur, there would be no leases offered in the Beaufort Sea through 2007, and no oil and gas would be developed from any of the blocks considered for leasing in this EIS. None of the potential 1.38 billion barrels of oil would be produced (460 million from each sale), and there would be no potential oil spills and no effects to the flora and fauna either on- or offshore the Beaufort Sea coast. There would be no noise, habitat disturbance and alteration, or water discharges and air emissions from the activities associated with potential island and pipeline construction and operation from exploration drilling and development/production operations from these proposed lease sales. The economic benefits, royalties, and taxes to the Federal and State governments would be forgone.

To replace the potential 1.38 billion barrels of oil not developed from this Beaufort Sea multiple-sale program, a large portion of the oil would be imported from other countries. The associated environmental impacts from producing oil and transporting it to market still would occur. These imports have attendant environmental effects and negative effects on the Nation's balance of trade.

IV.B.1. The Most Important Substitutes for Lost Production

The energy that would have flowed into the United States' economy from this development would need to be provided from a substitute source. Possible sources include:

- other domestic oil production
- imported oil production
- other alternative energy sources such as
- imported methanol
- ethanol
- gasohol
- compressed natural gas
- electricity
- conservation in the areas of transportation, heating, or reduced consumption of plastics
- fuel switching
- reduction in the consumption of energy

If the proposed multiple-sale initiative is denied, substitute energy likely would be a mix of the above sources largely from imported oil production followed by conservation, additional domestic production, and fuel switching.

A new paper from the recent 5-Year OCS Oil and Gas Program entitled *Energy Alternatives and the Environment* (USDOI, MMS, 2001a), which is incorporated here by reference, discusses a long list of potential alternatives to oil and natural gas and evaluates their potential to replace a critical part of our county's energy sources. The costs and reliability of these alternative sources make them less viable than oil and gas resources. It seems very likely that during the life of this project, oil and gas resources at or above the current levels will be used in the United States and the world to fuel our economies.

This paper also indicates that imports and additional domestic production will replace most of the lost oil production, while conservation and fuel switching will decrease the demand for fuel. Every fuel alternative, however, imposes its own negative environmental effects. The following list shows the approximate percent and quantity we expect would substitute for the lost oil (1.38 billion barrels). The quantity of conservation and fuel switching are in barrels of oil equivalent.

- Additional imports: 88% of the loss of production equivalent to 1.214 billion barrels.
- Conservation: 5% of the loss in production equivalent to 69 million barrels.
- Additional domestic production: 4% of the loss in production equivalent to 55 million barrels.
- Fuel switching: 3% of the loss in production equivalent to 41 million barrels.

IV.B.2. Environmental Impacts from the Most Important Substitutes

IV.B.2.a. Additional Oil Imports

Energy Alternatives and the Environment (USDOI, MMS, 2001a) indicates that if imports are increased to satisfy the demand for oil, the effects to the environment would be similar in kind to those of the Proposal but would happen in a different location. The species of animals and plants affected may be different, depending on the location of the development. Some of these effects still could occur within the United States from accidental or intentional discharges of oil, whether from tanker or pipeline spills. These events would:

- generate greenhouse gases and air pollutants from transportation and dockside activities;
- degrade air quality from emissions of nitrogen oxides and volatile organic compounds;
- degrade water quality; and
- destroy flora, fauna, and water.

The impacts of oil spills from additional imported oil are not likely to occur on the shores of the Arctic Ocean or, for the most part, in Alaska. Imported oil imposes negative environmental impacts in producing countries and in countries along trade routes. By not producing our own domestic oil and gas resources and relying on imported oil we are exporting, from a global perspective, at least a sizeable portion of the environmental impacts to those countries from which the United States imports and through or by which our imported oil is transported.

IV.B.2.b. Conservation

Substituting energy-saving technology (adding insulation to buildings or more efficient engines in vehicles, etc.) or consuming less energy (lowering thermostat settings during the winter; using public transportation rather than private automobiles) will conserve energy. The former could result in positive net gains to the environment but may require additional manufacturing. The amount of gain would depend on the extent of negative impacts from such manufacturing. Consuming less energy generally would have a positive environmental effect.

IV.B.2.c. Additional Domestic Production

Onshore oil production has notable negative impacts on surface water, groundwater, and wildlife. It also can cause negative impacts on soils, air quality, and vegetation and cause or increase noise and odors.

Offshore oil production may result in impacts similar to those of the Proposal, but they would occur in a different location. To the extent other offshore production offsets the potential loss of these resources, the effects will be similar to those of the Proposal but would occur in a different location. Offshore activities also may have adverse impacts to subsistence activities, recreation, and tourism.

IV.B.2.d. Fuel Switching

Consumers probably could switch to natural gas to heat their homes and businesses and for industrial uses. While natural gas production will create environmental impacts, these impacts would be at a lower level than those impacts normally associated with oil spills. Other alternative transportation fuels may constitute part of the fuel-substitution mix noted here. This mix depends on future technical and economic advances. At this time, no single alternative fuel appears to have the advantage.

IV.B.2.e. Other Substitutes

The Federal Government could impose regulations mandating other substitutes for oil. The most likely sectors to target would be transportation, electricity generation, or various chemical processes; however, there are many possibilities. The reader is referred to the paper *Energy Alternatives and the Environment* (USDOI, MMS, 2001a), which discusses many of the alternatives at too great a level of detail to reproduce in this EIS.

If this alternative (No Lease Sale) is adopted, the projected effects of the Proposal would not occur. Similar effects would occur elsewhere, but they would be in a different location and probably of a different magnitude. Natural resources in the Arctic Ocean and the Beaufort Sea still would be exposed to other ongoing oil and gas activities in the area, as analyzed in Section V on cumulative impacts.

IV.C. Analysis of Effects by Resource by Alternatives

This section analyzes effects by resource category for Alternative I and Alternatives III through VI. Alternative II - No Lease Sale is analyzed in Section IV.B. Each resource category includes an assessment of effects common to all alternatives (general areawide) and then a sale-by-sale and alternative-by-alternative assessment of effects. If the analysis is lengthy, a summary of the effects analysis is given.

This section looks at each of the 16 resources and analyzes both the effects common to all alternatives and specific effects to alternatives for each of the three sales on that resource. Under both discussions, analysts first address the exploration phase and then address the development and production phase of oil and gas leasing. The discussion of effects common to all alternatives begins with a discussion of the general areawide effects, addressing the disturbance aspect first. Disturbances are events (i.e., noise, construction, discharges) that likely would affect the resources in the Beaufort Sea. This is followed by a discussion of an oil spill. This event, although unlikely, could happen. Such an event depends on many things happening at the same time. In the unlikely event that a large oil spill occurs, it will impact the resource only if certain conditions exist at that time.

If the effects for alternatives or sales are identical or essentially the same, we do not repeat them. Instead, for each resource category, we group the alternatives and sales together when the effects are the same and provide a single analysis and conclusion. The groups are not consistent across resources, because the effects between alternatives and sales affect the resources differently.

We present the following four types of groups:

The effects of the alternatives are estimated to be essentially the same for all the alternatives, or combination of alternative. Justification or rationale that supports that statement is included. If all effects are estimated not to be the same, the exception(s) are discussed. If the analysts see no difference in causes and effects (for example, the disturbances, level and timing of noise events, likelihood of an oil spill, etc. are essentially identical), the analysts state that the effects are basically the same for every option in this group.

- Some of the causes of effects (disturbances, noise levels, timing, etc.) are estimated to be different, but the differences in effects are not measurable and the bottom-line effects of the alternatives/sales are essentially the same. Justification or rationale that supports that statement is included.

- Some of the causes of effects (disturbances, noise levels, timing, etc.) are estimated to be different and the effects are estimated to be different, but the differences in effects are not significant. The analysts list the observable and measurable differences and state the differences in impacts. If the discussion is lengthy, a summary is provided.
- A conclusion is provided at the end of the analysis for the effects common to all alternatives and the end of each alternative and/or group analysis.
- Some of the causes (disturbances, noise levels, oil spills) are estimated to be different, and the effects are estimated to be significantly different. The analysts list the observable and measurable differences and state the differences in impacts. If the discussion is lengthy, a summary is provided.

We are taking this approach to effects analysis in an attempt to not repeat the same bottom lines and to make it easier for the reader to follow.

IV.C.1. Water Quality

This section includes a general but detailed assessment of effects and then a brief sale-by-sale and alternative-by-alternative assessment of effects.

IV.C.1.a. Effects Common to All Alternatives

The agents associated with petroleum exploitation that are most likely to affect water quality are trace metals in permitted discharges of drilling muds and cuttings; turbidity from permitted dredging, filling, and other construction activities; and hydrocarbons from permitted discharges of produced waters and from oil spills. The effects of these agents on water quality are described in Sections III.A.5 and IV.B.1.a of the Sale 149 final EIS (USDOI, MMS, Alaska OCS Region, 1996); Sections III.A.5 and IV.B.1 of the Sale 144 final EIS (USDOI, MMS, 1996a); and Sections III.A.5 and IV.B.1 of Sale 170 final EIS (USDOI, MMS, 1998). The Sale 144 water quality section concluded in part that "contaminants from oil spills may exceed sublethal but not acute (toxic) levels over up to 200 km^2 for a few weeks; and contaminants from construction, island abandonment, and permitted discharges could exceed sublethal levels over a few square kilometers for several years" but that "regional water quality would not be affected" (USDOI, MMS, 1996a:IV-B-8). The Sale 170 water-quality section similarly concluded that "contaminants from permitted discharges over the life of the field and offshore construction activities for several years could exceed sublethal levels over a few square kilometers" but that "regional water quality would not be affected" (USDOI, MMS. 1998:IV-B-6). Those assessments are incorporated by reference into this EIS and augmented by the following additional information on trace metals, turbidity, and hydrocarbons.

Small Spills. The effects of small oil spills on water quality would be similar to but lower than those described for large spills. There likely would be an increase in the concentration of petroleum hydrocarbons in the water column, as described in detail in the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a:Section III.D.3.1). Hydrocarbons from small spills (3 barrels) could exceed the 0.015 parts per million chronic criterion for less than a day or two in an area less than 3 square kilometers (1.2 square miles). Thus, a small oil spill likely would not have any long-term degradational effect on overall water quality, but such spills that occur frequently (even though small) could result in local, chronic contamination.

IV.C.1.a(1) Effects of Permitted Discharges on Trace-Metal Concentrations

Trace metals would be added to the water by drilling muds and cuttings. Drilling muds used offshore of Alaska are limited to a low level of toxicity by the Environmental Protection Agency's National Pollution Discharge Elimination System permits; in the current permit, the toxicity limit is 30,000-parts per million LC_{50} (concentration at which half the test organisms die within 4 days) (Environmental Protection Agency, 1995). The Environmental Protection Agency will prohibit drilling-mud and -cutting discharges in water depths less than 5 meters (2.7 fathoms) (Environmental Protection Agency, 1995) in future offshore exploration in the Arctic. The Environmental Protection Agency estimates this restriction should ensure that Federal water-quality criteria will be met at the edge of the mixing zone (USDOI, MMS, 1996a:Appendix H) and also should lessen the likelihood of elevated trace-metal concentrations persisting in shallow marine sediments (see Snyder-Conn et al., 1990). However, barium discharged in the drilling mud may persist in the marine sediments in deeper waters, and the concentrations may be more than 100 times greater than the concentrations that occur naturally in marine sediments. Natural concentrations of barium in Beaufort Sea coastal sediments range from 185-745 (Crecelius et al., 1991). The barium in drilling mud is in the form of barium sulphate, the mineral barite. Barite has a low solubility and relatively high specific gravity, which makes it useful as a material to add weight to a drilling mud. (The solubility of barium sulphate in cold, freshwater is about 0.00222 grams per liter, which is quite low when compared to the solubility of salt, which is 357 grams per liter.)

Based on the above information and additional analysis provided by Tetra Tech (1994), the Environmental Protection Agency determined that exploratory discharges are not likely to exceed applicable water-quality criteria outside of a 100-meter (328-foot) radius, or 0.03 square kilometer (7 acres) around each drilling discharge site. Thus, exploration drilling mud necessarily would fall into the slightly toxic to nontoxic range and would not pose an acute toxicity risk to the Beaufort Sea.

IV.C.1.a(2) Effects of Permitted Dredging and Filling on Turbidity

Additional turbidity would be created by trenching for subsea pipelines and by construction of gravel islands. Also, dredging might be used to prepare subsea berms for production platforms, but this latter use would be comparatively small. Pipeline installation would involve greater volumes of dredged materials and greater areal disturbance. The greatest effect on water quality from dredging would be to locally increase the turbidity by increasing the amount of suspended-particulate matter in the water column.

Suspended sediments have very low direct toxicity for sensitive species, with expected toxicity somewhere between that of a clay such as bentonite (LC_{50} greater than 7,500 parts per million for the eastern oyster) and that of calcium carbonate (LC_{50} greater than 100,000 parts per million for the sailfin molly) (see National Research Council (USA), 1983). These are very low toxicities, falling into the ranges generally described as slightly toxic to nontoxic. Direct toxicity from suspended sediments, therefore, has not been considered a regulatory issue, and toxic or acute marine standards have not been formulated by either the State of Alaska or the Environmental Protection Agency.

Both State standards and the Federal criterion are directed toward protecting biota from chronic stresses rather than from acute toxicity, but the limits are very different in formulation. One State standard is 25 nephelometric-turbidity units, and the Federal criterion and a second State standard are no more than a 10% decrease in the seasonally averaged compensation depth for photosynthetic activity. A third State standard is no more than a 10% reduction in maximum secchi disk depth.

Experiences with actual dredging or dumping operations in other areas show a decrease in the concentration of suspended sediments with time (2-3 hours) and distance downcurrent (1-3 kilometers [0.5-2 nautical miles]) from the discharge. Similarly, in the dredging operations associated with artificial-island construction and harbor improvement in mostly sandy sediments of the Canadian Beaufort Sea, the turbidity plumes also tended to disappear shortly after operations ceased; they generally extended a few hundred meters to a few kilometers (1 kilometer = 0.54 nautical mile) (Pessah, 1982).

The size, duration, and amount of turbidity depend on the grain-size composition of the discharge, the rate and duration of the discharge, the turbulence in the water column, and the current regime. However, turbidity likely would not extend farther than 3 kilometers (2 nautical miles) from the trenching and dumping operations.

Based on the analysis in this EIS, the increased turbidity from offshore construction activities would be local and short term, exceeding the chronic criterion of a 10% temporary change in photo-compensation depth over a distance of 3 kilometers or less (2 nautical miles or less), a local water-quality effect. The site-specific effects of any proposed pipeline dredging on water quality would be examined in future NEPA assessment, as it was in the EIS for the proposed Liberty Development in Foggy Island Bay (USDOI, MMS, Alaska OCS Region, 2002a).

Buried pipelines for future development might be elevated at landfalls on short gravel causeways (Section IV.A.2.b(3)(a)), and new logistical shore bases with short docks might be constructed (Section IV.A.2.b(2)(a)). The 1-mile (1.5-kilometer) long East Dock was constructed about 30 years ago. During that time, there have been many studies of nearshore water quality, but none have documented adverse water-quality effects (for example, circulation changes or temperature and salinity discontinuities) due to East Dock. Therefore, short docks probably would not affect hydrologic conditions, and subsequent NEPA analysis of any development proposals with docks would help to alleviate site-specific water-quality effects.

IV.C.1.a(3) Effects of Permitted Discharges of Produced Waters

Produced waters include formation water, injection water, and any chemicals added downhole or during the oil/water separation process; formation waters contain dissolved minerals and soluble fractions of the crude oil. Process equipment installed on the production platform usually separates the formation water from the oil and treats it for disposal. Treated formation waters may be discharged into the open ocean, reinjected into the oil-producing formation to maintain pressure, or injected into underground areas offshore. Discharge of formation waters would require an Environmental Protection Agency permit and would be regulated so that water-quality criteria, outside an established mixing zone, are not exceeded. To date, the Environmental Protection Agency has prohibited the discharge of formation waters into the Beaufort Sea in waters less than 10 meters (5.5 fathoms) deep. Reinjection and injection projects to maintain field pressure have become almost standard operating procedure. Of the 12 active oil fields in Alaska in 1994, 10 had water-injection projects (State of Alaska, Oil and Gas Conservation Commission, 1995). Formation waters from the Endicott and Northstar fields, the first offshore fields in the Beaufort Sea, are reinjected into the oil formation as part of a waterflood project.

Oil and grease concentrations in produced waters discharged into offshore areas from new facilities are limited to 42 milligrams per liter (42 parts per million) daily maximum and 29 milligrams per liter (29 parts per million) monthly average for exploration test discharges (40 CFR 435). The Environmental Protection Agency-approved analytical procedures used to measure oil and grease exclude lower molecular-weight hydrocarbons (less than C14), which pose most of the risk to the biota (National Research Council, 1985). The National Research Council has estimated that formation waters average 20-50 parts per million of lower molecular-weight hydrocarbons and 30 parts per million of higher molecular-weight hydrocarbons.

As oil is pumped from a field, the ratio of water to oil being produced generally increases. The ratio of water to oil for (1) Prudhoe Bay in 1971 was less than 0.01 while in 1994, the ratio was 1.26; (2) Kuparuk in 1982 was less than 0.01 while in 1994, the ratio was 1.14. Prudhoe Bay oil production began in 1969 and Kuparuk began oil production in 1981 (State of Alaska, Dept. of Natural Resources, 1971; State of Alaska, Oil and Gas Conservation Commission, 1982, 1994). The ratio of total water produced to total oil produced for (1) Prudhoe Bay is 0.35 after 26 years of production and (2) Kuparuk is 0.62 after 14 years of production (State of Alaska, Alaska Oil and Gas Conservation Commission, 1994). Assuming the water-to-oil ratio is between 0.35 and 0.62, the production of formation waters over the 20 years of production is estimated to range from about 122-415 million barrels. If the oil and grease content in the treated produced waters is 29 milligrams per liter (Environmental Protection Agency monthly average limit), the maximum amount of oil and grease in the produced waters is estimated to range from 562-1,913 metric tons (620-2,109 short tons) over 21 years.

If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

IV.C.1.a(4) Effects of Oil Spills on Hydrocarbon Concentrations

Hydrocarbon concentrations also would be affected by oil spills. This analysis of the effects of spills on water quality does not consider the benefits that oil-spill-cleanup measures could have in reducing the volume of oil.

After the *Exxon Valdez* oil spill of 0.258 million barrels, the concentrations of hydrocarbons in the water were not measured in the first 6 days of the spill. However, Wolfe et al. (1994) have used an earlier version of the MMS weathering model (Payne et al., 1984) to estimate water concentrations after the passage of the storm on the third day of the spill and arrived at an average value of 0.8 parts per million within the top 10 meters (5 fathoms) of the water, within the "effective" or discontinuous spill area. Wolfe et al. also summarized the actual measurements made in Prince William Sound. Seven to 11 days after the spill, residual concentrations ranged from 0.067-0.335 parts per million petroleum hydrocarbons, 0.0015 parts per million volatile organic analytes (mostly mononuclear aromatics), and 0.001-0.005 parts per million polynuclear aromatic hydrocarbons. Concentrations in Prince William Sound decreased to levels below the chronic criteria levels of concern (Section IV.A.1) to between 0.001 and 0.006 parts per million petroleum hydrocarbons and 0.0001 parts per million polynuclear aromatic hydrocarbons after 21-41 days. The concentration decreases within these timeframes were attributable to advection and dilution, not decomposition.

In restricted cold waters under very calm seas, the lack of vertical mixing and dilution can result in higher concentrations, 1-3 parts per million, within the top 1-3 meters that persist for a day (Baffin Island Oil Spill Project; Humphrey et al., 1987).

The concentrations of hydrocarbons in the water column are relatively low, because oil is only slightly soluble in water and vertical, and especially horizontal, dispersion and consequent dilution rapidly would decrease hydrocarbon concentrations for all but the largest spills in several hours. For spills of the magnitude of the *Exxon Valdez* spill, hydrocarbon concentrations could remain elevated above chronic criteria for as long as 10-20 days. Aromatic compounds are the most toxic constituents of crude oil, partly because they are the most soluble constituents. The highest rates of dissolution of aromatics from a slick and, consequently, accumulation in underlying water occur in the first few hours after a spill (Payne, 1987). The bulk of these volatile compounds are lost in less than 3 days; 3-day trajectories (Section IV.A.2) have been judged the appropriate length to approximate the initial, higher toxicity of spills in Alaskan waters.

If the spilled oil were of a composition similar to that of Prudhoe Bay crude, about 40% of the spilled oil could persist on the water surface, dispersed into individual tarballs after the slick disappeared. Photo-oxidation and biological degradation would continue to slowly decrease the residual amount of oil. Through 1,000 days, about 15% of the tarballs would sink, with an additional 20% of slick mass persisting in the remaining tarballs (Butler, Morris, and Sleeter, 1976, as cited by Jordan and Payne, 1980). Because of the drift of the oil over distances of hundreds or thousands of kilometers (1,000 kilometers = 540 nautical miles) during the slow process of sinking, individual, sunken tarballs would be extremely widely dispersed in the sediments, at concentrations on the order of some fraction of a tarball per hectare (per 2 acres).

Under ice, the volatile compounds from a spill would be more likely to freeze into the ice within hours to days rather than dissolve or disperse into the water underneath the ice. After the onset of melting, oil spilled under ice generally tends to reach the ice surface in an unweathered state. However, once formed, a hydrocarbon plume in the water column underneath the ice would persist above ambient standards and background over about a fivefold greater distance than under open water (see Cline, 1981).

The characteristics of the assumed 4,600-barrel oil spill (Table IV.A-5) in the summer and during meltout are shown in Table IV.A-6b. Based on these characteristics, the estimated concentration of oil dispersed in the water column for a summer spill after (1) 3 days is estimated to be 1.74 parts per million (assuming a 2-meter dispersal depth); (2) 10 days is estimated to be 0.33 parts per million (assuming a 5-meter dispersal depth); and (3) 30 days is estimated to be 0.07 parts per million (assuming a 10-meter dispersal depth). If the spill occurred in the spring during melting, the environmental conditions affecting the characteristics of a spill would be different from those of summer (Table IV.A-6b). The estimated concentration of oil dispersed in the water column for a meltout spill after (1) 3 days is estimated to be 5.65 parts per million (assuming a 2-meter dispersal depth); (2) 10 days is estimated to be 0.88 parts per million; and (3) 30 days is estimated to be 0.13 parts per million (assuming a 10-meter dispersal depth). The estimated high concentrations of oil associated with dispersal in the water column may represent an upper range of dispersed-oil concentrations reached during the first several days following a large spill. These concentrations are greater than the 0.015 parts per million that was assumed to be the total hydrocarbon chronic criterion and, after 3 days, less than the 1.50 parts per million that was assumed to be the acute criterion. Both the summer and meltout concentrations of oil that are estimated to be dispersed in the water column after 30 days, 0.07 and 0.13 parts per million, respectively, are within the range of concentrations reported for the larger *Argo Merchant* and *Amoco Cadiz* spills noted in the Sale 170 final EIS (USDOI, MMS, 1998). However, these concentrations are much greater that the previously noted concentrations of petroleum hydrocarbons, 0.001-0.006 parts per million, in Prince William Sound 21-41 days after the *Exxon Valdez* oil spill. The estimated concentration of dispersed oil in the water 30 days after both the summer and meltout spills is greater than 0.015 parts per million and indicates a relatively long period of time, perhaps about a month or more, before dilution of the dispersed oil reduces the concentrations below the chronic criterion.

Conclusion. Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities: (1) The increased turbidity from permitted construction activities would be local and short term. (2) Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. (3) If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

Effectiveness of Mitigating Measures. Water-quality effects would be moderated partly by proposed Stipulation 7 - Pre-booming Requirements for Fuel Transfers. Even though the stipulation would not prevent a fuel spill, pre-booming would help with spill recovery and, therefore, would moderate water-quality effects. Also, the probable effects on water quality would be moderated partly by Stipulation 3 - Transportation of Hydrocarbons, and by ITL clause 15 - Information on Discharge of Produced Waters. The stipulation requires the use of pipelines, if feasible, rather than alternate transportation methods. Because less oil is spilled (per barrel transported) from pipelines than from barges, for example, the stipulation would moderate effects on water quality. The ITL clause advises lessees that the State prohibits discharge of produced waters within the 10-meter isobath, and that the Environmental Protection Agency could prohibit discharges on similar Federal tracts. Discharge restrictions in shallow water would moderate effects on water quality.

IV.C.1.b. Effects of Alternatives and Sales

IV.C.1.b(1) Effects of Alternatives I and III through VI for Sales 186 and 195 and Alternatives IV and V for Sale 202

The conclusion in Section IV.C.1.a would apply to these alternatives. The effects levels on water quality likely would not vary with these sales with alternatives for two main reasons. First, Section II.A.1 explains that most of the activities associated with the initial lease sales probably would be focused around Prudhoe Bay in the Near Zone (Sale 186) and then the Midrange Zone (Sale 195). Because the leased areas probably would be near the Prudhoe Bay infrastructure, exploration and development on existing leases in this area still would present the small risk to water quality, because the proposed deletions would not reduce substantially the risk of operations. Second, the deferred areas under these alternatives would be relatively small and would not reduce the chance of oil contact to nearshore water quality along the rest of the coast (Table A.2-27).

Sale 202 with Alternatives III (Barrow Subsistence Whaling Deferral) and VI (Eastern Deferral), however, likely would have different levels of effects on water quality for the following two reasons: the alternatives would delete relatively large areas, and (2) the areas that to be developed in Sale 202 could include the far western and eastern Beaufort Sea. The nearshore water quality in these areas is especially important, because bowhead whales sometimes feed there (Griffiths, Richardson, and Thomson, 2001). The level of effects for Sale 202 with these two alternatives is described in the following Sections IV.C.1.b(2) and (3).

Conclusion. Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

IV.C.1.b(2) Effects of Alternative III for Sale 202

Exploration and development might occur far to the west under Sale 202. Exploratory drilling operations were conducted in this area at the Cabot Prospect during 1991 without noticeable effects on water quality. Deferral of the Barrow subsistence-whaling area would reduce slightly the chance of oil contact to the water quality in the bowhead feeding area near Barrow. The chance of contact to nearshore water from about Point Barrow east to Pitt Point (Land Segments 25-31) would be reduced by 1-15% (assuming contact occurs within 30 days during the summer, Table A.2-27:LA2). However, the chance of contact to nearshore water quality east of the deferral would be about the same with or without the deferral (Table A.2-27:LA1, LA3-LA18, P1- -P13).

Conclusion: This alternative would reduce the risk that hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion for several days in nearshore waters near Barrow. Other effects would be similar to Sale 202 without a deferral (Alternative I). The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

IV.C.1.b(3) Effects of Alternative VI for Sale 202

Exploration and development might occur far to the east with Sale 202. Exploratory drilling operations were conducted in this area at the Aurora Prospect during 1988 without noticeable effects on water quality. Deferral of the area southeast of Kaktovik would reduce slightly the chance of oil-spill contact to the area. The chance of contact to nearshore water quality from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55) would be reduced 2-11% (assuming contacts occur within 30 days during the summer, Table A.2-27:LA18). However, the chance of contact to nearshore water quality to the west of Beaufort Lagoon (Table A.2-27:Land Segments 25-48) would be about the same as described for Sale 202 without a deferral.

Conclusion: The deferral would reduce the risk that hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion for several days in nearshore waters of the bowhead whale feeding area near Kaktovik. Other effects would be similar to Sale 202 without a deferral (Alternative I). The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).

IV.C.2. Lower Trophic-Level Organisms

This section begins with a general but detailed assessment of effects and ends with a sale-by-sale and alternative-by-alternative assessment of effects.

IV.C.2.a. Effects Common to All Alternatives

Lower trophic-level organisms, which include planktonic, epontic (under ice), and benthic forms, are described in Section III.B.1. Aspects of the proposed lease sales that may affect lower trophic-level organisms include discharges, construction activities, and oil spills. The effects of discharges, construction, and spills on lower trophic-level organisms have been discussed in the EIS's for Beaufort Sea Sale 144 and Sale 170). The Sale 144 EIS concluded in part that "each of two assumed 7,000-bbl oil spills is estimated to have lethal and sublethal effects on <1 percent of the phytoplankton and zooplankton populations in the sale area" and that "recovery in embayment areas is expected to take 1 to 2 weeks" (USDOI, MMS, 1996a:IV-B-15). The Sale 170 EIS concluded in part that "discharges are estimated to adversely affect <1 percent of the benthic organisms in the sale area" and that "recovery is expected within a year after the discharges cease" (USDOI, MMS, 1998:IV.B-11). The following analysis incorporates and updates the Sale 144 and 170 assessments in terms of the proposed lease sales.

IV.C.2.a(1) Effects of Permitted Discharges

The types of material discharged during exploratory operations usually include drilling muds and cuttings, although there usually are restrictions on such discharges in shallow water, under ice, and near special kelp communities. During production operations, there might be discharges of produced water; however, recent developments in the Beaufort Sea (for example, Endicott and Northstar) have reinjected the produced waters. The water-quality section explains that the Environmental Protection Agency has determined that exploratory discharges are not likely to exceed applicable water-quality criteria outside of a 100-meter (329-foot) radius around each drilling discharge site. In spite of the 100-meter zone of potential contamination, there is no evidence of the effects on lower trophic-level organisms. An extensive review found no evidence of effects on plankton from drilling muds (Neff, 1991), and benthic organisms near Beaufort Sea drilling sites have accumulated neither petroleum hydrocarbon nor heavy metals, as shown by monitoring during the 1980's, 1999, 2000, and 2002 (Brown, Boehm, and Cook, 2001). Heavy metals in Beaufort Sea marine mammals and their prey are the focus of an ongoing study at the University of Alaska Fairbanks (Dehn et al., 2002). The study found differences in the total mercury in the livers of ringed and bearded seals from the Alaskan and Canadian Arctic. As described in Section III.B.1.a, they suggested that those differences were related to differences in the prey, because ringed seals eat mostly pelagic organisms (i.e., euphausiids) and bearded seals eat benthic and epibenthic organisms. The variations were observed over broad regions of the arctic rather than near and far from areas in which there had been discharges.

Based on the 1,000-meter seafloor area that might be affected temporarily by drilling discharges, less than 1% of the benthic organisms in the sale area and none of its plankton probably would be affected. Benthic organisms within 1,000 meters of a platform likely would experience temporary sublethal effects due to trace metals in drilling muds. Within this distance, some changes likely would occur in the species composition of affected benthic areas. Recovery of the affected benthic communities likely would occur within 1 year after the termination of discharges.

Produced waters contain small amounts of hydrocarbons that might affect plankton. Recent studies by Shirley and Duesterloh (2002) have shown that toxic effects on zooplankton are increased manyfold by the presence of ultraviolet radiation near the water surface. As noted in the section on water quality, the discharge of formation waters would be regulated by the Environmental Protection Agency to avoid toxicity outside an established mixing zone. The effects of hydrocarbons on plankton are discussed further in the following section on oil-spill effects.

IV.C.2.a(2) Effects of Permitted Disturbances

Disturbance of benthic communities could be caused by ocean-bottom cable for seismic surveys, placement of bottom-founded platforms, construction of artificial islands and short docks, and/or pipeline dredging. Ocean-bottom cables for seismic surveys could affect benthic kelp communities such as the Boulder Patch. However, in most portions of the Beaufort Sea where ice gouges the seafloor, the effect of ocean-bottom cables could not be detected. Whenever proposals are submitted for specific seismic programs, the presence of kelp communities and the site-specific effects would be assessed.

Placement of bottom-founded production platforms, construction of artificial islands and short docks, and pipeline dredging would affect benthic organisms in the immediate site and downcurrent. Construction likely would have little or no effect on planktonic or epontic communities in the Beaufort Sea multiple-sale area. Construction could affect benthic organisms by physically altering the benthic environment, increasing sediments suspended in the water column, and killing organisms directly through mechanical actions (Lewbel, 1983). Platform placement and pipeline laying likely would kill the less-mobile benthic organisms in their path. Recovery likely would occur within 3 years. The more mobile organisms likely would avoid these areas of disturbance and not be affected. On the beneficial side, platforms add a three-dimensional structure to the marine environment, thereby providing additional habitat for those benthic organisms that require a hard, secure substrate for settlement. Colonization time likely would be a decade. Hence, the overall effect of a platform would be to alter species diversity near the platform in favor of organisms requiring hard substrates over those that do not. Buried pipelines for future development might be elevated at landfalls on short gravel causeways (Section IV.A.2.b(3)(a)) and docks, such as the one proposed for the Point Thompson development, might be constructed for new logistical shore bases (Section IV.A.2.b(2)(b)). The 1-mile (1.5-kilometer) long East Dock was constructed about 30 years ago. During that time, there have been many studies of nearshore water quality, but none have documented adverse effects on water quality or lower-trophic level organisms due to East Dock. Therefore, short docks and causeways probably would not affect hydrologic conditions, and subsequent NEPA analysis of any development proposals with docks would help to alleviate site-specific water-quality effects.

Most locations within the sale area support few benthic organisms. No construction activities likely would occur in areas where benthic communities are more concentrated (for example, Boulder Patch kelp habitat). Less than 1% of the immobile benthic organisms in the multiple-sale area would be affected by platform and pipeline construction associated with the exploration and development scenario. Because of the small area affected by platform and pipeline construction and the low density of benthic marine organisms in the sale area, construction likely would have little adverse effect on lower trophic-level communities.

IV.C.2.a(3) Effects of a Large Oil Spill

This section assesses the probable effects of accidental oil spills on planktonic and epontic communities first and then on benthic communities. The effects of oil spills on the coastal organisms are assessed in Section IV.C.9 – Vegetation and Wetlands.

IV.C.2.a(3)(a) Spill Effects on Planktonic and Epontic Communities

Some hydrocarbons are produced naturally by phytoplankton, and many have been found to be the same as, or similar to, those found in crude oil (Davenport, 1982). Therefore, some hydrocarbons are considered a normal part of the chemical makeup of phytoplankton. Hydrocarbons occurring in the water column that are similar to those occurring naturally in phytoplankton likely would have little effect on phytoplankton. Other petroleum-based hydrocarbons (for example, chlorinated hydrocarbons) are not of natural origin and may have adverse effects on some phytoplankton, even at low concentrations.

Effects on phytoplankton vary widely, depending on the concentration and type of oil or compounds used in the experiments and on the species being tested (National Research Council, 1985). Nevertheless, general patterns do exist, and both laboratory and field studies have shown that hydrocarbons typically inhibit phytoplankton growth at higher concentrations but sometimes enhance growth at lower concentrations. Growth inhibition and/or mortality in phytoplankton have been noted to occur at hydrocarbon concentrations of 1-10 parts per million. Growth enhancement has been noted at concentrations of less than or equal to 0.1 parts per million (National Research Council, 1985). In terms of data collected during an oil spill or field study, large-scale adverse effects on plankton have not been reported (National Research Council, 1985). Observations of phytoplankton biomass and primary productivity following the *Tsesis* spill (in Sweden in 1977) revealed no significant differences between noncontaminated and contaminated areas (Johansson et al., 1980, as cited in National Research Council, 1985:442). In cases where studies have been conducted following small or even large oil spills, this lack of substantial adverse effects on plankton populations due to spilled oil is common. Even if we assume that a large number of phytoplankton are contacted by an oil spill in an open-ocean area, the regeneration time of the cells (9-12 hours) and the rapid replacement of cells from adjacent waters likely would preclude any major effect on phytoplankton communities (National Research Council, 1985). Further, the vertical distribution of most phytoplankton in the water column typically is below the area where it would be adversely affected by hydrocarbons associated with an oil spill. For these reasons, a large oil spill likely would not have a significant effect on phytoplankton. Recovery from the effects of a large oil spill likely would require less than 2 days.

The effects of petroleum-based hydrocarbons on zooplankton have been observed in the field at spill sites and also in the laboratory. Some planktonic animals have the ability to metabolize and detoxify some types of hydrocarbons, and that this ability varies between species. The observed vulnerability of zooplankton to hydrocarbons (dispersed and dissolved) in the water column varies widely. Lethal hydrocarbon concentrations for zooplankton range from about 0.05-10 parts per million, which is similar to that expected for other small floating organisms (for example, fish eggs and larvae and crustacean larvae). Sublethal crude oil concentrations for zooplankton range from about 1 part per million to well below 0.05 part per million (National Research Council, 1985). Sublethal effects include lowered feeding and reproductive activity, altered metabolic rates, and community changes. Whether effects are lethal or sublethal depends on exposure time, hydrocarbon toxicity, species, and lifestage involved (early stages are the most sensitive).

Field observations of zooplankton communities at oil spills and in chronically polluted areas have shown that the communities were affected, but that these effects appeared to be short lived (Johansson et al., 1980). Individuals within chronically polluted areas have experienced direct mortality, external contamination by oil, tissue contamination by aromatic constituents, inhibition of feeding, and altered metabolic rates. However, because of their wide distribution, large numbers, rapid rate of regeneration, and high fecundity, zooplankton communities exposed to oil spills or chronic discharges in open-water areas appear to recover (National Research Council, 1985). In areas where flushing rates and water circulation are reduced, the effects of an oil spill likely would be greater, and the recovery of zooplankton biomass and standing stocks likely would take somewhat longer.

Several studies with freshwater organisms have shown that sunlight makes polycyclic aromatic hydrocarbons more toxic. A recent study by Pelletier et al. (1997) showed that marine invertebrates also are affected more by polycyclic aromatic hydrocarbons under ultraviolet radiation. The enhanced phototoxicity was more obvious with heavy oils, such as Liberty crude, than with light diesel oil. The authors noted that ultraviolet radiation would not penetrate turbid coastal water. These results have been corroborated by two other studies. Shirley and Duesterloh (2002) also observed increased oil toxicity to copepods in the presence of ultraviolet radiation. Gibson et al. (2000) conclude that ultraviolet radiation influences on food-web processes in the Arctic Ocean are likely to be small relative to the effects caused by variation in the concentrations of natural ultraviolet radiation-absorbing compounds that enter the arctic basin via its large rivers.

In general, the effect of the oil associated with a large oil spill would depend on the amount of sunlight, wind speed and duration, air and water temperature, and the composition of the oil. However, based on the assumptions associated with weathering of Prudhoe Bay crude oil (Tables IV.A-6a and IV.A-6b), within 10 days of a spill (winter), 10% of the oil would have evaporated, 57% would remain on the surface, and 32% would be dispersed into the water column. Dispersed and/or dissolved oil in the water column has the greatest potential of adversely affecting phytoplankton and zooplankton. Surface oil and that fraction that evaporates rarely would contact plankton, because plankton typically are beneath the surface.

A week after the *Exxon Valdez* oil spill, the concentration of hydrocarbons in the water column were well below (about 10-1,000 times below) the levels known to be toxic and below levels that cause sublethal effects in plankton. Further, the concentrations returned to background levels (0.20 parts per billion) in less than a month (Neff, 1991). However, because the water samples were taken a week or more after the spill, it is unclear what the actual hydrocarbon concentrations were during and immediately following the *Exxon Valdez* spill. Thus, for purposes of analysis, hydrocarbon concentrations in the water column during and immediately following an oil spill are conservatively assumed to be initially harmful to phytoplankton and zooplankton (exceeding 0.1 parts per million but for less than 5 days; Meyer, 1990).

The likelihood of plankton populations being adversely affected by an oil spill would be greatest during the summer in the coastal band of high production (Figures III.B-1a and III.B-1b). In the unlikely event that a large spill occurs during this period, less than 1% of the plankton in the sale area is estimated to experience sublethal and/or lethal effects. The 1% is relative small compared to the observed 10% inter-annual variation in zooplankton prey of bowhead whales (Griffiths and Thomsom, 2002). Further, phytoplankton likely would recover within 2 days through regeneration and replacement from adjacent waters, whereas zooplankton recovery may require up to 1 week. Recovery in embayments where water circulation is reduced likely would require up to 2 weeks. Small oil spills might adversely affect plankton in the area immediately around the spill, but they likely would not have a measurable effect at the population level. If oil were spilled under the ice and trapped directly beneath it, most epontic organisms living there likely would be killed. Oil trapped in this way probably would be encapsulated within the ice with increasing time. If oil on, in, or under the ice is released during breakup, the oil would continue to affect the planktonic community.

IV.C.2.a(3)(b) Spill Effects on Benthic Communities

Many benthic species are fed upon by higher food-web species, such as marine fishes, birds, and mammals. Benthic flora, such as that found in the Boulder Patch, also provides shelter for small fish and invertebrates and decreases erosion and turbidity. Hence, any significant effect on benthic-level organisms (natural or unnatural) likely would have an effect on higher trophic levels as well.

In the marine environment, hydrocarbons resulting from an oil spill are broken up by wave action into floating surface oil, dispersed and dissolved oil within the water column, and oil that is incorporated into bottom sediments. Marine plants and animals are affected most by floating surface oil and oil that is being incorporated into bottom sediments through wave action. In marine environments that have distinct intertidal and subtidal floral and faunal communities, the most persistent effects often occur when intertidal and shallow subtidal benthic communities are contacted by oil, particularly in areas where water circulation is restricted (for example, bays, estuaries, mud flats, and rock-armored shorelines).

IV.C.2.a(3)(b)1) Benthic Plants

What is known about the effect of crude oil on marine plants and shoreline substrates has come largely from observations following oil spills. Effects vary considerably depending on the substrate, plant species, type and concentration of oil, and the timing and duration of exposure. Following the *Exxon Valdez* oil spill, significant hydrocarbon concentrations were found in intertidal sediments at heavily oil sites, and the oil appeared to move into the shallow subtidal zone within a few years (Wolfe et al., 1993). Ongoing studies of the *Exxon Valdez* spill show that oil has persisted in the shoreline sediments for more than a decade (www.oilspill.state.ak.us/facts/lingeringoil.html). In spite of the lingering oil, plant recolonization of the heavily oiled intertidal rocky habitat began the first year after the spill (Duncan, Hooten, and Highsmith, 1993; van Tamelen and Stekoll, 1993), and complete recovery likely occurred within 6 years. The subtidal macroalgae populations in Prince William Sound, including the kelp *Laminaria*, were studied 1 year after the *Exxon Valdez* spill (Dean, Stekoll, and Smith, 1996). The investigators found that within a year of the spill, there were no differences in the total density, biomass, or percentage cover of macroalgae between oiled and control sites. Most areas that were oiled by the *Exxon Valdez* spill but not high-pressure washed recovered to prespill conditions by 1991. Further, all dominant flora and fauna (except barnacles) that were high-pressure washed suffered 60-100% mortality and have not recovered to date (Houghton et al., 1996). Hence, the high-pressure shoreline treatment associated with the *Exxon Valdez* spill appears to have had as great an effect on shoreline plants as the oil itself. In summary, the benthic plants in areas that were substantially affected by the *Exxon Valdez* oil recovered to prespill conditions within 3 years but small amounts of the oil have persisted in the shoreline sediments for more than a decade in spite of cleanup responses.

However, in the Beaufort Sea there is no intertidal zone in the traditional sense. This is due to the annual predominance of shorefast ice, which precludes marine plant life and most fauna along the shoreline, leaving macrophytes only above the tideline or below a depth of 2 meters. The effects of offshore oil spills on saltmarsh vegetation and wetlands above the tideline are assessed in Section IV.C.9.a(2)(b). Below the 2-meter depth, marine macrophytes grow in only a few locations in the Beaufort Sea, such as the Boulder Patch community in Stefansson Sound. The estimated effect of a large oil spill on subtidal marine plants in the Beaufort Sea area depends on the type and amount of oil reaching them. The main type of oil that could reach these marine plants in the subtidal zone (most are 5-10 meters deep) would be highly dispersed oil having no measurable toxicity occurring as a result of heavy wave action and vertical mixing. The amount and toxicity of oil reaching subtidal marine plants likely would be so low as to have no measurable effect on them.

Even though crude oil probably would not mix down into the water column and affect marine plants, even small spills of refined petroleum such as diesel fuel could be mixed deeper into the water column. Diesel fuel is used routinely to provide auxiliary power for offshore drilling and is transported to drilling sites in fuel barges. Most small spills on the OCS were of such stored oil, either crude or fuel oil (Anderson and

LaBelle, 1994). The specific effects of spilled diesel fuel on kelp communities is assessed in Section III.C.2.e(2)(b) of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a).

IV.C.2.a(3)(b)2) Benthic Invertebrates

The dominant marine invertebrates in the Beaufort Sea area include gastropods, mollusks, annelids, echinoderms, and crustaceans. Crude oil can have lethal effects on marine invertebrates from either a short-term exposure to high hydrocarbon concentrations or a long-term exposure to lower hydrocarbon concentrations. Laboratory studies indicate that oil concentrations ranging from 1-4 parts per million can be lethal to both adult and larval crab and shrimp after 96 hours of exposure (Starr, Kuwada, and Trasky, 1981). Large oil spills often have resulted in mortality of bivalves (Teal and Howarth, 1984), which are fed on by many species of marine birds, fishes, and mammals. Effects on bivalves can be almost immediate, but declines in numbers may continue for years (6 years) (Thomas, 1976).

Studies following the *Exxon Valdez* oil spill in 1989 showed that significant hydrocarbon concentrations in shoreline sediments were found at heavily oiled sites, followed by an apparent migration of the oil into the shallow subtidal zone in 1991 (Wolfe et al., 1993). However, significant concentrations of oil were not found in the subtidal zone. Regarding the toxicity of shoreline areas contaminated by the spill, Gilfillan et al. (1993) have shown that the toxicity of oiled intertidal sediments declined rapidly after the spill. Within 18 months, about 75% of the oiled shoreline had recovered. In fact, toxicological results indicate that the oiled shoreline was at toxic hydrocarbon levels for only a few months to 1 year. The remaining hydrocarbons were found to be generally nontoxic and are thought to serve as a food source for some biota (for example, bacteria).

For purposes of analysis, it is assumed that some of spilled oil would drift into shallow water. Because of the amount of time elapsed in reaching shallow water (several days), the more toxic hydrocarbon fractions would have evaporated and likely would not have toxic effects on benthic invertebrates that seasonally inhabit the shoreline. As mentioned earlier, the predominance of shorefast ice along the shoreline of the Beaufort Sea precludes all but seasonal shoreline invertebrate fauna down to about 2 meters in water depth. Subtidal organisms deeper than this also would not be contacted, because they live below the zone where oil is likely to measurably affect them.

Hence, the only marine invertebrates likely to be contacted by floating or dispersed oil associated with an oil spill would be those closest to the surface. These include zooplankton (such as copepods, euphausiids, mysids, and amphipods) and also the larval stages of marine invertebrates such as annelids, mollusks, and crustaceans. Because of similarities in habitat use and distribution, the percentage of marine invertebrate larva contacted by floating or dispersed oil is likely to be similar to that expected for plankton (i.e., less than 1%). Due to their wide distribution, large numbers, and rapid rate of regeneration, the recovery of marine invertebrate larva likely would require less than a month. Recovery in embayments where water circulation is reduced likely would require up to a year. Small oil spills likely would have a perceptible effect on lower trophic-level organisms at the population level.

Aside from the probable effect of spills to the coastline in general, the risk to the Arctic National Wildlife Refuge coastline in particular has been estimated. The coastline would be vulnerable to offshore spills mainly during the summer open-water period; during the rest of the year, the coastline probably would be buffered from offshore spills by the band of landfast ice. The Oil-Spill-Risk Analysis conditional probabilities for summer (Tables A.2-85 through A.2-90) indicate that the risk to the Refuge would be highest, of course, for any inshore spill in the eastern Alaskan Beaufort Sea. The specific probability that a spill from various offshore locations would contact the Refuge's coastline within 30 days is given in Table A.2-87. The table shows that the probability would be 38% or less from all hypothetical launch areas except one in Launch Area 18, which corresponds with the nearshore lease tracts in the eastern Alaskan Beaufort Sea. A summer spill in that area is estimated to have a 49% probability of contacting the Refuge's coastline within 30 days (Table A.2-87). As discussed further in Section IV.C.2.b, deferral of leasing in the eastern Alaskan Beaufort Sea would not eliminate the risk to the Refuge's coastline but would lower the maximum risk by about 25%. Specifically, the maximum probability that a summer spill would contact the coastline of the Arctic National Wildlife Refuge within 30 days would drop from 49% to 38% (Table A.2-87).

Summary. Resource-development activities could affect lower trophic-level organisms (phytoplankton, zooplankton, epontic, and benthic) by exposing them to drilling discharges, seismic surveys, construction, and petroleum-based hydrocarbons. In general, effects associated with the low and high ends of the resource-recovery range likely would be similar in most cases (one large oil spill was evaluated for both). Drilling discharges are estimated to affect less than 1% of the benthic organisms in the sale area and none of its plankton. Affected benthic organisms likely would experience sublethal effects, but some (mostly immature stages) would be killed. Recovery likely would occur within 1 year after the discharge ceases. Seismic surveys likely would have little or no effect on lower trophic-level organisms. Construction likely would have little or no effect on plankton communities. Less than 1% of the immobile benthic organisms would be affected by construction (mostly sublethal effects). Immobile benthic communities affected by pipeline construction likely would recover in less than 3 years. Marine organisms needing a hard substrate for settlement likely would benefit from the production platforms (particularly those associated with the high end of the resource-recovery range) and to colonize them within 2 years.

An oil spill is estimated to have sublethal and lethal effects on less than 1% of the plankton in the coastal band of high concentration. Recovery likely would require 2 days for phytoplankton and up to 1 week for zooplankton. Recovery within the affected embayments likely would require up to 2 weeks. During a winter oil spill, if oil were trapped under the ice, epontic organisms living there probably would be killed. Less than 5% of the epontic community in the sale area likely would be affected this way. Although crude oil probably would not mix down into the water column and affect benthic organisms, spills of refined petroleum such as diesel fuel could be mixed deeper into the water column, potentially affecting kelp communities. The Oil-Spill-Risk Analysis conditional probabilities for summer indicate that risk to the shoreline is low in general, and that the risk to the Arctic National Wildlife Refuge's coastline specifically would be highest for any inshore spill in the eastern Alaskan Beaufort Sea. If a spill did contact the shoreline, small amounts of the spilled oil would probably affect the shoreline for more than a decade in spite of cleanup responses.

Conclusion. Lower trophic-level organisms would be affected by discharges, disturbances, and spills. Permitted drilling discharges probably would affect benthic organisms within 1,000 meters of the discharge points, and recovery likely would occur within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area, and recovery likely would occur within 3 years. Special kelp communities could be protected from construction effects by required benthic surveys. In the unlikely event that a large oil spill occurs, it is estimated to affect only a small portion of the planktonic and/or epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Spills of refined petroleum in relatively shallow water could affect the benthos, including kelp communities. The Oil-Spill-Risk Analysis indicates that the risk to the coastline is low in general, and that the risk to the coastline of the Arctic National Wildlife Refuge specifically would be highest for any inshore spill in the eastern Alaskan Beaufort Sea. If a spill did contact the shoreline, a small amount of spilled oil probably would persist in sediments for more than a decade.

Effectiveness of Mitigating Measures: Spill responses would moderate some of the effects. Responses could recover most of any spilled oil on a solid-ice cover and some of any oil in open water, reducing the effects on lower trophic-level organisms; but oil in broken ice would be difficult to recover. Spill responses to oil on the shoreline probably would affect the habitat as much as the oil itself. The probable effects on lower trophic-level organisms would be moderated also by proposed Stipulation 7 - Pre-Booming Requirements for Fuel Transfers; by Stipulation 1 - Protection of Biological Resources; and by ITL clauses 5 - Information on River Deltas and 11 - Sensitive Areas to be Considered in Oil-Spill-Contingency Plans. Stipulation 1 states that the agency might require additional surveys of special biological resources and, depending on the results, modification of operations to ensure protection. The stipulation would moderate effects on kelp habitats. The Boulder Patch is one of the specified biological resources to be considered in contingency plans, and any effects to the Boulder Patch would be moderated by this ITL clause. Proposed Stipulation 7 about pre-booming during fuel transfers would moderate possible effects on lower trophic-level organisms. Even though the stipulation would not prevent a fuel spill, pre-booming would help with spill recovery and, therefore, would moderate effects on lower trophic-level organisms. The ITL clauses 5 and 11 would require preplanning of spill responses in sensitive areas, including river deltas that are biologically rich and where spilled oil would persist for about a decade.

IV.C.2.b. Effects of Alternatives and Sales

IV.C.2.b(1) Effects of Alternative I and III through VI for Sale 186 and 195 and Alternatives III, IV, and V for Sale 202

The conclusion in Section IV.C.2.a applies to these alternatives and sales. The effects levels on lower trophic-level organisms likely would not vary with these sales and alternatives for two main reasons. First, some of the leased areas probably would be near the Prudhoe Bay infrastructure; exploration and development on existing leases in this area still would present a small risk to lower trophic-level organisms, even with the alternative deletions. Second, the deferred areas under these alternatives would be relatively small and would not reduce the oil-spill risk to the organisms.

However, Alternative VI (Eastern Deferral) likely would have different levels of effects on lower trophic-level organisms for the following two reasons: (1) the alternative would delete relatively large areas, and (2) the areas that would be developed in Sale 202 could include the eastern portion of the Alaskan Beaufort Sea. The coastal production in these areas is especially important, because bowhead whales sometimes feed there (Griffiths, Richardson, and Thomson, 2001). The levels of effects for Sale 202 with these two alternatives are described in Section IV.C.2.b(2).

As assessed in Section IV.C.2.a above, the coastline would be vulnerable to offshore spills mainly during the summer open-water period; during the rest of the year, the coastline probably would be buffered from offshore spills by the band of landfast ice. The probability that a summer spill from various offshore locations would contact the coastline of the Arctic National Wildlife Refuge within 30 days is given in Table A.2-87. The table includes the probability for spills in hypothetical Launch Area 18, which corresponds with the eastern Deferral area and Kaktovik Subsistence Whale Deferral area combined. A summer spill from this launch area is estimated to have a 49% probability of contacting the Refuge's coastline within 30 days (Table A.2-87). Deferral of leasing in these two areas combined would not eliminate the risk to the Refuge's coastline but would lower the maximum risk by about 25%. Specifically, the maximum probability that a summer spill would contact the coastline of the Arctic National Wildlife Refuge within 30 days would drop from 49% to 38% (Table A.2-87).

Conclusion: Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced). A summer spill from the Eastern Deferral area and Kaktovik Subsistence-Whaling Deferral area combined is estimated to have a 49% probability of contacting the coastline of the Arctic National Wildlife Refuge within 30 days. Deferral of leasing in these two areas combined would not eliminate the risk to the Refuge's coastline but would lower the maximum risk by about 25%.

IV.C.2.b(2) Effects of Alternative VI for Sale 202

Exploration and development might occur far to the east with Sale 202; deferral of the area south and east of Kaktovik would reduce slightly the oil-spill risk to the area. The chance of contact to nearshore water quality from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55) would be reduced 2-11% (assuming contacts occur within 30 days during the summer [Table A.2-27:LA18]). However, the chance of contact to the coastal band of high production to the west of Beaufort Lagoon (Table A.2-27, Land Segments 25-48) would be about the same as those described for Sale 202 without a deferral.

The probability that a summer spill from various offshore locations would contact the coastline of the Arctic National Wildlife Refuge in particular within 30 days is listed in Table A.2-87. As explained in

Section IV.C.2.b(1), the table includes the probability for spills in hypothetical Launch Area 18, which correspond with the Eastern Deferral area and Kaktovik Subsistence-Whaling Deferral area combined. A summer spill from this launch area is estimated to have a 49% probability of contacting the Refuge's coastline within 30 days. Deferral of leasing in these two areas combined would not eliminate the risk to the Refuge's coastline, but would lower the maximum risk by about 25%. Specifically, the maximum probability that a summer spill would contact the Refuge's coastline within 30 days would drop from 49% to 38% (Table A.2-87).

Conclusion. The deferral would reduce the risk that hydrocarbons from a large oil spill would contaminate (Section IV.C.1.b) the area south and east of Kaktovik for several days. Other effects would be similar to those described for Sale 202 without a deferral (Alternative I). Permitted drilling discharges likely would adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. The Aurora Prospect in this area was explored during 1988 with no noticeable effects of discharges on lower trophic-level organisms. Platform and pipeline construction likely would adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unintentional construction effects on unusual kelp communities could be avoided by required benthic surveys (Stipulation 1). A summer spill from the Eastern Deferral area and Kaktovik Subsistence-Whaling Deferral area combined is estimated to have a 49% probability of contacting the coastline of the Arctic National Wildlife Refuge within 30 days. Deferral of leasing in these two areas combined would not eliminate the risk to the Refuge's coastline, but would lower the maximum risk by about 25%.

IV.C.3. Fishes

IV.C.3.a. Effects Common to All Alternatives

IV.C.3.a(1) Effects from Routine Activities

IV.C.3.a(1)(a) Effects from Noise and Disturbance

Fishes inhabiting the arctic region (Figure III.B-2) are described in Section III.C.2. Arctic fish differ substantially from their counterparts inhabiting warmer regions. In addition to their many differences, arctic fish also have developed unique life history, behavioral, physiological, and population characteristics that enable them to exist under extremely harsh and fluctuating environmental conditions of both daily and seasonal occurrence. These conditions occasionally cause high mortalities, especially to the more sensitive lifestages (eggs and juveniles). Because of this, arctic fish populations have adapted to withstand at least short-term perturbations and fluctuations in the environment. This adaptive ability applies equally to both human- and naturally caused events.

Disturbance-related activities associated with OCS exploration and development include disturbances from pipeline construction; discharges from gravel mining and island construction and reshaping; noise from platform, island, or ice-road construction; and abandonment. Because the water used for construction purposes is not likely to be withdrawn from waters supporting fish, the use of freshwater for ice-road and pad construction is not likely to have a measurable effect on fish populations.

IV.C.3.a(1)(a)1) Disturbance from Pipeline Construction

Pipeline construction involves trenching, hydraulic dredging, backfilling material into the trench, and storing excess trenching material on the ice. These activities are likely to temporarily displace fish from the immediate area of the activities, and a few fish could be harmed or killed. However, these effects are not likely to continue after construction is completed or to have a measurable effect on fish populations.

IV.C.3.a(1)(a)2) Discharges from Gravel Mining and Island Construction and Reshaping

During construction, a few fishes in the immediate area of a discharge could be harmed or killed. However, most are likely to avoid these areas, and no measurable effects would be likely at the population level.

IV.C.3.a(1)(a)3) Noise from Platform, Island, or Ice-Road Construction

Noise from island construction and similar activities may affect fishes. Fishes sometimes avoid sudden noise but typically ignore the same noise, if it is continuous over a longer period of time (Bell, 1990). Fishes appear to respond to sound waves within the range of 5-1,000 Hertz (Bell, 1990). Because OCS activities are likely to generate noise within this range, some fishes in the immediate area may be temporarily disturbed. Because marine fish are widely dispersed and are largely unrestricted in their movements, noises associated with these activities likely would not have a measurable effect on marine fish populations.

Freshwater and migratory fishes, however, overwinter in fresh- or brackish water, where depths are sufficient to provide ample space and oxygen below the winter ice. Hence, overwintering fishes essentially are captives in these areas until spring breakup. Because they depend on overwintering habitats and are unable to move away from noise, the noise generated by construction-related activities may stress some overwintering fishes in the immediate area of the proposed activities and, thereby, decrease the likelihood of survival for some. However, noise effects on most overwintering fishes are likely to be short term and sublethal. For this reason and because most activities are not likely to occur above overwintering habitat, these activities are not likely to have a measurable effect on overwintering freshwater and migratory fish populations.

IV.C.3.a(1)(a)4) Effects of Small Onshore Oil Spills

Small onshore spills in summer would not have any effect on fishes, unless they occurred in or flowed into waters containing fish. If a small spill were to occur, some fish and food resources in the immediate area may be harmed or killed. However, due to the small amount of oil involved, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in small waterbodies with restricted water exchange, small onshore oil spills are not likely to have a measurable effect on fish populations. A winter spill also likely would have no measurable effect on fishes, because the oil would spill on the ice above the waterways, would be cleaned up, and would not come in contact with fishes or their habitat.

IV.C.3.a(1)(a)5) Abandonment

Removing islands and undersea pipelines would increase the amount of suspended matter in the water, which could affect fishes. Typically, when the island's slope-protection materials are removed, waves, ice, and currents extensively erode its surface and, within a few years, the island is below sea level. If abandonment activities remove the concrete armor on the island's underwater slope, the amount of fish habitat and food resources would be reduced, which would reduce fish populations in the island area. Otherwise, none of these abandonment-related activities are likely to have a measurable effect on arctic fish populations.

Summary. Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations.

IV.C.3.a(2) Effects of a Large Oil Spill on Fish

The effects of oil spills on fish have been discussed in previous Beaufort Sea EIS's, including the Sale 144 Final EIS (USDOI, MMS, 1996a), which are incorporated here by reference and summarized. Oil spills have been observed to have a range of effects on fish (see Rice, Korn, and Karinen, 1981; Starr, Kuwada, and Trasky, 1981; Hamilton, Starr, and Trasky, 1979; and Malins, 1977 for more detailed discussions).

The specific effect depends on the concentration of petroleum present, the time of exposure, and the stage of fish development involved (eggs, larva, and juveniles are the most sensitive). If lethal concentrations are encountered, or sublethal concentrations are encountered over a long-enough period, fish mortality is likely to occur. However, mortality caused by a petroleum-related spill is seldom observed outside of the laboratory environment. Sublethal effects are more likely and include changes in growth, feeding, fecundity, and temporary displacement.

Other possibilities include interference with movements to feeding, overwintering, or spawning areas; localized reduction in food resources; and consumption of contaminated prey. Most acute-toxicity values (96-hour lethal concentration for 50% of test organisms [LC_{50}]) for fish generally are on the order of 1-10 parts per million. Concentrations observed under the oil slick of former oil spills at sea have been less than the acute values for fish and plankton. For example, concentrations observed 0.5-.0 meter beneath a slick from the *Tsesis* spill (Kineman, Elmgren, and Hansson, 1980) ranged from 50-60 parts per billion. Extensive sampling following the *Exxon Valdez* oil spill (about 260,000 barrels in size) also revealed that hydrocarbon levels were well below those known to be toxic or to cause sublethal effects in plankton (Neff, 1991).

The low concentration of hydrocarbons in the water column following even a large oil spill appears to be one of the main reasons for the lack of lethal effects on fish and plankton. Some of the studies following *the Exxon Valdez* oil spill (Michael et al., 1998; Marty et al., 1999) concerning the effects of that spill on fish populations in Prince William Sound were inconclusive. While adverse effects on some eggs and larva (pink salmon and herring) were likely to have occurred, natural perturbations cause extreme variation in these populations every year and preclude definitive conclusions. Other studies following the *Exxon Valdez* oil spill, conducted from 1989-1991 (Armstrong et al., 1995; Brannon et al., 1995; Pearson et al., 1999) were more conclusive. Regarding the effects of that oil spill on bottomfish and crustaceans, Armstrong et al. (1995) concluded:

> …we were not able to detect and document recurring and pervasive deleterious impacts at depth in PWS on the fauna of our study at either the individual or population levels, despite our best efforts to target species whose complete life cycle would cause persistent exposure in the water column, or on benthos through ontogenetic changes in location from larvae to juvenile to reproductive adult.

Regarding the effects of the *Exxon Valdez* oil spill on pink salmon, Brannon et al. (1995) stated:

> However, there was no apparent effect from oil exposure that would have a significant effect on the wild stock pink salmon population in the sound. Although negative indications of exposure to petroleum hydrocarbons have been reported in other studies related to the Exxon Valdez oil spill, neither results from the present early life-history studies nor the survival success of progeny of the 1988 and 1989 brood years would support such conclusions.

Regarding the effects of the *Exxon Valdez* oil spill on the collapse of the Pacific herring population in Prince William Sound that began in 1993, Pearson et al. (1999) stated:

> …we are convinced that a combination of increasing Prince William Sound herring biomass and decreasing food supply lead to poor condition of Prince William Sound herring, which resulted in the 1993 decline….

and

> The record high population levels and harvests of Prince William Sound herring in the years after the 1989 oil spill, the lack of change from the likely age class distribution, and the low level of oil exposure documented for herring in 1989 and the following years all indicate that the 1989 oil spill did not contribute to the 1993 decline.

Regarding the long-term effects of the *Exxon Valdez* spill on pink salmon fry, Rice et al. (2001) indicated that 4 years after the spill, the National Resource Damage Assessment researchers found elevated embryo mortality at streams that were oiled. Based on laboratory studies, National Resource Damage Assessment researchers hypothesized that this was due to exposure to polynuclear aromatic hydrocarbons in weathered oil, which were continuing to leach out of oiled streams. Industry researchers found no such evidence of instream oil or increased embryo mortality (Rice et al. 2001).

In summary, adverse effects on some fish eggs and juveniles (for example, pink salmon and herring) were likely to have occurred due to *the Exxon Valdez* oil spill, at least at the most heavily oiled sites. However, more than 10 years of study have revealed that the *Exxon Valdez* spill apparently had no measurable effect on any fish population, local or otherwise. Some still believe there were such effects and offer theories as to why they were never demonstrated. For example, Rice et al. (2001) states that effects of the *Exxon Valdez* oil spill could not be demonstrated at the stream population level (even at the most heavily oiled sites).

In 1985, this same researcher warned against making predictions concerning the effects of oil spills on fish populations based on laboratory studies alone, and suggested that laboratory results needed confirmation from field studies (due to conflicting laboratory results). Concerning the field studies conducted to that date (1985), he went on to state that even after the largest oil spills in history, the effects of those spills on fish populations were found to be negligible (Rice, 1985). Other researchers (for example, Pearson et al., 1999; Armstrong et al., 1995; Brannon et al., 1995; Maki et al., 1995) repeatedly have made similar conclusions concerning the effects of the *Exxon Valdez* oil spill on fish populations: that no population-level effects on fishes could be attributed to that oil spill. If measurable population-level effects were likely or even possible, they clearly would have been demonstrated by the largest spill in U.S. history, the *Exxon Valdez* oil spill. That oil spill occurred at a time of the year when it would have resulted in the maximum possible damage to fish populations. However, as can be seen from the oil-spill research conducted to date, population-level effects on fishes were not demonstrated, even in the worst-case situations. Hence, while adverse effects on some fish eggs and juveniles were likely to have occurred, measurable effects on fish populations (either local or regional) apparently did not occur. If any such effects did occur, they apparently have remained too small to observe or measure.

IV.C.3.a(2)(a) Offshore Oil Spill

From October through April, nearshore waters 6 feet or less in depth are frozen to the bottom, and marine fishes are widely dispersed seaward of the shorefast ice. Because of the barrier formed by this shorefast ice, and the fact that any oil trapped under floating ice would not disperse into the water, a winter offshore spill is not likely to have a measurable effect on marine fishes or on migratory fishes overwintering in the Sagavanirktok River Delta area. During the open-water period, the nearshore area of the Beaufort Sea is used for feeding and migratory purposes by marine and migratory fishes, including the areas of greatest species diversity, such as the Sagavanirktok River Delta. Hence, the unlikely occurrence of an offshore oil spill during the summer likely would have its greatest potential effect in the nearshore area.

In the unlikely event of an offshore oil spill occurring and contacting the nearshore area, some marine and migratory fish may be harmed or killed. However, lethal effects on fish from oil spills are seldom observed outside of the laboratory environment. For this reason, relatively small oil spills are likely to have mostly sublethal effects on the affected marine and migratory fish. Juvenile fish (for example, arctic cod), which are common in the nearshore area during summer, or nearshore spawners (for example, capelin) are among those most likely to be adversely affected. Some fish in the immediate area of a spill may be killed; however, it is not likely to have a measurable effect on marine and migratory fish populations. Recovery would be likely in 5-10 years. Oil-spill-cleanup activities are not likely to adversely affect fish populations. Small operational oil or fuel spills are not likely to contact fish habitat and, therefore, are not likely to affect fish.

IV.C.3.a(2)(b) Onshore Pipeline Oil Spill

Onshore bodies of freshwater are much smaller than the marine environment, where the effects of former oil spills have been observed. However, the amount of oil spilled onshore is likely to be much less than what might occur from an offshore spill. Additionally, an onshore pipeline spill would not affect fishes unless it entered freshwater habitat supporting fishes. In the unlikely event of an onshore oil spill contacting fish habitat, lethal effects are likely to be similar to those observed for oil spills at sea (very low). Sublethal effects are more likely to occur and would be similar to those discussed above. Some fish and food resources in the immediate area of an onshore oil spill may be harmed or killed, particularly if the spill occurred where and when fish were migrating, in overwintering areas during winter, or in small waterbodies having restricted water exchange.

Ninespine stickleback, arctic grayling, and Dolly Varden char have been found in the summer in the East Sagavanirktok Creek (Hemming, 1996). Ninespine sticklebacks move downstream and out of the creek in late summer as water temperatures drop. Dolly Varden char and arctic grayling may use the creek for summer rearing habitat (Hemming, 1996). Small runs of pink and chum salmon (anadromous species) sometimes occur in the Colville River, and in some of the drainages west of the Colville River; however, neither species has established populations anywhere on the North Slope (Bendock and Burr, 1984). In the unlikely event a pipeline oil spill occurred in winter, it likely would not affect fishes. However, if a summer spill of sufficient size occurred in a small waterbody containing fish with restricted water exchange, the fish and food resources in that waterbody likely would be harmed or killed. Recovery would be likely in 5-10 years. However, because of the small amount of oil from an onshore pipeline spill likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs) with restricted water exchange, there likely would be no measurable effect on fish populations. Oil-spill-cleanup activities are not likely to adversely affect fish populations.

IV.C.3.a(2)(c) Offshore Diesel Fuel Spill

Compared to a crude oil spill, a diesel spill would have a relatively short lifetime because of the high rates of dispersion and evaporation (USDOI, MMS, 1998). During winter, about 80% of the diesel fuel likely would evaporate and be dispersed by wave action within 30 days. During summer, all of the diesel likely would evaporate and be dispersed by wave action in only 7 days and likely would not reach shore.

In general, the effects of fuel spills on fish are likely to be similar to those of crude oil spills although much reduced in duration due to evaporation and dispersion. Hence, the likelihood of lethal effects likely would be even less than that observed for oil spills at sea. For this reason, a relatively small fuel spill is likely to have mostly sublethal effects on the marine and migratory fishes affected by it. Some fish in the immediate area of a spill might be harmed or killed; however, it is not likely to have a measurable effect on fish populations. Recovery of the number of fish harmed or killed would be likely within 5-10 years.

IV.C.3.a(2)(d) Oil-Spill Cleanup

Because of the low density of fish in the Beaufort Sea, and the low probability that they would be harmed by cleanup equipment, oil-spill-cleanup activities in open water or in broken ice are not likely to adversely affect fish populations. Reducing the amount of oil in the marine environment is likely to have a beneficial effect by reducing the possibility of hydrocarbons contacting fish and their food resources. The extent of that benefit would depend on the actual reduction in the amount of oil contacting fish and their food resources, as compared to that of not reducing the amount of contact.

Conclusion. Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations.

In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills.

In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.

Effectiveness of Mitigating Measures. Stipulations 1-3, and ITL clause 11 are the mitigating measures most likely to have a beneficial effect on arctic fish populations. With these mitigating measures in place, there is an increased probability that (1) spawning and overwintering fish would be unaffected by activities associated with oil and gas activities, (2) fish passage and stream flows would be maintained, and (3) the effects of accidental fuel spills would be minimized. To the degree they are implemented, these mitigation measures are likely to benefit arctic fish populations. However, because oil and gas activities are likely to have no measurable effect on arctic fish populations, their absence is not likely to result in a measurable increase in adverse effects on arctic fish populations.

IV.C.3.b. Effects of Alternatives and Sales

Effects of Alternatives I and III through VI for Sales 186, 195, and 202. The activities associated with these alternatives would be essentially the same for Sales 186, 195, and 202. The volume of oil and the level of activities that could adversely affect fish remain essentially the same for all alternatives; hence, they would have the same level of effects as Alternative I. The deferral areas associated with these alternatives for each sale would eliminate disturbances to fish populations within the deferral area. Nevertheless, the overall amount of activity outside these deferral areas is likely to remain essentially the same for each sale, and the overall effects to the fish resources in the Beaufort Sea would be essentially the same for all alternatives for all three sales. Hence, any disturbances associated with Alternative I for Sales 186, 195, and 202 simply would occur somewhere outside of the deferral areas. However, the level of activity outside the deferral areas still would remain well below that likely to cause a measurable effect on any fish population. For this reason, and for the same reasons discussed at the beginning of this section, disturbances associated with Alternative I for Sales 186, 195, and 202 are not likely to have a measurable effect on fish populations.

Oil spills associated with Alternative I for Sales 186, 195, and 202 have various conditional probabilities of contacting nearshore Beaufort Sea habitat ranging from less than 0.5-21% (Table A.2-27). These probabilities do not vary for Sales 186, 195, and 202. Nearshore habitat is of greater concern when considering fish populations, because fish tend to concentrate there during the spring and summer to feed and move about. However, combined probabilities factor in the probability of a large oil spill actually occurring and the probability of it contacting specific target areas. Alternative I for Sales 186, 195, and 202 have a combined probability of less than 0.5%, which means that the chance of a spill actually occurring and then contacting any shoreline area is extremely low and the same for each sale. Even if that chance was very high, Alternative I for Sales 186, 195, and 202 assumes the same basic oil-spill parameters: (1) the size of the assumed offshore oil spill, (2) the amount and composition of the oil reaching the shore, (3) the amount and location of shoreline contacted, and (4) the amount of time the spilled oil would remain in the nearshore area. Variations in these parameters generate the primary differences in the estimated effect of any sale-related oil spill on fish populations. If an oil spill were likely to have a measurable effect, differences in these parameters would be necessary to estimate the magnitude of that effect. Because the parameters that would affect fish do not vary substantially between alternatives and Sales 186, 195, and 202, each of these alternatives and sales are likely to have essentially no measurable effect on fish populations.

Conclusion. Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations.

In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills.

In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.

IV.C.4. Essential Fish Habitat

Analysis of essential fish habitat is required in environmental assessments as a result of The Sustainable Fisheries Act of 1997 and its enacting regulations. Regulations define essentially the whole of the Beaufort Sea to the limit of the 200-mile Exclusive Economic Zone as essential fish habitat for Pacific salmon. In this context, Pacific salmon comprises the five salmon species commonly known as pink or humpy (*Oncorchynchus gorbuscha*), chum or dog (*Oncorhynchus keta*), red or sockeye (*Oncorhynchus nerka*), silver or coho (*Oncorhynchus kisutch*) and king or chinook (*Oncorhynchus tshawutscha*).

By regulation, this section focuses in more detail on the potential as salmon habitat rather than on whether or not salmon presently use the habitat. The habitat includes not only the physical substrates and water-quality characteristics but also the salmon-prey foods and their habitats for all lifestages. These characteristics are more fully described in Section III.B.3 Affected Environment. The effects on salmon are evaluated in the general fisheries analysis of anadromous fish in Section IV.C.3. This section analyzes the remaining aspects of essential fish habitat.

IC.4.a. Effects Common to All Alternatives

The effects of development are common to all alternatives, but the same disturbances can have different effects on essential fish habitat in different regions within the Beaufort Sea.

IV.C.4.a(1) Introduction

A broad ecological look at the essential salmon habitat in the Beaufort Sea is the basis for defining the generic effects common to all alternatives. Dividing the Beaufort Sea into three areas and characterizing their differences from east to west is useful for understanding the effects of the various alternatives on salmon essential fish habitat. Map 13 illustrates the locations of these divisions along with the freshwater, estuarine, and marine salmon habitats. The total designated essential fish habitat to the limit of the Exclusive Economic Zone is shown on the inset map of Alaska to Map 13. Table III.B-1 summarizes the components, seasons, and areas of freshwater, estuarine, and marine essential fish habitats.

For purposes of analysis, the western Beaufort is from Barrow east to the Colville River Delta (see LA1-LA6 on Map 13). The central Beaufort encompasses most of the Colville River Delta and continues east to the Arctic National Wildlife Refuge (LA7-LA15 on Map 13). The eastern Beaufort continues from the western boundary of the Arctic National Wildlife Refuge east to the Alaska-Canada border (LA16-LA18 on Map 13).

The Beaufort Sea can be considered an ecological population sink for salmon rather than a source. It draws excess salmon from other areas rather than producing a surplus that colonizes new areas. The scarcity of documented salmon in the Beaufort Sea (see Section III.B.3) and the fact that the Beaufort Sea is at the northern boundary of the geographic distribution support this conclusion.

Within the Beaufort Sea itself, salmon have been documented in greater numbers and more often in the western than the eastern Beaufort. This reflects western locations being nearer the sources of the larger and more concentrated salmon populations in the Bering and Chukchi seas. The dominant ocean currents also tend to bring more nutrients to the western portion of the Beaufort Sea. Other physical differences such as temperature and salinity seem to differ little east to west. Overall, a given level of disturbance on essential fish habitat is likely to have a greater impact on the western Beaufort Sea than on the central or eastern Beaufort Sea.

IV.C.4.a(1)(a) Freshwater Habitat

As detailed in Section III.B.3, freshwater is most important for eggs and alevins from July through the winter and into May. The primary Beaufort Sea overwintering areas presently are the Colville and Sagavanirktok rivers in the central region. The Chipp River in the eastern region also may provide overwintering habitat (Fechhelm and Griffiths, 2001).

Effects on freshwater essential fish habitat potentially are greatest in the central Beaufort Sea. The central Beaufort provides the best freshwater (overwintering) habitat.

IV.C.4.a(1)(b) Estuarine Habitat

The largest variation in temperature and salinity that affects essential fish habitat is more directly a result of freshwater inputs rather than variation due to large-scale currents and ocean trends from east to west. Generally, freshwater inputs from large rivers will have a greater effect than overall east and west macro-effects. Primarily the large rivers, such as the Colville and Sagavanirktok rivers will have a warming and diluting effect on the nearshore. The warmer, less-saline waters from these rivers cause the 5-mile-wide estuarine belt that provides the juvenile salmon short-term rearing and migratory habitat as these salmon smolt move from freshwater, adapt to marine waters, and make their way to the Alaska Gyre. Salmon ride the gyre around the Gulf of Alaska until their time to return through this 5-mile-wide Beaufort Sea estuarine belt on their final spawning run. (The primary feeding and growth habitat for Pacific salmon, however, is recognized in the essential fish habitat literature to be south of the Beaufort Sea.)

Effects on estuarine habitats are likely to be greater in the western Beaufort Sea. Zooplankton is the primary prey of most salmon once they enter the estuarine habitat. The western and eastern Beaufort have greater zooplankton productivity than the central Beaufort. The eastern region has a pocket of particularly productive zooplankton habitat called the Boulder Patch, but it covers relatively small areas. Because salmon and baleen whales both favor the zooplankton copepod, the presence of bowhead whale-feeding areas in the eastern Beaufort indicates excellent marine feeding habitat for salmon. However, even if the eastern region has a higher zooplankton prey base, the western region is still more important, because all juvenile salmon have to transit the western Beaufort on their way to the Bering Sea.

IV.C.4.a(1)(c) Prey Habitat

Another portion of essential fish habitat is salmon prey and its habitat. Prey primarily is the zooplankton swimming in the open estuarine and marine waters. To a lesser extent, some benthic animals in the estuarine zone and on the shallow sea bottom along with smaller fish also compose part of the salmon prey base. (See Sections IV.C.1, IV.C.2, and IV.C.3 for effects on water quality, lower trophic-level organisms, and fishes for more detail.)

IV.C.4.a(1)(d) Marine Water Habitat

Effects in the marine habitat are similar to those in the estuarine habitat, because rearing salmon still depend on zooplankton resources.

It is useful to address the likelihood of Beaufort Sea marine waters ever actually becoming productive salmon habitat. The marine waters 320 kilometers north of the Beaufort coast formally are designated as essential salmon habitat. However, according to the preliminary assessment report for essential fish habitat (North Pacific Fisheries Management Council, 1997), this marine rearing stage historically does not involve the Beaufort Sea. Pink salmon occupy marine waters south of 60° N. latitude; coho south of 64° N. latitude; chinook in the Bering Sea 70° N. latitude and south; chum salmon south of the Bering Straight

(66° N. latitude), and sockeye in the larger Gulf of Alaska and the Pacific Rim. Temperature may explain most of this difference as the Beaufort Sea ranges around -2º Celsius in winter and -1º to +4º Celsius in summer (Okkonnen, 2002, pers. commun.) whereas coho salmon, for instance, prefer 12-15º Celsius (North Pacific Fisheries Management Council, 1997).

Over the entire Arctic Ocean, the annual trend in surface air temperature shows a warming of about 1.0 degrees Celsius per decade in the eastern Arctic primarily north of the Laptev and East Siberian seas. The western Arctic shows no trend or even a slight cooling in the Canadian Beaufort Sea (Rigor, Colony, and Martin, 2000). During fall, the trends show a cooling of about 1.0 degrees Celsius per decade over the Beaufort Sea and Alaska Sea (Rigor, Colony, and Martin, 2000). During spring, a significant warming trend of 2 degrees Celsius per decade can be seen over most of the Arctic. Summer shows no significant trend (Rigor, Colony, and Martin, 2000). Barrow has experienced a significant warming over the last 80 years, but this warming is not uniform for all seasons; neither is it uniform over the entire period from 1920-1980 (Lynch et al., 2001). It would be a warm day of global warming in the Beaufort Sea before salmon and grow to maturity in its marine waters. A temperature rise significant enough to create ecological effects bringing significant improvements to the presently very marginal habitat for salmon to rear and mature in the Beaufort Sea is unlikely over the next two decades. Sufficient warming for salmon, therefore, is unlikely to occur before expected production activity from these lease sales is completed in 2038.

In summary, the same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region.

IV.C.4.a(2) Effects of Exploration

IV.C.4.a(2)(a) Effects from Routine Activities

IV.C.4.a(2)(a)1) Seismic Surveys

Seismic waves will cause very short-term (less than 1 week in any one location) disturbances to essential fish habitat during exploration phases. Because the lease-sale blocks are beyond the estuarine habitat, seismic waves primarily will affect the marine habitat, especially during exploration, making it temporarily uninhabitable and displacing maturing fish. Hypothetically, there could be sublethal effects such as partial or temporary disruption of fish sensory organs (Hanna, 2002, pers. commun.) and effects to zooplankton. To our knowledge, however, the actuality of this possible sublethal effect has not been determined. Exploratory seismic testing likely would affect 162 square miles of habitat for 2-5 days. The effect would be spread out across the Beaufort Sea multiple-sale area and continue over 14 summers (about 630 open-water days) from 2004-2018. It likely would displace no more than three or four salmon, because salmon are expected to inhabit this area only after global warming significantly raises the Beaufort Sea temperature (see the discussion on global warming in Section I.C.1.e(3)). A temperature rise significant enough to cause ecological effects that would bring salmon to rear in the Beaufort Sea presumably would occur long after exploration is completed in 2018.

Seismic effects to zooplankton and zooplankton habitat would be of the same area and duration. The zooplankton would not be displaced but rather could have sublethal effects, from which they would recover within 1 week. If seismic waves do penetrate into the estuarine areas, zooplankton are expected to recover in 2 weeks. See Section IV.C.2 - Effects on Lower Trophic-Level Organisms for more detail. Effects on essential fish habitat from seismic exploration from the multiple sales are considered low.

IV.C.4.a(2)(a)2) Drilling-Mud Disposal

Short-term (less than 3 years) effects are expected from drilling-mud disposal. Drilling-mud disposal will not affect the major prey, zooplankton, or fish or their habitats. Drilling muds are expected to affect a minor prey, benthic organisms, at sublethal levels (and their benthic habitat) within 1,000 meters of the 34 exploratory wells or a total of 2,700 acres (approximately 2,000 hectares) per year. Benthic prey and habitat would recover from sublethal effects within 3 years. Effects on essential fish habitat from drilling-mud disposal are considered low.

IV.C.4.a(2)(a)3) Turbidity

Turbidity would be caused by gravel dumping during construction of up to three gravel islands during the development phase. Sediments would remain suspended for 2-3 hours but would not extend farther than 3 kilometers from the dumping site. Gravel dumping for island construction is estimated to take 45 days, and turbidity effects would last a few days beyond the dumping. Turbidity would range over 168 square kilometers of salmon and salmon prey habitat. See Section IV.C.1 - Effects on Water Quality for more details.

Disturbances to the water column (prey, prey habitat, and salmon habitat) in the form of increased turbidity from drilling muds are limited to 266 acres (108 hectares) of marine habitat around drilling operations. Water quality is expected to be slightly toxic to nontoxic inside of a 100-meter (328-foot) radius, or 0.03 square kilometer (7 acres) around each drilling discharge site as a result of those discharges. See Section IV.C.1 for a more detailed discussion of the effects on water quality. Effects to essential fish habitat from turbidity caused by gravel dumping are considered low.

Summary. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item.

IV.C.4.a(2)(b) Effects from Very Large and Very Unlikely Oil Spill

The effects of a very unlikely very large oil spill are evaluated in Section IV.I.2.d.

IV.C.4.a(3) Effects of Development and Production

IV.C.4.a(3)(a) Effects from Routine Operations

Effects on essential fish habitat from seismic surveys, drilling-mud disposal, and ice-road construction in the development phase generally would be similar in type but somewhat higher in volume than from the exploration phase. The construction and operation of offshore pipelines and the potential for oil spills, however, are a much greater threat to essential fish habitat during the development phase.

IV.C.4.a(3)(a)1) Seismic Surveys

Seismic effects during development would be similar in type, but they would take place over twice the area and for a longer duration. Seismic surveys in the development phase would affect the not only the marine habitat but also the estuarine habitat because of seismic surveys conducted for under sea pipelines from platforms to landfall. Possible sublethal effects have been hypothesized but not scientifically proven or disproven. Effects on essential fish habitat from seismic surveys conducted for the multiple sales are considered low.

IV.C.4.a(3)(a)2) Drilling-Mud Disposal

Volumes of drilling muds likely would be 13 times greater than during the exploratory phase, 292,000 short tons. The area affected would be about 12 times greater, because 314 production wells are likely compared to 36 exploratory wells. Effects on essential fish habitat from the disposal of drilling muds are considered low during the development phase.

IV.C.4.a(3)(a)3) Turbidity

Turbidity would result from dumping gravel to construct two or three gravel islands. Sediments would remain suspended for 2-3 hours, but they would not extend farther than 3 kilometers from the dumping site. Gravel dumping for island construction is estimated to take 45 days, and the effects would last a few days beyond the actual gravel dumping. Turbidity would range over 57-84 square kilometers of salmon and salmon prey habitat. See Section IV.C.1 - Effects on Water Quality for more details. Effects from turbidity on essential fish habitat are considered low.

IV.C.4.a(3)(a)4) Offshore Pipeline Construction and Operation

Turbidity effects on essential fish habitat from offshore pipeline construction would be similar to disturbance from dredging for constructing gravel islands. Dredging operations show that there is a decrease in the concentration of suspended sediments within a short time (2-3 hours) and distance (a few hundred meters to a few kilometers) downcurrent from the dredging operations (USDOI, MMS, 2001b:Section III.C.3.l). If construction of a 65-kilometer long pipeline creates a 2-kilometer wide plume on either side during the construction season, a 258 square kilometer area could be affected, which is three to five times the area affected by the construction of a gravel island. Effects on essential fish habitat from turbidity created from the construction of an offshore pipeline are considered low.

IV.C.4.a(3)(a)5) Onshore Pipeline Construction and Operation

Because of their relatively small size, new offshore projects will use the existing infrastructure wherever possible. Therefore, no increased effects on essential fish habitat are expected.

IV.C.4.a(3)(a)6) Ice-Road Construction

Ice roads and ice pads would be constructed for the offshore development phase. For the proposed Liberty development, an estimated 120 million gallons of freshwater could be needed annually during the construction phase and 20 million gallons annually thereafter for the construction of ice roads and ice pads (USDOI, MMS, Alaska OCS Region, 2002a).

Winter water withdrawals are prohibited from rivers and streams or shallow lakes (less than 7 feet deep) interconnected with or flooded by fish-bearing streams (USDOI, Bureau of Land Management and MMS, 1998). However, regulations allow withdrawal of up to 15% of the free-water volume from deeper, potential overwintering lakes, including those connected to river systems and available to anadromous fish.

Generally, winter water drawdown from “lakes 7 feet (2.1 meters) deep or deeper shall be limited to 15% of the estimated free-water volume (i.e., excluding the ice).” Regulators may authorize greater than 15% drawdown, if the proponent demonstrates that no fish exist in the lake. “Operators are encouraged to use new ice-road and ice-pad construction methods, such as using aggregate chips shaved from frozen lakes, to decrease water demands, construction time and impact on fisheries” (USDOI, Bureau of Land Management and MMS, 1998)

Deepwater habitat suitable for wintering fishes is a limiting factor that controls fish-species richness and the relative abundance of fish found on the North Slope (Hemming and Ott, 1994).

Despite the critical importance to survival, very little knowledge exists on actual overwintering habitat of Beaufort Sea anadromous fish. Overwintering habitat is a more-severe habitat constraint, because it is essential, scarce, isolated, and necessary for two-thirds of the year (Craig, 1989). In the Beaufort Sea, anadromous fish survive by retreating to essential overwintering habitat as the vast food-rich coastal marine summer habitat becomes frigid and inhospitable in fall. Just when the roughly equal-sized inland waters become essential for overwintering they become a scarce resource, shrinking by 98%. Even the Colville and Sagavanirktok, the two largest rivers on the North Slope, cease flowing by late winter and freeze to the bottom over long stretches (Arnborg et al., 1966). As fish crowd into limited deepwater pockets, the waters become overcrowded, anoxic, and subject to freezing. Once the connecting channels freeze solid, the fish are isolated and cannot move to better habitat. Fish must survive a minimum of 8 months a year in this limiting overwinter habitat, from fall freezeup to spring breakup, so they can return to the nourishing, food-rich coastal environments for their short 1.5- to 2.5-month summer-growth spurt. Human activities or water withdrawals can be fatal to fish during this particularly vulnerable overwintering period.

We have little knowledge of the location, characteristics, and variation of overwintering sites and few regulatory protections for this critical habitat. State of Alaska regulations limit freshwater removals to15% of any freshwater habitat in lakes greater than 2 meters deep (i.e., potential overwintering sites). If even 15% of the water in an overwintering site is used for ice roads to offshore development, it potentially could reduce survival by a much higher percentage. Therefore, the effects of ice-road construction for the multiple sales on freshwater essential fish habitat could range from low to moderate because of the uncertainty of the effects of withdrawing up to 15% of the free water during winter.

IV.C.4.a(3)(b) Effects of a Large Oil Spill

IV.C.4.a(3)(b)1) Effects on Freshwater Habitat

Oil spills probably pose the greatest risk to essential fish habitat. A recent survey of remaining North Slope Alaska crude oil from the *Exxon Valdez* oil spill in Prince William Sound found unexpectedly high levels of oil with little weathering, even after 10 years (Short, 2002, pers. commun.). Modeling on this broad Beaufort wide scale indicates that in the unlikely event that an oil spill greater than or equal to 1,000 barrels occurs, there is less than a 5% chance of freshwater resources being contacted within 10 days. However, 360-day oil movements are a more accurate predictor of which parts of the essential fish habitat may be contaminated by oil. Oil spilled during the ice season would freeze into the grease ice and slush ice. The pools on the ice surface would concentrate the oil but would allow 5% evaporation of the lighter, more toxic components of the crude oil. In late spring and summer, the unweathered oil pools would drain into the water. Evaluating the oil location after 360 days makes the small differences between alternatives more apparent.

The majority of the coastal regions have a 1-2% chance of being contacted, should a large oil spill occur. The greatest likelihood of spilled oil contacting the coastal freshwaters is a 3-14% chance near the western half of the National Petroleum Reserve in Alaska in the western Beaufort Sea. The second most-likely section of freshwater to be contacted is the Kaktovik/Barter Island vicinity in the eastern Beaufort Sea, a 2-10% chance. This eastern Beaufort coastline, though relatively shorter than the central and western Beaufort coastlines, is more densely populated with anadromous streams. While this eastern coastal region is short and adjacent to fewer potential lease blocks, it is more densely populated with anadromous streams containing potential spawning and overwintering areas. There is an intermediate chance (1-7%) of oil spills contacting freshwater habitat in the Colville River, Canning River, and Kuparuk/Simpson Lagoon/Oliktok Point coastal areas.

IV.C.4.a(3)(b)2) Effects on Estuarine Habitat

The 5-mile-wide band of estuary habitat along the coast is at a similar but slightly higher risk of being oiled as the freshwater habitat. Among the three habitat types (freshwater, estuary, marine waters), effects are most likely to be in the very shallow estuarine zone very close to shore where outmigrating salmon are at their most fragile lifestage as, all at once, they change their physiological regulatory mechanisms from fresh- to saltwater. Their osmoregulatory systems must make the transition from actively drawing salts into their cells in freshwater to actively pushing salts out across their semipermeable cell-wall membranes in saltwater. At the same time, they are entering this new more dangerous habitat and must, within a few days, feed on the new prey species to survive.

Because the new salmon smolt occupy the shallowest waters, for example, only a few centimeters deep for pink salmon (North Pacific Fisheries Management Council, 1997), surface oil is more likely to be deposited in the shallow substrate, and salmon prey are more likely to be oiled. The salmon smolt also are more likely to be oiled. They are unlikely to be able to effectively avoid oil washing the shore and this immediately adjacent very shallow estuarine habitat in the short term. One year of salmon smolt could be affected, and salmon populations would expect to recover within one generation.

There would be no intertidal effect on pink salmon spawning and resultant genetic effects as occurred in Prince William Sound, because the intertidal range in the Beaufort Sea multiple-sale area is only 10-20 centimeters.

IV.C.4a(3)(b)3) Effects on Marine Habitat

The marine areas have the greatest likelihood of being oiled, both immediately and longer term. The probability increases from the west to the east. In the unlikely event that a spill greater than or equal to 1,000 barrels of oil occurs, the eastern region has the greatest chance, up to a 59% chance of being contacted within 10 days and a 65% chance within a year. In most cases, salmon would recover within one generation. One year of maturing salmon would be affected, and salmon populations would expect to recover.

Conclusion. The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region.

Disturbance effects during the exploratory phase are limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item.

Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore) are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation.

In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects on estuarine and marine essential fish habitats could be moderate because, in most cases, salmon would recover within one generation. Effects on marine and estuarine essential fish habitats could be considered moderate because, in most cases, salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.

IV.C.4.b. Effects of Alternatives and Sales

IV.C.4.b(1) Effects of Alternative I for Sale 186

The effects of disturbances and discharges are the same for all alternatives and sales, because the level activities that would affect disturbances for essential fish habitat is the about the same for all alternatives and sales.

The immediate effects (within 10 days) of an oil spill likely would be highest in the Kaktovik/Barter Island area in the eastern Beaufort Sea and the National Petroleum Reserve-Alaska in the western Beaufort Sea. The areas with the greatest likelihood of being contacted within 1 year of a general spill are near the eastern Petroleum Reserve, the Colville River, and the Barter Island/Kaktovik areas.

Within 10 days of a pipeline spill, oil most likely would contact the eastern Petroleum Reserve, Oliktok Point (east of Colville River); the next most likely place is the Kaktovik/Barter Island areas. Within 1 year of a pipeline spill, the Colville River and Oliktok Point are most likely to be contacted by oil; the eastern Petroleum Reserve and the area west of the Colville River are slightly less likely to be contacted.

Conclusion. The effects of an oil spill on salmon essential fish habitat would be considered moderate because, in most cases, salmon and salmon habitat would recover within 1 generation. One year of salmon smolt would be affected, and salmon populations would expect to recover. Effects from disturbances and seismic activity in both the exploratory and development stages on freshwater and marine essential fish habitats would be low. Changes in abundance are limited to a population or portion of a populations (one stream, or in even or odd years for pink salmon) and/or for a short time period.

IV.C.4.b(2) Effects of Alternatives III through VI for Sale 186

Under sale 186, the alternatives are ranked based on the effects of an equal level of disturbance.

Table IV.B-1 gives a rank ordering of alternatives given equal disturbance. A ranking of 1 means that deferral mitigates the most potential impacts of development in the Beaufort Sea. These ranks are based on a composite of the following analysis of the freshwater, estuarine, and marine habitats.

In freshwater, the central region has by far the greatest potential for spawning and juvenile rearing. The central region has 78% of the potential freshwater habitat downstream of pipelines and roads.

For estuarine habitat, the east, central, and western Beaufort Sea areas are very similar, each between one-quarter and one-third of the total. The maximum difference in estuarine habitat value between the eastern, central, and western regions is 12%. The western Beaufort is most valuable in terms of potential salmon habitat, because it is closest to source populations, and all salmon transit on their way to and from the Pacific Ocean. Zooplankton are more productive here than in the central Beaufort. Marine essential fish habitat is largest in volume and most susceptible to oil spills compared to freshwater and estuarine habitats; however, largely because of cold temperatures it has the least realistic long-range potential to actually support salmon. The central Beaufort has 53% of the marine area. The eastern Beaufort has the least marine area (17%) and is the farthest from source populations.

Conclusion. The effects of an oil spill on salmon essential fish habitat would be considered moderate because, in most cases, salmon and salmon habitat would recover within 1 generation. One year of salmon smolt would be affected, and salmon populations would expect to recover. Effects from disturbances and seismic activity in both the exploratory and development stages on freshwater and marine essential fish habitats would be low. Changes in abundance are limited to a population or portion of a populations (one stream, or in even or odd years for pink salmon) and/or for a short time period.

IV.C.4.b(3) Effects of Alternatives I and III through VI, for Sale 195

Effects of seismic noise, drilling-mud discharges, offshore pipelines, and onshore pipelines and platforms essentially would be the same as above for Alternative I for Sale 186, because similar levels of exploration and development are expected. The expected difference in effects on essential fish habitat is due to changing technology, increasing knowledge of essential fish habitat, and changes in environment regulations. The changes from starting and ending development 3 years later, 2007-2039 versus 2004-2036, could reduce the effects of Sale 195 by approximately 5%, were the locations exactly the same. However, because the same blocks will be offered in each sale, the blocks that are closest to the central Beaufort Sea area would be leased in 2003 from Sale 186. Blocks that are more difficult to develop would be leased in Sales 195 and 202.

The ranking of effects of the alternatives will be the same as in Sale 186 (see Table IV.B-1).

Conclusion: The effects of an oil spill would be considered slightly higher than for Sale 186 but still moderate because, in most cases, salmon likely would recover within one generation. One year of salmon smolt would be affected, and salmon populations would expect to recover. Effects from disturbances and seismic activity in both the exploratory and development stages on freshwater and marine would be low, i.e., changes in abundance are limited to a population or portion of a populations (one stream, or in even or odd years for pink salmon) and/or for a short time period.

IV.C.4.c. Effects of Alternatives I and III through VI for Sale 202

Turbidity generated by building gravel islands for platforms will decrease by 33%, because two platforms instead of three are expected and only one platform will be in water shallow enough for an artificial gravel island. All of the other effects of exploration and development would be similar to those of the other alternatives and sales, because similar levels of exploration and development are expected.

The ranking of effects of the alternatives will be the same as in Sale 186 (see Table IV.B-1).

Conclusion: The effects of an oil spill would be considered higher than in Sales 186 and 195 but still moderate, because in most cases salmon would recover within one generation. One year of salmon smolt would be affected and salmon populations likely would recover. Effects from disturbances and seismic activity in both the exploratory and development stages on freshwater and marine would be low, i.e., changes in abundance are limited to a population or portion of a populations (one stream, or in even or odd years for pink salmon) and/or for a short time period.

IV.C.5. Endangered and Threatened Species

The endangered bowhead whale and the threatened spectacled eider and Steller's eider may occur seasonally in the Beaufort Sea Planning Area and may be exposed to OCS exploration and development/production activities associated with Alternative I for Sales 186, 195, 202. The OCS activities under the Alternative I for Sales 186, 195, and 202 and the development of any resources may result in noise and disturbance, altered habitat, and spilled oil or other contaminants, such as discharges of drilling muds and cuttings, which could adversely affect the behavior, distribution, and abundance of individuals or populations occurring in or adjacent to the Beaufort Sea multiple-sale area. It is assumed that crude oil would not be released during exploration.

Pursuant to requirements under the Endangered Species Act of 1973, as amended, the MMS Alaska OCS Region has consulted with the Fish and Wildlife Service and National Marine Fisheries Service on several previous lease sales in this region (most recently, Beaufort Sea Planning Area Oil and Gas Lease Sales 144 and 170). In both the Sale 144 and the Sale 170 Biological Opinions, the Fish and Wildlife Service concluded that the lease sales and associated activities would not be likely to jeopardize the continued existence of the spectacled eider or the Steller's eider. The National Marine Fisheries Service stated that the implications of these sales and previous sales in the Beaufort Sea were considered in the 1988 Arctic Regional Biological Opinion. The National Marine Fisheries Service stated that conclusions and recommendations contained in the 1988 Arctic Regional Biological Opinion were applicable to Sale 144 and Sale 170 and concluded that leasing and exploration activities were not likely to jeopardize the continued existence of endangered whales. Consultation on the Arctic Regional Biological Opinion was reinitiated because of new information on the effects of noise on bowhead whales from OCS activities and new technology for seismic operations. A revised Biological Opinion for Oil and Gas Leasing and Exploration Activities in the Beaufort Sea was issued in 2001. The 2001 Biological Opinion also concludes that oil and gas leasing and exploration in the Beaufort Sea is not likely to jeopardize the continued existence of bowhead whales.

In accordance with the Endangered Species Act Section 7, regulations governing interagency cooperation, MMS notified the Fish and Wildlife Service and the National Marine Fisheries Service by letter dated January 7, 2002, of the endangered and threatened species that would be included in a Biological Evaluation for section 7 consultation. The National Marine Fisheries Service responded on February 11, 2002, confirming the bowhead whale as the species under their jurisdiction to be included in the evaluation. They also indicated that separate consultations are underway or will be initiated regarding the effects of the Trans-Alaska Pipeline System and the marine transport of oil from the terminal at Valdez. They confirmed that MMS did not need to consult on listed species and critical habitat along the pipeline or out of Valdez. The MMS reinitiated formal consultation with the National Marine Fisheries Service for oil and gas leasing and exploration in 2000 and received the Beaufort Sea Biological Opinion from them in 2001. The National Marine Fisheries Service concluded that leasing and exploration are not likely to jeopardize the continued existence of the bowhead whale.

The Fish and Wildlife Service responded on February 11, 2002, and confirmed spectacled and Steller's eiders as the appropriate species under their jurisdiction to be discussed in the evaluation. They also confirmed that MMS did not need to evaluate the effects of transporting oil from Valdez to ports along the Pacific coast and the Far East, indicating this issue will be addressed in a separate consultation with the U.S. Coast Guard.

The draft EIS was completed and, in accordance with Section 7(a) of the Endangered Species Act, formal consultation on the proposed Beaufort Sea multiple-sale program, including leasing and exploration activities associated with the sales, was initiated with NOAA Fisheries and the Fish and Wildlife Service by letter dated May 9, 2002. The draft EIS served as the biological evaluation for the proposed action. The MMS plans to prepare an Environmental Assessment for subsequent sales (Sales 195 and 202) under the multiple-sale program and submit the Environmental Assessment to NOAA Fisheries and the Fish and Wildlife Service as part of the consultation process. Based on information contained in the Environmental Assessment, the MMS will reinitiate consultation if there is new information that would trigger the need to reinitiate consultation. The MMS requested that the NOAA Fisheries uphold the May 2001 Beaufort Sea Biological Opinion for the Beaufort Sea multiple-sale program. The NOAA Fisheries responded by letter dated July 23, 2002, that the May 2001 opinion addresses listed species and anticipated actions under the multiple-sale program, and that Section 7 consultation requirements have been met for Sale 186. The applicability of the May 2001 opinion will be reconsidered prior to the subsequent sales, based on information submitted in the Environmental Assessments prepared for those sales. The Fish and Wildlife Service responded with a Biological Opinion dated October 22, 2002. The Service determined that it is unlikely that the entire action, including eventual development and production, will violate Section 7(a)(2) of the Endangered Species Act. However, development and production activities would require separate consultations. The Fish and Wildlife Service biological opinion contained a reasonable and prudent measure that they and the MMS cooperatively develop a lighting protocol to minimize the likelihood of migrating spectacled or Steller's eiders striking exploration or delineation structures. Appendix C contains copies of the consultation communications.

The analysis contained in this section is based on an exploration and development scenario presented in Section IV.A.1 and Appendices B and F of this EIS. The reader is referred to these sections for a discussion of resource-recovery rates and quantities, timing of infrastructure development, platform emplacement, wells drilled, and resource production timeframes and other information relevant to the development of the resources of Alternative I for Sales 186, 195, and 202. Differences in effects to the species as a result of noise and disturbance over this range of scenarios likely would be minor. Differences in effects to the species as a result of an oil spill during the development/production scenario (million-barrel-resource range) also likely would be minor.

IV.C.5.a. Bowhead Whales

IV.C.5.a(1) Effects Common to All Alternatives

IV.C.5.a(1)(a) Effects of Noise and Disturbance on Bowhead Whales

There is concern that manmade noise affects bowheads by raising background noise levels. Increased noise levels could interfere with communication among bowheads, mask important natural sound, cause physiological damage, or alter normal behavior, such as displacing a migration route farther from shore.

Sound is transmitted efficiently through water. Hydrophones often detect underwater sounds created by ships and other human activities many kilometers away, far beyond the distances where human activities are detectable by senses other than hearing. Sound transmission from noise-producing sources is affected by a variety of factors, including water depth, salinity, temperature, sound frequencies, ice cover, bottom type, and bottom contour. In general terms, sound travels farther in deep water than it does in shallow water. Sound transmission in shallow water is highly variable, because it is strongly influenced by the acoustic properties of the bottom material, bottom roughness, surface conditions, and ice cover. Smooth, annual ice cover may enhance sound propagation as compared to open-water conditions. However, as ice cracks and roughness increases, sound transmission generally becomes poorer than in open water of equivalent depth. At this point, the roughness of the under-ice surface becomes more significant in influencing sound-transmission loss than bottom properties (Richardson and Malme, 1993).

Marine mammals use calls to communicate and probably listen to natural sounds to obtain information important for detecting open water, navigating, and avoiding predators. Baleen whale hearing has not been studied directly. There are no specific data on sensitivity, frequency or intensity discrimination, or localization (Richardson et al., 1995a). For each species, the frequency range of reasonably acute hearing in baleen whales likely includes the frequency range of their calls. Most baleen whale sounds are concentrated at frequencies less than 1 kilohertz, but the frequency range in bowhead songs can approach 4,000 Hertz (Richardson et al., 1995a). Most calls emitted by bowheads are in the frequency range of 50-400 Hertz, with a few extending to 1,200 Hertz. Based on indirect evidence, at least some baleen whales are quite sensitive to frequencies below 1 kilohertz but can hear sounds up to a considerably higher but unknown frequency. Most of the manmade sounds that elicited reactions by baleen whales were at frequencies below 1 kilohertz (Richardson et al., 1995a). Some or all baleen whales may hear infrasounds, sounds at frequencies well below those detectable by humans. Even if the range of sensitive hearing does not extend below 20-50 Hertz, whales may hear strong infrasounds at considerably lower frequencies. Based on work with other marine mammals, if hearing sensitivity is good at 50 Hertz, strong infrasounds at 5 Hertz might be detected (Richardson et al., 1995a).

There is speculation that under some conditions, extremely loud noise might cause temporary or permanent hearing impairment of bowheads, as occurs in terrestrial mammals under some conditions (Kryter, 1985). Exposure of mammals to strong noise, even for a brief period, causes a temporary elevation of the hearing threshold called a temporary threshold shift (Kryter, 1985, as cited in Richardson and Malme, 1993). If a temporary threshold shift occurs in bowheads, it could have a negative effect on their ability to hear calls and other natural sounds. In humans, prolonged exposure to intense noise or brief exposure to shock waves can cause permanent threshold shift. According to Richardson and Malme (1993), there is no evidence that noise from routine human activities (aside from explosions) would permanently cause negative effects to a marine mammal's ability to hear calls and other natural sounds. Given their mobility and avoidance reactions, it is unlikely that whales would remain close to a noise source for long. Also, baleen whales themselves often emit calls with source levels near 170-180 decibels re 1 microPascal (dB re 1µPa) comparable to those from many industrial operations. It is unknown whether noise pulses from non-explosive seismic sources, which can have source levels much higher than 170-180 decibel, are physically injurious at any distance. These devices were adopted, in part, because they cause little damage to fish, even at distances within a few meters (Richardson and Malme, 1993). Airguns are also safer for human operators. Airguns can be tuned in arrays and fired more frequently, advantages not available with explosives. The avoidance reactions of bowheads to approaching seismic vessels normally would prevent exposure to potentially injurious noise pulses (Richardson and Malme, 1993).

The zone of audibility is the area within which a marine mammal can hear the noise. The ability of a mammal to hear the sound, such as from seismic operations, depends on its hearing threshold in the relevant frequency band and the level of ambient noise in that band. The radius of the zone of audibility also depends upon the effective source level of the sonic pulse for horizontal propagation and on the propagation loss between the source and the potential receiver. The zone of responsiveness around a noise source is the area within which the animal would react to the noise. This zone generally is much smaller than the zone of audibility. The distance at which reactions to a particular noise become evident varies widely, even for a given species. A small percentage of the animals may react at a long distance, the majority may not react unless the noise source is closer, and a small percentage may not react until the noise source is even closer still. The activity of a whale seems to affect how a whale will react. In baleen whales, single whales that were resting quietly seemed more likely to be disturbed by human activities than were groups of whales engaged in active feeding, social interactions, or mating (Richardson et al., 1995a). Habitat or physical environment of the animal also can be important. Bowhead whales whose movements are partly restricted by shallow water or a shoreline sometimes seem more responsive to noise (Richardson et al., 1995a).

Noise-producing exploration activities, including geophysical seismic surveys, drilling, aircraft traffic, icebreaking or other vessel traffic, and construction are the activities most likely to affect bowhead whales.

IV.C.5.a(1)(a)1) Effects from Seismic Operations

Sound from seismic exploration is a potential source of noise disturbance to bowhead whales. Marine seismic exploration uses underwater sounds with source levels exceeding those of other activities discussed here. Marine seismic operations use high-energy airguns to produce a burst of underwater sound from the release of compressed air, which forms a bubble that rapidly expands and then contracts. Although the output of airgun arrays usually is tuned to concentrate low-frequency energy, the impulsive nature of the bubble collapse inevitably results in a broadband sound characteristic, and high-frequency energy also is produced. This means animals sensitive to either low-frequency or high-frequency sounds may be affected. Airgun arrays are designed to focus the sound energy downward. Despite this, sound pulses also are projected horizontally. Airgun arrays produce short-duration (transient) noise pulses with very high peak levels. The high peak level and impulsive nature of airguns have caused concern in the environmental community.

Marine seismic programs can be either 2- or 3-dimensional seismic surveys. A 2-dimensional seismic survey typically is more regional in nature and seismic lines tend to be much further apart (rarely closer than 1 kilometer) than in 3-dimensional surveys. Seismic programs generally use 2-dimensional seismic to explore large areas relatively inexpensively with the intent of identifying areas that warrant further exploration, such as drilling an exploration well or acquiring a 3-dimensional seismic survey. Seismic lines often are laid out in a number of different directions. Information that can be extracted from 2-dimensional seismic data is much more limited than information from 3-dimensional seismic data. Marine surveys in the Beaufort Sea OCS waters in the 1980s and most of the 1990s were 2-dimensional seismic. Ocean-bottom cable surveys in recent years have been 3-dimensional seismic. A 3-dimensional seismic survey is conducted on a closer grid and provides more detailed information about the subsurface. The more detailed data allow geoscientists to make realistic estimates of the amount and distribution of hydrocarbons within a reservoir.

Seismic surveys are of two types: (1) the high-resolution, shallow-seismic survey and (2) the low-resolution, deep-seismic survey. The next few paragraphs provide a brief discussion of a number of studies on the effects of noise from seismic operations on bowhead whales.

IV.C.5.a(1)(a)1)a) High-Resolution Seismic Surveys

These surveys, which are of much lower energy, generally are conducted on leases following a lease sale to evaluate potential shallow hazards to drilling. Equipment used to conduct high-resolution seismic surveys/shallow-hazard seismic surveys include side-scan sonar, sub-bottom profiler, boomers, sparkers, gas exploders, waterguns, airguns, etc. The energy level of many of these is from one to three orders of magnitude less than for some of the equipment used in deep-seismic surveys. For example, a 2000-cubic-inch airgun array used in deep-seismic surveys has approximately 2×10^6 foot-pounds of energy compared to an 80-cubic-inch airgun that likely would be the largest used in high-resolution seismic surveys and has approximately 9×10^4 foot-pounds of energy. Airguns used in high-resolution seismic surveys generally would be no larger than 40-cubic inches, although an 80-cubic-inch airgun rarely might be used in some circumstances. Boomers, sparkers, and gas exploders range from about 8×10^2-9×10^4 foot-pounds of energy. The majority of equipment used in these surveys has less than 5×10^3 foot-pounds of energy. For additional comparison, the 2,000-cubic-inch airgun has an energy equivalent of slightly more than 1 pound of 60% dynamite at the 30-foot depth, while the 80-cubic-inch airgun has an energy equivalent of .06 pound of 60% dynamite at the 30-foot depth (Telford et al., 1978).

Some high-resolution seismic surveys, such as those using airguns, emit loud sounds; but the sounds would not be as loud as sounds from deep-seismic surveys. The sound also would not be likely to propagate as great a distance as sounds from deep seismic surveys. Shallow-hazard seismic surveys for exploration- or delineation-well sites most likely would be conducted during the ice-free season. Because high-resolution seismic surveys are of lower energy and sound would be less likely to travel as far as sound from deep-seismic surveys, these activities are less likely to have significant effects on endangered whales. Bowheads appear to continue normal behavior at closer distances to high-resolution seismic surveys than to low-resolution seismic surveys. In the study by Richardson, Wells, and Wursig (1985), four controlled tests were conducted by firing a single 40-cubic-inch (0.66-liter) airgun at a distance of 2-5 kilometers (1.2-3.1 miles) from the whales. Bowheads sometimes continued normal activities (skim feeding, surfacing, diving, and travel) when the airgun began firing 3-5 kilometers (1.86-3.1 miles) away (received noise levels at least 118-133 dB re 1 μPa). Some bowheads oriented away during an experiment at a range of 2-4.5 kilometers (1.2-2.8 miles) and another experiment at a range of 0.2-1.2 kilometers (0.12-0.75 miles) (received noise levels at least 124-131 and 124-134 decibels, respectively). Frequencies of turns, predive flexes, and fluke-out dives were similar with and without airgun noise; and surfacing and respiration variables and call rates did not change significantly during the experiments.

IV.C.5.a(1)(a)1)b) Deep-Seismic Surveys

These surveys emit loud sounds, which are pulsed rather than continuous, and can propagate long distances from their source. Overall source levels of noise pulses from airgun arrays are very high, with peak levels of 240-250 dB re 1 μPa at 1 meter. However, most energy is directed downward, and the short duration of each pulse limits the total energy. Received levels within a few kilometers typically exceed 160 dB re 1 μPa (Richardson et al., 1995a), depending on water depth, bottom type, ice cover, etc.

Numerous studies have been conducted on the effects of noise from seismic surveys on bowhead whales. During the 1980s, the behavior of bowhead whales exposed to noise pulses from seismic surveys was observed during the summer in the Canadian Beaufort Sea and during the fall migration across the Alaskan Beaufort Sea. In general, many of the seismic surveys conducted during the 1980s were 2-dimensional seismic surveys that covered fairly large areas in deeper waters. Additional studies on seismic surveys were conducted in the central Alaskan Beaufort Sea during the fall migration in 1996-1998. These surveys were 3-dimensional seismic surveys that covered fairly small areas in relatively shallow water fairly close to shore. The results of these studies conducted during the 1980's and 1990's are discussed in the following text.

Reeves, Ljungblad, and Clarke (1983) conducted aerial surveys to observe bowhead whale behavior in the presence of active seismic vessels. Whales were observed as close as 3 kilometers (1.86 miles) and as far away as 135 kilometers (83.9 miles) from active seismic vessels. A pair of whales observed at a distance of 3 kilometers (1.83 miles) were not moving while at the surface although the two whales' heads were in contact. This pair of whales was closer to a shooting seismic vessel than any other whales observed during the study. No obvious response was apparent, but the observation time was brief. (The received level of low-frequency underwater sound from an underwater source, generally is lower by 1-7 decibels near the surface (depth of 3 meters) than at deeper (greater than 9 meters) depths (Richardson et al., 1995a). It is possible these whales may have been at the surface to avoid the louder noise in deeper water. For the group of 20 whales at a distance of approximately 135 kilometers (83.9 miles), the blow frequency per surfacing and time at the surface were greater during the period immediately after the seismic vessel began shooting than before it began shooting. The authors stated that no major changes in whale behavior (such as flight reactions) were observed that could unequivocally be interpreted as responses to seismic noise. They noted a possible exception of "huddling" behavior, which they thought may have been caused by the onset of seismic sounds. The authors concluded that although their results suggest some changes in behavior related to seismic sounds, the possibility that unquantified factors could be correlative dictates caution in attempting to establish causative explanations from the preliminary findings.

Ljungblad et al. (1985) conducted a set of four experiments where bowhead whales were approached by an operating seismic vessel. Sonobuoys were dropped near the whales to record received sound levels from the airguns and to record bowhead sounds. In Experiment 1, the *Western Beaufort* was actively shooting approximately 12 kilometers (7.5 miles) from the whales' position. A sonobuoy dropped near the whales indicated a received level of seismic sound near the whales of 131.1 dB re 1 µPa at 12 kilometers (7.5 miles). Additional seismic sounds from an unknown source also were received at the sonobuoy with a received level of 133.0 dB re 1 µPa. The *Western Beaufort* approached to within 1.3 kilometers (0.81 miles) with received sound level of 152.4 dB re 1 µPa. At 3.5 kilometers (2.18 miles), milling and social behavior ceased. Surfacing, respiration, and dive characteristics changed significantly and were accompanied with avoidance behaviors as the vessel approached to within 1.3 kilometers (0.81 miles). Because the vessel had been shooting prior to the beginning of the experiment, predisturbance observations were not obtained and postdisturbance observations were confounded by other geophysical vessels that had become active in the area. Experiment 2 involved a sudden seismic startup by the *Western Aleutian* at a range of 7.2 kilometers (4.47 miles) with a received sound level of 165 decibels. The sound level of this array at 1 meter was estimated at between 230 and 240 decibels. The *Western Aleutian* was about 12.4 kilometers (7.7 miles) from the whales and had been inactive. A sonobuoy revealed some low level seismic sound (less than 120 dB re 1 µPa) from an unknown source. The whales responded to the sudden startup of the *Western Aleutian* (165 decibels) by changing their surfacing behavior and, as the vessel approached 3.5 kilometers (2.18 miles) (170 dB), the surfacing, respiration, and dive characteristics changed significantly. In Experiment 3, the seismic vessel *Arctic Star* was approximately 15.5 kilometers (9.6 miles) from the whales and was actively shooting before the experiment. A sonobuoy dropped near the whales measured received sound levels of 148.4 dB re 1 µPa. After completing the survey line, the vessel's airguns were shut down and the vessel changed course to begin approaching the whales. The vessel activated 18 of the 24 airguns at 11.6 kilometers (7.2 miles) from the whales with an estimated sound source level of 246 dB re 1 µPa and a received level at the sonobuoy of 154.9 dB re 1 µPa. Surfacing, respiration, and dive characteristics changed significantly as the *Arctic Star* approached from 12-5 kilometers (7.5-3.1 miles) with received sound levels ranging between 154.9 and 171.2 decibels, respectively. Two whales remained until the vessel approached to within 3.5 kilometers (2.18 miles). In Experiment 4, seismic sounds from the *Western Polaris* were initiated at a distance of 11.7 kilometers (7.3 miles) with received levels of 154 dB re 1 µPa. The *Western Polaris* had been inactive before the experiment, although the *Mariner* was actively shooting at a distance of 28 kilometers (17.4 miles) from the whales with received sound levels at the whales of 120 dB re 1 µPa. Surfacing, respiration, and dive characteristics began to change at a range of 7 kilometers (4.35 miles) with a received sound level of 158.1 decibels, partial avoidance behavior began at 3.5 kilometers (2.18 miles) with a received sound level of

163.1 decibels, and complete avoidance reactions were exhibited at 1.8 kilometers (1.12 miles) when the estimated received sound level was 169 decibels. This study concluded that whales responded to seismic sounds at ranges less than 10 kilometers (6.2 miles), with the strongest responses occurring when whales were within 5 kilometers (3.1 miles) of the sound source, and that a period of 30-60 minutes is required before whales recover from the effects of close seismic disturbance. No discernable behavioral changes occurred during exposure to seismic sound at ranges greater than 10 kilometers (6.2 miles). It also was concluded that the findings in this study were consistent with the findings of several earlier studies. A subcommittee of the Scientific Committee of the International Whaling Commission reviewed this data and some members were critical of the methodology and analysis of the results.

> Comments included reference to: the small sample size; inconsistencies between the data and the conclusions; lack of documentation of calibration of sound monitoring; and possible interference from other active seismic vessels in the vicinity. The sub-committee acknowledged the difficulty of performing experiments of this kind, particularly in the absence of a 'control' environment free of industrial noise. The sub-committee recommended that additional research taking into account the concerns expressed above be undertaken, and that the 1984 experimental results be subjected to rigorous reanalysis, before it can draw any conclusions on the effects of seismic activity on this species (International Whaling Commission, 1987).

In Fraker et al. (1985), an active seismic vessel traveled toward a group of bowheads from a distance of 19 kilometers (11.8 miles) to a distance of 13 kilometers (8.18 miles). The whales did not appear to alter their general activities. Most whales surfaced and dove repeatedly and appeared to be feeding in the water column. During their repeated surfacing and dives, they moved slowly to the southeast (in the same direction as seismic-vessel travel) and then to the northwest (in the opposite direction of seismic-vessel travel). The study first stated that a weak avoidance reaction may have occurred but then stated there is no proof that the whales were avoiding the vessel. The net movement was about 3 kilometers (1.86 miles). The study found no evidence of differences in behavior in the presence and absence of seismic noise but noted that observations were limited.

In another study (Richardson, Wells, and Wursig, 1985) involving a full-scale seismic vessel with a 47-liter airgun array (estimated source level 245-252 dB re 1 μPa), bowheads began to orient away from the approaching ship when its airguns began to fire from 7.5 kilometers (4.7 miles) away. This airgun array had about 30 airguns, each with a volume of 80-125 cubic inches. The *Mariner* had been shooting seismic about 10 kilometers to the west of a group of six whales. Prior to the start of the experimental seismic period, the whales were surfacing and diving and moving at slow to medium speed while at the surface. The vessel ceased shooting and moved within 7.5 kilometers of the whales and began firing the airgun array while approaching the whales. The study reported no conspicuous change in behavior when the *Mariner* resumed shooting at 7.5 kilometers away. The bowheads continued to surface and dive, moving at slow to medium speeds. The received level was estimated at 134-138 decibels at 7 kilometers (4.35 miles). Some near-bottom feeding (evidenced by mud being brought to the surface) continued until the vessel was 3 kilometers (1.86 miles) away. The closest point of approach to any whale was approximately 1.5 kilometers (0.93 mile), with the received level probably well over 160 decibels. When the seismic vessel was within 1.5 kilometers of whales at the original location, at least two of the whales were observed to have moved about 2 kilometers to the south of the original location. The movements of the whales, at least while they were at the surface, were at the usual slow to moderate speeds. The study reported no conspicuous changes in behavior when the *Mariner* ceased shooting at 6 kilometers beyond the whales. The bowheads were still surfacing and diving and moving at slow to medium speed. The most notable change in behavior apparently involved the cessation of feeding when the vessel was 3 kilometers away. The whales began feeding again about 40 minutes after the seismic noise ceased.

While conducting a monitoring program around a drilling operation, Koski and Johnson (1987) noted that the call rate of a single observed bowhead whale increased after a seismic operation had ceased. During the 6.8 hours of observation, the whale was within 23-27 kilometers (14.3-16.8 miles) from the drillship. A seismic vessel was reported to be from 120-135 kilometers (74.58-83.9 miles) from the sonobuoy, and the two loudest calls received were determined to be approximately 7 kilometers (4.35 miles) and 9 kilometers (5.6 miles) from the sonobuoy, with received levels of 119 and 118 decibels, respectively. Approximate signal-to-noise ratios were 24 and 22 decibels, respectively. No information is provided regarding the exact distance the whale was from the operating seismic vessel. The increase in call rate was noted within

25 minutes after seismic noise ceased. It also needs to be noted that there were few, if any, calls heard during the 2 hours prior to the start of seismic operations, so it is unclear whether the increase in call rate relates to cessation of seismic noise, the presence of the operating drillship, the combination of both activities, or some other factor that occurred in the late afternoon. During this same study a subgroup of four to seven whales within a larger group (15-20 whales) was noted moving rapidly away from an approaching seismic vessel at a distance of 22-24 kilometers (13.7-14.9 miles). The received level of seismic pulses was 137 decibels at 19 kilometers (11.8 miles) from the sonobuoy and 22 kilometers from the whales. The surfacing and diving were unusually brief, and there were unusually few blows per surfacing. No information was available regarding the time required for these whales to return to normal behavior. Richardson and Malme (1993) noted that this apparent avoidance response is the longest distance avoidance of a seismic vessel documented in the studies they reviewed.

Richardson and Malme (1993), while synthesizing data on the effects of noise on bowheads, concluded that collectively, scientific studies have shown that most bowheads usually show strong avoidance response when an operating seismic vessel approaches within 6-8 kilometers (3.8-5.0 miles). Strong avoidance occurs when received levels of seismic noise are 150-180 dB re 1 μPa (Richardson and Malme, 1993). Strong pulses of seismic noise often are detectable 25-50 kilometers (15.5-31 miles) from seismic vessels, but most bowheads exposed to seismic sounds from vessels more than about 7.5 kilometers (4.7 miles) away rarely show avoidance. Seismic pulses can be detectable 100 kilometers (62.2 miles) or more away. Bowheads also may show specific behavioral changes, such as reduced surfacing, reduced dive durations; changes in respiration rates, including fewer blows per surfacing, and longer intervals between successive blows; and they may temporarily change their individual swimming paths. The authors noted that surfacing, respiration, and dive cycles may be altered in the same manner as those of whales closer to the vessels. Bowheads' surface-respiration-dive characteristics appeared to recover to pre-exposure levels within 30-60 minutes following the cessation of the seismic activity. These short-term responses are not likely to preclude a successful migration or to significantly disrupt feeding activities.

The North Slope Borough believes that many studies were different from the real-world situation, and various limitations have been pointed out. Most studies did not involve actively migrating whales; and those whales were being approached by the seismic ships whereas in the real world, the fall migrating whales are actively moving to the west and they are approaching a distant seismic boat that is firing. It is likely that some migrating bowheads show avoidance at distances exceeding those observed in studies conducted during the 1980's. Subtle shifts in direction could be occurring that cause the bowheads to be farther from shore as they gradually migrate toward the west. The MMS notes that many studies were observational and involved opportunistic sightings of whales in the vicinity of seismic operations. The studies were not designed to show whether more subtle reactions are occurring that can displace the migration corridor, so no definitive conclusions can be drawn from them on whether or not the overall fall migration is displaced by seismic activity.

Inupiat whalers suggest that the fall bowhead migration has tended to be farther offshore since seismic work began off northern Alaska. Aerial surveys have been conducted since 1979 to determine the distribution and abundance of bowhead whales in the Beaufort Sea during their fall migration. These surveys, while not designed to measure short-term bowhead whale displacement within a given year due to site-specific industrial noise, have been used for comparing the axis of the bowhead whale migration between years. Survey data from 1982-1987 were examined to determine whether industrial activity was resulting in displacement of bowhead whales further offshore (Ljungblad et al., 1988). It was determined that a good indicator of annual shifts in bowhead distribution could be obtained by analyzing the distance of random bowhead sightings from shore (Zeh, as cited in Ljungblad et al., 1988). An analysis of the distance of random bowhead sightings from shore (a total of 60 bowhead sightings) was conducted, but no significant differences were detected in the bowhead migratory route between years. The axis of the bowhead migratory route near Barrow was found to fall between 18 and 30 kilometers (7.76 and 18.6 miles) from shore. Although the analysis involved a relatively small sample size, these observations provide some insight into migration patterns during these years. The North Slope Borough, in a letter dated July 25, 1997, questioned the sample size and the precision of the Ljungblad et al. (1988) report to determine whether or not a displacement of fall migrating whales had occurred and how big a displacement would have to be before it could be detected.

As a follow up to work described in Ljungblad et al. (1988), Moore and Clark (1992) analyzed between-year data from 1982-1989 to determine the mean distance from shore of the fall migration of bowhead whales near Barrow, Alaska, irrespective of industrial activity. Because sample sizes in 1982, 1985, 1986, 1988, and 1989 were too small for calculating Confidence Intervals for the median distances, only ANOVA and Tukey tests on mean values were applied. A power analysis showed that a 12-kilometer (7 statute miles) shift in mean bowhead whale distance from shore would give a 90% chance of finding a significant difference ($\alpha = 0.05$) using these tests. Moore and Clark (1992) found that annual mean distances from shore ranged between 25 and 36 kilometers (15 and 22 statute miles), and they detected no difference between possible pairs of years. Because the ANOVA test requires large sample sizes for detecting small shifts in whale migrations, the MMS Bowhead Whale Aerial Survey Project also uses the Mann Whitney U test, one of the most powerful nonparametric tests for testing the significance of between-year differences in water depth used by bowhead whales during their fall migrations across the Alaskan Beaufort Sea. Using larger sample sizes (for which confidence intervals were calculated) obtained over a larger study area, the aerial survey project found many between-year (1982-1996) differences in the median water depth at whale sightings that were highly significant (P less than 0.05) (Treacy, 1997). Median depths ranged between 18 meters (59 feet) in 1989 and 347 meters (1,138 feet) in 1983, with an overall cumulative depth of 37 meters (121 feet, confidence interval = 37-38 meters). The aerial survey project has reported a potential association between water depth of the bowhead migration and general ice severity, especially in 1983, when severe ice cover may have forced the axis of the migration into waters 347 meters (1,138 feet) deep. To address short-term bowhead whale displacement within a given year from site-specific industrial noise, the MMS and the National Marine Fisheries Council require industry to conduct site-specific monitoring programs when industrial activity occurs during fall bowhead migrations.

A committee of the National Research Council, in commenting on the effects of industrial noise on marine mammals, including bowhead whales, stated that it is possible to argue at great length about the validity of individual studies, but the overriding issue is that there is widespread distrust of the results and dissatisfaction with the design of studies in arctic and other communities. Because the issue is so complicated, compounded by small sample sizes and interannual variability, further studies are unlikely to resolve it soon (National Research Council, 1994). The committee stated that the best (and perhaps only) solution is for MMS, the industry, and North Slope residents to attempt to reach agreement on the controversial matters and how they should be adjusted, remedied, or mitigated—as to specific times and places that various activities occur—in lieu of or concurrent with additional studies. Along those lines, the MMS has included, as part of the lease sales in recent years, a stipulation requiring the lessee to consult with potentially affected subsistence communities to discuss siting, timing, and methods of proposed operations and safeguards or mitigating measures that could be implemented by the operator to prevent unreasonable conflicts. Since 1995, consultations between the Alaska Eskimo Whaling Commission and lessees have resulted in Conflict Avoidance Agreements that require operators to cease geophysical operations east of Cross Island after August 31 until subsistence-whaling activities in the area have been completed. Measures such as these are intended to help ensure that disturbance to the subsistence bowhead whale hunt will be minimized.

Since 1996, seismic surveys in State of Alaska waters and adjacent nearshore Federal waters of the central Alaskan Beaufort Sea have been ocean-bottom cable surveys. These surveys have been 3-dimensional seismic programs. The area to be surveyed is divided into patches, each patch being approximately 5.9 by 4.0 kilometers in size. Within each patch, several receiving cables are laid parallel to each other on the seafloor. Seismic data are acquired by towing the airguns along a series of source lines oriented perpendicular to the receiving cables. While seismic-data acquisition is ongoing on one patch, vessels are deploying cable on the next patch to be surveyed, and/or retrieving cables from a patch where seismic surveys have been completed. Airgun arrays have varied in size each year from 1996-1998 with the smallest, a 560-cubic-inch array with 8 airguns, and the largest, a 1,500-cubic-inch array with 16 airguns. A marine mammal and acoustical monitoring program was conducted in conjunction with the seismic program each year in accordance with provisions of the National Marine Fisheries Service Incidental Harassment Authorization. One of the dominant considerations during the design of the marine mammal monitoring program was the need to determine whether any displacement of the bowhead whale migration corridor occurred during seismic surveys. The monitoring program each year was designed to take into account both the results of previous scientific studies and the experience of subsistence whalers.

LGL Ltd.; Environmental Research Assocs., Inc.; and Greeneridge Sciences Inc. conducted a marine mammal monitoring program for a seismic survey near the Northstar Development Project in 1996 (Miller et al., 1997). The marine mammal monitoring program was continued for subsequent seismic surveys in nearshore waters of the Beaufort Sea in 1997 and 1998 (Miller, Elliot, and Richardson, 1998; Miller et al., 1999). Sightings and sighting rates are based on combined data from LGL and MMS aerial surveys for all areas, excluding sightings during poor sighting conditions, as presented in Miller et al. (1999). During LGL and MMS surveys in 1996, there were 32 bowhead sightings during periods with no seismic operations and 11 sightings during periods with seismic operations, with sightings per 100-kilometer flight transect of 0.49 and 0.40, respectively. In 1997, there were 160 bowhead sightings during periods with no seismic operations and 6 sightings during periods with seismic operations, with sightings per 100-kilometer flight transect of 1.56 and 1.62, respectively. Bad weather during September 1997 resulted in numerous operational shutdowns, limiting the number of sightings during active seismic work. In 1998, there were 103 bowhead sightings during periods with no seismic operations and 116 sightings during periods with seismic operations, with sightings per 100-kilometer flight transect of 0.67 and 0.69, respectively. Sighting rates in the region from about 20 kilometers east to about 20 kilometers west of seismic operations were significantly lower during seismic operations than when no seismic operations were ongoing.

Survey data from 1996, 1997, and 1998 monitoring programs were analyzed to determine the general position of the bowhead migration corridor at times with and without seismic activity. The results revealed no clear effect of the 1996 and 1997 seismic programs on the position to the general migration corridor in the central Alaskan Beaufort Sea. In 1996, bowhead sightings were fairly broadly distributed between the 10-meter- and 50-meter-depth contours. However, the analyses were limited by the low number of sightings potentially influenced by seismic. In 1997, nearly all bowhead sightings were in relatively nearshore waters. Bowhead sightings were fairly broadly distributed between the 10-meter- and 40-meter-depth contours, unusually close to shore. Many aggregations of feeding whales were observed near or just shoreward of the 10-meter-depth contour. In 1998, the bowhead-migration corridor generally was farther offshore than in either 1996 or 1997, between the 10-meter- and 100-meter-depth contours and approximately 10-60 kilometers from shore. The distributions of sightings during periods with and without seismic exploration broadly overlapped. The 1996-1998 combined survey data indicated that sighting distributions tended to be farther offshore on days with seismic operations compared to days with no seismic operations, based on sightings per 100 kilometers of survey effort. This was true for the study area as a whole, for the east region, and marginally so for the west region. The same tendency was evident in the central region, but was not statistically significant.

During aerial surveys from 1996-1998, bowheads rarely were observed closer than 20 kilometers from seismic vessels when airguns were operating. The sighting rate within 20 kilometers of seismic operations was reduced significantly. However, the authors stated this effect should be interpreted cautiously, given the small sample size during times of active seismic operations. Avoidance reactions, rather than differences in sightability, are believed to be the main reasons for the lack of sightings during aerial surveys near operating seismic vessels. One bowhead was seen only 70 meters from the operating seismic vessel by boat-based observers in 1997, so not all bowheads avoided the area within 20 kilometers of the seismic vessel. Overall, the 1996-1998 results show that most bowheads avoided the area within about 20 kilometers of the operating airguns. Bowhead avoidance of the area within 20 kilometers of where active seismic operations had occurred in 1996-1998 did not persist beyond about 12 hours after the end of seismic operations. Within 12-24 hours after seismic operations ended, the sighting rate within 20 kilometers was similar to the sighting rate beyond 20 kilometers.

Based on 1996-1998 data, there was little or no evidence that bowhead headings, general activities, or swimming speeds were affected by seismic exploration. Bowheads approaching from the northeast and east showed similar headings at times with and without seismic operations. Miller et al. (1999) stated that the lack of any statistically significant differences in headings should be interpreted cautiously. Changes in headings must have occurred given the avoidance by most bowheads of the area within 20 or even 30 kilometers of active seismic operations. Westbound bowheads must have turned to the right at some point as they approached the seismic operation. Miller et al. (1999) noted that the distance at which deflection began cannot be determined precisely, but they stated that considering times with operations on offshore patches, deflection may have begun about 35 kilometers to the east. However, some bowheads approached within 19-21 kilometers of the airguns when they were operating on the offshore patches. It appears that in

1998, the offshore deflection might have persisted for at least 40-50 kilometers west of the area of seismic operations. In contrast, during 1996-1997 there were several sightings in areas 25-40 kilometers west of the most recent shotpoint, indicating the deflection in 1996-1997 may not have persisted as far to the west. General activities of bowheads were similar at times that were and were not influenced by seismic during 1996-1998. There also was little indication of differences in swimming speed with and without seismic operations.

The LGL and Greeneridge studies in 1996-1998 also recorded bowhead whale calls. Greene et al. (1999), summarizing the 3 years of study, stated the results are consistent in indicating that: (1) bowhead whales call frequently during the autumn migration through the study area; (2) calling continued at times when whales were exposed to airgun pulses; and (3) call detection rates at some locations differed significantly when airguns were detectable versus not detectable. However, there was no significant tendency for call-detection rate to change in a consistent way at times when airguns started or stopped. In 1998, more calls were detected at a site near the 25-meter-depth contour offshore of the survey area during times with airgun operations than without airgun operations. In contrast, fewer calls were detected during 1996 at a site near the 25-meter-depth during times with airgun operations than without airgun operations. Conversely, more calls were detected at a site farther offshore during times when seismic operations were closer to shore than at times without seismic operations. The 1996 results are consistent with the hypothesis that exposure of bowheads traveling along the southern part of the migration corridor to seismic noise resulted in whales diverting to the north, a reduced calling rate, or some combination of the two.

During the 1996-1998 bowhead hunting seasons, seismic operations were moved to locations well west of Cross Island, the area where Nuiqsut-based whalers hunt for bowheads (Miller et al., 1999). This was done under the provisions of the Conflict Avoidance Agreements established between industry and the hunters in 1996-1998. No perceived interference between seismic operations and hunting was reported either in 1998 or in 1996-1997. As a result of mitigating measures implemented under the 1996-1998 Conflict Avoidance Agreements, the 1996-1998 seismic surveys did not adversely affect the accessibility of bowheads to subsistence whalers (Miller et al., 1999).

In summary, the LGL and Greeneridge 1996-1998 monitoring studies found that the bowhead whale-migration corridor in the central Alaskan Beaufort Sea during 1998 was similar to the corridor in many prior years, although not 1997. In 1997, nearly all bowheads sighted were in relatively nearshore waters. The results of the 1996-1998 studies indicated a tendency for the general bowhead whale-migration corridor to be farther offshore on days with seismic airguns operating compared to days without seismic airguns operating, although the distances of bowheads from shore during airgun operations overlapped with those in the absence of airgun operations. However, aerial-survey results indicated that bowheads tended to avoid the area around the operating source, perhaps to a radius of about 20-30 kilometers. Sighting rates within a radius of 20 kilometers of seismic operations were significantly lower during seismic operations than when no seismic operations were happening. Within 12-24 hours after seismic operations ended, the sighting rate within 20 kilometers was similar to the sighting rate beyond 20 kilometers. There was little or no evidence of differences in headings, general activities, and swimming speeds of bowheads with and without seismic operations. The observed 20-30 kilometer area of avoidance is a larger avoidance radius than documented by previous scientific studies in the 1980's and smaller than the 30 miles suggested by subsistence whalers, based on their experience with the types of seismic operations that occurred in the Beaufort Sea before 1996 (Richardson, 2000). Whales avoiding seismic operations during the 1996-1998 whaling seasons did not affect the accessibility of bowheads for subsistence whaling.

Richardson provided a brief comparison between observations from seismic studies conducted in the 1980s and the 1996 seismic survey at the Arctic Seismic Synthesis Workshop in Barrow (USDOI, MMS, Alaska OCS Region, 1997). Observations from earlier seismic studies during the summer and early autumn show that most bowhead whales interrupt their previous activities and swim strongly away when a seismic ship approaches within about 7.5-8 kilometers. At the distances where this strong avoidance occurs, received levels of seismic pulses typically are high, about 150-180 dB re 1 μPa. The surfacing, respiration, and dive cycles of bowheads engaged in strong avoidance also change in a consistent pattern involving unusually short surfacing and diving, and unusually few blows per surfacing. These avoidance and behavioral effects among bowheads close to seismic vessels are strong, reasonably consistent, and relatively easy to document. Less consistent and weaker disturbance effects probably extend to longer distances and lower received sound levels at least some of the time. Bowheads often tolerate much seismic noise and, at least in summer, continue to use areas where seismic exploration is common. However, the same pattern of change in surfacing, respiration, and diving cycles has sometimes been seen in bowheads as much as 73 kilometers from seismic ships. Most of these whales were engaged in seemingly normal activities, and were not swimming away from the seismic boat. However, at least one case of strong avoidance has been reported as far as 24 kilometers from an approaching seismic boat (Koski and Johnson 1987). Richardson and Malme (1993) noted that the apparent avoidance response observed by Koski and Johnson was the longest distance of a seismic vessel documented in the studies they had reviewed.

Richardson noted that many of the observations involved bowheads that were not actively migrating. Actively migrating bowheads may react somewhat differently than bowheads engaged in feeding or socializing. Migrating bowheads, for instance, may react by deflecting their migration corridor away from the seismic vessel. Monitoring of the bowhead migration past a nearshore seismic operation in September 1996 provided evidence consistent with the possibility that the closest whales may have been displaced several miles seaward during periods with seismic activity. Even so, the main migration corridor during times with seismic activity was within 20-30 kilometers from shore and within 10-20 kilometers of the closest edge of the area with seismic exploration, well within the ensonified area.

With respect to these studies conducted in the Beaufort Sea from 1996-1998, the peer-review group at the Arctic Open-Water Noise Peer Review Workshop in Seattle from June 5-6, 2001, prepared a summary statement supporting the methods and results reported in Richardson (1999) concerning avoidance of seismic sounds by bowhead whales:

> Monitoring studies of 3-D seismic exploration (8-16 airguns totaling 560-1500 in^3) in the nearshore Beaufort Sea during 1996-1998 have demonstrated that nearly all bowhead whales will avoid an area within 20 km of an active seismic source, while deflection may begin at distances up to 35 km. Sound levels received by bowhead whales at 20 km ranged from 117-135 dB re 1µPa rms and 107-126 dB re 1µPa rms at 30 km. The received sound levels at 20-30 km are considerably lower levels than have previously been shown to elicit avoidance in bowhead or other baleen whales exposed to seismic pulses.

A recent study in Canada provides information on the behavioral response of bowhead whales in feeding areas to seismic surveys (Miller and Davis, 2002). During the late summer and autumn of 2001, Anderson Resources Ltd. conducted an open-water seismic exploration program offshore of the Mackenzie Delta in the Canadian Beaufort Sea. The program consisted of streamer seismic surveys and associated bathymetric surveys conducted off the Mackenzie Delta. The bathymetric surveys were conducted by two medium-sized vessels equipped with side-scan sonar and single-beam echosounders. The seismic vessel was the *Geco Snapper*. The acoustic sources used in the seismic operations were two 2,250 cubic inch arrays of 24 sleeve-type airguns. Each 2,250 cubic inch airgun array was comprised of 24 airguns with volumes ranging from 40-150 cubic inches. The two airgun arrays fired alternately every 8 seconds along the survey lines. The airgun arrays were operated at a depth of 5 meters below the water surface. Water depths within the surveyed areas ranged from 6-31 meters and averaged 13 meters (Miller, 2002).

Because marine seismic projects using airgun arrays emit strong sounds into the water and have the potential to affect marine mammals, there was concern about the acoustic disturbance of marine mammals and the potential effects on the accessibility of marine mammals to subsistence hunters. Although there are no prescribed marine mammal and acoustic monitoring requirements for marine seismic programs in the Canadian Beaufort Sea, it was decided that monitoring and mitigation measures in the Canadian Beaufort Sea should be as rigorous as those designed and implemented for marine seismic programs conducted in the Alaskan Beaufort Sea in recent years. The monitoring program consisted of three primary components: acoustic measurements, vessel-based observations, and aerial surveys. The National Marine Fisheries Service recommended criterion that exposure of whales to impulse sound not exceed 180 dB re 1µPa rms (65 *FR* 16374) was adopted as a mitigation standard for this monitoring program. Estimates of sound-propagation loss from the airgun array were used to determine the designated 1000-meter safety radius for whales (the estimated zone within which received levels of seismic noise were 180 dB re 1µPa rms or higher).

Aerial and vessel-based surveys confirmed the presence of substantial numbers of bowheads offshore of the Mackenzie Delta from late August until mid-September. The distribution of bowheads in the study area was typical of patterns observed in other years and suggests that there were good feeding opportunities for bowheads in these waters during that period.

A total of 262 bowheads were observed from the seismic vessel *Geco Snapper* (Moulton, Miller, and Serrano, 2002). Sighting rates during daylight hours were higher when no airguns were operating than during periods with airguns operating. During the period when bowheads were most abundant in the study area (August 23-September 19), the bowhead sighting rate during periods with no seismic (0.85 bowheads/hour) was about twice as high as that recorded during periods with seismic (0.40 bowheads/hour) or all seismic operations combined (0.44 bowheads/hour). Average sighting distances from the vessel were significantly ($P < 0.001$) lower during no guns (a mean radial distance of 1,368 meters) versus line-seismic periods (a mean radial distance of 1,957 meters). The observed difference in sighting rates and the significant difference in sighting distances suggest that bowheads did avoid close approach to the area of seismic operations. However, the still substantial number of sightings during seismic periods and the relatively short (600-meter) but significant difference in sighting distances suggests that the avoidance was localized and relatively small in nature. At a minimum, the distance by which bowheads avoided seismic operations was on the order of 600 meters greater than the average distance by which they avoided general vessel operations. The lower sighting rates recorded during seismic operations suggest that some bowheads avoided the seismic operations by larger distances and, thereby, stayed out of visual range of the marine mammal observers on the *Geco Snapper*.

A total of 275 bowhead whale sightings were recorded during aerial transects with good lighting conditions (Holst et al., 2002). Bowheads were sighted at similar rates with and without seismic, although the no-seismic sample was too small for meaningful comparisons. Bowheads were seen regularly within 20 kilometers of the operations area at times influenced by airgun pulses. Of 169 transect sightings in good conditions, 30 sightings were seen within 20 kilometers of the airgun operations at distances of 5.3-19.9 kilometers. The aerial surveys were unable to document bowhead avoidance of the seismic operations area. The area of avoidance around the seismic operations area was apparently too small to be evident from the broad-scale aerial surveys that were flown, especially considering the small amount of surveying done when seismic was not being conducted. General activities of bowheads during times when seismic operations were conducted were similar to times without seismic.

The bowheads that surfaced closest to the vessel (323-614 meters) would have been exposed to sound levels of about 180 dB re 1 μPa rms before the immediate shutdown of the array (Miller et al., 2002). There were seven shutdowns of the airgun array in response to sightings of bowheads within 1 kilometer of the seismic vessel. Bowheads at the average vessel-based sighting distance (1,957 meters) during line seismic would have been exposed to sound levels of about 170 dB re 1 μPa rms. The many aerial sightings of bowheads at distances from the vessel ranging from 5.3-19.9 kilometers would have been exposed to sound levels ranging from approximately 150-130 dB re 1 μPa rms, respectively.

The results from the present study in summer 2001 are markedly different from those obtained during similar studies during the autumn migration of bowheads through the Alaskan Beaufort Sea (Miller et al., 2002). For example, during the Alaskan studies only 1 bowhead whale was observed from the seismic vessel(s) during six seasons (1996-2001) of vessel-based observations compared with 262 seen from the *Geco Snapper* in 2001. The zone of avoidance for bowhead whales around the airgun operations in 2001 was clearly much smaller (~2 kilometers) than that observed for migrating bowhead whales in recent autumn studies in Alaskan waters (up to 20-30 kilometers). Davis (1987) concluded that migrating bowheads during the fall migration may be more sensitive to industrial disturbance than bowheads on their summering grounds, where they may be engaged in feeding activities.

Inupiat subsistence whalers have stated that industrial noise, especially noise due to seismic exploration, has displaced the fall bowhead migration seaward and, thereby, is interfering with the subsistence hunt at Barrow (Ahmaogak, 1989). Dr. Tom Albert, testifying at the Barrow public hearing on the Beaufort Sea Sale 144 draft EIS, said the whaling captains believe most bowheads are likely to show avoidance response to seismic operations at greater distances. "[T]he hunters that go out, feel that the reaction is on the order of a 10 miles or more..." (USDOI, MMS, 1995b). Fred Kanayurak and 16 other whaling captains from Barrow, Nuiqsut, and Kaktovik, in written testimony at the Arctic Seismic Synthesis and Mitigating Measures Workshop on March 5-6, 1997 in Barrow (USDOI, MMS, Alaska OCS Region, 1997) stated: "Factual experience of subsistence whalers testify that pods of migrating bowhead whales will begin to divert from their migratory path at distances of 35 miles from an active seismic operation and are displaced from their normal migratory path by as much as 30 miles." Also at the March 1997 workshop, Mr. Roxy Oyagak, Jr., a Nuiqsut whaling captain, stated in written testimony: "Based on the industrial activity, there is an unmitigable adverse impact on the village of Nuiqsut on subsistence whaling. i.e., 1) by causing the whales to abandon the hunting area, and 2) directly displacing the subsistence whalers, and 3) placing physical barriers between the subsistence whalers and marine mammals, including altering the normal bowhead whale migration route."

Seismic activity should have little effect on zooplankton. Bowheads feed on concentrations of zooplankton. Zooplankton that are very close to the seismic source may react to the shock wave, but little or no mortality is expected (LGL Ltd., 2001). A reaction by zooplankton to a seismic impulse would be relevant only if it caused a concentration of zooplankton to scatter. Pressure changes of sufficient magnitude to cause zooplankton to scatter probably would occur only if they were very close to the source. Impacts on zooplankton behavior are predicted to be negligible and would have negligible effects on feeding bowheads (LGL Ltd., 2001).

Sale-specific effects likely would be similar to those discussed above. However, the effect on whales from future seismic activity in the Beaufort Sea should be less than from previous activities during the 1980's and 1990's, because a substantial amount of seismic work, especially low-resolution, deep-seismic, already has been conducted in the area. Geophysical surveys conducted in conjunction with the multiple-sale program are likely to cover much smaller areas to fill in gaps from earlier seismic surveys. Also, some of the seismic work that is needed may be conducted when whales are not present in the area.

There is concern about industrial activities in the spring lead system. The general location of the spring lead system in the Beaufort Sea is based on relatively limited survey data and is not well defined. Noise-producing activities, such as seismic surveys, in the spring lead system during the spring bowhead migration have a fairly high potential of affecting the whales. Seismic surveys are not expected to be conducted in or near the spring lead system through which bowheads migrate because (1) degraded ice conditions would not allow on-ice surveys, and (2) insufficient open water is present for open-water seismic surveys.

IV.C.5.a(1)(a)2) Effects from Drilling Operations

Exploration-drilling units are another source of noise. Exploration drilling in the Beaufort Sea can be conducted from manmade gravel islands, ice islands, caisson-retained islands, bottom-founded drilling platforms such as the concrete island drilling system or steel drilling caisson, or from drillships in deeper water supported by icebreakers. The type of drilling platform used depends on water depth, oceanography, ice cover, and other factors. Stationary sources of offshore noise (such as drilling units) appear less disruptive to bowhead whales than moving sound sources (such as vessels). Drilling operations from most of these structures except drillships are likely to be conducted during the winter months. Drilling from ice islands would occur only during the winter when bowheads are not present, so noise from these activities would not affect bowhead whales. Therefore, this type of drilling activity is not discussed here.

As stated previously, the general location of the spring lead system in the Beaufort Sea is based on relatively limited survey data and is not well defined. Noise-producing activities, such as drilling operations, in the spring lead system during the spring bowhead migration have a fairly high potential of affecting the whales. The MMS believes that exploratory drilling operations using floating platforms within the spring lead system during the spring bowhead migration are unlikely, because the ice at this time of year would be too thick for floating drilling platforms to get to the location and conduct drilling operations, even with icebreaker support. Spring-migrating bowheads are not likely to be exposed to drilling noise from activities on Sale 186, Sale 195, or Sale 202 leases. Areas in or near the spring lead system could be leased during these sales, but any exploratory drilling operations likely would be conducted during the open-water season (August-October) using floating drilling platforms.

Some bowheads in the vicinity of drilling operations would be expected to respond to noise from drilling units by slightly changing their migration speed and swimming direction to avoid closely approaching these noise sources. Miles, Malme, and Richardson (1987) predicted the zone of responsiveness to continuous noise sources. They predicted that roughly half of the bowheads likely would respond at a distance of 0.02-0.2 kilometers (0.12-1.12 miles) to drilling from an artificial island when the signal-to-noise ratio is 30 decibels. By comparison, they predicted that roughly half of the bowheads likely would respond at a distance of 1-4 kilometers (0.62-2.5 miles) from a drillship drilling when the signal-to-noise ratio is 30 decibels. A smaller proportion would react when the signal-to-noise ratio is about 20 decibels (at a greater distance from the source), and a few may react at a signal-to-noise ratio even lower or at a greater distance from the source.

Although underwater sounds from drilling on some artificial islands and caissons have been measured, little information is available about reactions of bowheads to drilling from these structures. Underwater noise levels from drilling operations on natural barrier islands or artificial islands are low and are not audible beyond a few kilometers (Richardson et al., 1995a). Noise is transmitted very poorly from the drill-rig machinery through land into the water. Even under open-water conditions, drilling sounds are not detectable very far from the structure. Drilling noise from caisson-retained islands is much stronger. At least during open-water conditions, noise is conducted more directly into the water than from island drill sites. Noise associated with drilling activities at both sites varies considerably with ongoing operations. The highest documented levels were transient pulses from hammering to install conductor pipe.

IV.C.5.a(1)(a)2)a) Drilling Operations from Artificial Gravel Islands

The following is a brief discussion of several studies on the measurement of underwater noise and the effects of noise from drilling operations on gravel islands on bowhead whales.

Seal Island: Noise measurements were made during the open-water season near Seal Island, a manmade gravel island off Prudhoe Bay in water 12 meters deep. Davis, Greene, and McLaren (1985) measured underwater noise from Seal Island during the open-water season while well logging was occurring but not drilling operations. Underwater sound levels recorded from bottom hydrophones 1.65-2.4 kilometers from Seal Island were strongly affected by wind speed and active barge or tug traffic at the island. The strongest tone measured was 486 hertz from turbochargers on the generators used for well-logging operations. This tone was measured by a hydrophone on a boat at distances of up to 5 kilometers from Seal Island. Noise associated with barge or tug movement at the island could be readily detected at 2.4 kilometers from the island, even during high winds. Noise levels in the 20-1,000-Hertz band from barge traffic were about 118 dB re 1 μPa at 1.6 kilometers and had decreased to 108-110 dB re 1 μPa at 2.4 kilometers. At that rate of sound attenuation, the noise level from barges was estimated to be about 92 decibels at 6 kilometers. Underwater sounds from Seal Island were not detectable 2.3 kilometers away while people were on the island and power generators were operating, but no logging or drilling operations were ongoing.

Aerial surveys for bowhead whales near Seal Island in 1982 (during island construction) and 1984 found that most whales were in waters deeper than 18 meters, which is consistent with data from previous studies (Davis, Greene, and McLaren, 1985). In 1982, one whale was sighted in 12 meters of water about 11 kilometers northwest of Seal Island. In 1984, there were two sightings of single whales in 12-15 meters of water. Whales migrating in waters deeper than 18 meters would have been too far away to detect noise from Seal Island, because industrial noise was not audible in the water more than a few kilometers away. Acoustic data collected in 1982 and 1984 suggest that some bowheads were closer to Seal Island in 1984 than in 1982. Localizations made by the hydrophone array on three occasions indicated the whales were present between 2.5 and 6 kilometers from Seal Island. Bowhead calls recorded on hydrophones were thought to be from whales that were in waters at least 18 meters deep. The study concluded that there was no evidence to suggest that bowheads avoided Seal Island in 1984 compared to 1982.

Sandpiper Island: Johnson et al. (1986) measured underwater noise from Sandpiper Island, a manmade gravel island in water 15 meters deep. Sound was measured using a bottom-hydrophone system at 0.5 kilometers from the island and sonobuoys at greater distances from the island. The median sound levels observed at a fixed location 0.5 kilometers from Sandpiper Island were relatively low. Median noise levels in the 20-1,000-Hertz band were 93 and 95 dB re 1 μPa during 2 periods without drilling and 100 dB re 1 μPa during 1 period with drilling. In the absence of shipping or other industrial sounds, the expected level of noise in the 20-1,000-Hertz band is about 100 dB re 1 μPa for Beaufort Sea State 2 conditions (wind speeds at 7-10 knots and wave heights up to 0.5 meter). The most obvious components were tones at 20 and 40 Hertz, which were attributed to power generation on the island.

The low-frequency industrial sounds from Sandpiper Island attenuated rapidly with increasing range, at least partially due to the shallow water. The low-frequency sounds were evident when ambient noise levels were low but were largely masked during periods when ambient noise was above average. Sound levels received at a sonobuoy 3.7 kilometers from Sandpiper Island (76 dB re 1 µPa in both the 20- and 40-Hertz bands) were 24-30 decibels lower than the levels received at the bottom hydrophone 0.5 kilometers from the island. The bottom hydrophone measured drilling sounds of 100 dB re 1 µPa in the 20-Hertz frequency band at 0.5 kilometers from Sandpiper Island. The sounds were severely attenuated at 3.7 kilometers and not detectable at 9.3 kilometers. The effective source level of the 40-Hertz tone was estimated at 145 dB re 1 µPa at 1 meter.

Impulsive hammering sounds associated with installation of a conductor pipe were as high as 131-135 dB re 1 µPa at 1 kilometer, when pipe depth was about 20 meters below the island. In contrast, broadband drilling noise at this distance was about 100-106 decibels. During hammering, the transient signals had the strongest components at 30-40 Hertz and about 100 Hertz. Moore et al. (1984, as cited in Richardson, et al., 1995b) reported that received levels for transient pile-driving sounds recorded at 1 kilometer from a manmade island near Prudhoe Bay were 25-35 decibels above ambient levels in the 50- to 200-Hertz band. They estimated that the sounds might be received underwater as far as 10-15 kilometers from the source, farther than drilling sounds.

Aerial surveys for bowhead whales in 1985 indicated that no bowheads were seen closer than 30 kilometers from Sandpiper Island (Johnson et al., 1986). Almost all of the migrating bowheads traveled in water deeper than 18 meters, as was found in the surveys for Seal Island. Sandpiper and Northstar islands are both about 6 kilometers south of the 18-meter-depth contour. No drilling occurred at Sandpiper Island between September 4 and October 12, 1985, although drilling did resume a few days before the migration ended. Industrial noise from Sandpiper Island, with or without drilling, was not audible in the water more than a few kilometers away. Because the migration route of almost all bowheads is north of the 18-meter contour, few individual whales moved into the zone where industrial noise potentially was detectable.

The authors concluded that the number of whales that passed along the southern edge of the migration route and approached the artificial islands, both Seal and Sandpiper, must have been a very low fraction of the total population given the absence of sightings close to the islands.

Tern Island: Studies at Tern Island (proposed Liberty Island location) were conducted to determine sound levels that could be expected from the proposed Liberty development project. The studies provide information on distances that sound travels as a result of activities on gravel islands.

Greene (1997) measured underwater sounds under the ice at the proposed Liberty Island location from drilling operations on Tern Island in Foggy Island Bay in February 1997. Sounds from the drill rig generally were masked by ambient noise at distances near 2 kilometers. The strongest tones were at frequencies below 170 hertz, but the received levels diminished rapidly with increasing distance and dropped below the ambient noise level at ranges of about 2 kilometers. Drilling sounds were not detected at frequencies above 400 Hertz, even at 200 meters from the drill rig.

Greene noted that if production proceeded at Liberty, the types and frequency characteristics of some of the resulting sounds would be similar to those from the drilling equipment in this study. Electric power generation, pumps, and auxiliary machinery again would be involved, as would a drill rig during the early stages of production. However, the production island also would include additional processing and pumping facilities. If this equipment requires significantly more electric power, generators may produce sounds that are detectable at greater distances. However, these sounds would diminish rapidly with increasing distances due to high spreading losses (35 decibels per tenfold change in range) plus the linear attenuation rates of 2-9 decibels per kilometer (0.002-0.009 decibels per meter). Sound transmission within the lagoon for activities at Liberty would be similar to the sound transmission measured for activities at Tern Island, but the barrier islands to the north and the lagoon's very shallow water near those islands should make underwater sound transmission very poor beyond the islands and into the Beaufort Sea.

Greene (1998) measured ambient noise and acoustic-transmission loss underwater at the proposed Liberty Island site in Foggy Island Bay during the open-water season of 1997 to complement transmission loss and ambient-noise measurements made under the ice at Liberty in February 1997. For wind speeds of zero, 10, 20, and 30 knots, typical overall ambient noise levels in the 20-5000-Hertz band were 85, 94, 104, and 114 dB re 1 µPa, respectively. For the data from both recorders taken together, the median 20-5,000-Hertz band level for the 44 days was 97 dB re 1 µPa, or 9 decibels above the corresponding level for Knudsen's standard for Sea State 0 (Greene, 1998). The levels were consistent with other ambient noise measurements made in similar locations at similar times of the year. The measured ambient levels in winter generally were lower than those measured in summer, which means that industrial sounds would be expected to be detectable at greater distances during the winter. Bowheads are not present in the winter.

Acoustic-transmission loss was measured using a four-element sleeve-gun array and a minisparker as sources. The sleeve-gun array is a relatively low-frequency source (63-800 Hertz) compared to the minisparker (315-3,150 Hertz). Received sounds were recorded quantitatively at distances up to 8.1 kilometers southeast and 10.1 kilometers north of Liberty. At greater distances (up to 10 kilometers), the sounds from the sleeve-gun array diminished generally according to -25 log(R), while the minisparker sound diminished at approximately -10 log(R), corresponding to cylindrical spreading. This difference is attributed to the sleeve-gun array being a low-frequency source compared to the minisparker. Propagation-loss rates varied with frequency. The minisparker had a higher linear loss rate, which corresponds to higher absorption and scattering losses at higher frequencies.

Richardson et al. (1995a) summarized that noise from drilling activities varies considerably with operations. The highest documented levels were transient pulses from hammering to install conductor pipe. Underwater noise associated with drilling from natural barrier or artificial islands usually is weak and is inaudible beyond a few kilometers. Richardson et al. (1995a) estimated that drilling noise generally would be confined to low frequencies and would be audible at a range of 10 kilometers only during unusually quiet periods, while the audible range under more typical conditions would be approximately 2 kilometers.

IV.C.5.a(1)(a)2)b) Drilling Operations from Bottom-Founded Structures

Two types of caissons have been used for offshore drilling in the Alaska Beaufort Sea: the concrete island drilling system, which is a floating concrete rig that is floated into place, ballasted with seawater, and sits on the seafloor; and the steel drilling caisson, which is a section of a ship with a drill rig mounted on it and also is floated into place, ballasted with seawater, and sits on the seafloor. Drilling from these platforms generally is initiated after the bowhead whale migration is done and continues through the winter season.

In the absence of drilling operations, radiated levels of underwater sound from the concrete island drilling system were low, at least at frequencies above 30 Hertz. The overall received level was 109 dB re 1 µPa at 278 meters, excluding any infrasonic components. When the concrete island drilling system was drilling in early winter, radiated sound levels above 30 Hertz again were relatively low (89 decibels at 1.4 kilometer). However, when infrasonic components were included, the received level was 112 decibels at 1.4 kilometer. More than 99% of the sound energy received was below 20 Hertz. Received levels of sound at 222-259 meters ranged from 121-124 decibels. The maximum detection distance for infrasonic sounds was not determined. Such tones likely would attenuate rapidly in water shallow enough for a bottom-founded structure. Overall, the estimated source levels were low for the concrete island drilling system, even when the infrasonic tones were included (Richardson et al., 1995a).

Sounds from the steel drilling caisson were measured during drilling operations in water 15 meters deep with 100% ice cover. The strongest underwater tone was at 5 Hertz (119 dB re µPa) at a distance of 115 meters. The 5-Hertz tone apparently was not detectable at 715 meters, but weak tones were present at 150-600 Hertz. The broadband (20-1000 Hertz) received level at 215-315 meters was 116-117 dB re µPa, higher than the 109 decibels reported for the concrete island drilling system at 278 meters.

Inupiat whalers believe that noise from drilling activities displace whales farther offshore away from their traditional hunting areas. These concerns were expressed primarily for drilling activities from drillships with icebreaker support that were operating offshore in the main migration corridor. Concerns also have been expressed about noise generated from the single steel drilling caisson, the drilling platform used to drill two wells on the Cabot Prospect east of Barrow in October 1990 and November 1991. Mr. Jacob Adams, Mr. Burton Rexford, Mr. Fred Kanayurak, and Mr. Van Edwardson, all with the Barrow Whaling Captain's Association, stated in written testimony at the Arctic Seismic Synthesis and Mitigating Measures Workshop on March 5-6, 1997, in Barrow: "We are firmly convinced that noise from the Cabot drilling platform displaced whales from our traditional hunting area. This resulted in us having to go further offshore to find whales" (USDOI, MMS, Alaska OCS Region, 1997). The two wells drilled for the Cabot Prospect were spudded on October 19, 1990, and November 1, 1991, respectively.

IV.C.5.a(1)(a)2)c) Drilling Operations from Drillships and other Floating Platforms

Bowhead whales whose behavior appeared normal have been observed on several occasions within 10-20 kilometers (6.2-12.4 miles) of drillships in the eastern Beaufort Sea, and there have been a number of reports of sightings within 0.2-5 kilometers (0.12-3 miles) from drillships (Richardson et al., 1985b; Richardson and Malme, 1993). On several occasions, whales were well within the zone where drillship noise should be clearly detectable by them.

Richardson and Malme (1993) point out that the data, although limited, suggest that stationary industrial activities producing continuous noise, such as stationary drillships, result in less dramatic reactions by bowheads than do moving sources, particularly ships. It also appears that bowhead avoidance is less around an unattended structure than one attended by support vessels. Most observations of bowheads tolerating noise from stationary operations are based on opportunistic sightings of whales near ongoing oil-industry operations, and it is not known whether more whales would have been present in the absence of those operations. Because other cetaceans seem to habituate somewhat to continuous or repeated noise exposure when the noise is not associated with a harmful event, this suggests that bowheads will habituate to certain noises that they learn are nonthreatening. However, in Canada, bowhead use of the main area of oil-industry operations within the bowhead range was low after the first few years of intensive offshore oil exploration in 1976 (Richardson, Wells, and Wursig, 1985), suggesting perhaps cumulative effects from repeated disturbance may have caused the whales to leave the area. In the absence of systematic data on bowhead summer distribution until several years after intensive industry operations began, it is arguable whether the changes in distribution in the early 1980s were greater than natural annual variations in distribution, such as responding to changes in the location of food sources. Ward and Pessah (1988) concluded that the available information from 1976-1985 and the historical whaling information do not support the suggestion of a trend for decreasing use of the industrial zone by bowheads as a result of oil and gas exploration activities. They concluded that the exclusion hypothesis is likely invalid.

The distance at which bowheads may react to drillships is difficult to gauge, because some bowheads would be expected to respond to noise from drilling units by changing their migration speed and swimming direction to avoid closely approaching these noise sources. For example, in the study by Koski and Johnson (1987), one whale appeared to adjust its course to maintain a distance of 23-27 kilometers (14.3-16.8 miles) from the center of the drilling operation. Migrating whales apparently avoided the area within 10 kilometers (6.2 miles) of the drillship, passing both to the north and to the south of the drillship. The study detected no bowheads within 9.5 kilometers (5.9 miles) of the drillship, and few were observed within 15 kilometers (9.3 miles). The principal finding of this study was that migrating bowheads appeared to avoid the offshore drilling operation in fall 1986.

In other studies, Richardson, Wells, and Wursig (1985) observed three bowheads 4 kilometers (2.48 miles) from operating drillships, well within the zones ensonified by drillship noise. The whales were not heading away from the drillship but were socializing, even though exposed to strong drillship noise. Eleven additional whales on three other occasions were observed at distances of 10-20 kilometers (6.2-12.4 miles) from operating drillships. On two of the occasions, drillship noise was not detectable by researchers at distances from 10-12 kilometers (6.2-7.4 miles) and 18-19 kilometers (11.2-11.8 miles), respectively. In none of the occasions were whales heading away from the drillship. Ward and Pessah (1988, as cited in Richardson and Malme, 1993) reported observations of bowheads within 0.2-5 kilometers (0.12-3 miles) from drillships.

The ice-strengthened Kulluk, a specialized floating platform designed for arctic waters, was used for drilling operations at the Kuvlum drilling site in western Camden Bay in 1992 and 1993. Data from the Kulluk indicated broadband source levels (10-10,000 Hertz) during drilling and tripping were estimated to be 191 and 179 dB re µPa at 1 meter, respectively, based on measurements at a water depth of 20 meters in water about 30 meters deep (Richardson et al., 1995a).

Hall et al. (1994) conducted a site-specific monitoring program around the Kuvlum drilling site in the western portion of Camden Bay during the 1993 fall bowhead whale migration. Results of their analysis indicated that bowheads were moving through Camden Bay in a significantly nonrandom pattern but became more randomly distributed as they left Camden Bay and moved to the west. The results also indicated that whales were distributed farther offshore in the proximal survey grid (near the drill site) than in the distant survey grid (an area east of the drill site), which is similar to results from previous studies in this general area. The authors noted that information from previous studies indicated that bowheads routinely were present nearshore to the east of Barter Island and were less evident close to shore from Camden Bay to Harrison Bay (Moore and Reeves, as cited in Hall et al., 1994). The authors believed that industrial variables such as received level were insufficient as a single predictor variable to explain the 1993 offshore distribution of bowhead whales, and they suggested that water depth was the only variable that accounted for a significant portion of the variance in the model. They concluded that for 1993, water depth, received level, and longitude accounted for 85% of the variance in the offshore distribution of the whales. Based on their analyses, the authors concluded that the 1993 bowhead whale distribution fell within the parameters of previously recorded fall-migration distributions.

Davies (1997) used the data from the Hall et al. study in a geographic-information system model to analyze the distribution of fall-migrating bowheads in relation to an active drilling operation. He also concluded that the whales were not randomly distributed in the study area, and that they avoided the region surrounding the drill site at a range of approximately 20 kilometers (12.4 miles). He also noted that the whales were located significantly farther offshore and in significantly deeper water in the area of the drilling rig. As noted by Hall et al. (1994), the distribution of whales observed in the Camden Bay area is consistent with previous studies (Moore and Reeves, 1993), where whales were observed farther offshore in this portion of the Beaufort Sea than they were to the east of Barter Island. Davies concluded, as did Hall et al., that it was difficult to separate the effect of the drilling operation from other independent variables. The model identified distance from the drill rig and water depth as the two environmental factors that were most-strongly associated with the observed distribution of bowheads in the study area. The Davies analysis, however, did not note that surface observers (Hall et al., 1994) observed whales much closer to the drilling unit and support vessels than did aerial observers. In one instance, a whale was observed approximately 400 meters (436 yards) from the drill rig. Hall et al. suggest that bowheads, on several occasions, were closer to industrial activity than would be suggested by an examination of only aerial-survey data.

Schick and Urban (2000) also analyzed data from the Hall et al. study and tested the correlation between bowhead whale distribution and variables such as water depth, distance to shore, and distance to the drilling rig. The distribution of bowhead whales around the active drilling rig in 1993 was analyzed and the results indicated that whales were distributed farther from the drilling rig than they would be under a random scenario. The area of avoidance was localized and temporary (Schick and Urban, 2000; Angliss and Lodge, 2002). Schick and Urban (2000) stated they could not conclude that noise from the drilling rig caused the low density near the rig, because they had no data on actual noise levels. They also noted that ice, an important variable, is missing from their model and that 1992 was a particularly heavy ice year. Because ice may be an important patterning variable for bowheads, Schick and Urban said they were precluded from drawing strong inference from the 1992 results with reference to the interaction between whales and the drilling rig. Moore and DeMaster (1998, as cited in Schick and Urban, 2002) proposed that migrating bowheads are often found farther offshore in heavy ice years because of an apparent lack of feeding opportunities. Schick and Urban (2002) stated that ultimately, the pattern in the 1992 data may be explained by the presence of ice rather than by the presence of the drilling rig.

In playback experiments, some bowheads showed a weak tendency to move away from the sound source at a level of drillship noise comparable to what would be present several kilometers from an actual drillship (Richardson and Malme, 1993). In one study, sounds recorded 130 meters (426 feet) from the actual Karluk drill rig were used as the stimulus during disturbance test playbacks (Richardson et al., 1991). For the overall 20- to 1,000-Hertz band, the average source level was 166 dB re 1 μPa in 1990 and 165 dB re 1 μPa in 1989. Bowheads continued to pass the projector while normal Karluk drilling sounds were projected. During the playback tests, the source level of sound was 166 dB re 1 μPa. One whale came within 110 meters (360 feet) of the projector. Many whales came within 160-195 meters (525-640 feet), where the received broadband (20-1000 Hertz) sound levels were about 135 dB re 1 μPa. That level was about 46 decibels above the background ambient level in the 20- to 1,000-Hertz band on that day. Bowhead movement patterns were strongly affected when they approached the operating projector. When bowheads still were several hundred meters away, most began to move to the far side of the lead from the projector, which did not happen during control periods while the projector was silent.

In a subsequent phase of this continuing study, Richardson et al. (1995b) concluded:

> …migrating bowheads tolerated exposure to high levels of continuous drilling noise if it was necessary to continue their migration. Bowhead migration was not blocked by projected drilling sounds, and there was no evidence that bowheads avoided the projector by distances exceeding 1 kilometer (0.54 nautical mile). However, local movement patterns and various aspects of the behavior of these whales were affected by the noise exposure, sometimes at distances considerably exceeding the closest points of approach of bowheads to the operating projector.

Some migrating bowheads diverted their course enough to remain a few hundred meters to the side of the projector. Surfacing and respiration behavior, and the occurrence of turns during surfacings, were strongly affected out to 1 kilometer (0.62 mile). Turns were unusually frequent out to 2 kilometers (1.25 miles), and there was evidence of subtle behavioral effects at distances up to 2-4 kilometers (1.25-2.5 miles). The study concluded that the demonstrated effects were localized and temporary and that playback effects of drilling noise on distribution, movements, and behavior were not biologically significant.

The authors stated that one of the main limitations of this study (during all 4 years) was the inability of a practical sound projector to reproduce the low-frequency components of recorded industrial sounds. Both the Karluk rig and the icebreaker Robert Lemeur emitted strong sounds down to ~10-20 Hertz, and quite likely at even lower frequencies. It is not known whether the under-representation of low-frequency components (less than 45 Hertz) during icebreaker playbacks had significant effects on the responses by bowheads. Bowheads presumably can hear sounds extending well below 45 Hertz. It is suspected but not confirmed that their hearing extends into the infrasonic range below 20 Hertz. The authors believed the projector adequately reproduced the overall 20- to 1,000-Hertz level at distances beyond 100 meters (109 yards), even though components below 80 Hertz were under-represented. If bowheads are no more responsive to sound components at 20-80 Hertz than to those above 80 Hertz, then the playbacks provided a reasonable test of the responsiveness to components of Karluk sound above 20 Hertz.

The authors also stated that the study was not designed to test the potential reactions of whales to nonacoustic stimuli detected via sight, olfaction, etc. At least in summer/autumn, responses of bowheads to actual dredges and drillships seem consistent with reactions to playbacks of recorded sounds from those same sites. Additional limitations of the playbacks identified by the authors included low sample sizes and the fact that responses were only evident if they could be seen or inferred based on surface observations. The numbers of bowhead whales observed during both playback and control conditions were low percentages of the total Beaufort Sea population. Also, differences between whale activities and behavior during playback versus control periods represent the incremental reactions when playbacks are added to a background of other activities associated with the research. Thus, playback results may somewhat understate the differences between truly undisturbed whales versus those exposed to playbacks.

If drillships are attended by icebreakers, as typically is the case during the fall in the U.S. Beaufort Sea, the drillship noise frequently may be masked by icebreaker noise, which often is louder. There are no observations of bowhead reactions to icebreakers breaking ice. Response distances would vary, depending on icebreaker activities and sound-propagation conditions. Based on models, bowhead whales likely would respond to the sound of the attending icebreakers at distances of 2-25 kilometers (1.24-15.53 miles) from the icebreakers (Miles, Malme, and Richardson, 1987). Zones of responsiveness for intermittent sounds, such as an icebreaker pushing ice have not been studied. This study predicts that roughly half of the bowhead whales show avoidance response to an icebreaker underway in open water at a range of 2-12 kilometers (1.25-7.46 miles) when the sound-to-noise ratio is 30 decibels. The study also predicts that roughly half of the bowhead whales would show avoidance response to an icebreaker pushing ice at a range of 4.6-20 kilometers (2.86-12.4 miles) when the sound-to-noise ratio is 30 decibels.

Richardson et al. (1995b) found that bowheads migrating in the nearshore lead often tolerated exposure to projected icebreaker sounds at received levels up to 20 decibels or more above the natural ambient noise levels at corresponding frequencies. The source level of an actual icebreaker is much higher than that of the projectors (projecting recorded sound) used in this study (median difference 34 decibels over the frequency range 40-6,300 Hertz). Over the two-season period (1991 and 1994) when icebreaker playbacks were attempted, an estimated 93 bowheads (80 groups) were seen near the ice camp when the projectors were transmitting icebreaker sounds into the water, and approximately 158 bowheads (116 groups) were seen near there during quiet periods. Some bowheads diverted from their course when exposed to levels of projected icebreaker sound greater than 20 decibels above the natural ambient noise level in the one-third octave band of the strongest icebreaker noise. However, not all bowheads diverted at that sound-to-noise ratio, and a minority of whales apparently diverted at a lower sound-to-noise ratio. The study concluded that exposure to a single playback of variable icebreaker sounds can cause statistically but probably not biologically significant effects on movements and behavior of migrating whales in the lead system during the spring migration east of Point Barrow. The study indicated the predicted response distances for bowheads around an actual icebreaker would be highly variable; however, for typical traveling bowheads, detectable effects on movements and behavior are predicted to extend commonly out to radii of 10-30 kilometers (6.2-18.6 miles) and sometimes to 50+ kilometers (31.1 miles). Effects of an actual icebreaker on migrating bowheads, especially mothers and calves, could be biologically significant. It should be noted that these predictions were based on reactions of whales to playbacks of icebreaker sounds in a lead system during the spring migration and are subject to a number of qualifications. (The predicted "typical" radius of responsiveness around an icebreaker like the *Robert Lemeur* is quite variable, because propagation conditions and ambient noise vary with time and with location. In addition, icebreakers vary widely in engine power and thus noise output, with the *Robert Lemeur* being a relatively low-powered icebreaker. Furthermore, the reaction thresholds of individual whales vary by at least 10 decibels around the "typical" threshold, with commensurate variability in predicted reaction radius.)

While conducting aerial surveys over the Kuvlum drilling location, Brewer et al. (1993) showed that bowhead whales were observed within about 30 kilometers (18.6 miles) north of the drilling location. The closest observed position for a bowhead whale detected during the aerial surveys was approximately 23 kilometers (14.3 miles) from the project icebreakers. The drilling rig was not operating on that day, but all three icebreakers had been actively managing ice periodically during the day. The study did not indicate what the whale's behavior was, but it did not appear to be avoiding the icebreakers. Three whales were sighted that day, and all three appeared to be moving to the northwest along the normal migration route at speeds of 2.4-3.4 kilometers per hour (1.5-2.1 miles per hour). Bowhead whale call rates peaked when whales were about 32 kilometers (19.9 miles) from the industrial activity. There was moderate to heavy ice conditions throughout the monitoring area, with heavy, grounded icefloes to the west, north, and east of the drilling site. Generally, whales tend to be located in deeper waters during years of moderately heavy ice cover (Treacy, 1993). Brewer et al. (1993) were unable to determine if either ice or industrial activity by themselves caused the whales to migrate to the north of the drilling location, but they concluded that ice alone probably did not determine the observed distribution of whales.

Concerns have been raised regarding the effects of noise from OCS exploration and production operations in the spring lead system and the potential for this noise to delay or block the bowhead spring migration. Spring-migrating bowheads are not likely to be exposed to drilling noise. To date, no drilling or production operations have taken place in the vicinity of the spring lead system during the bowhead migration.

IV.C.5.a(1)(a)3) Effects from Aircraft Traffic

Most offshore aircraft traffic in support of the oil industry involves turbine helicopters flying along straight lines. Underwater sounds from aircraft are transient. According to Richardson et al. (1995a), the angle at which a line from the aircraft to the receiver intersects the water's surface is important. At angles greater than 13º from the vertical, much of the incident sound is reflected and does not penetrate into the water. Therefore, strong underwater sounds are detectable while the aircraft is within a 26° cone above the receiver. An aircraft usually can be heard in the air well before and after the brief period while it passes overhead and is heard underwater.

Data on reactions of bowheads to helicopters are limited. Most bowheads are unlikely to react significantly to occasional single passes by low-flying helicopters ferrying personnel and equipment to offshore operations. Observations of bowhead whales exposed to helicopter overflights indicate that most bowheads exhibited no obvious response to helicopter overflights at altitudes above 150 meters (500 feet). At altitudes below 150 meters (500 feet), some bowheads probably would dive quickly in response to the aircraft noise (Richardson and Malme, 1993). However, bowhead reactions to a single helicopter flying overhead probably are temporary (Richardson et al., 1995a). This noise generally is audible for only a brief time (tens of seconds) if the aircraft remains on a direct course, and the whales should resume their normal activities within minutes. Patenaude et al. (1997) found that most reactions by bowheads to a Bell 212 helicopter occurred when the helicopter was at altitudes of 150 meters or less and lateral distances of 250 meters or less. The most common reactions were abrupt dives and shortened surface time, and most, if not all, reactions seemed brief. However, the majority of bowheads showed no obvious reaction to single passes, even at those distances. The helicopter sounds measured underwater at depths of 3 and 18 meters showed that sound consisted mainly of main-rotor tones ahead of the aircraft and tail-rotor sounds behind the aircraft; more sound pressure was received at 3 meters than at 18 meters; and peak sound levels received underwater diminished with increasing aircraft altitude. Sound levels received underwater at 3 meters from a Bell 212 flying overhead at 150 meters ranged from 117-120 dB re 1 μPa in the 10- to 500-Hertz band. Underwater sound levels at 18 meters from a Bell 212 flying overhead at 150 meters ranged from 112-116 dB re 1 μPa in the 10- to 500-Hertz band.

Fixed-wing aircraft flying at low altitude often cause hasty dives. Reactions to circling aircraft are sometimes conspicuous if the aircraft is below 300 meters (1,000 feet), uncommon at 460 meters (1,500 feet), and generally undetectable at 600 meters (2,000 feet). Repeated low-altitude overflights at 150 meters (500 feet) during aerial photogrammetry studies of feeding bowheads sometimes caused abrupt turns and hasty dives (Richardson and Malme, 1993). Aircraft on a direct course usually produce audible noise for only tens of seconds, and the whales are likely to resume their normal activities within minutes (Richardson and Malme, 1993). Patenaude et al. (1997) found that few bowheads (2.2%) during the spring migration were observed to react to Twin Otter overflights at altitudes of 60-460 meters. Reaction frequency diminished with increasing lateral distance and with increasing altitude. Most observed reactions by bowheads occurred when the Twin Otter was at altitudes of 182 meters or less and lateral distances of 250 meters or less. There was little, if any, reaction by bowheads when the aircraft circled at an altitude of 460 meters and a radius of 1 kilometer. The effects from an encounter with aircraft are brief, and the whales should resume their normal activities within minutes.

IV.C.5.a(1)(a)4) Effects from Vessel Traffic

Bowheads react to the approach of vessels at greater distances than they react to most other industrial activities. According to Richardson and Malme (1993), most bowheads begin to swim rapidly away when vessels approach rapidly and directly. Avoidance usually begins when a rapidly approaching vessel is 1-4 kilometers (0.62-2.5 miles) away. A few whales may react at distances from 5-7 kilometers (3-4 miles), and a few whales may not react until the vessel is less than 1 kilometer (less than 0.62 mile) away. Received noise levels as low as 84 dB re 1 μPa) or 6 decibels above ambient may elicit strong avoidance of an approaching vessel at a distance of 4 kilometers (2.5 miles) (Richardson and Malme, 1993).

In the Canadian Beaufort Sea, bowheads observed in vessel-disturbance experiments began to orient away from an oncoming vessel at a range of 2-4 kilometers (1.2-2.5 miles) and to move away at increased speeds when approached closer than 2 kilometers (1.2 miles) (Richardson and Malme, 1993). Vessel disturbance during these experimental conditions temporarily disrupted activities and sometimes disrupted social groups, when groups of whales scattered as a vessel approached. Reactions to slow-moving vessels, especially if they do not approach directly, are much less dramatic. Bowheads often are more tolerant of vessels moving slowly or in directions other than toward the whales. Fleeing from a vessel generally stopped within minutes after the vessel passed, but scattering may persist for a longer period. After some disturbance incidents, at least some bowheads returned to their original locations (Richardson and Malme, 1993). Some whales may exhibit subtle changes in their surfacing and blow cycles, while others appear to be unaffected. Bowheads actively engaged in social interactions or mating may be less responsive to vessels.

Bowhead whales probably would encounter relatively few vessels associated with exploration activities during their fall migration through the Alaskan Beaufort Sea. Vessel traffic generally would be limited to routes between the exploratory-drilling units and the shore base. Each floating drilling unit probably would have one vessel remaining nearby for emergency use. Depending on ice conditions, floating drilling units may have two or more icebreaking vessels standing by to perform ice-management tasks. It is likely that vessels actively involved in ice management or moving from one site to another would be more disturbing to whales than vessels idling or maintaining their position. In either case, bowheads probably would adjust their individual swimming paths to avoid approaching within several kilometers of vessels attending a drilling unit and probably would move away from vessels that approached within a few kilometers. Vessel activities associated with exploration are not expected to disrupt the bowhead migration, and small deflections in individual bowhead-swimming paths and a reduction in use of possible bowhead-feeding areas near exploration units should not result in significant adverse effects on the species. During their spring migration (April through June), bowheads likely would encounter few, if any, vessels along their migration route, because ice at this time of year typically would be too thick for seismic-survey ships, drillships, and supply vessels to operate in.

IV.C.5.a(1)(a)5) Effects from Other Exploration Activities

Island-construction activities could cause noise and disturbance to bowhead whales. Placement of fill material for island construction generally occurs during the winter when bowhead whales are not present. Completion of island construction and placement of slope-protection materials may take place during the open-water season, but these activities generally are completed before the bowhead whale fall migration. Placement of sheetpile, if used, would generate noise during the open-water period for one construction season but also should be completed in early to mid-August, before the whales migrate. Noise is not likely to propagate far due to the shallow water and the presence of barrier islands that, in many cases, may lie between the drilling location and the migration corridor used by bowhead whales, depending on the island location. Even during the migration, noise from these activities would be minor and would not affect bowhead whales.

Preliminary analysis of noise measurements during the open-water construction season at Northstar Island by Blackwell and Greene (2001) indicated that the presence of self-propelled barges had the largest impact on the level of sound coming from Northstar Island. Self-propelled barges remained at Northstar for days or weeks and always had their engines running, because they maintained their position by “pushing” against the island. Sound measurements on a day when there were no self-propelled barges showed that sounds were inaudible to the field acoustician listening to the hydrophone signal beyond 1.85 kilometers, even on a relatively calm day. By comparison, the sounds produced by self-propelled barges, while limited in their frequency range, were detectable underwater as far as 28 kilometers north of the island. Other vessels, such as the crew boat and tugs, produced qualitatively the same types of sounds, but they were present intermittently, and their effect on the sound environment was lower.

Summary of Noise Effects: Bowheads are not affected much by any aircraft overflights at altitudes above 300 meters (984 feet). Below this altitude, some changes in whale behavior may occur, depending on the type of plane and the responsiveness of the whales present in the vicinity of the aircraft. The effects from such an encounter with either fixed-wing aircraft or helicopters generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior if approached by vessels at a distance of 1-4 kilometers (0.62-2.5 miles). Marine-vessel traffic also may include seagoing barges transporting equipment and supplies from Southcentral Alaska to drilling locations, most likely between mid-August and mid- to late September. If the barge traffic continues into September, some bowheads may be disturbed. Fleeing behavior from vessel traffic generally stopped within minutes after the vessel passed, but scattering may persist for a longer period. In some instances, at least some bowheads returned to their original locations. In many cases, vessel activities are likely to be in shallow, nearshore waters outside the main bowhead-migration route.

Several studies indicate that most bowheads exhibit avoidance behavior when exposed to sounds from seismic activity at a distance of a few kilometers but rarely show avoidance behavior at distances of more than 7.5 kilometers (4.7 miles). Bowheads also exhibited tendencies for reduced surfacing and dive duration, fewer blows per surfacing, and longer intervals between successive blows. Bowheads appeared to recover from these behavioral changes within 30-60 minutes following cessation of seismic activity. However, recent monitoring studies (1996-1998) indicate that during the fall migration, most bowhead whales avoid an area around a seismic vessel operating in nearshore waters by a radius of about 20 kilometers. The sighting rates of whales at a radius of 20 and 30 kilometers was higher than the sighting rate within the 20-kilometer radius, but it varied annually from no evidence of a reduced sighting rate in 1996 to a reduced sighting rate in 1998. This is a larger avoidance radius than was observed from scientific studies conducted in the 1980’s. Avoidance did not persist beyond 12 hours after the end of seismic operations.

Exploratory drilling from gravel islands generally is conducted during the winter. Should these activities occur during the migration, noise produced from the activities is not expected to affect whales, because gravel islands are constructed in fairly shallow water shoreward of the main migration route, and noise from operations on gravel islands generally is not audible beyond a few kilometers. Exploratory drilling from bottom-founded structures also generally is conducted during the winter. Bowheads have been sighted within 0.2-5 kilometers (0.12-3 miles) from drillships, although some bowheads probably change their migration speed and swimming direction to avoid close approach to noise-producing activities. A few bowheads may avoid drilling noise at 20 kilometers (12.4 miles) or more. If icebreakers attended drillships, as typically is the case during the fall in the U.S. Beaufort Sea, the drillship noise frequently may be masked by icebreaker noise, which often is louder. There are no observations of bowhead reactions to icebreakers breaking ice, but it has been predicted that roughly half of the bowheads would respond at a distance of 4.6-20 kilometers (2.86-12.4 miles) when the sound-to-noise ratio is 30 decibels. Whales appear to exhibit less avoidance behavior with stationary sources of relatively constant noise than with moving sound sources.

Island-construction activities likely will be conducted during the winter and generally are in nearshore shallow waters shoreward of the main bowhead whale migration route. These activities are not expected to affect bowhead whales. Some whales may be displaced seaward, if cleanup activities occurred outside the barrier islands or in the channels between the barrier islands during the whale migration.

Bowheads do not seem to travel more than a few kilometers in response to a single disturbance incident and behavioral changes are temporary, lasting from minutes (in the case of vessels and aircraft) up to 30-60 minutes (in the case of seismic activity in earlier seismic studies). In recent studies, avoidance of the area within 20 kilometers of seismic operations did not persist beyond 12 hours after the end of seismic operations. Occasional brief interruption of feeding by a passing vessel or aircraft probably is not of major significance. Similarly, the energetic cost of traveling a few additional kilometers to avoid closely approaching a noise source is very small in comparison with the cost of migration between the central Bering and eastern Beaufort seas. We do not believe these disturbances or avoidance factors will be significant, because the anticipated level of industrial activity is not sufficiently intense to cause repeated displacement of specific individuals. Reactions are less obvious in the case of industrial activities that continue for hours or days, such as distant seismic exploration and drilling. Behavioral studies have suggested that bowheads habituate to noise from distant, ongoing drilling or seismic operations (Richardson et al., 1985), but there still is some apparent localized avoidance (Davies, 1987). There is insufficient evidence to indicate whether or not industrial activity in an area for a number of years would adversely impact bowhead use of that area (Richardson et al., 1985), but there has been no documented evidence that noise from OCS operations would serve as a barrier to migration.

Overall, bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, seismic surveys, and construction activities most likely would experience temporary, nonlethal effects.

IV.C.5.a(1)(b) Effects from Discharges

There also could be a number of minor alterations in bowhead habitat as a result of exploration. Discharge of drilling muds and cuttings during exploration activities are not expected to cause significant effects, either directly through contact or indirectly by affecting prey species. Any effects would be primarily localized around the drill rig because of the rapid dilution/deposition of these materials. Bottom-founded drilling units and/or gravel islands may cover small areas of benthic habitat, and drilling muds and cuttings may cover portions of the seafloor that support epibenthic invertebrates used for food by bowhead whales. However, the effects likely would be negligible, because bowheads feed primarily on pelagic zooplankton and the areas of sea bottom that are impacted would be inconsequential in relation to the available habitat. Gravel-island-construction activities, including placement of fill material, or installation of sheetpile or gravel bags for slope protection would cause sediment suspension or turbidity in the water. It is likely that most of these construction activities would occur during the winter when bowheads are not present in the area. Activities occurring during the open-water season likely would be completed before the bowhead whales begin their fall migration. Bowheads should not be affected by these activities.

IV.C.5.a(1)(c) Effects of an Oil Spill on Bowhead Whales

The effects of an oil spill on bowhead whales are unknown. However, some conclusions can be drawn from studies that have looked at the effects of oil spills on other cetaceans. Engelhardt (1987) theorized that bowhead whales would be particularly vulnerable to effects from oil spills during their spring migration into arctic waters because of their use of ice edges and leads, where spilled oil tends to accumulate. Several other researchers (Geraci and St. Aubin, 1982; St. Aubin, Stinson, and Geraci, 1984) concluded that exposure to spilled oil is unlikely to have serious direct effects on baleen whales. Other studies (Loughlin, 1994; Dahlheim and Matkin, 1994; Dahlheim and Loughlin, 1990) either documented no effects to cetaceans from spilled oil, or the results of the studies were inconclusive. In the unlikely event of a large oil spill in the bowhead whale's habitat while they were present, some whales could experience the following (Geraci, 1990):

- oiling of skin
- inhaling of hydrocarbon vapors (from a fresh spill)
- ingesting contaminated prey
- fouling of their baleen
- reduced food source
- displacement from feeding areas
- death
- other effects

The number of whales contacting spilled oil would depend on the size, timing, and duration of the spill; how many whales were near the spill; and the whales' ability or inclination to avoid contact.

IV.C.5.a(1)(c)1) Effects of Skin Contact

Oil first would contact a whale's skin as it surfaces to breathe. The effects of oil contacting skin are largely speculative. Although oil is unlikely to adhere to smooth skin, it may stick to rough areas on the surface. Henk and Mullan (1997) studied skin lesions on bowheads and categorized them as shallow lacerations, circular depressions, and epidermal sloughing. All lesions remain on the top layer of the skin and produce no inflammation or other response. They stated that whatever the cause or form of the lesion, a layer of cells builds up next to the affected area. This layer eventually moves to the surface and heals the lesion without scarring. The authors suggest that a layer of cells on an otherwise smooth skin surface may increase the potential for petroleum to adhere.

Haldiman et al. (1981) also describe the skin and lesions on the skin of bowheads. Haldiman et al. (1985) detail the skin's structure, finding the epidermal layer to be as much as 7-8 times thicker than that found on most whales. This study included some very simple preliminary trials to determine possible interactions between bowhead skin and crude oil. The researchers found that little or no crude oil adhered to preserved bowhead skin that was dipped into oil up to three times, as long as a water film stayed on the skin's surface. Oil adhered in small patches to the surface and vibrissae (stiff, hairlike structures), once it made enough contact with the skin. The amount of oil sticking to the surrounding skin and epidermal depression appeared to be in proportion to the number of exposures and the roughness of the skin's surface.

Albert (1981) suggests that oil would adhere to the skin's rough surfaces (eroded areas on the skin's surface, tactile hairs, and depressions around the tactile hairs). Albert (1996, as cited in U.S. Army Corps of Engineers, 1998:Appendix B) characterizes the rough areas as variable in size and shape, often 1-2 inches in diameter and 1-3 millimeters deep, with hairlike projections extending up from the depths of the damaged skin surface. He theorizes that oil could irritate the skin, especially the eroded areas, and interfere with information the animal receives through the tactile hairs. Because we do not know how these hairs work, we cannot assess how any damage to them might affect bowheads. Albert (1981) is concerned that the eroded skin may provide a point of entry into the bloodstream for pathogenic bacteria, if the skin becomes more damaged. Shotts et al. (1990) found a large number of species of bacteria and yeast, both from the normal skin and from lesions on bowheads. Enzymatic assays from isolates from normal skin and skin with lesions demonstrated the production of enzymes capable of causing necrosis (tissue death). The presence of the enzymes suggests that the lesions are active sites of necrosis. The authors noted that 38% of the microorganisms in lesions contained enzymes necessary for hemolytic activity of blood cells (breaking down of red blood cells and the release of hemoglobin) compared to 28% of the microorganisms on normal skin. Many of these species of bacteria and yeast were determined to be potential pathogens of mammalian hosts. Hansen (1985) speculates that much of the oil is washed off the whale's skin as it moves through the water. However, we do not know how long spilled oil will adhere to the skin of a free-ranging whale. Oil might wash off the skin and body surface shortly after bowheads vacated oiled areas, if they left shortly after being oiled. However, oil might adhere to the skin and other surface features (such as sensory hairs) longer, if bowheads remained in these areas.

There is speculation that bowhead whale eyes may be vulnerable to damage from oil on the water due to their unusual anatomical structure.

In a study on nonbaleen whales and other cetaceans, Harvey and Dahlheim (1994) observed 80 Dall's porpoises, 18 killer whales, and 2 harbor porpoises in oil on the water's surface from the *Exxon Valdez* spill. They observed groups of Dall's porpoises on 21 occasions in areas with light sheen, several occasions in areas with moderate-to-heavy surface oil, once in no oil, and once when they did not record the amount of oil. Thirteen of the animals were close enough to determine if oil was present on their skin. They confirmed that 12 animals in light sheen or moderate-to-heavy oil did not have oil on their skin. One Dall's porpoise had oil on the dorsal half of its body. It appeared stressed because of its labored breathing pattern. The authors gave no other information on effects. The 18 killer whales and 2 harbor porpoises were in oil but had none on their skin. None of the cetaceans appeared to alter their behaviors when in areas where oil was present. The authors concluded their observations were consistent with other reports of cetaceans behaving normally when oil is present. It is probable that bowhead whales would respond in a similar manner (U.S. Army Corps of Engineers, 1998:Appendix B).

Histological data and ultrastructural studies by Geraci and St. Aubin (1990) showed that long exposures to petroleum hydrocarbons produced only transient damage to epidermal cells in whales. The authors began their experiments by applying a small sponge soaked in crude oil to the skin of four species of toothed whales. Contact for up to 45 minutes had no effect. They switched to gasoline and applied the sponge up to 75 minutes. Even unrealistically long contact times could not produce a severe reaction typical of that in other mammals. Subtle changes were evident only at the cell level and, in each case, healed within a week. The authors pointed out that a cetacean's skin is an effective barrier to the noxious substances in petroleum. These substances normally damage skin by getting between cells and dissolving protective lipids. In cetacean skin, however, tight intercellular bridges, vital surface cells, and the extraordinary thickness of the epidermis impeded the damage. The authors could not detect a change in lipid concentration between and within cells after exposing skin from a white-sided dolphin to gasoline for 16 hours in vitro.

Geraci and St. Aubin also investigated how oil might affect healing of superficial wounds in a bottlenose dolphin's skin. They found that following a cut, newly exposed epidermal cells degenerate to form a zone of dead tissue that shields the underlying cells from seawater during healing. They massaged the superficial wounds with crude oil or tar for 30 minutes, but the substances did not affect healing. Lead-free gasoline applied in the same manner caused strong inflammation, but it subsided within 24 hours and was indistinguishable from control cuts. The authors concluded that the dead tissue had protected underlying tissues from gasoline in the same way it repels osmotic attack by seawater. The authors further concluded that in real life, contact with oil would be less harmful to cetaceans than they and others had proposed.

Bratton et al. (1993) synthesized studies on the potential effects of contaminants on bowhead whales. They say no published data prove oil fouling of the skin of any free-living whales, and conclude that bowhead whales contacting fresh or weathered petroleum are unlikely to suffer harm. Cetacean skin is a strong barrier to the toxic effects of petroleum.

IV.C.5.a(1)(c)2) Effects of Inhalation

Bowheads would be most likely to contact spilled oil as they surface to breathe. They probably would not inhale oil into the blowhole, although bowheads surfacing in a spill of lightly weathered oil could inhale some hydrocarbon vapors that might affect breathing. Geraci and St. Aubin (1982) calculated the concentrations of hydrocarbons associated with a theoretical spill of a typical light crude oil. They calculated the concentrations of the more volatile fractions of crude oil in air. The results showed that vapor concentrations could reach critical levels for the first few hours after a spill. If a whale or dolphin were unable to leave the immediate area of a spill during that time, it would inhale some vapors, perhaps enough to cause some damage. Although the vapor concentrations would not reach levels high enough to threaten normal, healthy individuals, cetaceans that were stressed by lung and liver parasites or adrenal disorders might be vulnerable. A panicked or swiftly moving whale or dolphin would breathe rapidly and probably inhale more vapors. More likely, the animals would experience some irritation of respiratory membranes and absorb hydrocarbons into the bloodstream. Fraker (1984), while reviewing the effects of oil on cetaceans, stated that a whale surfacing in an oil spill will inhale vapors of the lighter petroleum fractions, and many of these can be harmful in high concentrations. Animals that are away from the immediate area or that are exposed to oils that had weathered for at least 2-4 hours would not be expected to suffer any consequence from inhalation, regardless of their condition. The most serious situation would occur if oil spilled into a lead that bowheads could not escape. In this case, Bratton et al. (1993) theorized the whales could inhale oil vapor that would irritate their mucous membranes or respiratory tract. They also could absorb volatile hydrocarbons into the bloodstream. However, they rapidly would excrete these volatile hydrocarbons, and vapor concentrations that harm whales would dissipate within several hours after a spill. Within hours after the spill, toxic vapors from oil in a lead could harm the whales' lungs and even kill them, but only a few whales likely would occupy the affected lead at any given time.

IV.C.5.a(1)(c)3) Effects of Ingestion

Bowheads sometimes skim the water surface while feeding, filtering a lot of water for extended periods. If oil were present, they could swallow it. Albert (1981) suggested that whales could take in tarballs or large "blobs" of oil with prey. He also said that swallowed baleen "hairs" mix with the oil and mat together into small balls. These balls could block the stomach at the connecting channel, which is a very narrow tube connecting the stomach's fundic and pyloric chambers (the second and fourth chambers of the stomach) (Tarpley et al., 1987). Hansen (1985; 1992) suggests that cetaceans can metabolize ingested oil, because they have cytochrome p-450 in their livers (Hansen, 1992). The presence of cytochrome p-450 (a protein involved in the enzyme system associated with the metabolism and detoxification of a wide variety of foreign compounds, including components of crude oil) suggests that cetaceans should be able to detoxify oil (Geraci and St. Aubin, 1982, as cited in Hansen, 1992). He also suggests that digestion may break down any oil that adheres to baleen filaments and causes clumping (Hansen, 1985). Observations and stranding records do not reveal whether cetaceans would feed around a fresh oil spill long enough to accumulate a critical dose of oil.

Bowheads may swallow some oil-contaminated prey, but it likely would be only a small part of their food. Some zooplankton eaten by bowheads consume oil particles but apparently can excrete hydrocarbons quickly from their system. Tissue studies by Geraci and St. Aubin (1990) revealed low levels of naphthalene in the livers and blubber of baleen whales. This result suggests that prey have low concentrations in their tissues, or that baleen whales may be able to metabolize and excrete petroleum hydrocarbons.

IV.C.5.a(1)(c)4) Effects of Baleen Fouling

Baleen hairs might be fouled, which would reduce a whale's filtration efficiency. Braithwaite (1983, as cited in Bratton et al., 1993) used a simple system to show a 5-10% decrease in filtration efficiency of bowhead baleen after fouling, which lasted for up to 30 days. The study looked at oil thickness for light (0.5 millimeter) and medium (1.0 millimeter) degrees of fouling and for heavy (10.0 millimeters) fouling. The baleen was placed and tested in a horizontal rather than vertical position. The fouled baleen allowed increased numbers of plankton to slip past the baleen without being caught. Fraker (1984) noted that there was a reduction in filtering efficiency in all cases, but only when the baleen was fouled with 10 millimeters of oil was the change statistically different. We do not know how such a reduction in food caught in the baleen would affect the overall health or feeding efficiency of these whales. Geraci and St. Aubin (1985) found that 70% of the oil adhering to baleen plates was lost within 30 minutes. In 8 of 11 trials, more than 95% of the oil was cleared after 24 hours. The study could not detect any change in resistance to water flowing through baleen after 24 hours. This study tested baleen from fin, sei, humpback, and gray whales. The baleen from these whales is shorter and coarser than that of bowhead whales, whose longer baleen has many hairlike filaments. Information from these two studies suggest that a spill of heavy oil, such as Bunker C, or residual patches of weathered oil, could interfere with feeding efficiency of the fouled plates for several days at least (Geraci and St. Aubin, 1985). Lighter oil should result in less interference with feeding efficiency. Geraci and St. Aubin, (1985) stated that it appeared that the concern for oiled whales (baleen fouling) is becoming less defensible based on the low-level immediate impact in Braithwaite's study and the rate of clearance of oil in this study.

Bowheads most likely would occupy oiled waters for only a short time, and filtration efficiency could return to normal in a matter of hours as oil flushes from the baleen. Repeated baleen fouling over a long time, however, might reduce food intake and blubber deposition, which could harm the bowheads.

IV.C.5.a(1)(c)5) Effects of Reduced Food Source

An oil spill probably would not permanently affect zooplankton, the bowhead's major food source, and any effects are most likely to occur nearshore (Richardson et al., 1987, as cited in Bratton et al., 1993). The amount of zooplankton lost, even in a large oil spill, would be very small compared to what is available on the whales' summer-feeding grounds (Bratton et al., 1993).

IV.C.5.a(1)(c)6) Effects of Displacement from Feeding Areas

We have no observations through western science whether bowheads may be temporarily displaced from an area because of an oil spill or cleanup operations. However, Thomas Brower, Sr. (1980) described the effects on bowhead whales of a 25,000-gallon oil spill at Elson Lagoon (Plover Islands) in 1944. It took approximately 4 years for the oil to disappear. For 4 years after the oil spill, Brower observed that bowhead whales made a wide detour out to sea when passing near Elson Lagoon/Plover Islands during fall migration. Bowhead whales normally moved close to these islands during the fall migration. These observations indicate that some displacement of whales may occur in the unlikely event of a large oil spill, and that the displacement may last for several years. Based on these observations, it also appears that bowhead whales may have some ability to detect an oil spill and avoid surfacing in the oil by detouring around the area of the spill. Potential displacement because of disturbance is discussed in Section III.C.3.

Several investigators have observed various cetaceans in spilled oil, including fin whales, humpback whales, gray whales, dolphins, and pilot whales. They did not avoid slicks but swam through them, apparently showing no reaction to the oil. During the spill of Bunker C and No. 2 fuel oil from the *Regal Sword*, researchers saw humpback and fin whales, and a whale tentatively identified as a right whale, surfacing and even feeding in or near an oil slick off Cape Cod, Massachusetts (Geraci and St. Aubin, 1990). Whales and a large number of white-sided dolphins swam, played, and fed in and near the slicks. The study reported no difference in behavior between cetaceans within the slick and those beyond it. None of the observations prove whether cetaceans can detect oil and avoid it. Some researchers have concluded that baleen whales have such good surface vision that they rely on visual clues for orientation in various activities. In particular, bowhead whales have been seen "playing" with floating logs and sheens of fluorescent dye on the sea surface of the sea (Wursig et al., 1985, as cited in Bratton et al., 1993). These observations suggest that if oil is present on the sea surface and is of such quality or in such quantity that it is readily optically recognizable, bowhead whales may be able to recognize and avoid it (Bratton et al., 1993).

After the *Exxon Valdez* oil spill, researchers studied the potential effects of an oil spill on cetaceans. Dahlheim and Loughlin (1990) documented no effects on the humpback whale. von Ziegesar, Miller, and Dahlheim (1994) found no indication of a change in abundance, calving rates, seasonal residency time of female-calf pairs, or mortality in humpback whales as a result of that spill, although they did see temporary displacement from some areas of Prince William Sound. It was difficult to determine whether the spill changed the number of humpback whales occurring in Prince William Sound. This study could not have detected long-term physiological effects to whales or to the humpback's prey.

IV.C.5.a(1)(c)7) Other Effects and Information

We know of no bowhead whale deaths resulting from an oil spill. Loughlin (1994) did necropsies on three gray whales and one minke whale (which are baleen whales) and three harbor porpoises (which are not baleen whales) after the *Exxon Valdez* oil spill. He found no indication of the cause of death and could not link the cause of death directly to the spill. He observed the carcasses of 26 gray whales, but attributed this large number to the timing of the search effort coinciding with the northern migration of gray whales, augmented by increased survey effort in the study area associated with the oil spill.

Dahlheim and Matkin (1994) observed killer whales near the *Exxon Valdez* oil spill. Before the spill, the AB pod in Prince William Sound had 36 whales. Following the spill, 14 killer whales were missing from the AB pod and presumed dead. Although there was a history of the AB pod interacting with the sablefish fishery in Prince William Sound, there was no evidence of fishery-related mortality in 1988-1990. No whales in distress were seen following the spill, nor were any carcasses found. It is assumed that the whales died. The authors concluded that some of the whales may have died from natural causes and the rest from interactions with fisheries or the spill, or a combination of both. The whales died after and near the spill, but the cause of death is uncertain. There is a spatial and temporal correlation between the loss of whales and the spill, but there is no clear cause-and-effect relationship.

During the oil spill off Santa Barbara in 1969, an estimated 3 million gallons of oil may have entered the marine environment. Gray whales were beginning their annual migration north during the spill. Whales were observed migrating northward through the slick. Several dead whales were observed and carcasses recovered, including six gray whales, one sperm whale, one pilot whale, five common dolphins, one Pacific white-sided dolphin, and two unidentified dolphins. Brownell (1971, as reported by Geraci, 1990) acknowledged that these whales totaled more than the usual number of gray whales and dolphins stranding annually on California shores, and concluded that increased survey efforts had led to the higher counts. Several of the whales examined were thought to have died from natural causes, and one may have been harpooned. No evidence of oil contamination was found on any of the whales examined. The Batelle Memorial Institute concluded the whales were either able to avoid the oil, or were unaffected when in contact with it.

Although there is no conclusive evidence that bowhead whales would be killed as a result of contact with spilled oil, a few whales could die from prolonged exposure to oil.

In the 1980s, there was fairly limited information regarding how heavy metals and other contaminants may affect bowhead whales. Heavy metals and other contaminants, while not specifically associated with oil spills, are of concern to the health of bowhead whales and to humans who use bowhead whales for food. Information about cetacean metabolism also is inadequate. Bratton et al. (1993) measured organic arsenic in the liver tissue of one bowhead whale and found that about 98% of the total arsenic was arsenobetaine. Arsenic in marine biota generally is in an organic form, mostly arsenobetaine, that appears to be nontoxic and of no concern to humans using them as food. Based on the limited data available, researchers (Bratton et al., 1993) concluded that petroleum products appear not to harm bowheads or humans who eat them, but we need more research to be certain. In addition, we provided funds to the National Oceanic and Atmospheric Administration in 1987 to establish and conduct a program for collection and long-term storage of tissues from Alaska marine mammals for future contaminant analysis. This program, the Alaska Marine Mammal Tissue Archival Project, which has been managed by the National Marine Fisheries Service since 1992, contains tissue samples from bowhead whales and other marine mammals. Tissue samples were collected from whales landed at Barrow in 1992. Initial studies of bowhead tissues (Becker et al., 1995) indicate that bowhead whales have very low levels of mercury, PCB’s, and chlorinated hydrocarbons, but they have fairly high concentrations of cadmium in their liver and kidneys. Cadmium is a naturally occurring heavy metal that commonly is present at high levels in marine mammal tissues, particularly in the liver and kidney. The study concluded that the high concentration of cadmium in the liver and kidney tissues of bowheads warrants further investigation. Becker (2000) noted that concentration levels of chlorinated hydrocarbons in bowhead whale blubber generally are an order of magnitude less than what has been reported for beluga whales in the Arctic. This probably reflects the difference in the trophic levels of these two species; the bowhead being a baleen whale feeding on copepods and euphausiids, while the beluga whale is a toothed whale feeding at a level higher in the food web. The concentration of total mercury in the liver also is much higher in beluga whales than in bowhead whales.

Bratton et al. (1997) looked at eight metals (arsenic, cadmium, copper, iron, mercury, lead, selenium, and zinc) in the kidneys, liver, muscle, blubber, and visceral fat from bowheads harvested from 1983-1990. These metals were chosen because they are the most common metals reported in the literature for cetaceans, they represent the most toxic metals to marine organisms, and they are the most likely metals to enter the Inupiat diet. They observed considerable variation in tissue metal concentration among the whales tested. Metal concentrations evaluated did not appear to increase over time between 1983 and 1990. Based on metal levels reported in the literature for other baleen whales, the metal levels observed in all tissues of the bowhead are similar to levels in other baleen whales. None of the metals studied were high enough in muscle, blubber, or visceral fat to pose a risk to human consumers. The study concluded the tissues from bowhead whales are, in general, nutritious and safe to eat. The bowhead whale has little metal contamination as compared to other arctic marine mammals, except for cadmium, which requires further investigation as to its role in human and bowhead whale health. The study recommended limiting the consumption of kidney from large bowhead whales pending further evaluation.

Cooper et al. (2000) analyzed anthropogenic radioisotopes in the epidermis, blubber, muscle, kidney, and liver of marine mammals harvested for subsistence food in northern Alaska and in the Resolute, Canada region. The majority of samples analyzed had detectable levels of ^{137}Cs. Among tissues of all species of marine mammals analyzed, ^{137}Cs was almost always undetectable in the blubber and significantly higher in epidermis and muscle tissue than in the liver and kidney tissue. The levels of anthropogenic radioisotopes measured were orders of magnitude below levels that would merit public health concern. The study noted there were no obvious geographical differences in ^{137}Cs levels between marine mammals harvested in Resolute, Canada and those from Alaska. However, the ^{137}Cs levels in marine mammals were two to three orders of magnitude lower than the levels reported in caribou in northern Canada and Alaska.

IV.C.5.a(1)(d) Probabilities of Contacting an Oil Spill

Neff (1990) reports that several studies have tried to model the probability that bowhead whales would contact spilled oil in the Navarin Basin, Chukchi Sea, and Beaufort Sea in the unlikely event of a large oil spill. The models suggest that only a small number of the Beaufort Sea bowhead population would be affected by a large spill. The model by Reed et al. (1987) predicted the greatest number of contacts would occur in the Beaufort Sea, but that no encounter involved more than 1.9% of the population. According to the diving-behavior study, most of the encounters involved fewer than 100 surfacings in oil-covered waters. Bratton et al. (1993), describing an oil-spill model and bowhead whale/oil-spill linkages, indicated one model calculated a total probability of 51.8% that at least one whale would encounter oil spilled in the Beaufort Sea Planning Area, should a spill occur or, alternatively, a 48.2% probability of no whales surfacings in oil. These models used oil-spill probabilities from MMS's 5-year oil and gas lease schedule for 1987-1991 for spills greater than 1,000 barrels. Whether bowhead whales would come into contact with oil would depend on the location, timing, and magnitude of the spill; the presence and extent of shorefast and broken ice; and the effectiveness of cleanup activities.

Geraci and St. Aubin (1990) stated that the notable weakness in modeling is that there is no information on the type and duration of oil exposure required to produce an effect. They further stated that for all but the sea otter, the premise that contact is fatal is indefensible. Models commonly overestimate the impact of a spill. They further stated that few, if any, cetaceans have been claimed by spilled oil.

IV.C.5.a(1)(e) Sale-Specific Probabilities of Contacting an Oil Spill

This section discusses the probabilities that oil spilled in the Beaufort Sea would contact specific environmental resource areas that are important to bowhead whales.

No oil spills are assumed to occur during exploration activities. For the development/production phase, the fate and behavior of a 1,500-barrel spill from a platform and a 4,600-barrel spill from a pipeline are considered in this EIS. The probabilities of either spill contacting specific environmental resource areas would be the same. The 1,500-barrel spill would cover a smaller area (181 square kilometers) (Table IV.A-6a) than the 4,600-barrel spill (320 square kilometers) after 30 days (Table IV.A-6b). Only the 4,600-barrel spill is analyzed in this section. Conditional and combined probabilities also are presented in the following.

A 4,600-barrel spill could contact environmental resource areas where bowhead whales may be present. Approximately 40% of a 4,600-barrel spill during the open-water period would remain after 30 days, covering a discontinuous area of 320 square kilometers (Table IV.A-6b). A spill during broken ice in the fall or under the ice in the winter would melt out during the following summer. Approximately 69% of a 4,600-barrel spill during the broken-ice/solid-ice period would remain after 30 days, covering a discontinuous area of 252 square kilometers (Table IV.A-6b). The following paragraphs present conditional and combined probabilities estimated by the Oil-Spill-Risk Analysis model (expressed as a percent chance) of a spill contacting bowhead whale habitat within 180 days. Conditional probabilities are based on the assumption that a spill has occurred. Combined probabilities, on the other hand, factor in the chance of the spill occurring.

Summer Spill. For conditional probabilities, the Oil-Spill-Risk Analysis model estimates a less than 0.5-37% chance that an oil spill starting at LA1-LA18 will contact ERA's 19-37 within 180 days during the summer, assuming a spill occurs, and a less than 0.5-46% chance, assuming a spill starts at Pipeline Segment (P) P1-P13 (Table A.2-23). The ERA's 19 through 28 are resource areas in the spring lead system in the Beaufort and Chukchi seas; ERA's 29 through 37 are resource areas along the bowhead whale fall-migration route in the Beaufort Sea, as defined by data from the MMS Bowhead Whale Aerial Survey Program. The greatest percent chance of contact from a launch area occurs at ERA 32, which has a 37% chance of contact from a spill occurring at LA10. The chance of contact in this environmental resource area is highest, because the Oil-Spill-Risk Analysis model's launch area and the environmental resource area are in close proximity to or overlap each other (Maps A-2a and 2b). Similarly, the highest chance of contact in other environmental resource areas occurs when the spill-launch area and the environmental resource area are in close proximity to or overlap each other. The greatest percent chance of contact from a pipeline segment occurs at ERA 32, which has a 46% chance of contact from a spill occurring at P4 (Table A.2-23). The chance of contact in this environmental resource area is highest, because the model's pipeline segment and the resource area are in close proximity to or overlap each other (Maps A-2a and 2b). Similarly, the highest chance of contact in other environmental resource areas occurs when the pipeline segment and the resource area are in close proximity to or overlap each other.

Winter Spill. The Oil-Spill-Risk Analysis model estimates a less than 0.5-27% chance that an oil spill starting at LA1-LA18 will contact ERA's 19-37 within 180 days during the winter, assuming a spill occurs, and a less than 0.5-32% chance, assuming a spill starts at P1-P13 (Table A.2-41). The greatest percent chance of contact from a launch area occurs at ERA's 25 and 28, which have a 27% chance of contact from a spill occurring at LA2 and LA7, respectively. The chance of contact in these environmental resource areas is highest, because the model's launch areas and the resource areas are in close proximity to or overlap each other (Maps A-2a and 2b). Similarly, the highest chance of contact in other environmental resource areas occurs when the launch area and the resource area are in close proximity to or overlap each other. The greatest percent chance of contact from a pipeline segment occurs at ERA 25, which has a 32% chance of contact from a spill occurring at P1 (Table A.2-23). The chance of contact in this environmental resource area is highest, because the model's pipeline segment and the resource area are in close proximity to or overlap each other (Maps A-2a and 2b). Similarly, the highest chance of contact in other environmental resource areas occurs when the pipeline segment and the resource area are in close proximity to or overlap each other.

For combined probabilities, the Oil-Spill-Risk Analysis model estimates a less than 0.5-1% chance that one or more oil spills greater than or equal to 1,000 barrels would occur from a production facility or a pipeline (LA1-LA18 or P1-P13, respectively) and contact ERA's 19-37 within 180 days (Table A.2-56). There is a 1% chance that one or more oil spills would occur and contact ERA 28 (Beaufort Spring Lead 10), the resource area with the highest chance of contact.

Summary of Oil-Spill Effects: In the unlikely event of a large oil spill, the probability of oil contacting whales is likely to be considerably less than the probability of oil contacting bowhead habitat. If a spill occurred and contacted bowhead habitat during the fall migration, it is likely that some whales would be contacted by oil. It is unknown what effects an oil spill would have on bowhead whales, but some conclusions can be drawn from studies that have looked at the effects of oil on other cetaceans. Engelhardt (1987) theorized that bowhead whales would be particularly vulnerable to effects from oil spills during their spring migration into arctic waters because of their use of ice edges and leads, where spilled oil tends to accumulate. Several other researchers (Geraci and St. Aubin, 1982; St. Aubin, Stinson, and Geraci, 1984) concluded that exposure to spilled oil is unlikely to have serious direct effects on baleen whales. Other studies (Loughlin, 1994; Dahlheim and Matkin, 1994; Dahlheim and Loughlin, 1990) either documented no effects to cetaceans from spilled oil, or the results of the studies were inconclusive. Geraci (1990) reviewed a number of studies on the physiologic and toxic effects of oil on whales and concluded there was no evidence that oil contamination had been responsible for the death of a cetacean.

Nevertheless, the effects of oil exposure to the bowhead whale population are uncertain, speculative, and controversial.

It is likely that some whales would experience temporary, nonlethal effects, including one or more of the following symptoms:

- oiling their skin, causing irritation
- inhaling hydrocarbon vapors
- ingesting oil-contaminated prey
- fouling of their baleen
- losing their food source
- temporary displacement from some feeding areas

Some whales could die as a result of contact with spilled oil, particularly if there is prolonged exposure to freshly spilled oil, such as in a lead. The extent of the effects would depend on how many whales contacted oil, the duration of contact, and the age/degree of weathering of the spilled oil. The number of whales contacting spilled oil would depend on the location, size, timing, and duration of the spill and the whales' ability or inclination to avoid contact. If oil got into leads or ice-free areas frequented by migrating bowheads, a large portion of the population could be exposed to spilled oil. Under some circumstances, some whales could die as a result of contact with spilled oil. Prolonged exposure to freshly spilled oil could kill some whales, but the number likely would be small.

IV.C.5.a(1)(f) Effectiveness of Mitigating Measures

Several mitigating measures will be considered for the Beaufort Sea sales that may offer some protection to bowhead whales. These include two stipulations, a standard stipulation, Industry Site-Specific Bowhead Whale-Monitoring Program and a new proposed stipulation, Pre-booming Requirements for Fuel Transfers, and the ITL clauses on Endangered Whales and MMS Monitoring Program.

The stipulation on Industry Site-Specific Bowhead Whale-Monitoring Program mandates that lessees will conduct a site-specific monitoring program during exploratory-drilling activities, including seismic activities, to determine when bowhead whales are present in the vicinity of leases and the extent of behavioral effects of these activities on bowhead whales. The stipulation requires a peer review of monitoring plans and the draft report from the monitoring program. If the information obtained from this or other monitoring programs indicates that there is a threat of serious, irreparable, or immediate harm to the species, the lessee will be required to suspend operations causing such threat, which should help to minimize the likelihood of disrupting whale feeding, migration, or socialization. Some endangered whales may interact with the activities associated with exploratory drilling and some inadvertent conflicts or incidental "taking" situations could occur. These inadvertent conflicts with or incidental "taking" situations of some individual whales as a result of exploration-drilling activities would not constitute a threat of harm to the species. This stipulation, in conjunction with the ITL clause on Information on Endangered Whales and MMS Monitoring Program, addresses Conservation Recommendations No. 3 and No. 4 in the May 25, 2001, National Marine Fisheries Service Biological Opinion for the Alaskan Beaufort Sea. This will help protect endangered bowhead whales during their migration from significant adverse effects due to exploratory activities, such as a blockage or delay of the migration.

The stipulation on Pre-booming Requirements for Fuel Transfers is designed to ensure that no fuel spills would occur for 3 weeks prior to or during the bowhead whale migration. This stipulation also could preclude disturbance activities involved with cleanup operations of a fuel spill prior to the migration.

Two other ITL clauses may offer protection of the bowhead whale: Bird and Marine Mammal Protection, which advises lessees of requirements under the Endangered Species Act and Marine Mammal Protection Act and provides guidelines regarding disturbance of marine mammals, and Sensitive Areas to be Considered in Oil-Spill-Contingency Plans, which identifies areas needing protection in the event of an oil spill.

While benefits are gained from these mitigating measures, the overall effects on bowhead whales with these mitigating measures in place is likely to be the same as if the measures were not in place. Overall, the mitigating measures may provide additional protection to whales but would not eliminate all potential effects. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration but not in preventing incidental take by harassment. Fewer whales may be affected by activities due to these measures or affected to a lesser extent. However, even with the mitigating measures in place, whales still are expected to experience temporary, nonlethal effects as a result of exposure to oil and gas activities, with potential for some mortality if whales are exposed to freshly spilled oil over a prolonged period.

Conclusion on Effects Common to all Alternatives: Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be primarily localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowheads prey species likely would be negligible. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration.

IV.C.5.a(2) Effects of Alternatives and Sales

Industry would view leasing, exploration, and development activities in the three proposed sales from an economic and resource perspective. Activities are analyzed over three geographic zones based on water depth and proximity to existing infrastructure (near/shallow, mid-range/medium depth, and far/deepwater) (Map 4). The Near Zone is in the central Beaufort Sea and extends from the Colville River on the west to the Canning River on the east in waters from approximately 0-10 meters. The Midrange Zone includes waters from 10-30 meters deep and extends from Cape Halkett on the west to Barter Island on the east. The Far Zone includes water depths greater than 40 meters and extends from offshore Barrow on the west to the Canadian Border on the east. The MMS expects that leasing and subsequent exploration and development activities will be concentrated in the Near Zone near existing infrastructure for all three sales, with activities expanding into deeper water and more remote areas in subsequent sales (Table IV.A-4).

IV.C.5.a(2)(a) General Information for the Exploration Phase

Exploration drilling in shallow water (5-10 meters) likely would be conducted during the winter from artificial ice islands grounded to the seafloor. Exploration activities are fairly temporary and could be widespread throughout the sale area. Activities in shallow water could occur in the Near, Midrange, or Far zone. Exploration activities will be supported by ice roads over landfast ice. It is unlikely that gravel islands will be constructed to drill exploration wells, although older artificial islands or natural shoals could be used as a base for temporary gravel or ice islands. Most construction activities also would occur during the winter. Bottom-founded platforms could be used to drill in water depths of 10-20 meters. Although the platform would be moved to the drill site during the open-water season and some activity may occur during the bowhead migration, drilling operations likely would be conducted only during the winter. Drill ships supported by icebreakers and supply boats would be used in waters deeper than 20 meters. Construction activities and drilling operations from ice islands, gravel islands, or bottom-founded structures are likely to have negligible effect on bowheads. Transport of the bottom-founded platform is likely to have a low effect on bowhead whales, if the activity continues into the bowhead migration. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively operating in the area.

IV.C.5.a(2)(b) General Information for the Development Phase

Gravel islands would be the likely platform for production facilities in water depths less than approximately 10 meters, and bottom-founded platforms would be used for production facilities in water depths up to 30 meters. Production from deeper water could be developed by extended-reach wells or by subsea wells. Development and production operations would be more permanent and more localized than exploration activities. Offshore pipelines in water less than 50 meters deep will be trenched to protect against ice damage. Construction could occur either in the summer open-water season or during mid- to late winter, when landfast ice has stabilized.

IV.C.5.a(2)(c) Alternatives

IV.C.5.a(2)(c)1) Effects of Alternative I for Sale 186

The sale-specific effects from noise and disturbance and oil spills from Alternative I for Sale 186 generally would be similar to those discussed in Sections IV.C.5.a(1)(a) and IV.C.5.a(1)(c)). Potential disturbances could result from seismic surveys, drilling operations, vessel and aircraft traffic, and construction activities. Some whales are likely to avoid these noise-producing activities. Assuming an oil spill occurred in bowhead whale habitat while bowheads were present, some whales could experience one or more of the following: skin contact, baleen fouling, respiratory distress caused by inhalation of hydrocarbon vapors (from a fresh spill), localized reduction in food resources, consumption of some contaminated prey items, and perhaps a temporary displacement from some feeding areas. The number of whales contacted would depend on the size, timing, and duration of the spill; the density of the whale population in the area of the spill; and the whales' ability or inclination to avoid contact with oil.

IV.C.5.a(2)c)1)a) Sale-Specific Information for the Exploration Phase

The MMS expects approximately 70% of leasing and exploration activities to occur in the Near Zone, 20% to occur in the Midrange Zone, and 10% in the Far Zone (Table F-1). The MMS expects 12 exploration and delineation wells to be drilled from one or two drilling rigs between 2004 and 2010 during the exploration phase (Table IV.A-4). From one to three wells would be drilled each year. Exploration activities would be supported by an estimated 155 helicopter flights and up to 14 supply-boat trips per year (Table IV.A-4). An estimated 54 square miles of shallow-hazards seismic surveys would be conducted.

IV.C.5.a(2)(c)1)b) Sale-Specific Information for the Development Phase

The MMS expects two development projects to occur in the Near Zone, one in the Midrange Zone, and none in the Far Zone. The MMS expects 69 production wells, 33 injection wells, and approximately 40 miles of offshore pipeline during the development phase (Table IV.A-4). For production, the MMS assumes three new fields, ranging in size from 120-220 million barrels of oil (total production of 460 million barrels), would be discovered as a result of this sale. Development and production activities would be supported by an estimated 300-600 helicopter flights during construction, 28-56 helicopter flights during development, and 12-28 helicopter flights during production (Table IV.A-4). Marine-support traffic for the construction phase may vary from 150-200 supply-boat trips each open-water season for nearshore platforms to as many as 250 for structures beyond the landfast-ice zone. During the production phase, vessel traffic would decline to 4-6 trips per season for nearshore platforms. An estimated 105 square miles of shallow-hazards seismic surveys would be conducted.

IV.C.5.a(2)(c)1)c) Effects from Noise and Disturbance

Most exploration-drilling operations and construction activities in Sale 186 would occur nearshore in shallow water during the winter, although bottom-founded platforms would be moved to the drill site during the open-water season, and some activity may occur during the bowhead migration. Construction activities and drilling operations from ice islands, gravel islands, or bottom-founded structures are likely to have negligible effect on bowheads. Some whales may avoid the area near these activities, if they are conducted during the open-water season. Transport of the bottom-founded platform is likely to have a low effect on bowhead whales, if the activity continues into the bowhead migration. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively operating in the area.

Overall, geophysical seismic operations in the Beaufort Sea sale area are likely to be relatively limited, because seismic surveys previously have been conducted over much of the area. Any presale seismic surveys conducted likely would be fill-in programs to cover an area not previously surveyed or a 3-dimensional seismic survey to better define a prospect. Seismic surveys associated with exploration and production for Sale 186 would be shallow-hazards surveys conducted over a relatively small area. Much of the seismic surveying in shallow water could be conducted during the winter over the ice. Seismic surveys in deeper waters likely would be conducted during the open-water season and much of it prior to the bowhead whale migration. Seismic surveys in the central Beaufort Sea conducted during the open-water season likely would be limited to areas west of Cross Island after September 1 under the provisions of the Conflict Avoidance Agreement between the operator and subsistence whalers and likely would have negligible effect on bowhead whales. Similar agreements between the operator and subsistence whalers are likely to be established for any seismic surveys proposed near Kaktovik and Barrow. Some whales may avoid seismic operations that are conducted during the whale-migration period. Overall, effects of seismic operations on bowhead whales are likely to range from negligible to low.

The effects of noise from production activities likely would be similar to those from exploration activities. Some whales may avoid the production facility during their migration across the Alaskan Beaufort Sea, depending on the type and location of the facility. Noise from production operations on gravel islands, bottom-founded platforms, and extended-reach wells is not likely to travel far. Whales are more likely to avoid subsea wells, because these may be in deeper water and farther from shore. The overall effect on bowheads from this avoidance behavior is likely to be negligible.

Overall, the effects of noise on bowhead whales and the bowhead whale population from exploration and development/production activities from Alternative I for Sale 186 generally would be similar to those discussed in Section IV.C.5.a(1), because the activities expected to occur are likely to be similar. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. Some bowheads may avoid drilling noise at 20 kilometers or more. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects.

IV.C.5.a(2)(c)1)d) Effects from an Oil Spill

No oil spills are assumed to occur during exploration activities. Development/production activities for Sale 186 are not expected to occur in the Far Zone; therefore, there would be no spill from launch areas or pipeline segments in this zone (LA1-LA6, LA11, LA13, LA14, LA16, LA18, P1, P2, P5, P6, P8, and P11). As a result, the Oil-Spill-Risk Analysis model's conditional probabilities for Sale 186 would be same as or slightly less for some environmental resource areas than those presented in Section IV.C.5, which discusses conditional probabilities for all launch areas and pipeline segments in the Beaufort multiple-sale area.

Summer Spill. Under Sale 186, the Oil-Spill-Risk Analysis model estimates a chance less than or equal to.5-37% that an oil spill will contact ERA's 19-37 within 180 days during the summer, assuming a spill occurs at LA7-LA10, LA12, and LA17 (Table A.2-23). There is a less than or equal to.5-46% chance, assuming an oil spill occurs at P3, P4, P7, P9, P10, P12, and P13. The greatest percent chance of contact occurs at ERA 32 (Ice/Sea Segment 4), which has a 37% chance of contact from a spill occurring at LA10 and a 46% chance of contact from a spill occurring at P4, the same as described in Section IV.C.5.a(1)(c)).

Winter Spill. The Oil-Spill-Risk Analysis model estimates a chance less than or equal to.5-27% chance that an oil spill will contact ERA's 19-37 within 180 days during the winter, assuming a spill occurs at LA7-LA10, LA12, and LA17 (Table A.2-41). There is a chance less than or equal to .5-23% assuming an oil spill occurs at P3, P4, P7, P9, P10, P12, and P13 (Table A.2-41). The greatest percent chance of contact occurs at ERA 28 (Beaufort Spring Lead 10), which has a 27% chance of contact from a spill occurring at LA7 and a 23% chance of contact from a spill occurring at P3.

For combined probabilities, the model estimates a chance less than or equal to 0.5-1% that one or more large oil spills would occur from a production facility or a pipeline and contact ERA's 19-37 within 180 days (Table A.2-56), the same as those presented in Section IV.C.5.a(1)(c)). There is a 1% chance that one or more large oil spills would occur and contact ERA 28 (Beaufort Spring Lead 10), the environmental resource area with the highest chance of contact. Combined probabilities are the same for all sales and for all alternatives.

Overall, the effects of an oil spill on bowhead whales and the bowhead whale population from exploration and development/production activities from Alternative I for Sale 186 generally are expected to be similar to those discussed in Section IV.C.5.a(1)(c)). In the unlikely event of a large oil spill, the probability of oil actually contacting whales would be considerably less than the probability of contact with bowhead habitat.

In the unlikely event of a large uncontrolled, uncontained spill, a few bowheads could experience one or more of the following: skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and perhaps temporary displacement from some feeding areas. Some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals so affected is expected to be small. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.

Conclusion: The sale-specific effects of noise, disturbance, and oil spills on bowhead whales and the bowhead whale population from exploration and development/production activities in Alternative I for Sale 186 generally are expected to be similar to those discussed in Sections IV.C.5.a(1) and IV.C.5.a(1)(c), because the activities expected to occur are likely to be similar. Overall, leasing, exploration, and production activities associated with Alternative I for Sale 186 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects.

The Oil-Spill-Risk Analysis model conditional probabilities for Alternative I for Sale 186 would be less for some environmental resource areas than those presented in Section IV.C.5.a(1), because no development activity is expected in the Far Zone. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.

IV.C.5.a(2)(c)2) Effects of Alternative I for Sale 195

The sale-specific effects for Alternative I for Sale 195 generally would be similar to those discussed in Section IV.C.5 and in Effects of Alternative I for Sale 186. Three new fields ranging in size from 120-220 million barrels are expected, with total production remaining at 460 million barrels. The number of wells drilled and level of support activities likely would be essentially the same as for Sale 186.

IV.C.5.a(2)(c)2)a) Differences between Alternative I for Sale 195 and Sale 186

Sale 195 would have the following differences from Sale 186:

- 50% of leasing and exploration activities in the Near Zone as compared to 70%
- 30% in the Midrange Zone as compared to 20%
- 20% in the Far Zone as compared to 10%
- one development project in the Near/Shallow Zone as compared to two

IV.C.5.a(2)(c)2)b) Effects from Noise and Disturbance

Seismic surveys, drilling operations, vessel and air traffic, and construction activities could cause noise and disturbance to bowhead whales during exploration and development/production activities. The effects of noise on bowheads from Sale 195 likely would be similar to those described in Section IV.C.5.a(1), because the activities expected to occur are likely to be similar.

IV.C.5.a(2)(c)2c) Effects from an Oil Spill

No oil spills are assumed to occur during exploration activities. There would be no spill from launch areas or pipeline segments in the Far Zone (LA1-LA6, LA11, LA13, LA14, LA16, LA18, P1, P2, P5, P6, P8, and P11), because no development activities are expected in the Far Zone. The Oil-Spill-Risk Analysis model conditional probabilities for Sale 195 would be the same as or slightly less for some environmental resource areas than those presented in Section IV.C.5.a(1)(c)). Sale-specific effects generally are expected to be similar to those presented in Section IV.C.5.a(1)(c) and essentially the same as described in Effects of Alternative I for Sale 186.

Conclusion: The effects of exploration and production activities on bowhead whales are likely to be similar to those described in Sections IV.C.5.a(1) and IV.C.5.a(1)(c) and in Effects of Alternative I for Sale 186, because the activities expected to occur are likely to be similar. Although more activities likely would occur in deeper waters, the differences in effects to bowhead whales between Sales 186 and 195 probably are not measurable.

IV.C.5.a(2)(c)3) Effects of Alternative I for Sale 202

The sale-specific effects of Alternative I for Sale 202 generally are expected to be similar to those discussed in Sections IV.C.5.a(1) and IV.C.5.a(1)(c). One new field ranging in size from 120-220 million barrels is expected, with total production remaining at 460 million barrels. The number of wells drilled and level of support activities likely would be slightly less than for Sale 186.

IV.C.5.a(2)(c)3a) Differences between Alternative I for Sale 202 and Sale 186

Sale 202 would have the following differences from Sale 186:

- 40% of leasing and exploration activities in the Near Zone as compared to 70%
- 30% in the Midrange Zone as compared to 20%
- 30% in the Far Zone as compared to 10%
- One fewer exploration/delineation well
- One fewer platform and one fewer production well
- One more injection well
- 5 miles of offshore pipeline
- 140 helicopter support flights as compared to 155
- 7 supply boat trips as compared to 14

IV.C.5.a(2)(c)3b) Effects from Noise and Disturbance

Seismic surveys, drilling operations, vessel and air traffic, and construction activities could cause noise and disturbance to bowhead whales during exploration and development/production activities. The effects of noise on bowheads from Sale 202 likely would be similar to those described in Section IV.C.5.a(1), because the activities expected to occur are likely to be similar.

IV.C.5.a(2)(c)3c) Effects from an Oil Spill

No oil spills are assumed to occur during exploration activities. One development/production project is expected to occur in the Far Zone for Sale 202. There would be no spill from LA8 and LA10, because no development/production projects are expected in the Near or Midrange zones. The Oil-Spill-Risk Analysis model conditional probabilities for Sale 202 would be the same as or slightly less for some environmental resource areas than those presented in Section IV.C.5.a(1)(c). Sale-specific effects of Alternative I for Sale 202 generally are expected to be similar to those discussed in Section IV.C.5.a(1)(c).

Summer Spill. The Oil-Spill-Risk Assessment model estimates a chance less than or equal to 0.5-36% that an oil spill will contact ERA's 19-37 within 180 days during the summer, assuming a spill occurs at LA1-LA7, LA9, and LA11-LA18 (Table A.2-23). There is a chance less than or equal to 0.5-46% assuming an oil spill occurs at P1-P13. The greatest percent chance of contact occurs at ERA 34 (Ice/Sea Segment 6), which has a 36% chance of contact from a spill occurring at LA15 and at ERA 32 (Ice/Sea Segment 4), which has a 46% chance of contact from a spill occurring at P4, respectively. These probabilities are similar to those presented in Section IV.C.5.a(1)(c).

Winter Spill. The model estimates a estimates a chance less than or equal to 0.5-27% that an oil spill will contact ERA's 19-37 within 180 days during the winter, assuming a spill occurs at LA1-LA7, LA9, and LA11-LA18 (Table A.2-41). There is a chance less than or equal to 0.5-32% assuming an oil spill occurs at pipeline segments P1-P13 (Table A.2-41). The greatest percent chance of contact occurs at ERA's 25 and 28 (Beaufort Spring Lead 7 and 10), which have a 27% chance of contact from a spill occurring at LA2 and LA7, respectively. There is a 32% chance of contact to ERA 25 from a spill occurring at P1.

Conclusion: The effects of exploration and production activities on bowhead whales for this sale are likely to be similar to those described in Sections IV.C.5.a(1) and IV.C.5.a(1)(c), because the activities expected to occur are likely to be similar. Although more activities likely would occur in deeper waters than in Sale 186 and Sale 195, the differences in effects to bowhead whales between Sale 202 and Sales 186 and 195 probably are not measurable.

IV.A.5.a(2)(c)4) Effects of Alternatives III through VI for Sale 186 and Sale 195

Alternatives III (Barrow Subsistence Whaling Deferral), IV (Nuiqsut Subsistence Whaling Deferral), VII (Kaktovik Subsistence Whaling Deferral), and VI (Eastern Deferral) are essentially the same for each sale. These alternatives are not likely to reduce noise or oil-spill effects to bowhead whales as compared to Alternative I for Sale 186 and Sale 195. Any differences in effects on bowheads between these deferrals and Alternative I likely be difficult to measure. These deferrals include only areas in the Far Zone. Under Sale 186, 10% of the leasing and exploration activities and no development activities likely would occur in the Far Zone. An estimated 90% of leasing and exploration activities and all of the development activities likely would occur in the Near and Midrange zones. Under Sale 195, 20% of the leasing and exploration activities likely would occur in the Far Zone. Exploration activities that might have occurred in the Far Zone in these deferral areas would be excluded under these alternatives.

The effects of noise on bowhead whales are likely to be essentially the same as described in Section IV.C.5 and in Effects of Alternative I for Sales 186 and 195. It is likely that exploration activities in the Far Zone, if any, would be limited. No development activities are likely to occur. Differences in noise effects to bowhead whales from these deferral alternatives as compared to Alternative I are not likely to be measurable.

The effects of an oil spill on bowhead whales likely would be similar to that described in Section IV.C.5.a(1)(c). For conditional probabilities, the same launch areas and pipeline segments excluded in Alternative I for Sales 186 and 195 would be excluded under these deferrals. Environmental resource areas likely to be contacted by spilled oil and the probabilities of contact would be essentially the same for conditional probabilities as described in Alternative I. The differences in oil-spill effects to bowhead whales from these deferrals compared to Alternative I likely would be difficult to measure.

Conclusion: The effects of noise and oil spills on bowhead whales are likely to be essentially the same as described in Sections IV.C.5.a(1) and IV.C.5.a(1)(c)) and in Effects of Alternative I for Sale 186 and 195, because the activities expected to occur are likely to be similar.

Differences in noise and oil-spill effects to bowhead whales from these deferrals compared to Alternative I likely would be difficult to measure.

IV.C.5.a(2)(c)5) Effects of Alternative IV for Sales 186 and 195

Alternatives IV (Nuiqsut Subsistence-Whaling Deferral) are essentially the same for each sale. This alternative could reduce noise and oil-spill effects to bowhead whales somewhat as compared to Alternative I under for Sales 186 and Sale 195. However, any differences in effects between this deferral and Alternative I likely would be difficult to measure. This deferral includes only areas in the Near and Midrange zones. Under Sale 186, 70% of the leasing and exploration activities likely would occur in the Near Zone and 20% likely would occur in the Midrange Zone under this sale. Under Sale 195, 50% of the leasing and exploration activities likely would occur in the Near Zone and 30% in the Midrange Zone. Although much of the exploration activity in this zone is likely to occur inside the barrier islands, some activity also is likely to be conducted outside the barrier islands. Much of the exploration activity likely would occur during the winter, when bowhead whales are not present. It is expected that two development activities would occur in the Near Zone and one in the Midrange Zone under this sale. The opportunity index for the Nuiqsut Subsistence Whaling Deferral shows a 5% chance that all 460 million barrels of oil resources expected for this sale would be discovered and developed in this area. There is a 95% chance that all 460 million barrels would be discovered outside this deferral area.

Exploration and development activities that might have occurred in this deferral area will be excluded. It is likely that some exploration and development activities would occur in these areas without the deferrals. Exploration and development activities that occur outside the barrier islands during the bowhead whale fall migration could affect the whales. The effects of noise on bowhead whales is likely to be similar to those described in Section IV.C.5 and in Effects of Alternative I under for Sales 186 and Sale 195. Differences in noise effects to bowhead whales from these deferral alternatives as compared to Alternative I are not likely to be measurable.

The effects of an oil spill on bowhead whales likely would be similar to those described in Section IV.C.5.a(1)(c) and in Effects of Alternative I under for Sales 186 and Sale 195. For conditional probabilities, the same launch areas and pipeline segments that were excluded in Alternative I under for Sale 186 would be excluded under these deferrals. Environmental resource areas likely to be contacted by spilled oil and the probabilities of contact would be essentially the same for conditional probabilities as described in Effects of Alternative I under for Sales 186 and Sale 195. The differences in oil-spill effects to bowhead whales from these deferrals compared to Alternative I likely would be difficult to measure.

Conclusion: The effects of noise and oil spills on bowhead whales are likely to be essentially the same as described in Sections IV.C.5.a(1) and IV.C.5.a(1)(c) and in Effects of Alternative I under for Sales 186 and Sale 195 because the activities expected to occur are likely to be similar. The differences in noise and oil-spill effects to bowhead whales from these deferrals compared to Alternative I likely would be difficult to measure.

IV.C.5.a(2)(c)6) Effects of Alternatives III, V, and VI for Sale 202

Alternatives III (Barrow Subsistence Whaling Deferral), V (Kaktovik Subsistence Whaling Deferral), and VI (Eastern Deferral) likely would have similar noise and oil-spill effects to bowhead whales as that described in Alternative I for Sale 202. Any differences in effects on bowheads between these deferrals and Alternative I likely would be difficult to measure. These deferrals include primarily areas in the Far Zone. An estimated 40% of the leasing and exploration activities likely would occur in the Near Zone, 30% likely would occur in the Midrange Zone, and 30% likely would occur in the Far Zone under this sale. Much of the exploration activity likely would occur during the open-water season. No development activities likely would occur in the Near or Midrange zones under this sale.

The opportunity index for the Barrow Subsistence Whaling Deferral, the Kaktovik Subsistence Whaling Deferral, and the Eastern Deferral (Table II.A.3) shows a 1%, 3%, and 3% chance, respectively, that all 460 million barrels of oil resources expected for this sale would be discovered and developed in these areas. However, there is a 99%, 97%, and 97% chance, respectively, that all 460 million barrels would be discovered outside these deferral areas.

Exploration and development activities that might have occurred in these deferral areas will be excluded. However, it is likely that no exploration and development activities would occur in these areas without the deferral alternative because of the relatively low probability of discovering oil. The effects of noise on bowhead whales is likely to be similar to those described in Section IV.C.5.a(1)(a) and in Effects of Alternative I for Sale 202, because the activities expected to occur are likely to be similar. The differences in noise effects to bowhead whales from these deferral alternatives as compared to Alternative I are not likely to be measurable.

The effects of an oil spill on bowhead whales likely would be similar to that described in Section IV.C.5.a(1)(c) and in Alternative I for Sale 202. For conditional probabilities, the same launch areas and pipeline segments that were excluded in Alternative I for Sale 202 would be excluded under these deferrals. In addition, LA18 would be excluded. The environmental resource areas likely to be contacted by spilled oil and the probabilities of contact to individual resource areas would be essentially the same for conditional probabilities as described in Effects of Alternative I for Sale 202. The differences in oil spill effects to bowhead whales from these deferrals compared to Alternative I likely would be difficult to measure.

Conclusion: The effects of noise and oil spills on bowhead whales are likely to be similar to that described in Sections IV.C.5.a(1) and IV.C.5.a(1)(c) and in Effects of Alternative I for Sale 202, because the activities expected to occur are likely to be similar. The differences in noise and oil-spill effects to bowhead whales from this deferral as compared to Alternative I likely would be difficult to measure.

IV.C.5.a(2)(c)7) Effects of Alternative IV for Sale 202

Alternative IV (Nuiqsut Subsistence Whaling Deferral) likely would have similar noise and oil-spill effects on bowheads as that described in Alternative I for Sale 202. This deferral includes mostly areas in the Near and Midrange zones and would affect primarily exploration activities. An estimated 40% of the leasing and exploration activities likely would occur in the Near Zone and 30% likely would occur in the Midrange Zone under this sale. No development activities likely would occur in the Near or Midrange zones under this sale. Although much of the exploration activity is likely to occur inside the barrier islands, some activity also is likely to be conducted outside the barrier islands. Much of the exploration activity would likely occur during the winter, when bowhead whales are not present.

Exploration activities that might have occurred in these deferral areas will be excluded. It is likely that some exploration activities would occur in these areas without the deferral. The deferral should have little effect on development/production activities, because these likely would occur in the Far Zone. Exploration activities that occur outside the barrier islands during the bowhead whale fall migration could affect the whales. The effects of noise on bowhead whales is likely to be similar to that described in Section IV.C.5 and in Effects of Alternative I for Sale 202, because the activities expected to occur are likely to be similar. The differences in noise effects to bowhead whales from this deferral alternative as compared to Alternative I are not likely to be measurable.

The effects of an oil spill on bowhead whales likely would be similar to that described in Section IV.C.5.a(1)(c) and in Alternative I for Sale 202. For conditional probabilities, the same launch areas and pipeline segments that were excluded in Alternative I for Sale 202 would be excluded under this deferral. The environmental resource areas likely to be contacted by spilled oil and the probabilities of contact to individual resource areas would be essentially the same for conditional probabilities as described in Effects of Alternative I for Sale 202. The differences in oil spill effects to bowhead whales from these deferrals as compared to Alternative I likely would be difficult to measure.

Conclusion: The effects of noise and oil spills on bowhead whales are likely to be similar to that described in Sections IV.C.5.a(1) and IV.C.5.a(1)(c) and in Effects of Alternative I for Sale 202, because the activities expected to occur are likely to be similar. Although noise and oil-spill effects in the deferral areas would be reduced, there likely would be little change in the overall effects of noise and oil spills on bowhead whales. The differences in noise and oil spill effects to bowhead whales from these deferrals as compared to Alternative I would likely be difficult to measure.

IV.C.5.b. Spectacled Eider

IV.C.5.b(1) Effects Common to All Alternatives

Seasonal distribution of spectacled eiders in the Beaufort Sea region determines their vulnerability to potentially adverse factors associated with oil and gas exploration and development to a large extent. Most spectacled eiders migrating north in spring apparently arrive at Arctic Coastal Plain breeding areas via overland routes from the Chukchi Sea (Troy Ecological Research Assocs., 1999). A major proportion (one-half to two-thirds) of those breeding on the Arctic Coastal Plain nest west of the longitude of Point Barrow; these individuals might not use the Beaufort Sea at all, moving overland to and from the Chukchi Sea. Along the Beaufort coast, most nests are within about 25 kilometers of marine waters, primarily west from the Sagavanirktok River (Troy Ecological Research Assocs., 1997).

After breeding, many males apparently either make little use of the Beaufort Sea prior to their migration west and south as dispersed flocks along the coast (median distance offshore = 6.6 kilometers; Petersen, Larned, and Douglas, 1999) or migrate overland directly to the Chukchi Sea. Others have remained in the Beaufort Sea for more than a week (Troy Ecological Research Assocs., 1999). Most females that have nested in the eastern portion of the range apparently migrate west through the Beaufort Sea to the Chukchi Sea, spending about three times as long as males in the Beaufort Sea. Females with young typically are found farther offshore (median distance offshore = 16.5 kilometers) than males as a result of migrating later when the ice usually is farther offshore (Map 9a). Apparently little use is made of marine habitats in the vicinity of Prudhoe Bay by either sex. Aerial surveys in the central Beaufort Sea suggest that spectacled eiders would be present offshore in low numbers during staging and fall migration periods (Fischer, Tiplady, and Larned, 2002; Stehn and Platte, 2000).

IV.C.5.b(1)(a) Effects of Exploration

IV.C.5.b(1)(a)1) Effects from Routine Operations

IV.C.5.b(1)(a)1)a) Effects of Aircraft/Vessel Disturbance

Spectacled eiders staging or migrating in offshore waters are not likely to experience significant disruption of foraging or other activities or displacement as a result of routine exploration, development, or production activities, primarily helicopter flights (10-20 flights/day during construction; 0.5-1/day during production, Table IV.A-4) during the open-water season. This is because over most of the lease area, there is a low probability that the few areas occupied by scattered flocks during the spring to fall staging and migration periods (males, early June-early July; females, early June-September) would be overflown routinely by support aircraft flying between a few offshore drill sites (for example, a maximum of three sites for Sale 186) and onshore facilities. However, eiders occurring in coastal or offshore portions of the Near Zone or western Midrange Zone areas (Maps 4 and 9a) that are relatively close to primary support facilities at Deadhorse and vicinity are much more likely to be overflown than those in the more distant or eastern portions of the lease area (eastern Midrange and Far zones). This could occur when flight paths from a few scattered offshore drilling sites converge in the air space over waters in the vicinity of support areas such that a greater proportion of this area would be overflown than areas east of Prudhoe Bay or farther offshore. Apparently, however, few eiders remain for long in marine waters in the immediate vicinity of Prudhoe Bay (Troy Ecological Research Assocs., 1996, 1999).

Aerial surveys in the central Beaufort area by the Fish and Wildlife Service in 1999 and 2000 estimated that 166-371 spectacled eiders (about 1 individual/10 square kilometers; Map 9) could have occurred in the area that includes the Near and western Midrange zones (Stehn and Platte, 2000). However, flight paths of eider flocks (average size about 21 individuals during Fish and Wildlife Service surveys) could be intersected by helicopters (disturbance corridor about 2 kilometers or 1.2 miles wide) and cause short-term disturbance effects. Thus, displacement of spectacled eiders is likely to occur only in the vicinity of these narrow but frequently used helicopter flight corridors in offshore areas, or in coastal areas where aircraft flight paths converge near primary support facilities. The convergence effect will be more intense for Sale 186, with two development sites in the Near Zone, one in the Midrange Zone, and none in the Far Zone (Appendix B, Table B-1), than Sale 195 (1, 1, 0) or Sale 202 (0, 0, 1).

Periodic disturbance is not likely to increase mortality significantly, but a small portion of the population may experience increased stress and somewhat lowered fitness if they are displaced routinely from favored foraging sites, especially soon after arrival from southern overwintering areas when there is limited access to ice-free foraging areas. This could cause depletion of stored energy during the critical migration and staging periods when energy requirements are high. However, bottom-survey video records indicate that alternative foraging habitat, similar in appearance and with similar prey organisms present, is widely distributed in the region (LGL Ecological Research Assocs., Inc., 1998). The net result of decreased energy availability may be somewhat lower survival and/or productivity. This is likely to increase the rate of decline, at least for some interval, and the overall length of time required for recovery to former population levels, which will not occur while the population is decreasing. However, in the absence of specific information bearing on this question, it is reasonable to assume that any additional mortality occurring as a result of oil and gas development could increase not only the rate of decline (currently nonsignificant), at least temporarily, but it also would delay the point (i.e., extend the time to status reversal) at which the population could enter a recovery mode (population decline reversed). Also, if additional mortality steepens the rate of decline, the population presumably would decrease to a lower level over a given interval. Thus, it should take the population longer to recover to a specified former level (i.e., delay recovery) at a given rate of increase. Because of the time lapse between sales, no significant overall effect is likely to result from these minor adverse effects associated with each individual sale or all three collectively. Any disturbance could be considered a "take" under the Endangered Species Act.

Because nest sites are scattered at low density over much of the Arctic Coastal Plain, relatively few nesting eiders are likely to be overflown by helicopters from offshore units, and substantial disturbance of nesting or broodrearing eiders is not likely to occur.

IV.C.5.b(1)(a)1)b) Effects of Construction Disturbance

Offshore drill site and pipeline construction that occurs during summer and fall may displace foraging eiders from the local area (within about 1 kilometer); however, such short-term and localized disturbances are not likely to cause significant population effects. Likewise, localized burial of potential prey and destruction of a few square kilometers of foraging habitat as a result of pipeline trenching, island construction, or rig placement is not likely to cause a significant decline in prey availability for eiders. Because few eiders would be likely to occur in these relatively small areas (representing much less than 1% of comparable habitat available in the proposed lease sale area), they are not likely to experience substantial adverse effects from routine construction activities. However, eiders or their foraging areas occurring closer to Prudhoe Bay (i.e., the Near Zone, Map 4) are more likely to be disturbed than those in the more distant portions of the lease sale area, because exploration and development structures and activities are likely to be more concentrated there due to its proximity to this primary support area.

Onshore, because nest sites are scattered at low density over much of the Arctic Coastal Plain, relatively few are likely to become unavailable through burial by pad or road construction or by location in areas of gravel extraction. Only small numbers of nesting eiders are likely to be displaced away from the vicinity of onshore pipeline corridors by construction activity, vehicle traffic, and disturbance by helicopters conducting pipeline inspections. Although pipeline burial would result in permanent removal of habitat, routine disturbance effects would persist only over the life of the field (potentially up to 28 years), and they would be localized primarily within about a kilometer of the pipeline. Positive effects may be realized from water impoundments and early-season food-plant growth in dust shadows along pipeline roads. Net habitat loss and disturbance effects on spectacled eider productivity are not likely to be significant, but recovery of the regional population from even minor adverse effects would not occur while it is in a declining status (currently nonsignificant).

IV.C.5.b(1)(a)1)c) Effects of Collisions with Structures

Because eiders typically fly at a relatively low altitude over water (Johnson and Richardson, 1982), the potential exists for these sea ducks to collide with offshore structures that protrude above the surface. This would be true especially under conditions of poor visibility (for example, fog or darkness) and may be compounded by the potentially attracting or disorienting effect of lights on the structures at night. The lack of information on routes followed by spectacled eiders during migration and other activities in the Beaufort Sea, and specific behavior near and vulnerability to obstructions during migration, makes it difficult to estimate potential mortality. Regarding the potential problems caused by structure lighting, under the terms of the Beaufort Sea Planning Area lease sale EIS Biological Opinion prepared by the Fish and Wildlife Service (USDOI, Fish and Wildlife Service, 2002), the MMS and the Fish and Wildlife Service will cooperate to coordinate development of lighting systems for offshore structures that may reduce the likelihood of bird collisions with such structures.

Although collision of an eider flock (average size $\cong$ 21 individuals) with an artificial island or drill structure could result in substantial mortality, such structures actually will be relatively small obstructions in the Beaufort Sea, very likely few in number (three or fewer; Appendix F, Table F-3), and most eiders are likely to see and avoid them when visibility is good. However, recent (late September/October 2001) bird fatalities at the currently operational Northstar Island (no spectacled eiders involved) apparently occurred equally during periods with good visibility conditions (although some of these may have occurred at night) and foggy conditions (Taylor, 2001, pers. commun.). In 2001, 20 sea ducks were recovered after colliding with the Northstar facility infrastructure and 16 at Endicott—no spectacled eiders were included. Because the typical spectacled eider density in the Beaufort Sea during most of the period they are present is expected to be relatively low; eider mortality from collisions with islands or drilling structures also is likely to be low. However, during fall migration, some members of flocks (of currently unknown size) of spectacled eiders could be involved in collisions. The risk is likely to be greater in areas closer to and particularly west of Prudhoe Bay (i.e., the Near Zone, Map 4), where structures are likely to be more concentrated because of their proximity to primary support facilities, rather than in the more distant portions of the lease area where development is less likely to occur.

Collision of nesting eiders with the elevated onshore portion of pipelines is considered unlikely, because the nests are likely to be at a very low density near a pipeline, and most of their activities would involve walking or swimming rather than flying. Arriving spring migrants or departing males and unsuccessful females flying to the marine environment could strike onshore pipelines or other structures. Overall, mortality from onshore collisions is likely to be low.

IV.B.5.b(1)(a)1)d) Effects of Discharges

Discharges from drilling operations during exploration or development typically disperse rapidly in the surrounding water, although some may be deposited on the bottom near drill sites. Because the little available survey data from the Beaufort Sea area suggest that eiders apparently occur in low numbers and as dispersed flocks in the Beaufort after breeding, although flocks may occur more frequently in some local areas such as Harrison Bay, relatively few individuals are expected to occur in most local drill-site areas or rely specifically on prey affected or buried in such areas. Thus, discharges are not likely to cause significant effects either through direct contact with birds or by affecting prey availability as a result of the three sales individually or all three collectively due to the insignificance of any additive effects. Drilling structures, the source of most discharges, are expected to be quite dispersed, with just two in the Near Zone, one in the Midrange Zone, and none in the Far Zone for Sale 186 (Sale 195-1, 1, and 0; Sale 202-0, 0, and 1). The minor effects that may result from each sale are not likely to substantially elevate the current nonsignificant rate of decline. For similar reasons, new pipeline construction (estimated to be 0 miles for Sale 186, 40 miles for Sale 195, and 35 miles for Sale 202) is not likely to cause significant effects. Low spectacled eider use of marine waters near Prudhoe Bay suggests a low potential for adverse effects where the most intense and earliest development is expected to occur.

IV.C.5.b(1)(b) Effects of Development and Production

IV.C.5.b(1)(b)1) Effects from Routine Operations

Effects from routine operations during development and production are likely to be the same as those previously discussed under exploration.

IV.C.5.b(1)(b)2) Effects of an Oil Spill

IV.C.5.b(1)(b)2)a) Effects of Disturbance from Oil-Spill Cleanup

In the unlikely event a large oil spill occurs, the presence of substantial numbers of workers, boats, and aircraft activity between the site and support facilities is likely to displace eiders foraging in affected offshore or nearshore habitats during open-water periods for one to several seasons. Disturbance during the initial season, possibly lasting 6 months, is likely to be frequent. Cleanup in coastal areas late in the breeding season may disturb broodrearing, juvenile, or staging eiders (Map 9a). However, staging or migrating flocks generally are dispersed and, thus, would not necessarily occur or stay in the vicinity of the cleanup activity, particularly that occurring on barrier islands. As a result, relatively few flocks are likely to be displaced from favored habitats and expend energy stores accumulated for migration. Predators may take some eggs or young while females are displaced off their nests if located near a site of operation. Survival and fitness of individuals may be affected to some extent, but this infrequent disturbance is not likely to result in significant population losses.

IV.C.5.b(1)(b)2)b) Effects of a Large Oil Spill

Spectacled eiders experiencing moderate or heavy oil contact will not survive; most lightly oiled birds also are not likely to survive at arctic water temperatures. Swallowed oil may cause reduced physiological function and production of fewer young (USDOI, MMS, 1996a; also see USDOI, MMS, Alaska OCS Region, 2002a:Section III.C.2 for details).

IV.C.5.b(1)(b)2)c) Vulnerability of Eiders to Oil Spills

In the unlikely event a large spill occurs during summer or fall periods when staging and migrating eiders occupy open-water marine habitats, a highly variable proportion of the Arctic Coastal Plain population could be vulnerable to oil in the Beaufort Sea, primarily west of the Sagavanirktok River. The probability of contact is lowered by individuals being concentrated in relatively few scattered flocks during the brief period present (Stehn and Platte, 2000:Table 1); however, some flocks may be relatively large (averaging ≅ 21 birds), and contact could result in substantial losses. The risk is likely to be greater in areas closer to Prudhoe Bay (i.e., the Near Zone, Map 4), where exploration and development is likely to be more concentrated because of proximity to the primary support area, than in the more distant portions of the lease sale area. Although most spectacled eiders apparently spend little time in nearshore coastal habitats, at least near Prudhoe Bay, females with broods may occupy them briefly before moving to offshore staging areas (Maps 9a and 9b). While eiders occur inside the barrier islands (approximately 50% of the coastline has adjacent islands), they are protected to some extent from contact by an offshore oil spill. During spring migration, most migrating spectacled eiders arrive at the nesting areas via overland routes; thus, few are likely to occupy leads offshore where they would be vulnerable to oil. In the unlikely event a large oil spill occurs during the winter season, it is assumed that at least part of the spill would not be cleaned up prior to ice breakup and, thus, could contact one or more important habitat areas after this occurs. This assumption is supported by results of the spring and fall 2000 North Slope broken-ice exercises during which multiple equipment failures were experienced while attempting to contain and clean up a simulated oil spill in broken-ice conditions and, thus, the simulated oil was not effectively removed from the environment (Robertson and DeCola, 2000). However, the low probability of such an event, the likelihood that a spill will not move into all portions of a given area, and the seasonal nature of the resources inhabiting the Beaufort Sea region, make it unlikely that a large oil spill would occur and contact substantial proportions of the eider populations. Regarding seasonality, although spectacled eiders are present on the North Slope for only 3-5 months of the year, there is a potential for cumulative effects from contact in succeeding years if all oil is not removed from the environment the first year.

Locations of early-season migrant eiders (males, and females that lose clutches) carrying satellite transmitters average 10.1 kilometers offshore, while those migrating later (females and young) average 21.8 kilometers, with some locations beyond 40 kilometers offshore (Map 9a). In the unlikely event a large spill occurs, the Oil-Spill-Risk Analysis model predicts the probability of oil contact in 30 days (from LA2-LA12 and associated pipelines [Maps A-4a and 4b]) to areas where migrants have been located (environmental resource areas from Point Barrow to Endicott Causeway, ERA's 2-7; Sea Segments 1-5, 11, 13, 18b, Harrison Bay, Prudhoe Bay, and nearby ERA's 29-33, 51, 53, 55, 65-73, 80 [Maps A-2c and A-2d]). These range from less than 0.5% to 66% for environmental resource areas and 79% for pipelines, depending on the distance between spill launch areas and resource area (Table A.2-21). These areas are located from about 5-55 kilometers offshore.

Although shoreline and nearshore areas generally are occupied for only a brief period as eiders move offshore from nesting and broodrearing areas, the probability of a spill contacting land segments (Maps A-3a and A-3b) from launch areas and associated pipelines within 30 days ranges up to 21% (Table A.2-27), suggesting that the risk to individuals is not insignificant even in these coastal areas in the unlikely event a spill were to occur. In particular, repeated eider satellite-transmitter locations in Simpson Lagoon west of Prudhoe Bay and outer Harrison Bay suggest that these are important areas for staging and migrating spectacled eiders. Oil-spill-contact probabilities in these areas range up to 23% and 38%, respectively, indicating a substantial risk in these apparently important areas. However, combined probabilities that incorporate the chance of a spill occurring (low) are only 2% or less in these areas.

IV.C.5.b(1)(b)2)d) Mortality from an Oil Spill

Because relatively few spectacled eiders were observed during aerial surveys conducted from Harrison Bay east to Mikkelsen Bay by the Fish and Wildlife Service, modeled estimates of oil-spill mortality for that portion of the coastal plain population occupying this marine area based on these values also were low (Fischer, Tiplady, and Larned, 2002; Stehn and Platte, 2000). The authors state that the predictive value of their model was limited by using some important assumptions such as (1) errors inherent in estimating numbers of birds present in or passing through a prescribed area during aerial surveys performed at one point in time, (2) turnover rates (duration of time a bird spends on the water at a specific site), (3) the possibility that the areas sampled on limited surveys do not accurately represent all areas occupied by eiders, (4) the possibility that a substantial proportion of the unidentified eiders may have been spectacled, and (5) limitations of the bird density/oil-spill-trajectory overlay analysis, that made the final estimates of numbers of birds exposed to oil less certain.

However, even if the model lacks precision, the relative magnitudes and patterns of exposure of birds to oil calculated by the model should have application for the management and protection of birds using this central Beaufort Sea area. If future surveys find similar eider distribution in areas to the west (see Fischer, 2002), the model may have application there as well. Using average estimated bird density and average to maximum severity of spill-trajectory paths, the model estimates that an average of 2 to a maximum of 52 spectacled eiders would be exposed to a large spill in 30 days in July and zero in August. However, if a substantial number of unidentified eiders that were observed in August were spectacled eiders, this latter estimate, in particular, could increase. Also, this range may represent a conservative estimate for potential mortality during periods of active westward migration, because migrants departing each successive area to the west could join those already in migration from the central Beaufort Sea area. Mortality of eiders from an oil spill is expected to be fewer than 100 individuals; however, any substantial losses (25+ individuals) would represent a significant effect. Recovery from substantial mortality would not occur while the population exhibits a declining trend.

IV.C.5.b(1)(b)3) Population Effects

The relatively small loss of spectacled eiders likely to result in the unlikely event of an oil or fuel spill in the Beaufort Sea, where so far there is little indication of large numbers gathering in offshore waters, may be difficult to separate from natural variation in population numbers. This has been found for other waterbird populations under similar circumstances (see USDOI, MMS, Alaska OCS Region, 2002a:Section III.C.2.a(2), which is incorporated by reference, for details). Regardless of the factors involved in causing deaths, which may include effects from lead ingestion and mortality from the subsistence harvest, complete recovery of the Arctic Coastal Plain spectacled eider population from even small losses in the proposed sale area may be slow, because the population apparently has been in a gradual nonsignificant decline from 1992-2001 (Larned et al., 1999, 2001; Larned, Platte, and Stehn, 2001; USDOI, Fish and Wildlife Service, 1999). This probably is due to the species' low reproductive rate and low nesting density in this eastern portion of its range, where eider numbers are relatively low, and the effect of any adverse factors on the population. Recruitment of individuals into the population under such circumstances is likely to be slow; the effect of losses from spill mortality, intensified by low productivity or lowered survival of any age groups, is likely to increase the rate of decline, at least for some interval, and the overall length of time required for recovery to former population levels, which will not occur while the population is decreasing. However, in the absence of specific information bearing on this question for any species occurring in the Beaufort Sea, it is reasonable to assume that any additional mortality occurring as a result of oil and gas development could increase not only the rate of decline for a declining species, at least temporarily, but also would delay the point (i.e., extend the time to status reversal) at which the population could enter a recovery mode (population decline reversed). Also, if additional mortality increases the rate of decline, the population presumably would decrease to a lower level over a given interval; thus, it should take the population longer to recover to a specified former level (i.e., delay recovery) at a given rate of increase.

Because the small amount of information available on factors such as rates of productivity, survival, and recruitment into the population makes it difficult to determine when either the local or entire coastal plain populations would recover from incidents causing mortality, the long-term effect of oil-spill mortality is uncertain. Also, different rates of decline could be ongoing in various parts of the population but undetected between individual survey years by current survey methodology (King and Brackney, 1997). Currently, spectacled eider numbers on the coastal plain generally appear to be stable or declining at a nonsignificant rate (Larned et al., 1999, 2001; Larned, Platte, and Stehn, 2001; USDOI, Fish and Wildlife Service, 1999). While the population is declining, any oil spill or other mortality associated with oil and gas development is likely to extend the period required for recovery, at least until the species recovers from circumstances that resulted in its threatened status. It should be noted, however, that any mortality resulting from a spill is likely to be a one-time occurrence as compared to the relatively unknown but presumably constantly acting factors that are causing this population to decline at a nonsignificant rate. Recovery from losses under these two types of circumstances may be quite different. Recovery from substantial mortality is not likely to occur while the population is declining, but determination of population status may be obscured by natural variation in population numbers.

In addition, recovery from mortality associated with development from the first sale, which is likely to involve the largest losses of the three sales, could be delayed by any mortality resulting from development associated with the following sales. With any substantial mortality, the potential exists for a significant adverse effect on this population.

IV.C.5.b(1)(b)4) Effects of Decreased or Contaminated Prey Populations

Local reduction or contamination of food sources in the unlikely event a large oil spill occurs also could reduce survival or reproductive success of some eiders, which could be a serious effect due to their low reproductive rates and a relatively small regional population. Lowered food intake may slow the completion of growth in young birds, replacement of energy reserves depleted during nesting by females, and energy storage for migration by all individuals. However, the contamination of some local habitats is not likely to affect a large proportion of the regional eider population because (1) they apparently are not abundant in much of the proposed lease area; (2) they do not occur in large feeding flocks; and (3) they would have access to alternative foraging habitat similar in appearance and with similar prey organisms, which is widely distributed in the region (see USDOI, MMS, Alaska OCS Region, 2002a:Section III.C.2a for details). Any eider losses would be recovered slowly while the species is in a declining status.

Conclusions. The effects from normal activities associated with oil and gas exploration and development during three sales in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a nonsignificant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality would not occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.

Effectiveness of Mitigating Measures. Several mitigating measures will be considered for the Beaufort Sea sales that may offer some protection to spectacled eiders. These include ITL clauses on Bird and Marine Mammal Protection and on the Spectacled Eider and the Steller's Eider. Most of the remaining stipulations and ITL clauses are not pertinent to protection of eiders, or would provide minimal benefits to individuals and no measurable benefit to the relatively small and widely dispersed regional spectacled eider population. For example, Stipulations 6a and 6b on the prohibition of permanent facilities within 10 miles of Cross Island would remove some obstructions to eider movement, thereby decreasing the potential for collision. However, few spectacled and no Steller's eiders are likely to occur in this area and, therefore, benefits would be minimal for individual eiders and virtually impossible to measure at the population level.

The ITL clause Information on Bird and Marine Mammal Protection advises lessees that they and their contractors are subject to the requirements of the Endangered Species Act, in particular the incidental take provisions, and applicable International Treaties. Lessees and their contractors should be aware that disturbance of threatened eiders could be determined to constitute a "taking" situation. This section of the ITL does not provide any direct protection for these species, but it does provide information to assure that lessees or their contractors are aware of the Endangered Species Act classification of the species and, thus, indirectly of the special regulatory provisions that govern interactions with them. Lessees also are advised by this ITL that behavioral disturbance of most birds found in or near the lease area would be unlikely if aircraft and vessels maintain at least a 1-mile horizontal distance and aircraft maintain at least a 1,500-foot vertical distance above known or observed wildlife concentration areas. If lessees and their contractors adhered to these recommendations, it is unlikely that either of these species would experience significant disturbance effects, a definite benefit for these threatened populations.

The ITL Information on the Spectacled Eider and Steller's Eider advises lessees that these two species are protected under the Endangered Species Act, and provides information on their seasonal distribution. This

ITL does not provide any direct protection for these species, but it does provide information to assure that lessees and their contractors are aware of the Endangered Species Act classification of the species and, thus, indirectly of the special regulatory provisions that govern interactions with them.

IV.C.5.b(2) Effects of Alternatives and Sales

IV.C.5.b(2)(a) Effects of Alternative I for Sale 186

The effects of normal activities on spectacled eiders under Alternative I for Sale 186 oil and gas exploration and development are likely to be about the same as those described in Section IV.C.5.b(1) - Effects Common to All Alternatives. This is because although eiders staging and migrating in the marine environment are vulnerable to disturbance or oil-spill contact across much of the central and western Beaufort Sea (Fischer, 2002; Fischer, Tiplady, and Larned, 2002; Map 9a), the effects common to all alternatives discussed primarily would occur in the vicinity of central Beaufort primary support facilities where the Near and Midrange zones (Harrison Bay to Mikkelsen Bay) are likely to contain 90% of the Sale 186 leasing activity and three development projects (Table IV.A-4). Fewer eiders are likely to occur in the central offshore portion of the Far Zone, where only 10% of the leasing and exploration activity and no development projects are likely to occur as a result of this sale.

Potential effects include disruption of foraging or other activities, particularly in the vicinity of primary support facilities, where converging support aircraft routes could cause more intensive disturbance than in distant (Far Zone) areas and, thus, displacement of eiders from near helicopter- and vessel-traffic routes during construction and operational activities in the open-water season. Collision with offshore structures is likely to be the greatest source of mortality during normal operations. Brief disturbances (a few minutes to a few days) are not expected to have a significant effect on eider movements and distribution. However, recovery from any collision losses is not likely to occur quickly, while the regional population remains in a declining status (currently nonsignificant).

In the unlikely event a large oil spill occurs under Alternative I for Sale 186, small to substantial numbers of eiders (average of 2 to a maximum of 52; Stehn and Platte, 2000) could be killed. Recovery of losses is not likely to occur while the regional population is in declining status. The probability of spill contact within 30 days in sea segments and other environmental resource areas that are contained within the modeled spill-launch areas that are most likely to contain development under Sale 186 (vicinity of primary support facilities) ranges up to 55% for launch areas and 64% for associated pipelines. These values are lower than those obtained if leasing occurred throughout the planning area with equal intensity, as assumed in Section IV.C.5.b(1) - Effects Common to All Alternatives. This is likely because most leases and developments are likely to occur in the Near Zone (70% of leasing and two developments) or nearby portions of the Midrange Zone (20% and one) close to centrally located primary support facilities in Deadhorse, rather than farther offshore or west where there are some environment resource areas used by eiders that have higher contact probabilities.

Conclusions. The effects from normal activities associated with Alternative I for Sale 186 include nonsignificant disturbance, and the potential loss of small numbers of eiders from collision with structures. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by eiders, which have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality would not occur while the spectacled eider is in a declining status; however, determination of status may be obscured by natural variation in population numbers.

IV.C.5.b(2)(b) Effects of Alternative I for Sale 195

The effects of normal activities on spectacled eiders under Alternative I for Sale 195 oil and gas exploration and development are likely to be less than described in Section IV.C.5.b(1) - Effects Common to All Alternatives, and somewhat less than under Sale 186. The decrease from Sale 186 is because most staging or migrating eiders pass through the Near Zone, where a lower proportion of the leasing and exploration, and just one development under Sale 195 as compared to Sale 186, is expected to occur (50% versus 70%). Also, somewhat less leasing and exploration activity and the same amount of development is likely to occur in the Midrange Zone (Map 4) under Sale 195, but this probably will have little effect. Few eiders are likely to occur in the Far Zone, where 20% of the leasing and exploration activity and no development projects are likely to occur under this sale.

Potential effects include disruption of foraging or other activities, particularly in the vicinity of primary support facilities where converging support-aircraft routes still could cause more intensive disturbance than in distant (Far Zone) areas and, thus, displacement of eiders from near helicopter- and vessel-traffic routes during construction and operational activities in the open-water season. Collision with offshore structures is likely to be the greatest source of mortality during normal operations. Brief disturbances (a few minutes to a few days) are not expected to have a significant effect on eider movements and distribution. However, recovery from any collision losses would not occur quickly while the regional population remains in a declining status (currently nonsignificant).

In the unlikely event of a large oil spill under Alternative I for Sale 195, small to substantial numbers of eiders (average of 2 to a maximum of 52, Stehn and Platte, 2000) could be killed. Recovery of losses is not likely to occur while the regional population is in declining status. The probability of spill contact within 30 days in environmental resource areas that are contained within the modeled spill launch areas most likely to contain development under Sale 195 is the same as for Sale 186. These values are lower than those obtained if leasing and development occurred throughout the planning area with equal intensity, as assumed in Section IV.C.5.b(1) - General Areawide Effects. This result is likely, because most leases and developments are likely to occur in the Near Zone (50% of leasing and 1 development) or nearby portions of the Midrange zone (20% of leasing and 1 development) close to centrally located primary support facilities in Deadhorse, rather than farther offshore or west in the vicinity of some areas with higher contact probabilities.

Conclusions. The effects from normal activities associated with Alternative I for Sale 195 include nonsignificant disturbance, and the potential loss of small numbers of eiders from collision with structures. Disturbance of eiders in the Near Zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is expected to take place there. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by eiders that have higher spill-contact probabilities indicated by the MMS oil spill model. Recovery from substantial oil-spill mortality would not occur while the species is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Effects are likely to be somewhat less than those that could occur as a result of Sale 186.

IV.C.5.b(2)(c) Effects of Alternative I for Sale 202

The effects of normal activities on spectacled eiders under Alternative I for Sale 202 oil and gas exploration and development are likely to be considerably less than described for Sales 186 or 195. This is because relatively few eiders are likely to occur in the portion of the Far Zone (Map 4) where 30% of the leasing and exploration activity and the only development project are likely to occur. Any project is likely to be located offshore of centrally located primary support facilities, which are near the eastern limit of common onshore occurrence of this species, suggesting that relatively few spectacled eiders would occur in the adjacent offshore area. The remainder of the Far Zone lies between Harrison Bay and Point Barrow, where eiders may be relatively common but leasing is less likely, because development sites would be far removed from industrial infrastructure.

Potential effects include disruption of foraging or other activities or displacement from within about 1-2 kilometers (0.62-1.2 miles) of helicopter routes to drill sites and vessel traffic during construction and operational activities in the open-water season. Collision with offshore structures is likely to be the greatest source of mortality during normal operations. Brief disturbances (a few minutes to a few days) are not likely to have a significant effect on eider movements and distribution. However, recovery from any collision losses is not likely to occur quickly while the regional population is in declining status (currently nonsignificant).

In the unlikely event a large oil spill occurs under Alternative I for Sale 202, small numbers of eiders may be contacted and die (average of 2 to a maximum of 52, Stehn and Platte, 2000), although the likely area of development (60 % of leasing in the Midrange and Far zones, and just one development in the latter) is beyond the areas where most spectacled eiders frequently would occur. Recovery of losses is not likely to occur while the regional population is in declining status.

Conclusions: The effects from normal activities associated with Alternative I, Sale 202 include a small amount of nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is low, because only one development likely would be located where spectacled eiders are relatively scarce. Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.

IV.C.5.b(2)(d) Effects of Alternative III, V, and VI for All Sales

Alternative III (Barrow Subsistence-Whaling Deferral) would defer leasing and development in some offshore and western Far Zone areas, where the probability of oil-spill contact within 30 days is relatively high and migrant spectacled eiders are known to occur. However, leasing and development is not likely to occur this far from primary support infrastructure under any of the three sale scenarios and, therefore, effects from normal activities or an oil spill under these alternatives are likely to be the same as under Alternative I for all Sales.

Alternatives V (Kaktovik Subsistence-Whaling Deferral) and VI (Eastern Deferral) would defer leasing and development in areas where few spectacled eiders occur; therefore, effects under these alternatives are to be the same as under Alternative I for Sale 186.

Conclusion: The effects from normal activities, and in the unlikely event a large oil spill occurs, associated with Alternatives III, V, and VI on spectacled eiders are likely to be the same as under Alternative I for Sales 186, 195, and 202.

IV.C.5.b(2)(e) Effects of Alternative IV for All Sales

Alternative IV (Nuiqsut Subsistence-Whaling Deferral) would defer leasing and development in central Beaufort Sea areas where some spectacled eiders are likely to occur. Although these deferrals would lower the probability of eider contact by oil in these areas in the unlikely event a large oil spill occurs, most spectacled eiders occur west of the Sagavanirktok River and their primary distribution is west of the deferred areas. As a result, the decreased risk of oil contacting eiders under these alternatives is likely to be only a small reduction from that expected under Alternative I for Sales 186, 195, and 202.

Conclusion: The effects on spectacled eiders from normal activities, and in the unlikely event a large oil spill occurs associated with Alternative IV, are likely to be somewhat less than under Alternative I for Sales 186, 195, and 202.

IV.C.5.c. Steller's Eider

IV.C.5.c(1) Effects Common to All Alternatives

Observations of this species during aerial surveys on the Arctic Coastal Plain have been extremely sparse and widely dispersed, primarily west of the Colville River and generally within about 60 kilometers of the coast (Map 9b). Most nesting in this region has been observed south and southeast of Barrow; nests have been found there in most years (Quakenbush and Suydam, 1999). Male Steller's eiders stage and migrate as dispersed flocks along the Beaufort or Chukchi coasts soon after the nesting period begins. Females with young may be found farther offshore as a result of migrating later, when the ice usually is farther from the coast (Petersen, 1997, pers. commun.). Substantial numbers of Steller's eiders apparently were taken during subsistence harvests in the 1990's (Georgette, 2000; Paige et al. 1996; Wentworth, 2001). It is not certain what proportion of these individuals were Alaskan or Russian breeders, nor is it certain what role this harvest played in the decline of this species.

IV.C.5.c(1)(a) Effects of Exploration

IV.C.5.c(1)(a)1) Effects from Routine Operations

IV.C.5.c(1)(a)1)a) Effects of Disturbance Factors and Collision

Steller's eiders staging or migrating in coastal Beaufort Sea areas in or adjacent to western blocks of the proposed lease area (western Midrange and Far zones, Map 4) are not likely to experience adverse effects from potentially disturbing routine activities, principally helicopter traffic. This is because of the low probability that the routes traveled and area occupied by scattered coastal flocks of this small Alaskan breeding population would be overflown by support aircraft traveling between onshore facilities in the Deadhorse or Barrow area and the one drill site assumed for the western lease area (Table IV.A-4). It also is unlikely that a primary Alaskan nesting area, located south and southeast of Barrow, would be overflown by helicopters from offshore units; therefore, significant disturbance of nesting or broodrearing eiders is not likely to occur. However, Fischer (2001) observed three Steller's eiders near Cape Simpson in Smith Bay during transects flown in late July 2001. This is an area where a staging facility could be built for barges to offload equipment and, thus, potentially become a source of disturbance if eiders routinely use this nearshore area.

It is likely that any small reduction of available foraging habitat as a result of burial by gravel island or pipeline construction, or disturbance from various activities in the western lease area during the brief time males in late June and females with juveniles in late August occupy coastal waters, primarily in the Barrow area, would have a negligible effect on the small Alaskan breeding population.

It is not likely that significant numbers of Steller's eiders would collide with structures at a single drill site in the western sale area; these eiders are rare in the area east of the Colville River, where most development is likely to occur (see the previous discussion for spectacled eider). Disturbance from coastal cleanup activities in the unlikely event a large oil spill occurs is likely to be minor; offshore cleanup activity within or near the lease area is likely to be quite distant from flocks staging or migrating in coastal areas. Any disturbance of individuals could be considered a "take" under the Endangered Species Act.

IV.C.5.c(1)(b) Effects of Development and Production

IV.C.5.c(1)(b)1) Effects from Routine Operations

Effects from routine operations during development and production are expected to be the same as those under exploration, discussed above.

IV.C.5.c(1)(b)2) Effects of a Large Oil Spill

In the unlikely event a large oil spill occurs, Steller's eiders experiencing moderate to heavy contact oil contact would not survive; most lightly oiled birds also are not likely to survive at arctic water temperatures (see USDOI, MMS, Alaska OCS Region , 2002a:Section III.C.2.a for detailed effects). A minor proportion of the small Alaskan breeding population is likely to be vulnerable to an oil spill, because staging and migrating individuals generally are scattered in relatively few flocks along the coast during the brief summer/fall period of breeding and migration, and the oil would be well weathered and dispersed after moving west from the most likely development areas in the Near Zone (Map 4). Small numbers of spring-migrant Steller's eiders (for example, in 1996, 10 of 182,781 eiders counted = 0.01%; Suydam, et al., 2000) typically are observed during migration counts of eiders past Point Barrow, suggesting that many of the small population nesting in northwestern Alaska may arrive at the nesting areas via overland routes from the Chukchi Sea. If this is the case, relatively few eiders are likely to occupy leads offshore the northern coastline east of Point Barrow where they would be vulnerable to oil entering such habitat (note: 3 eiders were observed near Cape Simpson in Smith Bay during transects flown in late July 2001; Fischer 2001). Given the apparently small population seasonally occupying northwestern Alaska, low Steller's eider mortality is likely from an oil spill; however, recovery of the Alaska population from spill-related losses is not likely to occur, if numbers on the breeding ground continue to decline and the reproductive rate remains relatively low. An onshore spill is not likely to cause significant eider mortality, because the small regional population is widely scattered and pipeline construction in the Barrow area associated with this lease sale, where small numbers of eiders nest, is not certain to occur.

Conclusions. Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses would not occur while the regional population is declining.

Effectiveness of Mitigating Measures. Steller's eiders occur mainly onshore and in nearshore waters near the extreme western portion of the proposed lease area. Thus they are not likely to be affected by exploration, development, or production activities, and are not likely to realize any measurable benefits from the proposed mitigating measures. Effects, if any, would be as described above for the spectacled eider.

IV.C.5.c(2) Effects of Alternatives and Sales

IV.C.5.c(2)(a) Effects of Alternative I for Sales 186 and 195

The effects of normal activities on Steller's eiders under Alternative I for Sales 186 and 195 oil and gas exploration and development are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity, as assumed in Section IV.C.5.c(1) - Effects Common to All Alternatives. This is because Steller's eiders using the marine environment rarely occur in the Near or Midrange zones from Harrison Bay east, where 90% of the Sale 186 leasing activity and three development projects and 80% of the Sale 195 leasing activity and two development projects (Table IV.A-4) are expected to occur. In the unlikely event a large oil spill occurs, the probability of contact where Steller's eiders are likely to occur in the Far Zone (ERA 2 from LA9-LA12) is 1% or less and, therefore, substantial mortality is not expected to occur.

Conclusion: The effects of normal activities on Steller's eiders under Alternative I for Sales 186 and 195 are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. In the unlikely event a large oil spill occurs, substantial mortality is unlikely to occur.

IV.C.5.c(2)(b) Effects of Alternative I for Sale 202

The effects of normal activities on Steller's eiders under Alternative I for Sale 202 oil and gas exploration and development potentially could be higher than those resulting from leasing and development occurring throughout the planning area with equal intensity, as assumed in Section IV.C.5.c(1) - Effects Common to All Alternatives. This is because up to 30% of the leasing activity and one development may occur in the Far zone and, thus, potentially could take place in the western Far Zone where Steller's eiders may be present. Under this relatively unlikely scenario (because this area is far from oil industry infrastructure in the central Beaufort), an oil spill originating at the one development site potentially could contact eiders in this area. However, even if development in the western area occurred, in the unlikely event of a large oil spill it is unlikely that substantial numbers of eiders would be affected because of their low numbers and scattered distribution; thus, it is unlikely that significant effects would occur. It is more likely that effects would be lower than described for effects common to all alternatives for leasing and development, and about the same as under Alternative I for Sales 186 and 195.

Conclusion: The effects of normal activities on Steller's eiders under Alternative I for Sale 202 are likely to be significantly less than those obtained if leasing occurred throughout the planning area with equal intensity, and about the same as indicated for Sales 186 and 195. In the unlikely event of a large oil spill, substantial mortality is unlikely to occur.

IV.C.5.c(2)(c) Effects of Alternative III for All Sales

Alternative III (Barrow Subsistence-Whaling Deferral) would defer leasing and development in some offshore and western Far Zone areas where, in the unlikely event a large oil spill occurs, the probability of oil contact within 30 days is relatively high and migrant Steller's eiders may occur. However, the likelihood that leasing and development would occur this far from primary support infrastructure in the central Beaufort is low and, therefore, effects from normal activities or an oil spill under these alternatives are expected to be the same as under Alternative I for Sales 186, 195, and 202.

Conclusion: The effects from activities and any oil spill associated with Alternative III on Steller's eiders are likely to be the same as under Alternative I for Sales 186, 195, and 202.

IV.C.5.c(2)(d) Effects of Alternatives IV, V, and VI for All Sales

Because Alternatives IV (Nuiqsut Subsistence-Whaling Deferral) and V (Kaktovik Subsistence-Whaling Deferral) would defer leasing and development in areas where Steller's eiders rarely, if ever, are sighted, effects under these alternatives are likely to be the same as under Alternative I for Sales 186, 195, and 202.

Conclusion: The effects from activities and any oil spill associated with Alternatives IV, V, and VI on Steller's eiders are likely to be the same as under Alternative I for Sales 186, 195, and 202.

IV.C.6. Marine and Coastal Birds

IV.C.6.a. Effects Common to All Alternatives

Several million migratory birds of about 70 species occur in the Beaufort Sea region, occupying offshore and coastal marine, freshwater, and tundra habitats during the summer breeding and summer/fall migration seasons. Seasonal distribution of birds in the region determines their vulnerability to potentially adverse factors associated to a large extent with oil and gas exploration and development to a large extent. Loons, waterfowl, shorebirds, and the few seabird species are among the most vulnerable to exploration and development activities. Aerial surveys in the central Beaufort Sea have documented that birds are widespread in substantial numbers in both nearshore and offshore waters of this area (Fischer, 2002; Fischer, Tiplady, and Larned, 2002; Larned, Platte, and Stehn, 2001; Stehn and Platte, 2000), and it is likely that approximately this distribution and abundance prevails along the entire Beaufort coastline and into the northern Chukchi Sea, although some surveys in the eastern Beaufort suggest there are lower numbers in that area. Birds occur out to at least 70 kilometers offshore where open water is available. Of the more common species in marine waters, Pacific loons, king eiders, glaucous gulls, and jaegers are dispersed at all distances offshore; the common eider, scoters, and a majority of long-tailed ducks mainly occupy nearshore waters (Maps 10a, 10b and 11a). Onshore, nesting waterfowl, shorebirds, gulls, and terns are widespread in most coastal habitats.

IV.C.6.a(1) Effects of Exploration

IV.C.6.a(1)(a) Effects of Routine Operations

IV.C.6.a(1)(a)1) Effects of Aircraft/Vessel Disturbance

The response of birds to disturbance varies according to the species, the physiological and reproductive status of individuals, distance from the disturbance, and type/intensity/duration of the disturbance. Local populations of species nesting on barrier islands, river deltas, or coastal wetlands, or molting/staging/migrating in coastal or offshore areas, are likely to experience brief but not significant disruption of these activities, primarily from helicopter flights (10-20 flights/day during construction; 0.5-1/day during production [Table IV.A-4]) during the open-water season. This is because over most of the lease area, routine flights following relatively direct flight paths between a few offshore drill sites (for example, a maximum of three sites for Sale 186) and primary support facilities at Deadhorse and vicinity are not likely to frequently overfly flocks that typically are rather widely scattered; thus, they are likely to cause only intermittent displacement of birds from within 1-2 kilometers (0.62-1.2 miles) of flight paths.

However, molting, staging, or migrating loons and waterfowl occurring in lagoons and other nearshore waters in the Near Zone, or waters just offshore of this area in the Midrange zone (Maps 4, 10a, 10b, and 11a), relatively close to primary support facilities at Deadhorse and vicinity, are much more likely to be overflown than those in the more distant portions of the lease area (eastern and western Midrange and Far zones). This could occur when helicopter flight paths from a few scattered offshore drill sites to the central support area converge in the airspace over waters of the Near Zone and nearest portions of the Midrange

Zone such that a greater proportion of this area is overflown. The convergence effect will be more intense for Sale 186, with two development sites in the Near Zone and one in the Midrange Zone (Appendix B, Table B-1) than for Sale 195 (1, 1, 0) or Sale 202 (0, 0, 1). As a result, it is likely that birds nesting in coastal areas, on barrier islands, or routinely foraging along support helicopter routes will be disturbed and potentially displaced more frequently than those farther offshore or east or west. Relatively intense disturbance could result in seasonal abandonment of some local areas.

Aerial surveys in the central Beaufort Sea conducted by the Fish and Wildlife Service several times during the open water season in 1999 and 2000 found 73.8 long-tailed ducks, 56.4 common eiders, 10.4 king eiders, and 0.3 Pacific loons per square kilometer, suggesting that substantial numbers could be overflown in the Near and Midrange zones (Maps 10a, 10b, and 11a) where most development is likely to take place (Fischer, Tiplady, and Larned, 2002; Stehn and Platte, 2000). Surveys in 2001 covering the area from Point Barrow to Demarcation Point (Fischer, 2002) found substantial numbers of king eiders from Harrison Bay westward (western Midrange and Far zones). Common eider nesting colonies on barrier islands and large numbers of long-tailed ducks molting in lagoons are particularly susceptible (potentially thousands of molting long-tailed ducks; Maps 10a and 10b) (Johnson, 1984; Johnson, Herter, and Bradstreet, 1987). However, studies by Gollup, Goldsberry, and Davis (1974) suggest that if aircraft-disturbance events are relatively infrequent and of short duration, long-term displacement or abandonment of molting and foraging areas by long-tailed ducks, for example, is unlikely. Likewise, brant colonies and broodrearing areas and snow goose colonies, particularly in coastal locations from Harrison Bay west to Dease Inlet, species that are highly sensitive to aircraft disturbance (Derksen et al., 1992), could experience adverse effects during nesting, broodrearing, and molting as a result of aircraft overflights. However, because this area primarily is adjacent to the Far Zone, development is likely to be deferred for an indeterminate period, depending on oil prices and indications of the presence of oil resources.

The occurrence of occasional larger flocks and a disturbance corridor up to about 2 kilometers (1.2 miles) in width along flight paths suggests a disturbance event occasionally could involve substantial numbers of waterfowl and other birds. This is not likely to increase mortality significantly; however, a small portion of the population may experience increased stress and somewhat lowered fitness if they are routinely displaced from favored foraging sites. This could be a problem especially soon after arrival in late spring when there is limited access to ice-free foraging areas, or during the fall staging period, which could cause depletion of stored energy and/or adversely affect the ability of birds to acquire the critical energy reserves necessary for successful migration when energy requirements are high. However, in the case of sea ducks and other bottom feeders, bottom-survey-video records indicate that alternative foraging habitat, similar in appearance and with similar prey organisms present, is widely distributed in the region (LGL Ecological Research Assocs., Inc. 1998). Disruption of postbreeding and juvenile shorebird foraging activity may hamper their ability to acquire critical fat reserves needed to complete migration (Connors, 1976). The net result of decreased energy availability may be somewhat lower survival and/or productivity, from which the regional population would not recover if it is in a declining status. Because of the time lapse between sales, no significant overall effect is likely to result from these minor adverse effects associated with each individual sale, or all three collectively.

In addition, productivity of most species may be affected adversely if displaced adults are no longer able to protect eggs or young from predator populations (for example, foxes, gulls), which have increased as a result of decreased trapping pressure (foxes, as noted by Barrow elders in USDOI, Fish and Wildlife Service, 1996) or increased availability of human-generated food. Relatively few mainland coastal nest sites of individual species are likely to be overflown by helicopters from offshore units, because most are scattered at low density on tundra areas and, thus, substantial disturbance of nesting or broodrearing birds is not likely to occur.

Frequent boat-traffic disturbance of nesting ducks has resulted in a 200-300% increase in the gull-predation rate on duck eggs and young ducklings in nesting areas that occur within 200 meters of gull colonies, when compared to predation rates at undisturbed duck-nesting areas (Ahlund and Gotmark, 1989). Birds nesting on barrier islands and river deltas are particularly susceptible to such predation.

The net result of these various scenarios is likely to be somewhat lower survival and/or productivity; however, losses are not likely to be significant because of the relatively low probability that areas occupied by scattered flocks during the relatively brief staging and migration periods, or nest sites during the brief nesting season, would be overflown frequently by support aircraft flying between drill sites and shore bases. Because of the time lapse between sales, no significant overall effect is likely to result from these minor adverse effects associated with each individual sale, or all three collectively.

IV.C.6.a(1)(a)2) Effects of Other Disturbance Factors and Habitat Alteration

Any construction activities that take place in summer, associated with drill-rig placement during exploration and facilities for development, could temporarily (i.e., one season or less) displace birds using areas near such sites. This local disturbance of birds within about 1 kilometer of construction activities would be short term, and is not likely to cause significant population effects. Few birds would be expected to occur in these relatively small areas (represents less than 1% of potential comparable foraging habitat available in the proposed lease sale area). Likewise, localized burial of potential prey and destruction of a few square kilometers of foraging habitat as a result of pipeline trenching or island construction is not likely to cause a significant decline in prey availability. Disturbance of maximum numbers of birds is likely to occur in the general vicinity of Prudhoe Bay, because most development probably will focus on this area. However, it is likely that much construction, particularly of pipelines and gravel islands, would take place during winter when most birds are absent.

Onshore, because nest sites are scattered at low density on the Arctic Coastal Plain, relatively few are likely to become unavailable through burial or location in areas of gravel extraction, and only small numbers of nesting birds are likely to be displaced away from the vicinity of onshore pipeline corridors (few hundred meters) by construction activity (lasting about 2 years), vehicle-traffic disturbance, or helicopter traffic for pipeline inspections. Although burial would result in permanent removal of habitat, routine disturbance effects would persist only over the life of the field (potentially up to 28 years), and they would be localized primarily within about a kilometer of the pipeline. Positive effects may be realized from water impoundments and early-season food-plant growth in dust shadows along any new roads, which would benefit waterfowl; however, the availability of shorebird insect prey is likely to be adversely affected near roads, and some shorebird-nesting attempts would be displaced. Net habitat loss and disturbance effects on most species' productivity are not expected to be substantial but would persist over the life of the field in the local areas affected. Because of the time lapse between sales, no significant overall effect is likely to result from these minor adverse effects associated with each individual sale, or all three collectively.

IV.C.6.a(1)(a)3) Effects of Collisions with Structures

Because sea ducks typically fly at a relatively low altitude over water (Johnson and Richardson, 1982), the potential exists for these birds to collide with offshore structures that protrude above the surface. This would be true especially under conditions of poor visibility (for example, fog or darkness), and may be compounded by the potentially attracting or disorienting effect of lights on the structures at night. The lack of information on routes followed by most species during migration and other activities in the Beaufort Sea, and specific behavior near and vulnerability to obstructions during migration, makes it difficult to estimate potential mortality. With regard to the potential problems caused by structure lighting, under terms of the Beaufort Sea Planning Area lease sale EIS Biological Opinion prepared by the Fish and Wildlife Service (USDOI, Fish and Wildife Service, 2002), the MMS and the Fish and Wildlife Service will jointly develop a protocol for lighting systems for offshore structures that may reduce the likelihood of bird collisions with such structures.

Although the collision of a flock of waterfowl or shorebirds, or small numbers of loons, with artificial islands or drill structures could result in substantial mortality, such structures actually will be relatively small obstructions in the Beaufort Sea, very likely few in number (three or fewer; Appendix F, Table F-3), and most ducks are likely to see and avoid them when visibility is good. However, recent (late September/October 2001) bird fatalities at the currently operational Northstar island apparently occurred equally on days with good visibility conditions (although some of these may have occurred at night) and foggy conditions (Taylor, 2001, pers. commun.). In 2001, 20 birds were retrieved at Northstar island, all sea ducks, including 4 king eiders, 8 common eiders, and 8 long-tailed ducks. Because the typical density of most species in the Beaufort area during most of the period they are present is relatively low, mortality from collisions with islands or drilling structures also is likely to be low. However, during periods of migration there is a potential for substantial numbers of flocks containing large numbers of individuals to pass near such structures, with the possibility of collision by some birds. The risk is expected to be greater in areas closer to Prudhoe Bay (i.e., the Near Zone, Map 4), where exploration and development structures are most likely to be located because of proximity to primary support facilities rather than in the more distant portions of the lease area, where development is less likely to occur.

Collision of nesting waterfowl with the elevated onshore portion of pipelines is considered unlikely, because they are likely to be at a very low density near a pipeline, and most of their activities would involve walking or swimming rather than flying. Departing males and unsuccessful females flying to the marine environment could strike onshore pipelines. Overall, mortality from pipeline collisions is likely to be negligible.

IV.C.6.a(1)(a)4) Effects of Discharges

Discharges from drilling operations during exploration and development/production typically disperse rapidly in the surrounding water, although some may be deposited on the bottom near drill sites. Because bottom-feeding sea ducks and guillemots occur in dispersed flocks, relatively few are expected to occur in or rely specifically on prey potentially affected or buried at six project drill sites during the 28-year development period. Thus, discharges are not likely to cause significant effects either through direct contact with birds or by affecting prey availability as a result of the three sales individually, or all three collectively, due to the insignificance of any additive effects. Drilling structures, the source of most discharges, are likely to be quite dispersed, with just two in the Near Zone, one in the Midrange Zone, and none in the Far Zone (Map 4) for Sale 186 (Sale 195-1, 1, and 0; Sale 202-0, 0, and 1). In addition, there likely is sufficient time between sales for regional bird populations to recover from the minor effects that may result from each sale. For similar reasons, new pipeline construction (estimated to be 0 miles for Sale 186, 40 miles for Sale 195, and 35 miles for Sale 202) is not likely to cause significant effects.

IV.C.6.a(2) Effects of Development and Production

IV.C.6.a(2)(a) Effects from Routine Operations

Effects from routine operations during development and production are likely to be the same as those previously discussed under exploration.

IV.C.6.a(2)(b) Effects of an Oil Spill

IV.C.6.a(2)(b)1) Effects of Disturbance from Oil-Spill Cleanup

In the unlikely event of a large oil spill, the presence of large numbers of cleanup workers, boats, and additional aircraft is likely to displace waterfowl, loons, and shorebirds foraging in affected offshore, nearshore, and/or coastal habitats during open-water periods for one to several seasons. Disturbance during the initial season, possible lasting 6 months, is expected to be frequent. Cleanup in coastal areas late in the breeding season may disturb broodrearing, juvenile, or staging birds. Staging or migrating flocks of some species generally are dispersed and, thus, would not necessarily occur in the vicinity of the cleanup activity. As a result, relatively few flocks are likely to be displaced from favored habitats and expend energy stores accumulated for migration. However, numerous large flocks of molting long-tailed ducks in lagoons, in addition to common eiders occupying barrier islands or lagoons, are particularly susceptible if they are nesting, broodrearing, or flightless. Although little direct mortality from cleanup activity is likely predators may take some eggs or young while females are displaced off their nests if located near a site of operation. Survival and fitness of individuals may be affected to some extent, but this infrequent disturbance is not likely to result in significant population losses.

IV.C.6.a(2)(b)2) Effects of a Large Oil Spill

Exposure of loons, waterfowl, seabirds, and shorebirds to oil is expected to result in the general effects reviewed in USDOI, MMS, 1996a; USDOI, MMS, Alaska OCS Region, 2002a:Section III.C.2). Individuals would not survive moderate to heavy oil contact; most lightly oiled birds also are not likely to survive at arctic water temperatures. Swallowed oil may cause impaired physiological function and production of fewer young.

IV.C.6.a(2)(b)2)a) Vulnerability of Birds to Oil Spills

In the unlikely event a large oil spill occurs during summer or fall periods when molting, staging, or migrating waterfowl, seabirds, and shorebirds occupy open-water marine habitats, a highly variable proportion of their Arctic Coastal Plain populations could be vulnerable to oil in the Beaufort Sea (Maps 10a, 10b, and 11a). The probability of contact is lowered by species being concentrated in relatively few scattered flocks during the brief period present (Stehn and Platte, 2000: Table 1; Fischer, Tiplady, and Larned, 2002:Table 10; Maps 10a, 10b, 11a, and 11b). However, some flocks may be relatively large (mean sea duck flock size in nearshore areas = 11-34 individuals; in offshore areas, 6-22 individuals; Fischer, Tiplady, and Larned, 2002), and any contact could result in substantial losses. The risk is likely to be greater in areas closer to Prudhoe Bay (i.e., the Near Zone, Map 4) where exploration and development is likely to be more concentrated because of proximity to the primary support area than in the more distant portions of the lease area. Flocks foraging inside the barrier islands (approximately 50% of the coastline has adjacent islands) are protected to some extent from oil-spill contact. During spring migration, many migrant waterfowl arrive at the nesting areas via overland routes; thus, few of these are likely to occupy leads offshore where they would be vulnerable to oil; king eiders, however, do occupy offshore spring leads in substantial numbers, and loons and several duck species are common in nearshore leads and open water off river deltas. Waterfowl, shorebirds, and most seabirds are absent from the area essentially from late October to May. However, in the unlikely event a large spill occurs during the winter season, it is assumed that at least part of the spill would not be cleaned up prior to ice breakup and thus could contact one or more important habitat areas after ice breakup. This assumption is supported by results of the spring and fall 2000 North Slope broken-ice exercises during which it was evident that further equipment design changes will be required to enhance oil recovery in broken-ice conditions (Robertson and DeCola, 2000).

In the unlikely event a large spill occurs, the vulnerability of bird populations to oil contact is highly variable as a result of their irregular distribution during the open-water season and the relatively small period (3-5 months) during which molting, staging, and migrating individuals or flocks could be exposed to a spill. The low probability of such an event, the likelihood that a spill will not move into all portions of a given area, and the seasonal nature of the resources inhabiting the area, make it unlikely that a large oil spill would occur and contact substantial proportions of these resources. However, although long-tailed ducks, and king and common eiders, for example, are present in the Beaufort Sea region only seasonally, there is a potential for cumulative effects from contact in succeeding years when vulnerable birds are present, if all oil is not removed from the environment the first year.

The MMS Oil-Spill-Risk Analysis model predicts that the probability of oil contacting any coastal or offshore environmental resource areas out to about 55 kilometers/35 miles offshore within 30 days (see the discussion of spill-launch areas, pipelines, and environmental resource areas and identification numbers in Appendix A-1-C.1.a to C.1.h. ranges from less than 0.5-66% from spill-launch areas and 79% (Table A.2-21) from pipelines, depending on the distance between launch points and environmental resource areas (Maps A-4a and 4b). If groups of land segments are considered, contact probability from a summer spill in the easternmost launch area within 30 days in several areas of concern ranges from 0.5% at Kendall Island Bird Sanctuary in the Mackenzie River Delta to 2% at Herschel Island Territorial Park (Table A.2-87). Thus, the risk to large numbers of postbroodrearing snow geese that nest there is not substantial. However, the risk to coastal resources of the Arctic National Wildlife Refuge is substantial. The probability of summer contact in 30 days ranges from 15-49% at the Refuge's coastline from launch areas adjacent to the Refuge. This suggests potentially substantial losses of migrating long-tailed ducks (common during molt), common eiders (common migrant) and king eiders uncommon migrant) in addition to numerous individuals of several shorebird species.

If only lagoons and other coastal areas and nearshore waters are considered, the maximum probability of spill occurrence and contact drops to 21% (Table A.2-27). This suggests a lower risk of contact and assumed mortality for long-tailed ducks, the most abundant species that gather in aggregations of several thousands to molt in central Beaufort lagoons, in addition to common eiders that nest on barrier islands (Map 11b). However, contact probabilities in Simpson Lagoon and outer Harrison Bay areas, for example, where large numbers of long-tailed ducks in addition to king eiders and other species occur (Maps 10b, 11a, and 11b), range up to 23% and 38%, respectively. As noted, for purposes of modeling and determining which areas are at highest risk, the foregoing contact probabilities assume that a spill occurs; if the probability of spill occurrence is incorporated, the probability of oil contacting any environmental resource area or land segment is 2% or less (Table A.2-55).

The risk of contact is expected to be greater in the vicinity of Prudhoe Bay (i.e., Near Zone, Map 4), where more development is expected because of its proximity to the primary support facilities, than in the more distant portions of the proposed lease area. For example, two development projects are proposed for Sale 186 in the Near Zone, one in the Midrange Zone, and none in the Far Zone, while Sale 202 proposes one development only in the Far Zone.

IV.C.6.a(2)(b)2)b) Mortality from an Oil Spill

Aerial surveys conducted in the Harrison Bay to Mikkelsen Bay area by the Fish and Wildlife Service in 1999 and 2000 recorded substantial numbers of about 20 bird species distributed along the shoreline and seaward to about 60 kilometers (Fischer, Tiplady, and Larned, 2002; Stehn and Platte, 2000; Maps 10a,b and 11a). Estimates of oil-spill mortality for that portion of the coastal plain population occupying this marine area after nesting were calculated using a model that simulated oil-spill movement over time. In addition to the necessity of assuming large oil-spill occurrence, an unlikely event, the authors state that the predictive value of their model was constrained by the incorporation of a number of important assumptions that contribute to the uncertainty of final model estimates of numbers of birds exposed to oil. These assumptions include (1) errors inherent in estimating numbers of birds present in or passing through a prescribed area during aerial surveys performed at one point in time, (2) no consideration of turnover rates or duration of time a bird spends on the water at a specific site or movements during the period a spill was present, (3) the possibility that the areas sampled on limited surveys do not accurately represent all areas occupied by each bird species, (4) assumption of uniform rather than clumped bird distributions, and (5) limitations of the bird density/oil-spill-trajectory overlay analysis that made the final estimates of numbers of birds exposed to oil less certain. Together, these have considerable potential to influence the number of deaths predicted to result from the oil-spill scenarios analyzed, and indicate the difficulty of determining the actual levels of mortality. However, even if the model lacks precision, the relative magnitudes and patterns of exposure of birds to oil calculated by the model should have application for the management and protection of birds using the Beaufort Sea area.

Long-tailed ducks were the most abundant species found in the nearshore or offshore Beaufort Sea area during these surveys (i.e., up to 37,792 estimated to be present during one survey period), followed by king eiders (19,842), scoters (4,814), common eiders (3,300), glaucous gulls (2,478), and Pacific loons (764). Using average estimated bird-density calculated from these values, and average severity of spill-trajectory paths (i.e., numbers of birds exposed to oil averaged across all possible spill paths and bird densities) and, thus, exposure of birds to oil, the Fish and Wildlife Service model estimates, for example, that at average bird densities and severity of oil-spill movement an average of 1,443 long-tailed ducks, 232 king eiders, 147 scoters, 159 common eiders, 217 glaucous gulls, and 23 Pacific loons could be exposed to a large spill (5,912 barrels) within 30 days in July (Stehn and Platte, 2000). In August, comparable exposure values were 2,062 long-tailed ducks; 8 king eiders; 22 scoters; 125 common eiders; 72 glaucous gulls; and 9 Pacific loons.

These values may represent conservative estimates for potential mortality during the molting period of long-tailed ducks and common eiders, because some proportion would be unable to avoid a spill by flying away. Also, substantial numbers of birds migrating westward from eastern localities could temporarily stop and join those molting or staging in a given area thereby increasing the numbers that could be exposed to a spill there; in each successive area to the west, this effect could be multiplied as more birds join the westward migration stream. Estimates of maximum mortality, calculated from the interaction of higher bird densities and spill movements that expose larger numbers of birds to oil, are 4-19 times as large as the mean values. Also, many individuals of several species remain in the Beaufort beyond the date of the last surveys made during the Fish and Wildlife Service study. In fact, only data that allow determination of waterbird densities are useful for making such mortality estimates, using the MMS oil-spill-model estimates of area covered by a spill. Prior to the migration period, it is reasonable to assume that offshore densities would dictate the number of individuals exposed to a spill and not the larger number passing during the migration period. During migration periods, potentially much greater mortality could occur, as new migrants enter the spill area. However, unless migrant sea ducks alight on the water during migration, they are not particularly susceptible to oiling. In addition, a spill in a particular area during summer would not necessarily move far enough to substantially affect those birds moving offshore from nesting areas much farther to the west, but it could oil migrants from the east. For example, a spill in the Prudhoe Bay area probably would not affect a substantial proportion of birds that nest on the western coastal plain, but it would be expected to potentially affect those flying across the Beaufort from Canada and eastern Alaska.

The MMS oil-spill model predicts that a 4,600-barrel oil spill, an unlikely event, would occupy a discontinuous area (i.e., oil assumed to sweep over the entire spill area, but at any given moment appears as a series of separate patches of oil) of about 320 square kilometers after 30 days (Table IV.A-6b). This suggests that, for example, using the bird densities in Stehn and Platte (2000) for the central Beaufort area, along some nearshore lagoon areas it would not be unusual for about 773-5,372 long-tailed ducks to be oiled and, in areas east of Mikkelsen Bay, a spill could contact up to 23,600 molting individuals. Other species with smaller numbers dispersed in this area are likely to experience lower mortality from a spill, for example: 176 king eiders, 91 scoters, 568 common eiders, 487 glaucous gulls, and 17 Pacific loons. The model also predicts about 49 kilometers of coastline would be oiled as a result of a spill of this size, suggesting that hundreds to low thousands of shorebirds (Larned et al., 2001) that pause along the coast during migration potentially could be exposed to beached oil.

Survey data obtained in late July 2001 (Fischer, 2002) spanning the Beaufort from Point Barrow to Demarcation Point suggest that offshore bird distributions across this area generally were similar to those found within the more extensively surveyed central area in 1999 and 2000 (Maps 10a and 10b; note that apparently higher offshore bird densities in the central Beaufort Sea region, as compared to areas farther east or west, may be partly an artifact of sampling intensity. This is because aerial survey flight lines along which birds were counted during 1999 and 2000 were separated by only 5.4 kilometers and confined to the area between Harrison Bay/Cape Halkett to Mikkelsen Bay/Brownlow Point in the central area, as compared to 10 kilometers in the 2001 survey, which covered the entire Alaskan Beaufort coast from Point Barrow to Demarcation Point. Thus, lines along which birds are plotted are closer together and almost twice as numerous in the central area as to the east and west. A notable exception was observed for the king eider, which was distributed farther offshore than in July 1999 or 2000 and almost exclusively west of Harrison Bay (Map 11a). This suggests that in some years, substantial numbers of king eiders could be vulnerable in this area; a 4,600-barrel spill could contact an area containing 544 of these eiders in 30 days. However, in this portion of the Far Zone, little development is expected because of its distance from primary support facilities at Deadhorse.

Of the three proposed sales, Sale 186 with two development projects in the Near Zone and one in the Midrange Zone would present the greatest potential for exposing birds to an oil spill, because these two zones are where most molting, staging, and migrating birds are found.

IV.C.6.a(2)(b)2)c) Population Effects

The effect of the death of several thousand long-tailed ducks on the regional population may be substantial, regardless of whether the current population is 67,010 and undergoing a significant recent decline, as estimated by the Fish and Wildlife Service Aerial Breeding Pair Survey (Mallek, 2001), or 35,609 and either stable or slightly increasing, as estimated by the Fish and Wildlife Service Eider Breeding Population Survey, which is conducted annually about 2 weeks earlier (Larned et al., 2001). However, mortality at the higher levels predicted by the Fish and Wildlife Service oil-spill model is expected to result in a significant long-term adverse effect on the regional population. If the results of the eider survey accurately reflect the current population situation, recruitment could replace a portion of the loss within several generations; if the breeding pair survey results are more accurate and the population is in fact declining significantly, we would not expect recovery until the population stabilizes or is increasing.

The recovery period required for a loss from the suite of species typically occupying the nearshore and offshore Beaufort Sea of up to about 10,000 individuals is difficult to estimate, because species will recover at different rates. Most species with low reproductive rates or population levels (for example, loons, common eider, black guillemot) are not likely to suffer high mortality as a result of an oil spill, because they are not abundant in most of the proposed the sale areas and do not occur in large feeding flocks, although any losses would be recovered slowly due to relatively low reproductive rates. In the case of king and common eiders, because they have experienced substantial losses over the past several decades, mortality at the higher levels estimated by Fish and Wildlife Service data are expected to represent a significant effect.

The relatively small losses of most species, other than the long-tailed duck, likely to result from an oil or fuel spill in the Beaufort Sea may be difficult to separate from natural variation in population numbers. This has been found for other waterbird populations under similar circumstances (for details, see USDOI, MMS, 2002: Section III.C.2.a(2)). Regardless of the factors involved in causing mortality, complete recovery of the Arctic Coastal Plain populations of some species (such as eiders) from even small losses in the proposed lease area would not occur until their populations, which apparently have been declining since 1992, stabilize or are increasing (Larned et al., 1999; Larned, Platte, and Stehn, 2001; USDOI, Fish and Wildlife Service, 1999). This probably is due to these species' low reproductive rate. Recruitment of individuals into the population under such circumstances is likely to be low and losses from spill mortality, intensified by low productivity or lowered survival of any age groups, is likely to increase the length of time required for recovery to former population levels, once the population status becomes favorable to this occurrence. In the absence of specific information bearing on this question for any species occurring in the Beaufort Sea, it is reasonable to assume that any additional mortality occurring as a result of oil and gas development could increase not only the rate of decline for a declining species, at least temporarily, but also would delay the point (i.e., extend the time to status reversal) at which the population could enter a recovery mode (population decline reversed). Also, if additional mortality increases the rate of decline, the population presumably would decrease to a lower level over a given interval and, thus, it should take the population longer to recover to a specified former level (i.e., delay recovery) at a given rate of increase.

Because the small amount of information on factors such as rates of productivity, survival, and recruitment into the population currently available makes it difficult to determine the recovery rate of either local or entire coastal plain populations from incidents causing mortality, the long-term effect of oil-spill mortality is uncertain. Also, different rates of decline could be ongoing in various parts of the population but undetected between individual survey years by current survey methodology (King and Brackney, 1995; Mallek and King, 2000). Currently, numbers of most species on the coastal plain generally appear to be stable, or increasing or declining at nonsignificant rates (Larned et al., 2001; Larned, Platte, and Stehn, 2001; USDOI, Fish and Wildlife Service, 1999).

Of major species surveyed, only the red-throated loon population appears to be declining at a significant rate (Larned, et al., 2001; Gotthardt, 2001). Arctic tern and brant populations are increasing significantly. Those populations declining at nonsignificant rates include the yellow-billed loon, Sabine's gull, Canada goose, and snowy owl. Nonsignificant upward trends are displayed by the Pacific loon, jaegers, glaucous gull, northern pintail, greater scaup, long-tailed duck, king eider, snow goose, white-fronted goose, tundra swan, small shorebirds, and short-eared owl. When a population is declining, the point at which recovery from any oil spill or other mortality associated with oil and gas development begins will be delayed until the species recovers from its decline. In addition, recovery from mortality associated with the first sale, which is likely to involve the largest losses of the three sales due to the presence of two drill sites in the relatively small Near Zone where bird activity is concentrated, could be delayed by any mortality resulting from development associated with the following two sales. With any substantial mortality, which could occur if substantial proportions of migrants from nesting areas outside a contacted spill area were to be affected, the potential exists for a significant adverse effect on Beaufort Sea populations of eiders and long-tailed ducks.

IV.C.6.a(2)(b)2)d) Effects of Decreased or Contaminated Prey Populations

Local reduction or contamination of food sources in the unlikely event a large oil spill occurs also could reduce survival or reproductive success of the portion of populations occupying or nesting in the local area affected. This generally is not likely to affect a large proportion of any species' regional population, because most exhibit a dispersed breeding distribution. However, it could be a serious effect for species with low reproductive rates, with a relatively small regional population, and/or that is experiencing periods of regional population decline in the past decade, such as the northern pintail, long-tailed duck (some surveys), and red-throated loon. Effects during seasonal migration, when birds are more likely to occur in flocks and require high levels of energy intake, could have a more severe population effect. Lowered food intake may slow the completion of growth in young birds, the replacement of female energy reserves used during nesting, and energy storage for migration of all individuals. However, the contamination of some local habitat areas is not likely to affect a large proportion of the regional bird populations, because they are likely to have access to alternative foraging habitat similar in appearance and with similar prey organisms present that is widely distributed in the region (for details, see USDOI, MMS, 2002:Section III.C.2.c).

Conclusions. The adverse effects on marine and coastal birds from normal exploration and development/production activities during three sales in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, recovery from small losses or declines in fitness or productivity of populations currently declining at a nonsignificant rate, in addition to those declining at a significant rate, would be delayed until the population stabilizes or increases. No significant overall population effect is likely to result from small losses for most species.

In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far zone due to the greater likelihood of oil development in the former area.

Effectiveness of Mitigating Measures. Several mitigating measures will be considered for the Beaufort Sea sales that may offer some protection to spectacled eiders. This includes the ITL clause on Bird and Marine Mammal Protection. Most of the remaining stipulations and ITL clauses are not pertinent to protection of birds, or would provide minimal benefits to individuals and no measurable benefit to the regional populations of the various species, many of which are relatively small and/or widely dispersed. For example, Stipulations 6a and 6b, prohibition of permanent facilities within 10 miles of Cross Island, would remove some obstructions to movements of species such as loons, the long-tailed duck, king eider, and common eider, thereby decreasing the potential for collision. However, although individuals of these species might benefit minimally, it appears that it would be virtually impossible to measure benefit at the population level.

The ITL on Information on Bird and Marine Mammal Protection advises lessees that they and their contractors are subject to the requirements of the Endangered Species Act, in particular the incidental take provisions, and applicable International Treaties. This section of the ITL does not provide any direct protection for bird species, but it does provide information to lessees and their contractors that there may be special regulatory provisions in International Treaties that govern interactions with marine and coastal birds in the Beaufort Sea region. Lessees also are advised by this ITL that behavioral disturbance of most birds found in or near the lease area would be unlikely if aircraft and vessels maintain at least a 1-mile horizontal distance and aircraft maintain at least a 1,500-foot vertical distance above known or observed wildlife concentration areas. If lessees and their contractors adhered to these recommendations it is unlikely that any of these species would experience significant disturbance effects, a definite benefit, particularly for populations of those species that declined severely in recent decades.

IV.C.6.b. Effects of Alternatives and Sales

IV.C.6.b(1) Effects of Alternative I for Sale 186

The effects of normal activities on marine and coastal birds under Alternative I for Sale 186 oil and gas exploration and development are likely to be about the same as those described in Section IV.C.6.a (Effects Common to All Alternatives). This is because although birds using the marine environment apparently are relatively abundant and, thus, vulnerable to disturbance or oil-spill contact in the central and western Beaufort Sea (Fischer, 2002; Fischer, Tiplady, and Larned, 2002), the general effects discussed above primarily would occur in the vicinity of central Beaufort primary support facilities where the Near and Midrange zones (Harrison Bay to Mikkelsen Bay, Map 4) are likely to contain 90% of the Sale 186 leasing activity and all three development projects (Table IV.A-4) and, thus, where most adverse effects are likely to occur. Fewer birds are likely to occur in the central offshore portions of the Far Zone, where only 10% of the leasing and exploration activity and no development projects are likely to occur as a result of this sale.

Potential effects include disruption of foraging or other activities, particularly in the vicinity of primary support facilities where converging support aircraft routes could cause more intensive disturbance than in distant (Far Zone) areas and, thus, displacement of birds from near helicopter- and vessel-traffic routes during construction and operational activities in the open-water season (Map 10a). Collision with offshore structures is likely to be the greatest source of mortality during normal operations. Brief disturbances (a few minutes to a few days) are not likely to have a significant effect on overall bird movements and distribution. However, recovery from any collision losses would not occur for species whose regional populations remain in a declining status (most currently are nonsignificant rates of decline).

In the unlikely event a large oil spill occurs under Alternative I for Sale 186, small to substantial numbers of birds could be killed. This could include 773-5,372 molting long-tailed ducks and, in areas east of Mikkelsen Bay, a spill could contact up to 23,600 individuals (Map 10b). Other species with smaller numbers dispersed in this area are likely to experience lower mortality from a spill, for example: 176 king eiders, 91 scoters, 568 common eiders, 487 glaucous gulls, and 17 Pacific loons. Mortality at the higher levels predicted by Fish and Wildlife Service data (Stehn and Platte, 2000) could result in significant effects for long-tailed ducks and king and common eiders. Recovery of losses would not occur for those species whose regional populations are in declining status. The probability of spill contact within 30 days in sea segments and other environmental resource areas that are contained within the spill launch areas most likely to contain development in Sale 186 ranges up to 55% for spill-launch areas and 64% for associated pipelines. These risk values are lower than those obtained if leasing occurred throughout the planning area with equal intensity. This is likely, because most leases and developments are likely to occur in the Near Zone (70% of leasing and two developments) or nearby portions of the Midrange Zone (20% and one development) close to centrally located primary support facilities in Deadhorse, rather than farther offshore or west where there are some environmental resource areas used by several marine and coastal species that have higher contact probabilities.

Conclusions. The effects from activities associated with Alternative I for Sale 186 include nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by marine and coastal birds that have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality would not occur in any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects of an unlikely large oil spill could result in significant effects for long-tailed ducks and king and common eiders.

IV.C.6.b(2) Effects of Alternative I for Sale 195

The effects of normal activities marine and coastal birds under Alternative I for Sale 195 oil and gas exploration and development are likely to be about the same as those described in Section IV.C.6.a - Effects Common to All Alternatives, and somewhat less than under Sale 186. This is because although most species apparently are relatively abundant and, thus, vulnerable to disturbance or oil-spill contact in the central and western Beaufort Sea (Fischer, 2002), the general effects discussed primarily would occur in the vicinity of central Beaufort primary support facilities (Near and Midrange zones, Map 4) where 80% of the Sale 195 leasing activity and two development projects (Table IV.A-4) are likely to occur and, thus, where most adverse effects are likely to occur. The decrease from Sale 186 is because a large proportion of staging or migrating birds pass through the Near Zone where a lower proportion of the leasing and exploration, and just one development under Sale 195 as compared to two developments under Sale 186, are likely to occur. Similar intensity of lease activity and the same amount of development likely to be occurring in the Midrange Zone (Map 4) under the two sales probably would have little effect. Fewer birds and, thus, less chance of impacts, are likely to occur in the centrally located offshore portions of the Far Zone, where it is most likely a major proportion of the 20% of leasing and exploration activity and no development projects are likely to occur as a result of this sale.

Potential effects include disruption of foraging or other activities, particularly in the vicinity of primary support facilities where converging support aircraft routes could cause more intensive disturbance than in distant (Far Zone) areas and, thus, displacement of birds from near helicopter- and vessel-traffic routes during construction and operational activities in the open-water season. Collision with offshore structures is likely to be the greatest source of mortality during normal operations. Brief disturbances (a few minutes to a few days) are not likely to have a significant effect on marine and coastal bird movements and distribution. However, recovery from any collision losses would not occur for any regional populations that are in declining status (most species currently are increasing, stable or in non-significant decline).

In the unlikely event a large oil spill occurs under Alternative I for Sale 195, small to substantial numbers of several species could be killed, including an average of 773-5,372 molting long-tailed ducks; in areas east of Mikkelsen Bay a spill could contact up to 23,600 individuals (Stehn and Platte, 2000). Other species with smaller numbers dispersed in this area are likely to experience lower mortality from a spill, for example: 176 king eiders, 91 scoters, 568 common eiders, 487 glaucous gulls, and 17 Pacific loons. Mortality at the higher levels predicted by Fish and Wildlife Service data (Stehn and Platte, 2000) could result in significant effects for long-tailed ducks and king and common eiders. Recovery of losses would not occur for those species whose regional populations are in declining status. The environmental resource areas that occur within the spill-launch areas that are most likely to contain development under Sale 195 within 30 days is the same as for Sale 186. These risk values are lower than those obtained if leasing occurred throughout the planning area with equal intensity. This is a likely result, because most leases and developments are likely to occur in the Near Zone (50% of leasing and one development) or nearby portions of the Midrange Zone (20% and one development) close to centrally located primary support facilities in Deadhorse, rather than farther offshore or west in the vicinity of some areas with higher spill contact probabilities.

Conclusions. The effects from normal activities associated with Alternative I, Sale 195 include nonsignificant disturbance and the potential loss of small numbers of birds from collisions with structures. Disturbance of birds in the Near Zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is likely to occur there, while lease activity in the Midrange Zone is somewhat greater but the number of development projects is the same. In the event a large oil spill occurs, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by several bird species that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil spill mortality would not occur for any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects are likely to be somewhat less than those that could occur as a result of Sale 186 but still could result in significant effects for long-tailed ducks and king and common eiders.

IV.C.6.b(3) Effects of Alternative I for Sale 202

The effects of normal activities under Alternative I for Sale 202 oil and gas exploration and development on marine and coastal birds are likely to be considerably less than described for Sales 186 or 195. This is because although 30% of the leasing and exploration activity and the only development project are likely to occur in the Far Zone (Map 4), such activity is likely to take place offshore of the centrally located primary support facilities where relatively few birds are likely to consistently occur. The remainder of this zone lies from offshore Harrison Bay to Point Barrow, where several species may be relatively common (eiders, long-tailed ducks, Pacific loons) but leasing is less likely, because development sites would be far removed from industrial infrastructure.

Potential effects include disruption of foraging or other activities or displacement from within about 1-2 kilometers (0.62-1.2 miles) of helicopter routes to drill sites and vessel traffic during construction and operational activities in the open-water season. Collision with offshore structures is likely to be the greatest source of mortality during normal operations. Brief disturbances (a few minutes to a few days) are not likely to have a significant effect on bird movements and distribution. However, recovery from any collision losses would not occur for any regional population in declining status (most species currently are increasing, stable, or in nonsignificant decline).

In the unlikely event a large oil spill occurs under Alternative I for Sale 202, small numbers of a few species could be contacted and die, although the likely area of development (60% of leasing in the Midrange and Far zones, and just one development in the latter) is beyond the areas where most species would occur in abundance. Recovery of losses would not occur for any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195; however, under conditions favorable to an oil spill spreading toward the shore, they still may result in significant effects for long-tailed ducks and king and common eiders.

Conclusions. The effects from activities associated with Alternative I, Sale 202 include a small amount of nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. The risk of oil-spill contact is relatively low, because only one development is likely, most likely located where most species are relatively scarce. Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.

IV.C.6.b(4) Effects of Alternatives III, V, and VI for All Sales

Alternative III (Barrow Subsistence-Whaling Deferral) would defer leasing and development in some offshore and western Far Zone areas, where the probability of oil-spill contact within 30 days is relatively high and marine and coastal birds are known to occur. However, the likelihood that leasing and development would occur this far from primary support infrastructure is low under any of the three sale scenarios, and effects from normal activities or an oil spill under these alternatives are likely to be the same as under Alternative I for Sales 186, 195 and 202.

Alternatives V (Kaktovik Subsistence-Whaling Deferral) and VI (Eastern Deferral) would defer leasing and development in areas where most marine and coastal bird species are relatively less common than to the west. In addition, because these areas are relatively far removed from primary support facilities in the vicinity of Deadhorse, it is less likely that leasing and development would occur there than in the central Beaufort area. Effects from normal activities or an oil spill under these alternatives for any of the three sale scenarios are likely to be the same as under Alternative I for Sales 186, 195, and 202.

Conclusion: Because Alternatives III, V, and VI defer areas well removed from primary support facilities in the central Beaufort, where most leasing and development is likely to occur, effects from activities and any oil spill associated with any of the three sales on marine and coastal birds are likely to be the same as under Alternative I for Sales 186, 195, and 202.

IV.C.6.b(5) Effects of Alternative IV for All Sales

Alternative IV (Nuiqsut Subsistence-Whaling Deferral) would defer leasing and development in central Beaufort Sea areas, where several species of marine and coastal birds are relatively abundant during at least part of the open-water season. Aerial survey in this area suggest that in nearshore areas ranging approximately from 19-301 square kilometers, and an offshore area approximately 4,914 square kilometers in area, up to 17,497 long-tailed ducks, 6,201 king eiders, 1,075 common eiders, and 105 Pacific loons could be present (Stehn and Platte, 2000). Because these deferrals are likely to substantially lower the probability of oil contact in these areas in the unlikely event a large oil spill were to occur, the risk of contact and presumably the effects on these bird populations that could result are likely to be decreased substantially.

Conclusion. The effects from activities associated with Alternative IV on several bird species are likely to be somewhat less than under Alternative I for Sale 186; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.

IV.C.7. Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales)

Seven species of nonendangered marine mammals—ringed, spotted, and bearded seals; polar bears; walruses; and beluga and gray whales—commonly occur year-round or seasonally in a portion of or throughout the Beaufort Sea Planning Area. Some individuals of these species are likely to be exposed to some OCS exploration and development and production activities as a result of the proposed Sales (186, 195, and 202).

IV.C.7.a. Effects Common to All Alternatives

The following effects to marine mammals would be the same for all alternatives and sales and as the result of routine operations for exploration and development and production. Section IV.C.7.a(2) describes effects that might occur in the unlikely event of a large oil spill.

IV.C.7.a(1) Effects of Exploration

The effect of exploration would occur primarily from routine operations. The unlikely effects associated with a very unlikely very large oil spill (a blowout) are discussed in Section IV.I.2.g.

IV.C.7.a(1)(a) Effects of Noise and Disturbance from Routine Exploration Activities

The primary sources of noise and disturbance of ringed, bearded, and spotted seals; polar bears; and beluga and gray whales would come from the air and marine traffic associated with Beaufort Sea oil exploration. More specifically, sources would come from the supply boats, icebreakers, and helicopters associated with the assumed one to two exploration-drilling platforms per year. Secondary disturbance sources would be low-frequency noises from drilling operations on the one to two exploration-drilling rigs and nine production platforms (see Section IV.A.2 and 3 and Table IV.A.1-4). Aircraft traffic, about 140-155 helicopter round trips per year over a 2- to 4-year exploration period (140 in the Far Zone to 155 in the Near and Midrange zones), would be centered primarily out of Deadhorse-Prudhoe Bay, traveling to and from the one to two exploration platforms per year. This traffic is assumed to be a source of primary disturbance to some bearded and ringed seals hauled out on the ice and polar bears traveling on the ice within the planning area (Point Barrow east to Demarcation Bay). Some beluga and gray whales might be diverted by helicopter noise up to 100 meters away (Richardson et al., 1998). Such brief, occasional disturbances are not likely to have any serious consequences for these cetaceans (Richardson et al., 1991; 1998).

Some of the air traffic to and from the one to two exploration-drilling platforms (see Table IV.A.1) could disturb hauled-out seals and walruses, causing them to charge in panic into the water. Because of frequent low visibility due to fog, aircraft may not always be able to avoid disturbing seals and walruses hauled out on the ice. Aircraft disturbance of hauled out seals and walruses in the planning area could result in injury or death to some young seal pups and walrus calves. Although air-traffic disturbance would be very brief, the effect on individual seal pups and walrus calves could be severe, if the pups or calves were injured or abandoned by their mothers. The number of seals and walruses affected is expected to be small due to the low number of disturbance incidents expected under the proposed activities during exploration. Aircraft disturbance of small groups of spotted and ringed seals hauled out along the coast or disturbance of bearded and ringed seals hauled out offshore near the one or two drill platforms is expected to result in the death, injury, or abandonment of no more than small numbers (fewer than 10) of seals. Increases in physiological stress of adult or juvenile seals caused by the disturbance might reduce the longevity of some seals, if disturbances were frequent. However, the number of disturbances likely would be relatively infrequent, given that the helicopter flight paths will vary depending on the locations of the exploration platforms and the scattered distribution of seals and walruses in the planning area. During the beluga whale migration, some of the aircraft traffic over open-water ice leads temporarily may divert the migration movements of some beluga whales as the aircraft pass overhead or nearby, but these reactions are not likely to be biologically significant (Richardson et al., 1995b).

Boat traffic (between about 7 and 14 supply boat trips per year during exploration (see Table IV.A-4) could briefly (a few days) disturb some marine mammals within a lead system and may temporarily interrupt the movements of beluga and gray whales and seals or temporarily displace some animals when the vessels pass through the area. However, there is no evidence to indicate that vessel traffic would block or delay marine mammal migrations. In fact, severe ice conditions are likely to have a far greater influence on spring and fall migrations than vessel traffic associated with oil exploration. Such traffic is not likely to have more than a short-term (a few hours to a few days) effect on marine mammal movements or distributions; but the displacement of pinnipeds, polar bears, beluga and gray whales could affect the availability of these animals to subsistence hunters for that season. Icebreaker activity and offshore ice-road construction also physically might alter some ice habitats and destroy some ringed seal lairs in pack-ice areas, perhaps crushing or displacing some ringed seal pups and perhaps displacing some denning polar bears.

IV.C.7.a(1)(b) Effects of Seismic Activities

We assume that geophysical shallow-hazard surveys (162 square miles during exploration) would be shot over an estimated 7 days, primarily during the open-water seasons, using about two vessels per year (see Table IV.A-4). Geophysical site-clearance surveys for a block survey would occur during development in association with production-platform installation; and high-resolution seismic-survey lines are assumed to be run in association with the laying of about 115 miles of offshore pipelines under Alternative I for Sales 186, 195, and 202.

Ringed seals pupping in floating-shorefast-ice habitats within about 150 meters (490 feet) of the on-ice shot lines, and female polar bears that may be denning within a mile of the shot lines, could be disturbed by on-ice seismic exploration. However, the number of ringed seal pups and polar bears that possibly could be affected as a result of this very low level of disturbance is likely to be no more than a few hundred seals and a few bears, considering the low density of breeding seals and the dispersed distribution of denning polar beards in the Beaufort Sea, and would represent no more than a short-term (less than 1 year) effect on the seal and polar bear populations. Aerial surveys of ringed seals during the spring to monitor their distribution after winter ice road and seismic operations from 1997-1999 indicated no significant effect on ringed seal density (Moulton et al., 2002).

Similar to other boat traffic, open-water, active seismic activities are likely to result in startle responses by ringed, bearded, and spotted seals; polar bears; and beluga and gray whales near the sound source. The zone of influence is estimated to be within an area (out to 4.9 kilometers) where sound levels form seismic activities exceed 160 decibels (Harris, Miller, and Richardson, 2001). As with other vessel traffic, this disturbance response is likely to be brief; and the affected animals are likely to return to normal behavior patterns within a short period of time after a seismic vessel has left the area. If the presence of noise from industrial activity occurred very near coastal subsistence areas and reduced or delayed the use of these habitats by marine mammals, the availability of these subsistence resources to villagers could be adversely affected for that season (see Section IV.C.11 - Subsistence-Harvest Patterns).

IV.C.7.a(1)(c) Summary

The effect of exploration only is expected to be low, with only brief disturbances of small numbers of pinnipeds, polar bears, and beluga and gray whales from air and vessel traffic, with recovery from any disturbance event occurring within less than 1 day.

IV.C.7.a(2) Effects of Development

Noise and disturbance, alteration of habitats, and oil pollution during development could adversely affect some portion of these marine mammal populations found in the proposed Sale 186, 195, and 202 areas.

Traditional Knowledge on Disturbance of Seals and Polar Bears. Natives of the North Slope are concerned that noise heard miles away from drilling platforms may drive ringed and bearded seals away from subsistence-hunting areas (Philip Tikluk from the village of Kaktovik, as cited in Kruse et al., 1983). This may happen during construction when high levels of industrial activity occur. Thus, construction could displace some ringed and bearded seals for up to two seasons or 2 years within perhaps 1 kilometer of offshore pipeline and platform installation sites. However, the presence of exploration and production islands in the Beaufort Sea could result in the formation of leads and cracks in the ice on the leeward side of the island. Such local changes in the ice habitat after island construction is completed could attract seals that, in turn, could attract polar bears to the drilling platforms, as was reported in association with exploration gravel islands in the Canadian Beaufort Sea (Stirling, 1988).

Constructing gravel islands in the seals' ice habitats and breathing-hole ice habitats is a concern (Akootchook, 1986, pers. commun.).

IV.C.7.a(2)(a) Effects of Routine Operations

IV.C.7.a(2)(a)1) Effects of Noise and Disturbance

Airborne or underwater noise associated with OCS activities is the main source of disturbance of seals, walruses, polar bears, and gray and beluga whales.

IV.C.7.a(2)(a)1)a) Airborne Noise

Major sources of mobile airborne-noise disturbance are low-flying aircraft and high-speed motorboats and other high-frequency, high-pitched sounds. Low-flying aircraft are known to panic hauled-out seals and walruses (Johnson, 1977; Salter, 1979). If walrus nursery herds in the far western portion of the sale area are hauled out on the ice, disturbance may result in the death or injury of walrus calves from trampling by disturbed adults. If disturbance of hauled-out seals occurs frequently during molting, the successful regrowth of skin and hair cells may be retarded, increasing physiological stress on seals during a normally stressful period. Increases in physiological stress possibly could decrease fertility and longevity of affected seals. Aircraft-noise disturbance of beluga whales from flyovers generally is very transient, with events not lasting more than a few seconds (Stewart, Awbrey, and Evans, 1983). Belugas reacted to a low-flying (at an altitude of less than or equal to 250 meters [820 feet]) helicopter by diving, veering away, or showing other changes in behavior; however, most whales showed no obvious reaction to single passes of helicopters at altitudes greater than or equal to 150 meters (Richardson et al., 1995b). Such brief disturbances are not likely to have any serious consequences to beluga or gray whales.

Major stationary sources of airborne noise include construction of artificial islands and dredging and drilling operations. These activities may disturb hauled-out seals, walruses, and polar bears occurring within a few kilometers of the noise sources. However, underwater noises borne from these sources could influence marine mammals over a greater area. Land-based industrial activities and human presence near polar bear dens pose potentially serious disturbances. However, some denning polar bears tolerated ice-road traffic (400 meters away) and seismic testing as close as 135 meters from their dens (Amstrup, 1993). Only noise from seismic operations within 100 meters and a helicopter taking off within 3 meters of the den could be notably heard above background sounds within the den (Amstrup, 1993). Experience with captive female polar bears suggests that these bears can be especially sensitive to noise and human presence during maternity denning. Onshore seismic activities within 1.8 kilometers of a grizzly bear den caused changes in heart rate and movement of the female bear and cubs (Reynolds, Reynolds, and Follman, 1986). Human scent and other noises near maternity dens also may disturb the bears. The latter investigators suggest that seismic-testing activities within 200 meters of the den may cause abandonment of the den. If a female bear with cubs is forced to prematurely abandon a den, the survival of the cubs is likely to be low (Amstrup and Garner, 1994).

IV.C.7.a(2)(a)1)b) Underwater Noise

Sound is more efficiently transmitted and travels at a greater velocity in water than in air. Underwater sound-propagation loss is higher in shallow water than in deepwater (Greene, 1981). Bottom material, structures, and the undersurface of ice cover strongly influence sound transmission; and propagation of most sound frequencies is greater in summer than in winter in the Beaufort Sea (Greene, 1981). Mobile sources of industrial underwater noise primarily include support vessels, icebreakers, seismic boats, and aircraft; stationary sources include active dredges, drill rigs, drillships, and offshore-production and -processing facilities.

Underwater noise may alarm beluga whales and pinnipeds, causing them to flee the sound source. For example, Fraker, Sergeant, and Hoek (1978) reported the startled response and flight of beluga whales from barges and boats traveling through a whale-concentration area. In two documented cases, Finley and Davis (1984) reported strong fleeing reactions by beluga whales when icebreaker ships approached at distances of 35-50 kilometers. The whales were displaced or moved over 80 kilometers along the ice edge, or they stopped moving within 20 kilometers when they reached coastal waters (Finley and Davis, 1984). Stewart, Awbrey, and Evans (1983) reported that beluga whales responded to outboard-motor noises by immediately moving downriver away from the source; but whale exposure to playback recordings of drilling sound had little effect on the movement and general activity of the whales. Reactions of beluga whales or pinnipeds to noise sources, particularly mobile sources such as marine vessels, are likely to be highly variable depending on the animals' prior exposure to the disturbance source and their need to be in a particular habitat area where they are exposed to the noise and visual presence of the disturbance sources. For example, beluga whales foraging within the busy fishing grounds of Bristol Bay may be more tolerant of boat traffic, with shorter recovery times and shorter displacement distances from passing fishing vessels, than migrating belugas that reacted to icebreaker traffic in Lancaster Sound (located between Baffin and Devon islands in the Canadian arctic islands), as reported by Finley and Davis (1984). The latter whales may be "naïve" with respect to vessel noise (Finley and Davis, 1984).

Because vocalizations are an important source of communication between mother and pups in pinnipeds, underwater noise may interfere with or mask reception of marine mammal communication (Perry and Renouf, 1987), or it may interfere with the reception of other environmental sounds used by marine mammals for navigation (Terhune, 1981). Noise produced by outboard motors operating at high speeds may have the greatest potential for interfering with beluga whale communication and some echolocation signals (Stewart, Awbrey, and Evans, 1983), but exposure to this interference source is likely to be very transient. Low-frequency noises from drilling platforms would not mask the high-frequency echolocation signals of beluga or other toothed whales (Gales, 1982). Theoretically, very noisy drilling platforms may slightly mask low-frequency whale sounds out to a range of 35 miles (56 kilometers), but the possible masking range more likely would be limited to about 3 miles (4.8 kilometers) (Gales, 1982). If the distance between communicating whales does not exceed their distance from the platforms, no appreciable interference is likely to occur (Gales, 1982).

Experiments exposing captive beluga whales to recorded drilling sounds suggest that whales can acclimate quickly to typical oil-drilling sound levels (Aubrey et al., 1984). Informal observations of beluga whales near drilling platforms in Cook Inlet support this suggestion (McCarty, 1981). Beluga whales did not react to recorded drilling noise in the Beaufort Sea at distances greater than 200-400 meters, even though the projected drilling noise was measurable up to several kilometers away ((Richardson et al., 1995b). At distances beyond 200 meters, received levels of low-frequency drilling sounds usually were less than the measured hearing sensitivity of beluga whales. The potential beluga and gray whale disturbance radius used for monitoring industrial noise associated with construction of the Northstar oil development was 1-2 kilometers (Richardson and Williams, 2001).

Received noise levels associated with nearshore (25 kilometers of the shore) open-water geophysical seismic activities in the Beaufort Sea in 1998 diminished below 160 decibels (ambient noise levels) at distances less than 4 kilometers (Richardson, 1999). The operation of a seismic airgun array had effects on the distribution and the behavior of some ringed, bearded, and spotted seals within a few hundred meters of the array (Richardson, 1999).

Intense noise could damage the hearing of marine mammals or cause other physical or physiological harm (Geraci and St. Aubin, 1980; Hill, 1978). Probably the most intense noise that was associated with offshore industrial activity was the use of explosives in seismic-survey work (no longer used in seismic exploration). The sound pressure from these sources is very high and might physically injure or kill marine mammals near the explosion site. However, if spherical spreading of sound pressure is assumed, the pressure would fall below a harmful level at 2,752 meters (3,000 yards) from the source, and nonauditory effects would be unlikely (Gales, 1982). Loss of hearing or auditory discomfort still may occur at greater distances from this potential noise source. Noise levels measured from various existing drilling platforms generally are well below a level of high marine mammal sensitivity for toothed cetaceans such as beluga whales (Greene, 1986) and pinnipeds such as harbor seals at a distance of 15 meters from the platform (Gales, 1982). This information suggests that drilling operations are not likely to cause any annoyance to nonendangered cetaceans and pinnipeds except perhaps to individuals passing very close to the platforms. The playback of recorded industrial noises in the presence of breeding ringed seals indicated no effect or no reduction in ringed seal vocalizations or other sounds made by the seals (Cummings, Holliday, and Lee, 1984). The noise associated with construction of a gravel island in shallow water could not be detected at 2 miles (3.2 kilometers) from the island (Greene and Johnson, 1983), and ringed seal distribution was slightly altered in the immediate vicinity of the island (Green and Johnson, 1983).

Frequent and/or intense noise that causes a flight or avoidance response in marine mammals permanently could displace animals from important habitat areas. However, the monitoring of beluga behavior and distribution for the past 10 years in the Mackenzie River Delta estuary (in association with marine traffic supporting Canadian oil and gas activities) has not shown any long-term or permanent displacement from the estuary, even with comparatively high levels of industrial activity (Fraker, 1983). The presence of several thousand beluga whales, seals, and walruses in Bristol Bay during intensive commercial-fishing activity and their exposure to noise from numerous fishing boats suggests that these species and perhaps other marine mammals can habituate to fairly high levels of human activity.

Noise could cause disruption of reproductive activities such as displacement of ringed seals from important denning and pupping habitats. A comparison of ringed seal densities between areas of seismic exploration and areas where no on-ice seismic activities occurred (using aerial data collected in June 1975-1977 to investigate variation in ringed seal distribution) showed a lower density of seals in areas where there had been seismic exploratory activity (Burns, Shapiro, and Fay, 1980). However, such survey data are an indication only of overall survival through the long winter-spring period and provide no insight into the nature, extent, or causes of changes recorded (Burns and Kelly, 1982). Burns and Kelly (1982) conducted ground examination of ringed seal-den structures to determine the fate of such structures along seismic lines and along control lines. The latter investigators reported no significant overall difference in the fates of den structures between seismic and control lines; however, they reported significant differences in the fates of den structures in relation to distance from seismic lines (within 150 meters of the shot line in comparison to beyond this distance). The investigators concluded that displacement of seals in close proximity (within 150 meters) to seismic lines does occur. However, based on data from aerial surveys in 1982, there is no large-scale displacement of seals away from on-ice seismic operations as currently conducted in the Beaufort Sea. Aerial surveys conducted in 1985 and 1986 along the Beaufort Sea coast also indicated no large-scale displacement of ringed seals from industrialized areas (Frost et al., 1988).

IV.C.7.a(2)(a)1)c) Beaufort Sea Planning Area Specific Effects of Noise

The primary sources of noise and disturbance of ringed, bearded, and spotted seals; polar bears; and beluga and gray whales would come from the air and marine traffic associated with Beaufort Sea oil development. More specifically, sources would come from the supply boats, icebreakers, and helicopters associated with the nine production platforms under the assumed three sales in the Beaufort Sea Planning Area. Secondary disturbance sources would be low-frequency noises from drilling operations on nine production platforms (see Sections IV.A.2 and 3 and Tables IV.A.1-4). Aircraft traffic, about 300-600 round-trips per month during construction, 28-56 during development, and 12-28 during production, would be centered primarily out of Deadhorse-Prudhoe Bay, traveling to and from eight production platforms. This traffic is assumed to be a source of primary disturbance to some bearded and ringed seals hauled out on the ice and polar bears traveling on the ice within the planning area (Point Barrow east to Demarcation Bay). Some beluga and gray whales might be diverted by helicopter noise up to 100 meters away (Richardson et al., 1995b). Such brief, occasional disturbances are not likely to have any serious consequences for these cetaceans (Richardson et al., 1991; 1995b).

Some of the air traffic to and from the eight production platforms (see Table IV.A.1) could disturb hauled-out seals and walruses, causing them to charge in panic into the water. Because of frequent low visibility due to fog, aircraft may not always be able to avoid disturbing seals and walruses hauled out on the ice. Aircraft disturbance of hauled out seals and walruses in the planning area could result in injury or death to some young seal pups and walruses calves. Although air-traffic disturbance would be very brief, the effect on individual seal pups and walrus calves could be severe, if the pups or calves were injured or abandoned by their mothers. The number of seals and walruses affected is expected to be small due to the low number of disturbance incidents expected under the proposed activities development. Increases in physiological stress of adult or juvenile seals caused by the disturbance might reduce the longevity of some seals, if disturbances were frequent. However, the number of disturbances likely would be relatively infrequent, given that the helicopter flight paths will vary depending on the locations of the eight platforms and the scattered distribution of seals and walruses in the planning area. During the beluga whale migration, some of the aircraft traffic over open-water ice leads temporarily may divert the migration movements of some beluga whales as the aircraft pass overhead or nearby, but these reactions likely would not be biologically significant (Richardson et al., 1995b).

It is possible that some polar bears could be unavoidably killed to protect oil workers, when the bears were attracted to the rigs due to food odors and curiosity. Under the Marine Mammal Protection Act, oil companies are required to have a permit to take or harass polar bears. Consultation between the companies and the Fish and Wildlife Service on this matter is expected to result in the use of nonlethal means in most cases to protect the rig workers from polar bear encounters. The number of bears lost as a result of such encounters is expected to be very low (such as fewer than 10 bears "taken") over the life of the oil fields in the Beaufort Sea.

Boat traffic or icebreakers (for offshore platforms in the Far Zone) could briefly (a few days) disturb some marine mammals within a lead system and may temporarily interrupt the movements of beluga and gray whales and seals or temporarily displace some animals when the vessels pass through the area. However, there is no evidence to indicate that vessel traffic would block or delay marine mammal migrations. In fact, severe ice conditions are likely to have a far greater influence on spring and fall migrations than vessel traffic associated with oil exploration and development. Such traffic is not likely to have more than a short-term (a few hours to a few days) effect on marine mammal movements or distributions; but the displacement of pinnipeds, polar bears, beluga and gray whales could affect the availability of these animals to subsistence hunters for that season. Icebreaker activity and offshore ice-road construction also physically might alter some ice habitats and destroy some ringed seal lairs in pack-ice areas, perhaps crushing or displacing some ringed seal pups and perhaps displacing some denning polar bears.

IV.C.7.a(2)(a)1)d) Effects of Seismic Activities

We assume that geophysical shallow-hazard surveys (162 square miles during exploration and 280 square miles during development) would be shot over an estimated 7 days, primarily during the open-water seasons, using about two vessels per year (see Table IV.A-4). Geophysical site-clearance surveys for a block survey would occur during development in association with production-platform installation; and high-resolution seismic-survey lines are assumed to be run in association with the laying of about 115 miles of offshore pipelines under Alternative I for Sales 186, 195, and 202.

Ringed seals pupping in floating-shorefast-ice habitats within about 150 meters (490 feet) of the on-ice shot lines could be disturbed by on-ice seismic exploration. However, the number of ringed seal pups that possibly could be affected as a result of this very low level of disturbance is likely to be no more than a few hundred, considering the low density of breeding seals in the Beaufort Sea, and would represent no more than a short-term (less than 1 year) effect on the population. During development, an estimated 280 square miles of open-water shallow-hazard survey lines at (eight platforms) survey sites (based on past seismic activity), using perhaps one or two seismic vessels for 7 days, could disturb some pinnipeds, polar bears, and beluga whales during the days of survey activity.

Similar to other boat traffic, open-water, active seismic activities are likely to result in startle responses by ringed, bearded, and spotted seals; polar bears; and beluga and gray whales near the sound source. The zone of influence is estimated to be within an area (out to 4.9 kilometers) where sound levels form seismic activities exceed 160 decibels (Harris, Miller, and Richardson, 2001). As with other vessel traffic, this disturbance response is likely to be brief; and the affected animals are likely to return to normal behavior patterns within a short period of time after a seismic vessel has left the area. If the presence of noise from industrial activity occurred very near coastal subsistence areas and reduced or delayed the use of these habitats by marine mammals, the availability of these subsistence resources to villagers could be adversely affected for that season (see Section IV.C.11 - Subsistence-Harvest Patterns). Overall, noise and disturbance from air and marine traffic associated with exploration only and the development in the planning area likely would have short-term (a few minutes to a few hours) local effects on marine mammal populations.

IV.C.7.a(2)(a)1)e) Effects of Offshore Construction

Under the assumed development scenario, one to two exploration-drilling units per year and the eight oil-production platforms are assumed under the three sales in the Beaufort Sea Planning Area (see Table IV.A-4). Platform-site preparation and pipeline trenching along the assumed 115 miles of offshore pipelines (80 miles in the Near and Midrange zones and 35 miles in the Far Zone) could affect marine mammals through noise and disturbances, alterations (a few square kilometers) of benthic habitat (representing less than 1% of the benthic habitat in the planning area affected by pipeline trenching), and temporary changes in the availability of food sources within this area. Some pinnipeds, polar bears, and beluga and gray whales could be temporarily displaced by noise and disturbance from platform-installation and pipelaying activities and also from other support activities. Temporary displacement could occur within about 2-3 kilometers of the following eight production platforms and pipeline-trenching locations: three projects in the Near Zone, two projects in the Midrange Zone, and one project in the Far Zone (Map 4). Prey species could be temporarily disrupted or buried near the pipeline-trenching and platform-preparation sites. Noise disturbance and adverse habitat effects associated with platform and offshore-pipeline installation likely would be very local (within a few kilometers or less of the platforms) and not affect marine mammal populations.

IV.C.7.a(2)(a)1)f) Effects of Onshore Construction

Landfalls are assumed to be developed for the offshore pipelines to the existing facilities under the assumed Sales 186 and 195 in the Beaufort Sea. These landfalls are assumed to be at either Oliktok Point, Northstar landfall, West Dock, or the Badami Field for Near Zone development (Figure III.A-1); additional landfalls at either Bullen Point and Point Thomson for Midrange Zone development and potential Far Zone development landfalls at either Smith Bay for a western Beaufort Sea discovery or Point Thomson for an eastern Beaufort Sea discovery. Either of the latter landfalls is assumed to occur under Sale 202 (Map 1) with the construction of 12- and 50-mile long elevated onshore pipelines to the existing pipeline facilities (see Table IV.A-4). During construction activities associated with Beaufort Sea development, a small number of seals and polar bears located within a few kilometers of the landfall sites could be disturbed and perhaps displaced. However, the number of animals disturbed and/or displaced would be few, and the amount of coastal habitat altered would be localized near the pipeline-landfall site. Onshore-development effects on regional marine mammal populations likely would be short-term (1 year or season) and local (1-3 kilometers [0.62-1.9 miles] from activity), with any disturbance of seals and polar bears declining after construction activities are complete.

IV.C.7.a(2)(b) Effects of a Large Oil Spill

Traditional Knowledge on Oil-Spill Effects on Seals and Polar Bears. In an interview in 1978, Thomas Brower, Sr. (as cited in U.S. Army Corps of Engineers, 1998), gave an account of a 25,000-gallon (6,000-barrel) oil spill and its effects at Elson Lagoon in 1944. He saw birds and seals that were blinded and suffocating from the oil in the water. It took about 4 years for the oil to disappear and, during that time, whales avoided passing near the lagoon during their fall migration.

IV.C.7.a(2)(b)1) General Effects of Oil Pollution

See OCS Reports MMS 85-0031 and MMS 92-0012 (Hansen, 1985; 1992) and the Sale 144 final EIS (USDOI, MMS, 1996a) for detailed discussions of the various possible direct and indirect effects of oil and other chemical pollutants on marine mammals.

IV.C.7.a(2)(b)1)a) Direct Effects of Oil

Direct contact with spilled oil may kill some marine mammals and have no apparent effect on others, depending on factors such as the species involved and the animals' age and physiological status. Some polar bears and newly born seal pups occurring in the sale area are likely to suffer direct mortality from oiling through loss of thermoinsulation, which could result in hypothermia. Adult ringed, spotted, and bearded seals and walruses are likely to suffer some temporary adverse effects such as eye and skin irritation with possible infection. Such effects may increase physiological stress and perhaps contribute to the death of some individuals (Geraci and Smith, 1976; Geraci and St. Aubin, 1980; Hansen, 1985, 1992). Deaths attributable to oil contamination are more likely to occur during periods of natural stress such as during molting or times of food scarcity and disease infestations. In case histories, the few recorded mammal deaths attributed to oil spills occurred during winter months (Duval, Martin, and Fink, 1981), a season of increased natural stress.

Although species-specific effects of oil contact on beluga whales have not been conducted, studies of hydrocarbon effects on dolphins and porpoises as representative odontocetes by Geraci and St. Aubin (1982) provide sufficient insight on potential effects of oil-spill contact on belugas. The findings of these experiments suggest that smooth-skinned cetaceans such as beluga whales, dolphins, porpoises, and killer whales could suffer some minor skin damage if they were confined to a small surface area contaminated with oil (such as an ice lead). However, such effects on the skin are likely to be short term or transient (oil is unlikely to adhere to the skin), with recovery occurring within a few days (Hansen, 1985, 1992).

Oil ingestion by marine mammals through consumption of contaminated prey and by grooming or nursing could have pathological effects, depending on the amount ingested, species involved, and the animal's physiological state. Death would be likely to occur if a large amount of oil were ingested or if oil were aspirated into the lungs. Ingestion of sublethal amounts of oil can have various physiological effects on a marine mammal, depending on whether the animal is able to excrete and/or detoxify the hydrocarbons. Geraci and Smith (1976) demonstrated that seals are able to excrete as well as absorb oil. Both seals and cetaceans potentially can metabolize oil through the function of an oxygenase enzyme complement (Engelhardt, 1983) demonstrated as cytochrome p-450 in the liver of cetaceans (Geraci and St. Aubin, 1982) and as aryl hydroxylase in the liver and kidney tissues of seals (Engelhardt, 1983).

Oil-Spill Avoidance. Seals, walruses, polar bears, and beluga whales are not likely to avoid oil spills intentionally, although they may limit or avoid further contact with oil if they experience discomfort or apprehension as a result of contact with an oil slick (Hansen, 1985, 1992). Under some circumstances, they may be attracted to the spill site if concentrations of food organisms are near by, or they may have little choice but to move through the spill site during migration.

IV.C.7.a(2)(b)1)b) Indirect Effects of Oil

Indirect effects of oil pollution on seals, walruses, polar bears, and beluga and gray whales would be those associated with changes in availability or suitability of various food sources. The arctic marine ecosystem consists of a relatively simple food web with top-level consumers such as ringed seals, beluga whales, and marine birds feeding primarily on a few species of abundant invertebrates and arctic cod. During heavy ice years, primary productivity is comparatively low, and food could be a limiting factor for large areas of the Beaufort Sea (Frost and Lowry, 1981).

If a major spill occurred during such a heavy ice year, the short-term loss of plankton and benthic invertebrates could locally reduce marine mammal food sources during a critical period and result in local decreased productivity of breeding ringed seals. The local reduction in ringed seal numbers as a result of direct or indirect effects of oil could, in turn, affect polar bear distribution.

However, ringed, spotted, and bearded seals; walruses; and beluga whales opportunistically prey on a variety of available food organisms and are quite capable of moving from an area of local prey depletion to other locations of prey abundance. Breeding ringed seals that remain in local areas during the pupping season may be an exception, but the reduction of food organisms would persist for no more than one season due to the rapid recruitment of the food organisms and would represent a short-term effect.

IV.C.7.a(2)(b)2) Specific Effects of a Large Oil Spill

Oil-spill contact and probabilities referred to in this section assume the occurrence of development to the extent estimated in Section II and the associated spill rates under the assumed three sales in the Beaufort Sea Planning Area (Section IV.A). Most attention is devoted to potential spills greater than or equal to 1,000 barrels that have a trajectory period of up to 30 days during the open-water period and up to 180 days after meltout during spring. The mean number of one (1,500 or 4,600 barrels) or more oil spills greater than or equal to 1,000 barrels occurring during development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero.

Assuming a spill occurs, marine mammal offshore habitats from about Point Barrow (Ice/Sea Segment 29) east to about Barter Island (Ice/Sea Segments 30-35) have a less than 0.5-35% chance of contact within 3 days during the summer open-water season (July 1 through September 30) (Table A.2-19; Maps A-4a and

4b). The highest chance (35%) of contact is to habitats offshore of about the Colville River east to offshore of Prudhoe Bay (ERA 32) (Table A.2-19). The highest winter (October 1 through June 30) conditional probabilities of spill contact to the spring ice lead system (Ice Segments 24-28) varies between 14-26% for spills assumed to occur within the planning area and contact occurring within 3 days (Table A.2-37, Maps A-4a and 4b). Coastline habitats from Dease Inlet, Cape Simpson east to Atigaru Point-Kogru River (Land Segments 26, 28-33, and 47), and the Kaktovik area (Land Segment 74) have the highest chance of contact, greater than 15% up to 21% from either LA1-LA18 or P1-P13, assuming spills occur during the summer season and contact the coastline within 30 days (Table A.2-27). Thus, polar bears and seals frequenting these coastal habitats have the highest chance of exposure to potential oil spills that contact the shoreline of the Beaufort Sea Planning Area. Winter spills that occur nearshore within the 20-meter isobath fast-ice zone are likely to affect some pupping and breeding ringed seals. Spills that occur in October are not likely to be cleaned up effectively under freezeup conditions and may contaminate fast-ice habitats of ringed seals. However, once freezeup occurs in the fast-ice zone, little spill movement or oil spreading would occur under the fast ice. The number of ringed seal pups and adult seals contaminated is likely to be small (2-3 seals per square kilometer in fast ice or perhaps 50-100 seals total loss). If an oil spill (1,500-4,600 barrels) occurred during the open-water period or occurred during winter and contacted the offshore flaw zone, larger numbers of ringed and bearded seals might be contaminated. Aggregations of hundreds of seals do occur in open water. Such an event could result in the contamination and loss of perhaps 100-200 seals.

In the unlikely event that a crude oil spill occurred in October, it is not likely to be effectively cleaned up under freezeup conditions and might contaminate the fast-ice habitats. However, once freezeup occurs in the fast-ice zone, the oil would spread very little under fast ice. A winter spill that occurred nearshore (within the 20-meter isobath fast-ice zone) would affect very few ringed seals during the pupping and breeding season, because the spill would cover only a few acres or less than 1 square kilometer under the ice (Tables IV.A-6a and IV.A-6b). If the spill occurred during broken ice or meltout (1,500-4600-barrels), it is assumed it would spread as a discontinuous slick over 143-252 square kilometers (Tables IV.A-6a and IV.A-6b). This spill could affect about 116-204 ringed seals, based on a spring density of about 0.81 seals per square kilometer (Frost et al., 1998) times the area swept by the spill (181-320 square kilometers). During the open-water summer season, a crude oil spill of 1,500-4,600 barrels could sweep over 181-320 square kilometers in 30 days (Tables IV.A-6a and IV.A-6b). The number of ringed seal pups and adults contaminated is likely to be small. If a 1,500-4,600-barrel crude oil spill were released during spring meltout or in broken ice and contacted the offshore flaw zone, more ringed and bearded seals could be contaminated, because hundreds of them sometimes do aggregate in ice leads or open water. Such an event could contaminate and kill up to perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals, small numbers (fewer than 100) of walruses, and fewer than 10 beluga and gray whales (which have a much lower density than ringed seals in the planning area).

The net westward movement of spills and the chance of spill contact to offshore primary feeding habitats of gray whales and walruses during the summer open-water season (July 1 through October 1) is low, less than 0.5-6%, assuming spills occur in the planning area and contact Ice/Sea Segments 46-51 within 180 days or less (Table A.2-23). Oil contamination of walruses or gray whales probably would not result in direct mortality of healthy individuals. However, contamination seriously could stress diseased or injured animals and stress young calves, causing some deaths. Perhaps a small number of walrus calves (fewer than 100), gray whale calves (fewer than 10), and some adults could die from oil contamination, but such a loss is likely to be replaced within 1 year by natural recruitment in the population. Little or no significant contamination of benthic food organisms and bottom-feeding habitats of walruses, bearded seals, and gray whales is expected, because the fraction of the spill (such as 1-5%) is expected to be widely dispersed in the water column and to be weathered and degraded by bacteria before sinking to the bottom as scattered tarballs (see Section IV.A.4 - Spilled Oil Fate and Behavior in Marine Waters). The amount of benthic prey killed or contaminated by scattered tarballs from the spill that is 30 days old or more is likely to be very small and represent an insignificant proportion of the prey and benthic habitat available in the western Beaufort and eastern Chukchi seas.

Polar bears would be most vulnerable to oil-spill contamination along the ice-flaw zone north of Point Barrow east to Demarcation Bay (Ice/Sea Segments 24-37 and 52-58, respectively). However, the number of bears likely to be contaminated or indirectly affected by local reduction in seals as a result of an oil spill probably would be small considering the approximate density of one bear per 25 square kilometers (Amstrup, Durner, and McDonald, 2000). In a severe situation where a concentration of perhaps 20 or 30 bears were contaminated by an oil spill and assuming all the bears died, this one-time loss is not likely to affect the Beaufort Sea population of polar bears; annual recruitment probably would replace lost bears within 1 year up to more than one generation (7-10 years).

Polar bears are most likely to be oiled or eat oiled prey at a whale carcass on either Cross or Barter Island or at a concentration of seals in the sale area. Perhaps an estimated 5-30 bears may be harmed. This estimate is based on the number of polar bears sometimes observed by the bowhead whale aerial surveys conducted in the Cross and Barter islands areas during the fall Bowhead whale harvest (Treacy, 1988 through 1997). An estimated 5-30 bears could be lost to a spill, if the spill contacted Cross or Barter island when and where that many polar bears may be concentrated during the subsistence-whale harvest. This represents a severe event. However, the probability of this occurrence is low (for example, there is only a 2% conditional annual probability of a spill starting at area offshore Point Thompson or along the pipeline and contacting either the Cross or Barter island environmental resource areas within 30 days (Tables A.2-39 and Maps A-3a and 3b). The more likely loss would be no more than 6-10 bears (5.7-10 bears, assuming a bear density of 1 bear per 25 square kilometers [Amstrup, Durner, and McDonald; 2000] divided into 143-252 square kilometers, the area swept by the 1,500- to 4,600-barrel spill as a discontinuous slick in broken ice or meltout; Table IV.A-6a). The seal, walrus, beluga whale, and polar bear populations are expected to recover individuals killed by the spill within 1 year, and there would be no effect on the population.

Beluga whales would be most vulnerable to oil contact during the spring migration off Point Barrow. Contamination of the ice-lead system from an oil slick during spring migration (April-June) could directly expose several whales to some oil-spill contact. However, such contact is expected to be brief or intermittent and probably would not result in any deaths of healthy whales or have long-lasting sublethal effects after short exposure. The probability of oil-spill occurrence and contact to the lead system (Johnson et al., 2002; Table A.2-22,) during the spring (May-June) period is very low(less than 0.5%). The likely physical reaction between oil, ice, water temperature, and wind off Point Barrow appreciably would reduce the chance of an oil slick persisting in the lead system (Sackinger, Weller, and Zimmerman, 1983). Therefore, belugas of the western Beaufort population may have some contact with an oil spill (hydrocarbons in the water column or on the surface) that would temporarily contaminate the lead system off Point Barrow; however, few, if any, beluga whales are likely to be seriously affected, even in a severe situation, with no long-term effect on the population.

Over the production life of the multiple sales, 82 small crude oil spills (3 barrels) and 157-202 small refined oil spill (average of 0.7 barrels) are estimated to occur (Tables A-6a and A-6e). These minor spills could be expected to have an additive effect on seal, walrus, and polar bear losses, perhaps increasing losses by a few polar bears, seals, and walrus pups and increasing habitat contamination by perhaps about 1-2%. These small spills are not expected to affect beluga and gray whales that generally occur further offshore in the Beaufort Sea Planning Area.

IV.C.7.a(2)(b)3) Effects of Oil-Spill Cleanup

If a large spill were to oil habitats along the Beaufort Sea coast containing several hundred seals and some polar bears during the spring or open-water season, the hundreds of people, many boats, and several aircraft operating in the area for cleanup probably would displace some seals, walruses, beluga whales, and polar bears from oiled areas and temporarily stress others. It is possible that cleanup operations could displace some bears and ringed seals from maternity dens during the winter, resulting in the loss of a few bear cubs and seal and walrus pups. These effects may occur during 1 or 2 years of cleanup; however, we do not expect it to greatly affect seal, walrus, beluga whale, and polar bear behavior and movement beyond the area or after cleanup.

Cleanup efforts should include the removal of all oiled animal carcasses to prevent polar bears from scavenging on them. Oil-spill-contingency measures that include the aircraft hazing of wildlife away from the oil spill could reduce the chances of polar bears entering coastal waters where there is an oil slick. However, such hazing may have to be repeated to prevent polar bears from entering the oiled water or oiled shoreline area after the aircraft has left. Poor weather conditions would prevent this contingency measure from being effective.

The Alaska Clean Seas tactics (Alaska Clean Seas, 1998) for responding to spills in broken ice and pack ice could help, including the strategies for tracking oil in pack ice (Tactics T-1, -3, and -5) and the in situ burning of oil on ice (Tactics B-4, -5, and -6). However, poor weather conditions would prevent this contingency measure from being effective. The response plan discusses the importance of timely salvage of oiled carcasses and the required State and Federal permits (Tactics W-1 and -4).

Effects of Disturbance from Oil-Spill Cleanup. In the event of a large oil spill contacting and extensively oiling coastal habitats, the presence of several hundred humans, many boats, and several aircraft operating in the area involved in cleanup activities is expected to cause displacement of seals, polar bears, and other marine mammals in the oiled areas and to contribute to increased stress and reduced pup survival of ringed seals, if operations occur during the spring. This effect is expected to persist for perhaps 1 or 2 years and to affect seals, polar bears, and other marine mammals within about 1.6 kilometers (1 mile) of the activity.

IV.C.7.a(2)(c) Summary of Effects Common to All Alternatives

IV.C.7.a(2)(c)1) Effects of Noise, Disturbance, and Habitat Alteration

For Beaufort Sea oil and gas exploration and development, noise and disturbance and habitat alterations from drill-platform installation, pipeline laying, and other construction and oil spills could have some adverse effects on pinnipeds, polar bears, and beluga whales found in the sale area. Scientific and local Native knowledge of the behavior of nonendangered marine mammals and the nature of noise associated with offshore oil and gas activities suggest that intense noise causes startle, annoyance, and/or flight responses of pinnipeds, polar bears, and beluga whales. Helicopter trips and supply-boat traffic to and from the one or two exploration-drilling units and the three to five production platforms could disturb some hauled out ringed, bearded, and spotted seals, and may cause them to panic and charge into the water, which could result in perhaps the injury, death, or abandonment of small numbers of seal pups and walrus calves. Because nursing seals and pups are widely distributed along the ice front, aircraft moving to and from drill platforms are likely to temporarily disturb only a small portion of the seal and walrus populations. Thus, aircraft disturbance of seals, walruses, and polar bears is likely to cause short-term displacement (a few minutes to less than a few days) of small numbers of these animals (less than a few hundred) within about 1 kilometer of the air-traffic route. Vessel traffic (7-14 trips per year) associated with the 1-2 exploration-drilling units per year and eight production platforms and seismic vessels operating during the open-water season temporarily could displace or interfere with marine mammal movements and change local distribution for a few hours to a few days. Such short-duration and local displacement (within 1-3 kilometers [0.62-1.9 miles] of the traffic) likely would not affect the overall distribution of pinnipeds, polar bears, and beluga whales. The installation of eight production platforms and the laying of 115 miles of offshore pipelines within a few square kilometers of benthic habitat likely would have a short-term and local effect on a few of these marine mammals.

IV.C.7.a(2)(c)2) Effects of Large Oil Spill

The mean number of one (1,500 or 4,600 barrels) or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event of an oil spill, the spill poses the greatest risk of contact (35%) to all marine mammals in habitats offshore of the Colville River east to offshore of Prudhoe Bay (Table A.2-19, Ice Segment 32). The highest winter (October 1 through June 30) conditional probabilities of spill contact to the spring ice-lead system (Ice Segments 24-28) varies between 14% and 26% for spills assumed to occur within the planning area and contacts occurring within 3 days (Table A.2-37, Maps A-4a and A-4b). Coastline habitats from Dease Inlet, Cape Simpson east to Atigaru Point-Kogru River (Land Segments 26, 28-33, and 47), and the Kaktovik area (Land Segment 74) have the highest risks of spill contact, greater than 15% up to 21% from either LA1-LA18 or P1-P13, assuming spills occur during the summer season and contact the coastline within 30 days (Table A.2-27). Some aggregations of perhaps 100-200 ringed, 10-20 spotted, 30-50 bearded seals, and small numbers of walruses (fewer than 100) and beluga and gray whales (fewer than 10) occurring in these habitats could be contaminated and suffer lethal or sublethal effects. Polar bears also would be most vulnerable to oil spills in the ice-flaw zone; however, a small number of bears (6-10) are likely to be affected because of their sparse distribution, with recovery taking place within 1 year.

Walrus herds and their seasonal feeding habitat west and north of Point Barrow are at a very low risk of oil-spill contact (less than 0.05%). If a spill contacts this area, direct effects of oil are likely to include the loss of some walrus calves and highly stressed adults. Such a loss is likely to be replaced by natural recruitment within less than 1 year. Little or no significant contamination of benthic food sources of walruses and bearded seals is expected, because very little oil is likely to sink to the bottom except for scattered tarballs. This contamination is not expected to reduce the availability of benthic organisms.

Beluga whales are most vulnerable to oil-spill contact during the spring migration off Point Barrow. Some belugas could contact hydrocarbons in the water column or on the surface if an oil spill contaminated the lead system off Point Barrow during spring migration. However, few (fewer than 10) beluga whales are likely to be seriously affected by probable brief exposure to the spill, with population recovery taking place within 1 year.

Gray whales are most vulnerable to oil spills that contact feeding habitats west and south of Point Barrow. The low probabilities of spill contact with this area suggest that few (fewer than 10) gray whales are likely to come in contact with oil from a spill in the sale area or be affected by oil contamination of benthic feeding habitat. The number of gray whales likely to be adversely affected by oil contamination would be few and oil would not affect the population that ranges primarily in the Chukchi Sea during the open-water season.

These losses would represent no more than a short-term (1-year) effect on the Beaufort Sea populations, with losses within the populations replaced within about 1 year. The combined effect of noise and disturbance, habitat alterations, and oil spills is likely to be short-term, with populations recovering within about 1 year.

Conclusion. The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from an oil spill (0.11 % chance) of small numbers of pinnipeds (perhaps 300 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.

Effectiveness of Mitigating Measures. Stipulation 1 - Protection of Biological Resources primarily concerns protection of benthic habitats that may be buried or covered by drill-platform installation. The amount of benthic habitats (the probability is less than 1 square kilometer [0.62 square mile]) is not expected to be of consequence to marine mammal populations; thus, this stipulation is not expected to provide much protection to pinnipeds, polar bears, and gray and beluga whales.

Stipulation 2 - Orientation Program and ITL 4 - Information on Bird and Marine Mammal Protection likely would reduce potential noise and disturbance effects of air and vessel traffic on pinnipeds, polar bears, and gray and beluga whales. The Orientation Program is expected to inform oil-company workers and company contractors of the sensitivity of seals, polar bears, walruses, and gray and beluga whales to noise and disturbance from air and vessel traffic and to make the workers (and aircraft pilots) aware of the ITL and the recommended measures to be taken to avoid disturbing seal and walrus haulout areas.

Other standard stipulations are not expected to provide any additional protection for nonendangered marine mammals or to reduce potential adverse effects.

This analysis assumes that the oil industry and its contractors would comply with the ITL clause on Bird and Marine Mammal Protection and avoid flying within 1.6 kilometers (1 mile) of seal- and walrus-haulout sites and other known marine mammal-concentration areas, when weather conditions permitted them to avoid these areas. This compliance is expected to prevent excessive or frequent disturbance of seals, walruses, polar bears, and gray and beluga whales. However, some unavoidable disturbance of hauled out and feeding seals, beluga whales, and a few polar bears is expected to occur when (1) weather conditions prevent aircraft from flying at or above the recommended 545-meter (1,500-foot) altitude or within 1.6 kilometers (1 mile) or more from concentrations; (2) aircraft may fly low over concentrations of seals, walruses, polar bears, and gray or beluga whales during takeoffs and landings; and (3) boats may disturb some seals, polar bears, or beluga whales near ice floes in leads. These effects are expected to be short term and local and not to affect pinnipeds, polar bears, and gray or beluga whale populations.

The ITL 9 - Polar Bear Interaction likely would reduced the chances of oil workers-polar bear interactions by informing the lessees that oil workers and their contractors must avoid attracting polar bears to camp facilities and avoid encounters with polar bears that could lead to injury or death of the workers and polar bears. Existing guidelines on oil and gas operations in polar bears habitat have been effective in reducing lethal encounters between polar bears and oil workers. Only three lethal takes of polar bears were related to industrial activities on the North Slope over the past 20 years (Gorbics, Garlich-Miller, and Schliebe, 1998).

The ITL 11 - Information on Sensitive Areas to be Considered in the Oil-Spill-Contingency Plans may provide some protection, at least in theory, for nonendangered marine mammal sensitive habitats that are listed in the ITL (such as the lead system off Point Barrow). The lessees are informed that these areas should be protected in the event of an oil spill. However, it is unlikely that oil-spill-protection and -cleanup measures would prevent a large spill from contacting these marine mammal habitats, if wind and ocean currents were driving the spill into these areas.

If these mitigating measures are adopted for any of the Sales, the effects on pinnipeds, polar bears, and gray and beluga whales are expected to be about the same as with the measures enforced. This is because the measures that provide protection for marine mammals, primarily the ITL on Bird and Marine Mammal Protection, are still likely to be complied with by the lessees because of the Marine Mammal Protection Act. This act requires lessees to have a permit to conduct activities that may harass or take marine mammals to limit and avoid excessive harassment or taking of nonendangered marine mammals.

IV.C.7.b. Effects or Alternatives and Sales

IV.C.7.b(1) Effects of Alternative I for Sale 186

The effects of Alternative I for Sale 186 oil exploration and development on ringed, spotted, and bearded seals; polar bears; walruses; and beluga and gray whales are expected to be the same as described in the previous discussion in this section. They include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the offshore pipelines and platform sites during installation, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of seals and walruses, pods of whales, and individual polar bears or sow and cubs could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect marine mammal movements and distribution. If an oil spill occurred under Alternative I for Sale 186, it is expected to result in the loss of no more than a small number of seals, walruses, and polar bears and fewer beluga and gray whales, with recovery expected within about 1 year.

Seventy percent of the leasing activity and two production projects are expected to occur in the Near Zone, which includes the nearshore area from about the eastside of the Colville River Delta east to about Camden Bay (Map 4). One development project and 20% of the leasing activity are expected to occur in the Midrange Zone, which extends from about offshore of Cape Halkett east to about Barter Island. Only 10% of leasing activity and no projects or industrial activity is expected to occur in the Far Zone that extends west of Cape Halkett west to near Barrow and from near Barter Island east to the Canadian border (Map 4).

Conclusion: The effects from activities associated with Sale 186 exploration and development are estimated to include the loss of small numbers of pinnipeds, polar bears, and beluga and gray whales (perhaps 100-200 ringed seals, probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 6-10 bears, and fewer than 10 beluga and gray whales), with populations recovering within about 1 year.

IV.C.7.b(2) Effects of Alternative I for Sales 195 and 202

The effects of Sales 195 and 202 oil exploration and development on pinnipeds; polar bears; beluga, and gray whales likely would be the same as described under Alternative I for Sale 186, because the amount of oil and the activities associated with these sales would have essentially the same effects on marine mammals as those identified for Alternative I for Sale 186.

Conclusion: The effects from activities associated with Alternative I for Sales 195 and 202 exploration and development are estimated to include the loss of small numbers of pinnipeds, polar bears, and beluga and gray whales (perhaps 100-200 ringed seals, probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 6-10 bears, and fewer than 10 beluga and gray whales), with populations recovering within about 1 year.

IV.C.7.b(3) Effects of Alternatives III through VI for Sales 186 and 195

The effects of Beaufort Sea oil and gas exploration and development for these alternatives under these sales on pinnipeds, polar bears, and beluga and gray whales likely would be about the same as described under Alternative I for Sales 186 and 195, because the amount of oil and the activities associated with these alternatives and sales would have essentially the same effects on marine mammals as those identified for Alternative I for Sale 186.

Conclusion: The effects from activities associated with Alternatives III through VI for Sales 186 and 195 exploration and development are estimated to include the loss of small numbers of pinnipeds, polar bears, and beluga and gray whales (perhaps 100-200 ringed seals, probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 6-10 bears, and fewer than 10 beluga and gray whales), with populations recovering within about 1 year.

IV.C.7.b(4) Effects of Alternatives III and V for Sale 202

The effects of Beaufort Sea oil and gas exploration and development under these alternatives for this sale on pinnipeds, polar bears, and beluga and gray whales likely would be about the same as described under Alternative I for Sale 202, because the amount of oil and the activities associated with these alternatives would have essentially the same effects on marine mammals as those identified for Alternative I for Sale 202.

Conclusion: The effects from activities associated with Alternatives IV, V, and VI for Sale 202 exploration and development are estimated to include the loss of small numbers of pinnipeds, polar bears, and beluga and gray whales (perhaps 100-200 ringed seals, probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 6-10 bears, and fewer than 10 beluga and gray whales), with populations recovering within about 1 year.

IV.C.7.b(5) Effects of Alternatives IV and VI for Sale 202

These alternatives potentially could reduce noise and disturbance, habitat alteration, and oil-spill effects on pinnipeds, polar bears, and gray and beluga whales from in the following areas.

Under Alternative VI for Sale 202, effects could be reduced from about Barter Island east to Demarcation Bay. Potential conditional risks of oil contact to pinniped, polar bear, and beluga whale offshore habitats from about Barter Island east to Herschel Island (ERA's 36-37 sea/ice segments, assuming contact occurs within 30 days during the summer) would be reduced somewhat, if oil exploration and development were deferred under this alternative (Table A.2-21, LA 18). However, potential oil-spill risks to habitats west of the Beaufort Lagoon area (Table A.2-21, ERA's 29-35 Ice/Sea Segments 1-6) would be the same as described under general effects.

However potential oil-spill effects and noise and disturbance, and habitat effects on pinnipeds, polar bears, and gray and beluga whales east of Alternative III for Sale 202 and west of Alternative VI for Sale 202 would be the same as described under Alternative I for Sale 202.

Conclusion: The overall exploration and development effects of Alternatives IV and VI for Sale 202 on pinnipeds, polar bears, and beluga and gray whales likely would be about the same as described under Alternative I for Sale 202 because the amount of oil and the activities associated with these alternatives would have essentially the same effects on marine mammals as those identified.

IV.C.8. Terrestrial Mammals

Among the terrestrial-mammal populations that could be affected by oil exploration and development in the Beaufort Sea Planning Area are: caribou of the Central Arctic, Western Arctic, Teshekpuk Lake, and Porcupine Caribou herds; muskoxen; grizzly bears; and arctic foxes occurring along the coast adjacent to or near the planning area. The primary potential effects of OCS exploration and development activities on terrestrial mammals would come from ice-road and air-support traffic (disturbance) along pipeline corridors and near other onshore-support facilities and habitat alteration associated with gravel extraction (mining) to support the construction of offshore gravel islands and gravel pads for onshore facilities. Secondary effects could come from potential oil spills contacting coastal areas used by caribou for insect relief and scavenging by grizzly bears and arctic foxes.

IV.C.8.a. Effects Common to All Alternatives

The following effects are caribou, muskoxen, grizzly bears, and arctic foxes would occur the same for all alternatives and would result from routine operations or from unplanned unlikely large oil spills.

IV.C.8.a(1) Effects of Routine Operations for Exploration

The effects of exploration would occur primarily from routine operations. The unlikely effects associated with a very unlikely oil spill are discussed in Section IV.I.2.h.

IV.C.8.a(1)(a) Effects of Disturbances

Disturbance of caribou associated with exploration activities would come primarily from helicopter traffic. Aircraft traffic (about 140-155 helicopter round trips per year over a 2- to 4-year exploration period and 140 in the Far Zone to 155 in the Near and Midrange zones) centered primarily out of Deadhorse-Prudhoe Bay, traveling to and from the 1-2 exploration platforms/year and to and from one or two exploration platforms, is assumed to be a source of primary disturbance (see Section IV.A.1 and Table IV.A-4). Caribou have been shown to exhibit panic or violent flight reactions to aircraft flying at elevations of 60 meters (162 feet) or less and exhibit strong escape responses (animals trotting or running from aircraft) to aircraft flying at 150-300 meters (500-1,000 feet) (Calef, DeBock, and Lortie, 1976). These documented reactions of caribou were from aircraft that circled and repeatedly flew over caribou groups. Some of the aircraft traffic associated with exploration is likely to pass overhead of caribou once during any flight to or from the platforms; and the disturbance reactions of caribou are expected to be brief, lasting for a few minutes to no more than 1 hour and have no effect on caribou herd distribution and abundance. Muskoxen cows and calves appear to be more sensitive (responsive) to helicopter traffic than males and groups without calves, and muskoxen in general are more sensitive to overflights by helicopter than by fixed-wing aircraft (Miller and Gunn, 1979; Reynolds, 1986). A cow disturbed during the calving season may abandon her calf, if the calf is a day or two old (Lent, 1970). However, muskoxen appear to get used to helicopter flights above 500 feet (180 meters), at least for a time (Miller and Gunn, 1980). Groups of muskoxen responded less to fixed-wing flying over them during the summer, rutting season, and fall than during winter and calving periods (Miller and Gunn, 1980; Reynolds, 1986).

IV.C.8.a(1)(b) Effects of Habitat Alteration

No significant habitat alteration is expected to occur during exploration, because it is assumed that existing onshore-support facilities at Prudhoe Bay or other facilities will be used. The only habitat alteration that might occur would be gravel extraction from onshore-mining sites used in construction of an artificial gravel island. Such gravel is likely to come from existing quarries and would represent a very small (a few acres or hectares) loss of tundra habitat.

Summary. Exploration is expected to have very brief (few minutes to less than 1 hour) disturbance effects on caribou, muskoxen, grizzly bears, and arctic foxes with recovery occurring within 1 day or less for any disturbance event and have no effect on their populations.

IV.C.8.a(2) Effects of Development and Production

IV.C.8.a(2)(a) Effects from Routine Operations

The effects of routine operations are expected to occur if the proposed leasing occurs and results in exploration, development, and production activities. Routine operations that may affect terrestrial mammals include disturbances from transportation, pipelines, gravel mining, and small spills.

IV.C.8.a(2)(a)1) General Effects of Disturbance to Caribou

Caribou can be disturbed briefly by low-flying aircraft, fast-moving ground vehicles associated with onshore pipelines, and the construction of other facilities (Calef, DeBock, and Lortie, 1976; Horejsi, 1981). The response of caribou to potential disturbance is highly variable, from no reaction to violent escape reactions, depending on their distance from human activity; speed of approaching disturbance source; frequency of disturbance; sex, age, and physiological condition of the animals; size of the caribou group; and season, terrain, and weather. Cow and calf groups appear to be the most sensitive to vehicle traffic, especially during the early summer months immediately after calving, and bulls appear to be least sensitive during that season.

Tolerance to aircraft, ground-vehicle traffic, and other human activities has been reported in several studies of hoofed-mammal populations in North America including caribou (Davis, Valkenburg, and Reynolds, 1980; Valkenburg and Davis, 1985; Johnson and Todd, 1977). The variability and unpredictability of the arctic environment (snow conditions, late spring or early winter, etc.) dictate that caribou have the ability to adapt their behavior (such as change the time and route of migration) to some environmental changes. Consequently, repeated exposure to human activities such as oil exploration and development over several hundred square kilometers of summer range has led to some degree of tolerance by most caribou of the Central Arctic Herd. Some groups of caribou that overwinter in the vicinity of Prudhoe Bay and that have been continually exposed to disturbance stimuli apparently have become accustomed to human activities. However, most of the North Slope caribou herds that overwinter south of the Brooks Range are less tolerant to human activities, to which they are seasonally or intermittently exposed, than some caribou that overwinter on the arctic coast.

Some displacement of the Central Arctic Herd from a small portion of the calving range near the Prudhoe Bay and Milne Point facilities has occurred (Cameron, Whitten, and Smith, 1981, 1983; Cameron et al., 1992). This displacement of some caribou cows and calves has occurred within about 1-2 kilometers (0.62-1.2 miles) of some oil facilities (Dau and Cameron, 1986). The use of specific calving sites within the broad calving area varies from year to year; and the amount of displacement may be of secondary importance due to the low density of caribou on the calving range and the abundance of the Central Arctic Herd's calving habitat.

IV.C.8.a(2)(a)2) General Effects of Disturbance to Muskoxen

Muskoxen cows and calves appear to be more sensitive (responsive) to helicopter traffic than males and groups without calves, and muskoxen in general are more sensitive to overflights by helicopter than by fixed-wing aircraft (Miller and Gunn, 1979; Reynolds, 1986). A cow disturbed during the calving season may abandon her calf, if the calf is a day or two old (Lent, 1970). However, muskoxen appear to get used to helicopter flights above 500 feet (180 meters), at least for a time (Miller and Gunn, 1980). Groups of muskoxen responded less to fixed-wing flying over them during the summer, rutting season, and fall than during winter and calving periods (Miller and Gunn, 1980; Reynolds, 1986).

Studies on the effects of oil and gas exploration on muskoxen in Alaska and Canada have focused on disturbances associated with winter seismic operations. Some muskoxen reacted to seismic activities at distances up to 2.48 miles(4 kilometers) from the operations; however, reactions by muskoxen were highly variable among individuals, with some individuals not reacting at very close distances (0.12 miles [0.2 kilometers]) (Reynolds and LaPlant, 1985). Responses varied from no response to becoming alert, forming defense formations, or running away (Winters and Shideler, 1990). The movements of muskoxen away from the seismic operations did not exceed 3.1 miles (5 kilometers) and had no apparent effect on muskoxen distribution (Reynolds and LaPlant, 1986). Helicopter support traffic seemed to have a cumulative effect on muskoxen responses to seismic activities (Jingfors and Lassen, 1984). Muskoxen reacted to helicopters flown at 325 and 1,300 feet (100 and 400 meters) with response durations lasting from 2-12 minutes (Miller and Gunn, 1984). Muskox cows and calves appear to be more sensitive (responsive) to helicopter traffic than other age/sex classes, and muskoxen in general are more sensitive to overflights by helicopter than by fixed-wing aircraft (Miller and Gunn, 1979; Reynolds, 1986). Disturbances during the calving season may result in abandonment of the calf, if it occurs within the first or second day of life (Lent, 1970). Muskoxen appear to habituate to helicopter flights above about 500 feet (180 meters), at least on a short-term basis (Miller and Gunn, 1980).

In general, muskoxen responses to seismic activities in the planning area are expected to be a gradual and temporary avoidance of the local area, with reoccupation of the area after exploration activities are complete (Urquhart, 1973; Jingfors and Lassen, 1984).

Potential effects of oil-development activities include direct habitat loss from gravel mining in river floodplains and at oil field facilities, and indirect habitat loss through reduced access caused by physical or behavioral barriers created by roads, pipelines, and other facilities (Clough et al., 1987, as cited by Winters and Shideler, 1990; Garner and Reynolds, 1986). Muskoxen may be more exposed to oil exploration and development than caribou, because they tend to remain year-round in the same habitat area (Jingfors, 1982); therefore, muskoxen may be more likely to habituate because of this year-round exposure. Muskoxen have been exposed to the Trans-Alaska Pipeline System and the Dalton Highway with the expansion of their range west from the Arctic National Wildlife Refuge and the Kavik River.

IV.C.8.a(2)(a)3) General Effects of Disturbance to Grizzly Bears

Major sources of noise and disturbance include air and ground vehicle traffic and human presence associated with onshore operations, such as construction of ice roads, installation of onshore pipelines, and gravel mining. These activities may disturb grizzly bears occurring within a few miles of the activities. However, most onshore construction activities such as gravel mining, ice-road construction and ice-road traffic is assumed to occur during the winter months when grizzly bears are denning. In the case of denning bears, industrial activities and human presence pose potentially serious disturbances. In one study, seismic activities within 1.15 miles (1.8 kilometers) of a grizzly bear den caused changes in heart rate and movement of the female bear and cubs (Reynolds, Reynolds, and Follman, 1986). The investigators suggest that seismic-testing activities within about 600 feet of the den may cause abandonment of the den. Human scent and other noises also may disturb the bears.

Initially, when grizzly bears first encounter humans on foot, their response is to flee; responses to ground-based human activities are stronger than responses to aircraft, especially when encounters occur in open areas such as the Arctic Slope (McLellan and Shackleton, 1989). The increase in human presence and encounters with grizzly bears associated with recreation and tourism usually is temporary in nature. However, the establishment of permanent settlements (oil fields, mines, etc.) usually leads to human-bear encounters on a regular basis and to conflict, particularly when bears learn to associate humans with food (Schallenberger, 1980; Harding and Nagy, 1980; Miller and Chihuly, 1987; McLellan, 1990). Grizzly bears initially will avoid human settlements because of the noise and disturbance (Harding and Nagy, 1980), but if the area includes an important food source (such as a fish stream), some bears are likely to habituate to the noise and human presence, leading to an increase in encounters. People often will not accept the risk of bear attacks, and these encounters too often lead to the loss of bears (Archibald, Ellis, and Hamilton, 1987). However, individual bears, especially females with cubs, vary in the degree of habituation-tolerance to human presence, and some will continue to avoid areas when humans are present (Olson and Gilbert, 1994).

The attraction of grizzly bears to garbage and/or food odors at field camps and other facilities has led to encounters in which the need to protect workers results in the loss of bears (Schallenberger, 1980). Once bears become conditioned to the availability of human sources of food, measures to reduce this availability by improved garbage handling are not always effective (McCarthy and Seavoy, 1994). The bears will make an extra effort to get to the food sources that they are conditioned to having. Cubs of female bears conditioned to anthropogenic food source and habituated to human presence have a higher survival rates as cubs but have a high mortality rate after they are weaned (Shideler and Hechtel 2000). These young-habituated bears are more vulnerable to Dalton Highway hunters and to being killed near settlements and camps in human-bear encounters.

However, grizzly bears that occur along the coast of the planning area are not likely to encounter construction workers and most onshore development activities, because they will take place during winter when the bears are denning, and because the camps will be located on the production island offshore. Grizzly bears use earthen dens along riverbanks during winter months where gravel extraction for the construction of gravel pads and gravel islands supporting offshore oil development may occur. This mining activity could disturb and displace a few bears from den sites. Advising oil workers to consult the MMS publication *Guidelines for Oil and Gas Operations on Polar Bear Habitats* to minimize interactions with polar bears also would be applicable to encounters with grizzly bears. Implementing these guidelines would reduce the chances of adverse grizzly bear-human interactions that may lead to the injury or loss of people and bears.

IV.C.8.a(2)(a)4) General Effects of Disturbance to Arctic Fox

Oil and gas exploration and development activities can affect the arctic fox by increasing the availability of food and shelter. Seismic camps and oil-field facilities provide additional food sources for foxes at dumpster sites near the galley and dining halls and at dumpsites (Eberhardt et al., 1982; Rodrigues, Pollard, and Skoog, 1994). Crawlspaces under housing, culverts, and pipes provide foxes with shelter for resting and, in some cases, artificial dens (Eberhardt et al., 1982; Burgess and Banyas, 1993). At least localized seismic and oil-development activities do not appear to have any dramatic, deleterious effect on the fox population (Eberhardt et al., 1982). A study of den sites and fox productivity in the area of Prudhoe Bay indicates that adult fox densities and pup production are higher in the oil fields than in surrounding undeveloped areas (Burgess et al., 1993). An increase in the fox population associated with oil development may adversely affect some fox-prey species (such as ground-nesting birds) in the development area and over a region larger than the oil field itself (Burgess et al., 1993).

IV.C.8.a(2)(a)5) Effects of Aircraft Traffic

Some of the helicopter traffic associated with development 300-600 round-trip flights/month during construction, 28-56 during development, and 12-28 during production) is likely to pass overhead of caribou once during any flight to or from the eight production platforms under the assumed three sales in the Beaufort Sea Planning Area. The disturbance reactions of caribou are expected to be brief, lasting for a few minutes to no more than 1 hour and have no effect on caribou and muskoxen distribution and abundance.

IV.C.8.a(2)(a)6) Effects of Pipelines

Some Natives of the North Slope believe that caribou migration movements have changed since the construction of the Trans-Alaska Pipeline (Jonas Ningeok, as cited in Kruse et al., 1983). Recent studies (Roby, 1978; Cameron, Whitten, and Smith, 1981, 1983; Cameron et al., 1992; Pollard and Ballard, 1993) indicate significant seasonal avoidance of habitat near (within 1-2 kilometers [0.62-1.2 miles]) some existing Prudhoe Bay area facilities by cows and calves during calving and early postcalving periods (May through June). Therefore, disturbance from vehicle traffic and human presence associated with present levels of oil development in the Prudhoe Bay area apparently has affected local distribution on a small percentage (an estimated 5%) of the caribou's summer range. However, caribou abundance and overall distribution have not been affected, and the Central Arctic Herd has greatly increased since oil development began, although this increase in caribou numbers is not to be inferred as having been caused by oil development. Caribou successfully cross under pipelines that are elevated a minimum of 5 feet above the tundra, a requirement for onshore pipelines on the North Slope. Pipelines without adjacent roads and vehicle traffic are not likely to affect caribou movements. Some Natives from Kaktovik have noticed that caribou overwintering on the North Slope have become scarce since development of the oil fields (Herman Rexford, 1982).

Ice-road traffic (such as 3-6 vehicles/hour during the assumed 90-day use of ice roads) could have the greatest manmade influence on behavior and movement while caribou are crossing the Prudhoe Bay and Kuparuk oil fields and pipeline corridors (Murphy and Curatolo, 1984; Lawhead and Flint, 1993).

However, this traffic would occur only during winter months along ice roads (about 90 days), when most caribou are on their winter range south of the North Slope.

IV.C.8.a(2)(a)7) Effects of Habitat Alteration

The construction of pipelines and other onshore facilities on the North Slope necessitates the use of very large quantities (several million tons) of gravel. With the construction of roads and gravel pads for facility-building sites, small areas of tundra vegetation are excavated at the gravel-quarry sites. However, the several square kilometers of caribou and muskoxen tundra-grazing habitat destroyed by onshore development represent a very small percentage of the range habitat available to the caribou herd and muskoxen populations. The construction of roads and gravel pads also provides the caribou with additional insect-relief habitat on the roads and gravel pads, particularly when there is little or no road traffic present.

Among the terrestrial-mammal populations that could be affected by onshore pipeline construction are caribou of the Teshekpuk Lake and Central Arctic herds. Caribou of the Western Arctic Herd are not expected to be greatly affected, because their calving range is located far to the west of the planning area (Figure III.B-4). Some Western Arctic Herd caribou temporarily may be exposed to helicopter traffic and other activities associated with pipeline construction, but such exposure is not expected to have any effects on the population. Arctic foxes may be locally affected by this activity. Small rodents (such as lemmings and voles) and their predators (such as short-tailed weasels) could be affected locally along the pipelines, landfall gravel pads, and other facilities. However, these losses are expected to be insignificant to populations on the Arctic Slope of Alaska.

IV.C.8.a(2)(a)8) Effects of Gravel Mining on Caribou and Muskoxen

Gravel mining would alter a small area of river habitat along rivers but would not disturb many terrestrial mammals. Most caribou migrate south to the Brook s Range during the winter months when gravel will be mined, but small bands may be present.

Muskoxen use riparian (river) habitats on the North Slope, where gravel-mining sites may be located and the gravel used to construct pipeline landfall gravel pads and other gravel pad facilities associated with offshore oil development.

IV.C.8.a(2)(a)9) Effects of Habitat Alteration on Arctic Foxes

Arctic foxes could benefit from development in the Beaufort Sea area, because they would find shelter under buildings and potential food sources (temporary refuse storage) that would be on the production island. Camps and oil-field facilities in the Prudhoe Bay area provide food sources for foxes at dumpster sites near galleys and dining halls and at dumpsites (Eberhardt et al., 1982; Rodrigues, Pollard, and Skoog, 1994). Crawlspaces under housing, culverts, and pipes provide foxes with shelter for resting and, in some cases, artificial dens (Eberhardt et al., 1982; Burgess and Banyas, 1993). Oil development has not harmed the fox population (Eberhardt et al., 1982). Arctic fox numbers and productivity are higher in the Prudhoe Bay area compared to adjacent undeveloped areas (Burgess et al., 1993). An increase in the fox population could adversely affect ground-nesting birds in the Prudhoe Bay area and in nearby undeveloped areas (Burgess et al., 1993).

IV.C.8.a(2)(a)10) Effects of Site-Specific Onshore Development

Assuming oil development takes place in the Beaufort Sea, the following potential oil-transportation (pipeline) projects and facility-construction projects could take place and potentially affect caribou, muskoxen, grizzly bears, and arctic foxes. Development of projects would include the landfalls at either the existing facilities located at Oliktok Point, Northstar landfall, West Dock, or the Badami Field for development in the Near Zone (Map 4); additional landfalls at either Bullen Point and Point Thomson for development in the Midrange Zone; and landfalls for the potential development in the Far Zone at either Smith Bay for a western Beaufort Sea discovery or Point Thomson for an eastern Beaufort Sea discovery (Map 4). The pipeline corridors are assumed not to include interconnecting roads to the Prudhoe Bay complex. The Alpine/Badami oil-transportation model would be incorporated in the proposed development.

IV.C.8.a(2)(a)10)a) Oil Transportation East of Point Thomson

Oil transportation from assumed platforms located in Camden Bay and connecting with the leases from Beaufort Sea sales in this area is assumed to be by offshore pipeline connecting to an onshore pipeline with a landfall at Point Thomson. The onshore pipeline (12 miles long) from Point Thomson (or Flaxman Island) to the Badami facilities would increase air traffic by perhaps 155-600 flights per year during construction, which could temporarily disturb some caribou along the pipeline route from during construction activities. Disturbance and habitat effects on the Central Arctic and Porcupine caribou herds are expected to be short term, (probably a few minutes to less than a few days); caribou eventually would cross the pipeline corridor. Additionally, disturbance reactions would diminish after construction is complete, and air-traffic levels are likely to decrease to 12-28 per year at the most. The abundance and overall distribution of the Central Arctic and Porcupine caribou herds are not likely to be affected by the construction and operation of oil-transportation facilities east of Prudhoe Bay that are assumed to be associated with Alternative I for Sales 186, 195, and 202.

IV.C.8.a(2)(a)10)b) Oil Transportation West of Harrison Bay

It is assumed that oil would be transported from offshore platforms located west of Prudhoe Bay, with the landfall located on the coast of Smith Bay. Construction and support activities associated with this pipeline-landfall and 5-mile long pipeline to the Alpine development facilities could temporarily disturb some caribou (of the Teshekpuk Lake and Western Arctic herds), muskoxen, grizzly bears, and arctic foxes, particularly when there are high levels of air and ice-road along the pipeline corridor during construction.

IV.C.8.a(2)(a)11) Effects of Small Oil Spills

Over the production life of the Beaufort multiple sales, 82 small crude oil spills (3 barrels) and 157-202 small refined oil spill (average of 0.7 barrels) are estimated to occur (Tables A-6b and A-6e). These onshore spills likely would occur on gravel pads near the tie-in locations and should have only a minimal effect on terrestrial mammals. These minor spills could have an additive effect on caribou, muskoxen, grizzly bears, and arctic foxes perhaps increasing contamination of terrestrial habitats at facility sites and along pipelines by perhaps 1-2%. Some tundra vegetation in the pipeline corridor would become contaminated from these spills. However, caribou and muskoxen probably would not ingest oiled vegetation, because they are selective grazers and are particular about the plants they consume (Kuropat and Bryant, 1980). If a pipeline spill occurred, it is likely that control and cleanup operations (ground vehicles, air traffic, and personnel) at the spill site likely would frighten caribou, muskoxen, grizzly bears, and arctic foxes away from the spill and prevent the possibility of caribou and muskoxen grazing on the oiled vegetation. Thus, onshore oil spills associated with Alternative I for Sales 186, 195, and 202 are not likely to directly affect caribou or muskoxen through ingestion of oiled vegetation.

IV.C.8.a(2)(b) Effects of a Large Oil Spill

IV.C.8.a(2)(b)1) General Effects of a Large Oil Spill

Caribou sometimes frequent barrier islands and shallow coastal waters during periods of heavy insect harassment and may possibly become oiled or ingest contaminated vegetation. During late winter-spring, caribou move out on to the ice and lick sea ice for the salt and, thus, may be exposed to oil if a spill contaminates the ice (Roosman Petook of Barrow, 1983). Caribou that become oiled are not likely to suffer the loss of thermoinsulation through fur contamination, although toxic hydrocarbons could be absorbed through the skin and also could be inhaled.

Oiled caribou hair would be shed during the summer before the caribou grow their winter fur. Toxicity studies of crude-oil ingestion in cattle (Rowe, Dollahite, and Camp, 1973) indicate that anorexia (significant weight loss) and aspiration pneumonia leading to death are possible adverse effects of oil ingestion in caribou. However, caribou frequent coastal areas to avoid insects and, thus, are not likely to be grazing on coastal or tidal plants that may become contaminated. In the event of an onshore oil spill that contaminated tundra habitat, caribou probably would not ingest oiled vegetation, because they are selective grazers that are particular about the plants they consume. However, caribou that become oiled by contact with a spill in coastal waters could die from toxic hydrocarbon inhalation and absorption through the skin.

Muskoxen may become oiled or may ingest contaminated vegetation. Muskoxen that become oiled are not likely to suffer from a loss of thermoinsulation during the summer, although toxic hydrocarbons could be absorbed through the skin or inhaled. However, the oiling of young calves significantly could reduce thermoinsulation, leading to their death. Oiled hair would be shed during the summer before the winter fur is grown. Toxicity studies of crude-oil ingestion in cattle (Rowe, Dollahite, and Camp, 1973) indicate that anorexia (significant weight loss) and aspiration pneumonia leading to death are possible adverse effects. Muskoxen that become oiled by contact with a spill in lakes, ponds, rivers, or coastal waters could die from toxic hydrocarbon inhalation and absorption through the skin. The number affected is expected to be fewer than 10 individuals, based on their scattered distribution on the North Slope.

Grizzly bears depend on coastal streams, beaches, mudflats, and river mouths during the summer and fall for catching fish and finding carrion. If an oil spill contaminates beaches and tidal flats along the Beaufort Sea coast, some grizzly bears, and some arctic foxes, are likely to ingest contaminated food, such as oiled birds, seals, or other carrion. Such ingestion could result in the loss of at least a few bears and a few foxes through kidney failure and other complications (Oritsland et al., 1981; Derocher and Stirling, 1991). The number affected is expected to be fewer than 10 individuals, based on their scattered distribution on the North Slope.

IV.C.8.a(2)(b)2) Site-Specific Effects of a Large Oil Spill

Unless otherwise specified, the probabilities of oil-spill contact referred to in this section assume the occurrence of exploration and development activities to the extent estimated for Alternative I for Sales 186, 195, and 202 in Section IV.A.1.a and associated spill rates (Section IV.A.2). The mean number of one or more oil spills occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. Attention is devoted to a platform oil spill of 1,500 barrels or a pipeline spill of 4,600 barrels and to spill contacts that occur within 180 days during the summer season.

In the unlikely event that a 1,500-barrel or 4,600-barrel platform or pipeline oil spill occurred during the open-water season or during winter and melted out of the ice during spring, some caribou of the Central Arctic, Teshekpuk Lake, Western Arctic, and Porcupine herds that frequent coastal habitats from Demarcation Bay (Land Segment 52) west to Point Barrow (Land Segment 25) could be directly exposed to and contaminated by the spill along the beaches and in shallow waters during periods of insect-pest-escape activities (Figure III.B-4). An estimated 29-49 kilometers of coastline could be oiled by a 1,500-barrel or 4,600-barrel spill. However, even in a severe situation, a comparatively small number of animals (perhaps a few hundred) are likely to be directly exposed to the oil spill and die as a result of toxic hydrocarbon inhalation and absorption. This loss probably would be small for any of the caribou herds, with these losses replaced within about 1 year. The numbers of muskoxen, grizzly bears, and arctic foxes affected likely would be fewer than 10 individuals/species, based on their scattered distribution on the North Slope.

Coastline habitats from Dease Inlet, Cape Simpson east to Atigaru Point-Kogru River (Land Segments 26, 28-33, and 47) and coastline habitats in the Kaktovik area (Land Segment 74) have the highest chance of contact, greater than 15% up to 21%, from either LA1-LA18 or P1-P13, assuming spills occur during the summer season within 30 days (Table A.2-27). Assuming a spill occurs within LA6 north of the Teshekpuk Lake Special Use Area, there is up to a 45% chance that a spill would contact the shoreline of the special use area (Land Segments 29-33) within 30 days during the summer open-water season (Table A.2-87). Assuming a spill occurs within LA18 offshore of the Arctic National Wildlife Refuge, there is is up to a 49% chance that a spill would contact the shoreline (Land Segments 43-51) within 30 days during the summer open-water season (Table A.2-87). Some caribou from the Teshekpuk Lake, Western Arctic, Central Arctic, and Porcupine herds are more likely to contact oil in these areas. Caribou move into these areas to escape insects. However, even in a severe situation, perhaps 10 to a few hundred animals from one of these herds could get oil on their coats and die from toxic hydrocarbon inhalation and absorption.

Over the production life of the Beaufort Sea multiple sales, 82 small crude oil spills (3 barrels) and 157-202 small refined oil spills (average of 0.7 barrels) are estimated to occur (Tables A.1-6b and A.1-6e). These minor spills could have an additive effect on caribou, muskoxen, grizzly bears, and arctic foxes, increasing losses by perhaps a few animals and increasing coastal and tundra habitat contamination by perhaps about 1-2%.

IV.C.8.a(2)(b)3) Effects of Disturbance from Oil-Spill Cleanup

In the event of a large oil spill contacting and extensively oiling coastal habitats with herds or bands of caribou during the insect season, the presence of several thousand humans, hundreds of boats, and several aircraft operating in the area involved in cleanup activities is expected to cause displacement of some caribou in the oiled areas and contribute temporarily to seasonal stress on some caribou. This effect is expected to occur during cleanup operations (perhaps 1 or 2 seasons) but is not expected to significantly affect the caribou herd movements or the foraging activities of the populations.

Cleaning up a large oil spill also would disturb some muskoxen, grizzly bears, and arctic foxes. The presence of several thousand humans, hundreds of boats, and several aircraft operating to clean up the area probably would displace some muskoxen, grizzly bears, and arctic foxes. An oil spill could result in the loss of small numbers of grizzly bears and arctic foxes through ingestion of contaminated prey or carrion. However, such losses likely would not affect their populations on the Arctic Slope.

Onshore oil spills on wet tundra kill the moss layers and aboveground parts of vascular plants, or they kill all macroflora at the spill sites (McKendrick and Mitchell, 1978). Thus, pipeline oil spills can destroy or alter the local grazing habitat along the pipeline corridor. Damage to oil-sensitive mosses may persist for several years, if the spill sites are not rehabilitated (for example, by applying phosphorus fertilizers to spill sites) (McKendrick and Mitchell, 1978). For the most part, the effect of onshore oil spills would be very local and would contaminate tundra in the immediate vicinity of the pipeline; these spills would not be expected to significantly contaminate or alter caribou and muskoxen range within the pipeline corridors.

Summary. Under development, the primary source of disturbance to caribou, muskoxen, grizzly bears, and arctic foxes is air and ice-road traffic (perhaps as much as 300-600 aircraft/vehicles/month during construction and 12-28 aircraft/vehicles/month during operation) that could be associated with onshore construction and transportation of oil from offshore leases. Disturbance of caribou, muskoxen, grizzly bears, and arctic foxes along the onshore pipelines to the Trans-Alaska Pipeline through existing facilities in the Prudhoe Bay and adjacent oil fields would be most intense during the construction period (perhaps 6 months), when ice-road traffic is highest, but would subside after construction is complete. Caribou and muskoxen are likely to successfully cross the pipeline corridor within a short period of time (a few minutes to a few hours) during breaks in the traffic flow, even during high traffic periods, with little or no restriction in movements.

Because oil transportation for development of Federal offshore leases east of the Canning River is expected to be located offshore of the Arctic National Wildlife Refuge caribou of the Porcupine Caribou Herd that calve on the Refuge are not likely to be affected by Alternative I for Sales 186, 195, and 202.

The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. A possible oil spill (1,500 or 4,600 barrels) could cause the loss of small numbers (perhaps 10 to a few hundred) of caribou. The numbers of muskoxen, grizzly bears, and arctic foxes affected are expected to be fewer than 10 individuals/species, based on their scattered distribution on the North Slope.

Coastline habitats from Dease Inlet, Cape Simpson east to Atigaru Point-Kogru River (Land Segments 26, 28-33, and 47), and coastline habitats in the Kaktovik area (Land Segment 47) have the highest chance of contact (greater than 15% up to 21%) from either LA1-LA18 or P1-P13, assuming spills occur during the summer season within 30 days (Table A-27). An estimated 29-49 kilometers of coastline could be oiled by the 1,500- or 4,600-barrel spill. Some caribou from the Teshekpuk Lake, Western Arctic, Central Arctic, and Porcupine Caribou herds could contact oil in these areas. Caribou move into these areas to escape insects. However, even in a severe situation, perhaps 10 to a few hundred animals from one of these herds could get oil on their coats and die from toxic hydrocarbon inhalation and absorption. This loss probably would be small for any of these caribou herds and would be replaced within about 1 year.

For the most part, the effect of onshore oil spills would be very local and would contaminate tundra in the immediate vicinity of the pipeline; these spills would not be expected to significantly contaminate or alter caribou and muskoxen range within the pipeline corridors.

Conclusion. The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

Effectiveness of Mitigating Measures. The ITL 1 - Information on Bird and Mammal Protection is expected to indirectly reduce noise and disturbance effects of air and vessel traffic on caribou, muskoxen, grizzly bears, and arctic foxes occurring along the coast of the sale area. This measure recommends air- and vessel-traffic distances to avoid disturbance of birds and marine mammals that generally use many of the same coastal habitats as terrestrial mammals and is expected to prevent frequent disturbance of caribou from air traffic along the coast of the sale area. However, air traffic, on occasion, likely would disturb individuals or small numbers of caribou, muskoxen, grizzly bears, and arctic foxes. This effect is expected to be short term and local and is not expected to affect their populations.

IV.C.8.b. Effects Alternatives and Sales

IV.C.8.b(1) Effects Alternative I for Sale 186

The effects of Alternative I for Sale 186 on caribou, muskoxen, grizzly bears, and arctic foxes are expected to be the same as described under general effects. They include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect caribou, muskoxen, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred under Alternative I for Sale 186, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

Two production projects and 70% of the leasing activity are expected to occur in the Near Zone, which includes the nearshore area from about the eastside of the Colville River Delta east to about Camden Bay (Map 4). One development project and 20% of the leasing activity are expected to occur in the Midrange Zone, which extends from about offshore of Cape Halkett east to about Barter Island. Only 10% of leasing activity and no projects or industrial activity is expected to occur in the Far Zone, which extends west of Cape Halkett west to near Barrow and extends from near Barter Island east to the Canadian border (Map 4).

Conclusion: The effects of Alternative I for Sale 186 on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect caribou, muskoxen, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

IV.C.8.b(2) Effects of Alternative I for Sales 195 and Sale 202

The effects of oil exploration and development from Alternative I for Sales 195 and 202 on caribou, muskoxen, grizzly bears, and arctic foxes likely would be the same as described under Sale 186 because the level of activities and their effects on terrestrial mammals are essentially the same as those for Alternative I for Sale 186.

Conclusion: The effects of Alternative I for Sales 195 and 202 on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect caribou, muskoxen, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

IV.C.8.b(3) Effects of Alternatives III through VI for Sales 186 and 195

The effects of Beaufort Sea oil and gas exploration and development for these alternatives for Sale 186 and 195 on caribou, muskoxen, grizzly bears, and arctic foxes likely would be about the same as described under Alternative I for Sales 186 and 195, respectively, because the level of activities are essentially the same as those for Alternative I for Sale 186.

Conclusion: The effects of Alternatives III through VI for Sales 186 and 195 on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect caribou, muskoxen, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

IV.C.8.b(4) Effects of Alternatives III, IV and V for Sale 202

The effects of Alternatives III, IV, and V for Sale 202 on caribou, muskoxen, grizzly bears, and arctic foxes likely would be about the same as described under Alternative I for Sale 202, because the level of activities and their effects on terrestrial mammals are essentially the same.

Conclusion: The effects of Alternatives III, IV, and V for Sale 202 on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect caribou, muskoxen, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

IV.C.8.b(5) Effects of Alternative VI for Sale 202

This alternative for Sale 202 potentially could reduce noise and disturbance, habitat alteration, and oil-spill effects on caribou, muskoxen, grizzly bears, and arctic foxes in the following areas.

Under Alternative VI for Sale 202, noise and disturbance and habitat effects could be reduced from about Barter Island east to Demarcation Bay. The chance of contact to terrestrial mammal coastal habitats from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55), within 30 days during summer), would be reduced (2-11%) if oil exploration and development were deferred under this alternative (Table A.2-27, LA18). However, the chance of contact to coastal habitats west of Beaufort Lagoon (Table A.2-27, Land Segments 25-48) would be about the same as described in Section IV.C.8.b.

Conclusion: The overall effects Alternative VI for Sale 202 on caribou, muskoxen, grizzly bears, and arctic foxes likely would be about the same as described under Alternative I for 202.

IV.C.9. Vegetation and Wetlands

IV.C.9.a. Effects Common to All Alternatives

IV.C.9.a(1) Effects of Routine Operations

IV.C.9.a(1)(a) Effects of Gravel Pads

We assume that gravel fill would cover less than 1 acre of tundra at the pads. Some nearby tundra vegetation would be partially covered by dust that blows off the gravel pads and smothers some of the original plants, resulting in a shift to weedy species, and cause thermokarsting, which develops into high-centered polygons with deep moats (Jorgenson, 1997, as cited by U.S. Army Corps of Engineers, 1999). For purposes of analysis, we assume the projects would include an onshore valve and helicopter pad at the shore crossing, pipeline tie ins, and gravel pads at pipeline booster stations, which may spread dust over a few acres. This local effect, however, would not be significant to the tundra ecosystem in the project areas or in the Beaufort Sea Planning Area.

A gravel pad can change the moisture in the nearby tundra, because the pad causes snow to drift and accumulate around it and blocks normal surface-water flow in the summer. This blockage thickens the active layer (soil that thaws during summer), which increases production of grasses and mosses in wet habitats or decreases production of shrubs and lichen in moist or dry habitats within about 160 feet of the pad (Woodward-Clyde Consultants, 1993). Thus, changes in water drainage and tundra moisture (wetness) have occurred near gravel pads.

From 1968-1983, flooding caused the greatest effect on vegetation. In the Prudhoe Bay oil field during the first 15 years of development (Walker et al., 1986, 1987), flooding resulted when roads and pads intercepted the natural flow of water and caused ponding. The onshore development would have to identify natural drainage patterns before construction and maintain them during and after construction. Even if such conditions were not required (under U.S. Army Corps of Engineers permits) or completely successful, flooding would affect no more land than that affected by dust and snow drifting, as described earlier. The change in vegetation from flooding could result in more aquatic grasses and sedges versus dwarf shrubs. However, because the onshore pipeline gravel pads and landfall-site development will cover no more than a few acres, they are likely to have very little effect on nearby tundra. We assume that standard dust-abatement practices, as currently used in North Slope oil fields, would be implemented in the planning area. These measures would minimize the amount of dusting of tundra adjacent to the gravel pads and landfall sites.

IV.C.9a.(1)(b) Effects of an Onshore Pipeline

For purposes of analysis, we assume vertical support members (pilings) would support the elevated onshore pipelines. The pipeline routes would include the following landfalls at either the existing facilities at Oliktok Point, Northstar landfall, West Dock, and the Badami Field for development in the Near Zone (Figure III.A-1); additional landfalls at either Bullen Point and Point Thomson for development in the Midrange Zone; and potential development for landfalls in the Far Zone at either Smith Bay for a western Beaufort Sea discovery or Point Thomson for an eastern Beaufort Sea discovery (Figure III.A-1). Onshore pipeline support members are assumed to be 12 inches in diameter and would be placed 55-70 feet apart. Workers would remove vegetation at each support member (about 70-100 beams per mile) along the elevated pipeline connecting to the existing pipeline. Less than 1 acre of vegetation would be removed along the 12- or 50-mile pipeline route for development projects in the Far Zone. The onshore pipeline route to Deadhorse-Prudhoe Bay would come from Smith Bay or Point Thomson for development in the Far Zone. Each beam would disturb about 2 inches of vegetation around it in addition to the vegetation it would directly affect (Jorgenson, 1997, as cited by U.S. Army Corps of Engineers. 1999). The disturbance zone would result from locally deposited spoil material and possible thermokarsting; it could change the composition of plant species. Each vertical beam would disturb about 1.4 square feet of vegetation, of which 6% would be destroyed or replaced. This would result in 0.0032 acres being disturbed per pipeline mile, or 0.0384-0.175 acre (0.0032 x 12 miles and 0.0032 x 50 miles).

Pipelines also could harm vegetation indirectly through snow drifting or shading. Any vegetation under a pipeline would receive less direct sunlight during the growing season, potentially leading to a shallower active layer in the soil and reduced photosynthesis by the plants. If this effect did occur, it would take place only along the 1.4-mile long pipeline.

IV.C.9.a(1)(c) Effects of Onshore Ice Roads

We assume that no interconnecting access roads would be built next to the onshore pipelines tying into the Trans-Alaska Pipeline System or existing pipelines. Much of the length of ice roads would be located offshore and routed from the one or two exploration platforms (in a given year) and from the eight production platforms. Ice roads tend to compress and flatten the vegetation under them, and compressed vegetation would be common along onshore ice roads to the gravel mine and to the freshwater lakes. Ice roads probably would melt later in spring than nearby tundra and green up later because of the ice cover, resulting in “green trails” along the ice roads. Compression would not kill the vegetation, and we expect it to recover within a few years. We assume that currently implemented stipulations on ice roads would be followed for Alternative I for Sales 186, 195, and 202.

IV.C.9.a(1)(d) Effects of a Small Onshore Oil Spill on Vegetation and Wetlands

Over the production life of the Beaufort Sea multiple sales, 82 small crude oil spills (3 barrels) and 157-202 small refined oil spills (average of 0.7 barrels) are estimated to occur (Tables A.1-6b and A.1-6e). These onshore spills likely would occur on the gravel pads near the tie-in locations and could have only a minimal effect on vegetation. Most spills occur on gravel pads and, consequently, their effects do not reach the vegetation. About 20-35% of past crude-oil spills have reached areas beyond pads. The corresponding proportion for refined oil spills probably is much less but, for purposes of analysis, it is assumed that 27% of all spills occur or reach beyond gravel pads. Because winter spans the majority of each year, most spills happen when there is sufficient snow cover so that cleanup efforts take place before the oil reaches the vegetation; this situation occurs during about 60% of the year. Thus, for purposes of analysis, it is assumed that 11% of all spills will affect vegetation.

Most spills cover less than 500 square feet (less than 0.01 acre) with a maximum coverage of 4.8 acres, if the spill is a windblown mist. For purposes of analysis, it is assumed that the average spill would cover 0.1 acre. Under Alternative I, the total area of vegetation that would be impacted by spilled oil over the lifetime of developed oil fields would be 0.5-2.6 acres. Overall, past spills on Alaska’s North Slope have caused minor ecological damage, and ecosystems have shown a good potential for recovery (Jorgenson, 1997).

Over the production life of the Beaufort Sea multiple-sale activities, 82 small crude oil spills (3 barrels) and 157-202 small refined oil spills (average of 0.7 barrel) are estimated to occur (Tables A.1-6b and A.1-6e). These minor spills could have an additive effect on tundra and coastal vegetation-wetlands, perhaps increasing contamination of vegetation-wetlands by less than 10 acres.

IV.C.9.a(2) Effects of a Large Oil Spill on Vegetation and Wetlands

The main potential effects on vegetation and wetlands include oil-fouling, smothering, asphyxiation, and poisoning of plants and associated insects and other small animals. Complete recovery of oiled wetlands could take perhaps 10 years or longer. A second main effect is the disturbance of wetlands from spill-cleanup activities. Complete recovery of oiled coastal wetlands from these disturbances could take several decades. Effects on coastal vegetation-wetlands would occur only if a spill occurred during the summer open-water season. In winter, bottomfast ice covers the lagoon and coastal shorelines, and snow buffers the oil from the tundra.

IV.C.9.a(2)(a) Effects of an Offshore Oil Spill

The mean number of one (1,500-barrel or 4,600-barrel) or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs, the analysis assumes a platform spill of 1,500 barrels or a pipeline spill of 4,600 barrels (Table IV.A-5). Wetlands in coastal habitats from Dease Inlet, Cape Simpson east to Atigaru Point-Kogru River (Land Segments 26, 28-33, and 47), and the Kaktovik area (Land Segment 74) have the highest chance of contact to vegetation, greater than 15% up to 21%, during the summer season within 30 days (Table A.2-27 from either LA1-LA18 or P1-P13). Additionally, there is a 9-73% chance oil will contact the shoreline somewhere in the planning area within 30 days (Table A.2-21 contacts to Land). A spill of 1,500 barrels or 4,600 barrels could oil an estimated 29-49 kilometers of shoreline (Tables IV.A-6a and 6b) and extend onshore a few feet to several yards, depending on tides and storm surges. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of rivers. Stranded oil on sheltered intertidal areas, especially along peat shorelines, is likely to persist for many years (Nummedal, 1980; Owens et al, 1983).

IV.C.9.a(2)(b) Effects of Offshore Oil Spills on Saltmarsh Vegetation and Invertebrate Communities

Heavy oiling of saltmarsh vegetation and insects and other small animals in the marshes would kill some plants through fouling, smothering, and asphyxiation and poisoning from direct contact with the oil (Zieman et al., 1984). Oil contamination stunts the growth of saltmarsh vegetation, mainly because it stays on the shoots; the effect depends on the amount of oiling and contamination (Scholten, Leendertse, and Blaauw, 1987). Sea grasses, however, have been shown to grow well under chronic, low-level exposure to hydrocarbons (McRoy and Williams, 1977). Diesel fuel is more toxic than crude oil and could kill more vegetation, but diesel fuel would evaporate more quickly and not persist in the saltmarsh.

The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs, there is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.

Conclusion: Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed.

The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs, there is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.

Effectiveness of Mitigating Measures: The ITL - 5 Information on River Deltas and ITL - 11 Information on Sensitive Areas to be Considered in Oil-Spill-Contingency Plans could reduce potential oil-spill effects on coastal vegetation and wetlands by giving these habitats priority in protection from an oil spill through the use of booms to divert the spill away from the wetlands. However, the effectiveness of such measures would be determined by weather conditions during the time of the spill.

The ITL - 6 Information on Use of Existing Pads and Islands potentially could reduce the number of gravel pads onshore and reduced the amount of gravel needed for construction of new pads and islands. This measure potentially could reduce the amount of vegetation and wetlands that would be dug up or covered at gravel-mine sites and at pad locations.

These ITL clauses could minimize effects on vegetation and wetlands.

IV.C.9.b. Effects of the Alternatives for the Sales

IV.C.9.b(1) Effects of Alternative I for Sales 186, 195, and 202

The effects of Alternative I for Sales 186, 195, and 202 likely would be about the same as described in Section IV.C.9.a. Disturbances mainly come from gravel mining, building gravel pads and ice roads, and installing the onshore pipeline. Gravel mining, landfall gravel-pad construction, and onshore pipeline installation would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation with recovery expected within a few years, and no vegetation would be killed. The effect of an oil spill on vegetation and wetlands would include oil fouling, smothering, asphyxiation, and poisoning of plants and associated insects and other small animals. Complete recovery of oiled wetlands would take perhaps 10 years or longer.

Under Alternative I for Sale 186, two production projects and 70% of the leasing activity are expected to occur in the Near Zone, which includes the nearshore area from about the east side of the Colville River Delta east to about Camden Bay (Map 4). One development project and 20% of the leasing activity likely would occur in the Midrange Zone, which extends from about offshore of Cape Halkett east to about Barter Island. Only 10% of leasing activity and no projects or industrial activity is expected to occur in the Far Zone, which extends west of Cape Halkett west to near Barrow and extends from near Barter Island east to the Canadian border (Map 4).

The effects of Alternative I for Sales 195 and 202 on vegetation-wetlands likely would be about the same as described for Sale 186, because the level of activities for Sales 195 and 202 are similar to the levels assumed for Sale 186.

Conclusion: The effects of Alternative I for Sales 186, 195, and 202 on vegetation and wetlands likely would include the destruction of some acres of vegetation-wetlands from gravel mining, landfall gravel-pad and onshore pipeline installation, and potential oil-spill effects and spill-cleanup effects, which could persist for 10 years or longer.

IV.C.9.b(2) Effects of Alternatives III through VI for Sales 186 and 195 and III through V for Sale 202

The effects of these alternatives on vegetation-wetlands likely would be about the same as described under Alternative I for any of these sales, because the level of activities are similar for the alternatives in both sales.

IV.C.9.b(3) Effects of Alternative VI for Sale 202

This alternative potentially could reduce oil-spill effects on coastal vegetation-wetlands, and potential onshore habitat effects from gravel mining, gravel pads, and onshore pipeline installation in the following areas would be avoided.

Under Alternative VI for Sale 202, potential onshore habitat effects could be avoided from about the Canning River east to Demarcation Bay and potential onshore habitat effects from gravel mining, gravel pads, and onshore pipeline installation in this area. The chance of contact to vegetation-wetland coastal habitats from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55 within 30 days during the summer) would be reduced (2-11%), if oil exploration and development were deferred under this alternative (Table A.2-27, LA18). However, the chance of contact to coastal habitats west of Beaufort Lagoon (Table A.2-27, Land Segments 25-48) would be about the same as described under general effects.

Potential oil-spill and habitat effects on vegetation and west of the Alternative VI area would be the same as described under Alternative I for Sale 202.

Conclusion: While the effects on coastal vegetation and wetlands in the central Beaufort area could be reduced by Alternative VI for Sale 202, similar levels of activities to Alternative I for Sale 202 still would occur elsewhere and the overall effects vegetation and wetlands likely would be about the same as described under Alternative I for Sale 202.

IV.C.10. Economy

All of the alternatives, except Alternative II - No Lease Sale Alternative, for each of the proposed sales (186, 195, and 202) assume the same amount of oil and, for purposes of economic analysis, the levels of activity among alternatives and sales are very similar. Therefore, the economic effects to communities and to the State of Alaska are essentially the same. The analysis that follows focuses on the economic effects and does not follow the format used by the other resources evaluated in this section.

If any of the sales occur, they would generate economic activity manifested primarily in revenue to government, employment, and personal income. The economic effects would be in the North Slope Borough, Southcentral Alaska and Fairbanks, and the rest of the U.S. The exploration and development scenario in Section IV.A.1 and Appendix A is the basis for analysis of potential economic effects in this section. The reader should refer to these sections for a description of timing of OCS activity including infrastructure of wells, rigs, platforms, pipelines, and shore bases. The activities and construction and operation of infrastructure described in the exploration and development scenario generate the economic activity.

Economic effects would not exceed the significance threshold. Section IV.A defines the significance threshold for economics as effects “that will cause important and sweeping changes in the economic well-being of the residents or the area or region. Local employment is increased by 20% or more for at least 5 years.” The term “local employment” here means workers who are permanent residents of the North Slope Borough, both Inupiat and non-Inupiat, and does not include North Slope oil industry workers who commute to residences within or outside of Alaska.

IV.C.10.a. Revenues and Expenditures

If held, each of the sales would generate increases in North Slope Borough property taxes averaging about 1% above the level of Borough revenues without the sales in the early years and taper off to less than 0.5% in the latter years. This increase would occur for each sale (186, 195, and 202). For each sale, the revenue to the North Slope Borough would be about $2.5 million in the first year of production, tapering off to $0.5 million in the later years.

In the early years of production, each of the sales would generate increases in revenues to the State of Alaska of less than 0.25% above the level without the sales. The increases would taper off to an even smaller percentage in the latter years of production. This increase would occur for each sale (186, 195, and 202). For each sale, the revenue to the State would be about $50 million in the first year of production, tapering off to $4 million in the latter years.

In the early years of production, each of the sales would generate increases in revenues to the Federal Government of less than 0.001% above the level without the sales. The increases would taper off to an even smaller percentage in the latter years of production. This increase would occur for each sale (186, 195, and 202). For each sale, the revenue to the Federal Government would be about $165 million in the first year of production, tapering off to $12 million in the latter years.

These revenue forecasts are based in part on the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a). That forecast is based on barrels of production. We took the ratio of revenue to barrels and applied it to the barrels forecast, which is the same for Sales 186, 195, and 202.

IV.C.10.b. Employment and Personal Income (Not Related to Oil Spills)

Each of the sales would generate employment and personal income in three major phases: exploration, development, and production. In general, employment and associated personal income would be at a relatively low level in exploration, peaking during development, and dropping to a plateau in production. This pattern of economic effect reflects the exploration and development scenario described in Section IV.A.1 and Appendix A. All direct OCS workers are assumed to work in enclaves on the North Slope during their work time and commute to residences elsewhere in their time off. Their place of residence during the time they are not in an OCS worker enclave would be in villages of the North Slope Borough or in Southcentral Alaska or Fairbanks, as indicated in Table IV.C-2. Additional workers on the North Slope commute to residences outside the State. Approximately 30% of current North Slope workers in the classification of oil and gas workers commute to locations outside Alaska (Hadland, 2002, pers. commun.; Hadland and Landry, 2002). However, the workers commuting to residences outside the State would not generate economic effects of indirect and induced employment or expenditure of income in the State, and they would have a negligible effect on the economy of the rest of the U.S. All of the commuting workers would be present at new OCS enclaves offshore or in associated enclave-support facilities in and near the Prudhoe Bay complex approximately half of the days in any year.

For Sale 186, the forecast increase of total employment and personal income is shown in Table IV.C-2. The change is less than 2% over the 1999 baseline for the North Slope Borough or the rest of Alaska for each of the three major phases of OCS activity. Abandonment of production facilities is technically an activity separate from production. However, for the sake of simplicity of presenting data in Table IV.C-2, production includes abandonment. Employment and personal income generated by abandonment would be small compared to production and would last only 2 years. Abandonment also is known as decommissioning.

Sale 195 would generate employment and personal income that is about 10% more than Sale 186 for exploration and development stages, but production would be only slightly higher. This is because the scenario for Sale 195 indicates activity in deeper water and farther from shore than Sale 186. Exploration and development activities require more workers, which in turn, generate more income.

Sale 202 would generate employment and personal income that is about 30% more than Sale 186 for exploration and development stages, but production would be only slightly higher. The reason for this increase is the same as for the differences between Sales 195 and 186. Sale 202 also includes 50 miles of offshore pipeline. Even with these increases, the increase of total employment and personal income for Sale 195 and Sale 202 would not exceed 3% over the 1999 baseline for the North Slope Borough or the rest of Alaska for each of the three major phases of OCS activity.

Sale 186 also would generate total employment and personal income in the rest of the U.S. approximately equal to workers residing in Southcentral Alaska and Fairbanks, as indicated in Table IV.C-2. The change for the rest of the U.S. would be less than 0.001% for all three phases of activity. This also is true for Sales 195 and 202. The exploration and development scenario for Sale 186 indicates exploration activity would take place in 2004-2010, development activity in 2009-2016, and production in 2010-2033. Abandonment of production facilities would start at the end of production for each of the fields in 2025, 2027, and 2033. Abandonment would take place over a 2-year period. The pattern for Sales 195 and 202 is similar to Sale 186. Each lease sale has some overlap of the three main activities of exploration, development, and production. To simplify analysis but define the primary distinctions, data for employment and personal income are presented as annual averages for the three main OCS activity categories.

For Alternatives III through VI, the economic effects would be the same as Alternative I for Sale 186. For purposes of economic analysis, we assume that the full exploration and development scenario for each of the deferral alternatives would occur as for Sale 186. That is, the OCS activity would take place in a different area and be the same for each deferral alternative as for Sale 186. These increases would occur for each sale (186, 195, and 202) for Alternatives III through VI.

For Alternative II No Action (i.e., not having Sale 186), the economic effect would be a loss of: $15 million in revenue to the North Slope Borough, $190 million to the State of Alaska, and $930 million to the Federal Government; an average of 800 jobs for 30 years; and a total of $1.7 billion of total personal income for these workers. This Alternative also would result in a shorter lifespan for the Trans-Alaska Pipeline.

"Direct employment" includes those workers with jobs directly in oil and gas exploration, development, and production. "Indirect employment" includes those workers in industries that support the direct exploration, development, and production activities. These include jobs in transportation, such as shuttling workers by air between Anchorage and the North Slope. Direct and indirect workers spend a part of their earnings for expenses such as food, housing, clothing, etc. The aggregate of workers associated with providing those goods and services is termed "induced employment." Each of the direct, indirect, and induced workers has compensation derived from their work defined as "personal income" in Table IV.C-2.

The direct workers residing in the North Slope Borough who are forecast in Table IV.C-2 represent about 5-10% of the total of the workers resident in Southcentral Alaska and Fairbanks. This is an increase from the early 1990s total of about 1%. All of the Borough residents forecast are assumed to be Alaska Natives. This is based on research in 1999 (Jack Faucett Assocs., Inc., 2000). We acknowledge that forecasting North Slope Borough Native residents working in OCS activities is particularly conditional given past history. See Section III.C.1 for a further discussion of past history of North Slope Borough Natives working in the North Slope oil industry.

Because of the development of facilities or the continued use of facilities onshore that are taxable by the North Slope Borough, the Borough will have additional revenues available that most will be used for its ongoing operations. This, in turn, results in North Slope Borough government jobs. This is in large part how the indirect and induced jobs are generated in the North Slope Borough.

IV.C.10.c. Employment Related to Spills

In the unlikely event of a large oil spill of 1,500 barrels, we estimate employment to clean it up to be 60 cleanup workers for 6 months in the first year, declining to zero by the third year following the spill. In the unlikely event of a large spill of 4,600 barrels, we estimate employment to be 190 cleanup workers for 6 months in the first year, declining to zero by the third year following the spill. This is for each sale (186, 195, and 202). The 60-190 workers make up about 0.6-1.9% of the workers who cleaned up the *Exxon Valdez* oil spill. For an analysis of spill sizes, see Section IV.A.4.

Our estimate of employment to clean up spills is based on the most relevant historical experience of a spill in Alaskan waters, the *Exxon Valdez* oil spill of 1989. That spill was 240,000 barrels. It generated enormous employment that rose to the level of 10,000 workers directly doing cleanup work in relatively remote locations. Smaller numbers of cleanup workers returned in the warmer months of each year following 1989 until 1992. Numerous local residents quit their jobs to work on the cleanup at often significantly higher wages. This generated a sudden and significant inflation in the local economy (Cohen, 1993). Similar effects on the North Slope Borough would be mitigated due to the likelihood that cleanup activities, including administrative personnel and spill-cleanup workers, would be located in existing enclave-support facilities. In the unlikely event of a 1,500-4,600-barrel oil spill, the number of workers actually employed to clean it up would depend on a number of factors. These include the procedures called for in the oil-spill-contingency plan, how well prepared with equipment and training the entities responsible for cleanup were, how efficiently the cleanup was executed, and how well coordination of the cleanup was executed among numerous responsible entities.

IV.C.10.d. Trans-Alaska Pipeline

Sale 186 would produce 460 million barrels of oil over 23 years of production. This oil probably would extend the useful life of the Trans-Alaska Pipeline. The same is true for sales 195 and 202.

IV.C.10.e. Stipulations and Information to Lessees

The 5 standard stipulations and 16 ITL clauses would not change the effects analyzed.

IV.C.10.f. Subsistence as a Part of the North Slope Borough Economy

The predominately Inupiat residents of the North Slope Borough traditionally have relied on subsistence activities. Although not fully part of the cash economy, subsistence hunting is important to the Borough's whole economy, and even more important to culture. For the analyses of effects on these activities, see Sections IV.C.11 - Subsistence-Harvest Patterns and IV.C.12 - Sociocultural Systems.

Conclusion. Each of the Sales (186, 195, and 202) would generate increases in North Slope Borough property taxes that would average about 1% above the level of Borough revenues without the sales in the early years and taper off to less than 0.5% in the latter years. In the early years of production, each sale would generate increases in revenues to the State of Alaska of less than 0.25% above the same level without the sale. The increases would taper off to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 2% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity. The three major phases are exploration, development, and production. The employment and personal income increase includes workers to clean up possible large oil spills of 1,500 barrels and 4,600 barrels. Increases in employment and personal income for Sales 195 and 202 would be less than 3% over the 1999 baseline. Sales 186, 195, and 202 probably would extend the lifespan of the Trans-Alaska Pipeline.

For Alternatives III through VI, the economic effects would be the same as for Alternative I for Sales 186, 195, and 202. For purposes of economic analysis, we assume that the full exploration and development scenario for each of the deferral alternatives would occur as for Sale 186. That is, the OCS activity would take place in a different area and be the same for each deferral alternative as for Sale 186. These increases would occur for each sale (186, 195, and 202) for Alternatives III through VI.

For Alternative II No Lease Sale (not having Sale 186. 195, or 202), the economic effect would be a loss of: $15 million in revenue to the North Slope Borough, $190 million to the State of Alaska, and $930 million to the Federal Government; an average of 800 jobs for 30 years; and a total of $1.7 billion of total personal income for these workers. This Alternative would result in a shorter lifespan for the Trans-Alaska Pipeline.

IV.C.11. Subsistence-Harvest Patterns

IV.C.11.a. Introduction

This section analyzes the effects of Alternative I for Sales 186, 195, and 202 on subsistence-harvest patterns of communities near the proposed Beaufort Sea multiple-sale area. This analysis is organized by types of effects and by subsistence resource and discusses effects on subsistence-harvest patterns from oil spills, and noise and disturbance activities. The discussion of effects on subsistence-harvest patterns that follows this analysis is organized by community. Analytical descriptions of affected resources and species in addition to indigenous Inupiat knowledge concerning effects are described in detail.

Effects on communities outside of the lease-sale area are not discussed in this analysis because: (1) effects of noise and disturbance on subsistence are very localized and would not affect the subsistence harvests of Alaskan (or Canadian) communities other than Barrow, Nuiqsut, and Kaktovik; (2) it is extremely unlikely that an oil spill would contact subsistence-harvest areas of Alaskan (or Canadian) communities other than Barrow, Kaktovik, and Nuiqsut; and (3) pipelines would be constructed only in the lease-sale area, and effects from construction would be localized.

The Beaufort Sea multiple-sale area includes the eastern portion of the marine subsistence-resource area of Barrow and the entire marine subsistence-resource areas of Nuiqsut and Kaktovik. Moreover, if economically recoverable amounts of oil were discovered, onshore pipelines and roads associated with development could affect the terrestrial subsistence resources that are harvested by these three coastal communities in addition to the inland community of Atqasuk.

As noted in Sections III.C.2 and 3, onshore oil developments at Prudhoe Bay already have affected the subsistence-harvest system. Many of these effects are the indirect result of increased wage employment made available through projects and services funded by the North Slope Borough. Wage employment has led to an upgrading of hunting technology; alternatively, it has constricted the total time available for hunting. Additionally, Prudhoe Bay development has restricted access to traditional hunting areas in the vicinity. Currently, diminished household incomes, reduced by the loss of high earnings from the North Slope Borough Capital Improvements Projects period in the early to mid-1980's, tend to encourage subsistence-hunting activity and to foster an increase in harvest levels and an expansion of subsistence-harvest areas for many subsistence resources (Pedersen, 1997). Another effect on subsistence-harvest patterns has been the alteration of use areas due to Prudhoe Bay development. Pedersen (1998, pers. commun.) has indicated that Nuiqsut residents have altered their use patterns around Prudhoe Bay, and Nuiqsut residents confirm this. Another major change has been increased access to Deadhorse, via the haul road and beyond, provided by a winter ice road that has connected Nuiqsut and Prudhoe Bay for the last few years.

IV.C.11.a(1) Effects Agents

Access to subsistence resources, subsistence hunting, and the use of subsistence resources could be affected by reductions in subsistence resources and changes in subsistence-resource-distribution patterns. These changes could occur as a result of oil spills and noise and disturbance from seismic surveys; aircraft and vessel traffic; drilling activities; pipeline construction; structure placement; and support-base, pump-station, and gravel- and ice-road construction. The following analysis examines the effects of each of these disturbance agents on the subsistence resources harvested by the Inupiat living in the communities near the Beaufort Sea multiple-sale area. This analysis includes the marine and terrestrial resources harvested by the residents of Barrow, Nuiqsut, and Kaktovik. Atqasuk residents also harvest marine mammals, but only in conjunction with Barrow whaling crews. All subsistence-harvest effects on marine mammals in Barrow also would occur in Atqasuk.

IV.C.11.a(2) Factors Affecting Subsistence-Harvest Patterns in Barrow, Nuiqsut, and Kaktovik

The factors affecting the subsistence-harvest patterns of Barrow, Nuiqsut, and Kaktovik are summarized as follows (the information on harvests is taken from records of annual subsistence-resource harvests averaged over 20 years [Stoker, 1983, as cited by ACI/Braund, 1984; S.R. Braund, 1989a; State of Alaska, Dept. of Fish and Game, 1993a,b]):

- Heavy reliance on caribou in the annual average harvest for Barrow (22-58% of the total subsistence harvest), Nuiqsut (30-37%), and Kaktovik (11-16%). (See Tables III.C-8, III.C-9, III.C-10, III.C-11, III.C-12, III.C-13, III.C-15, and III.C-16; ACI/Braund, 1984; S.R. Braund,1989b; State of Alaska, Dept. of Fish and Game, 1995d; S.R. Braund and Assocs. and UAA, ISER, 1993; Pedersen, 1995a,b; S.R. Braund and Associates, 1996; Brower and Opie, 1997; Opie, Brower, and Bates, 1997; Brower, Olemaun, and Hepa, 2000).
- Heavy reliance on bowhead whales in the annual average harvest for Barrow (21-38% of the total subsistence harvest), Kaktovik (27-63%), and Nuiqsut (4-38%). (See Tables III.C-8, III.C-9, III.C-10, III.C-11, III.C-12, III.C-13, III.C-15, and III.C-16). Percentages have continued to rise because International Whaling Commission quotas have almost doubled in recent years (ACI/Braund, 1984; S.R. Braund and Assocs. 1989, 1996; North Slope Borough Planning Dept., 1993; Kaleak, 1996; Brower and Opie, 1997; Brower, Olemaun, and Hepa, 2000; State of Alaska, Dept. of Fish and Game 1995a,b; Stephen R. Braund and Assocs. and UAA, ISER, 1993; Pedersen, 1995a,b).
- Reliance on fish in the annual average harvest for Barrow (6-7% of the total subsistence harvest), Nuiqsut (33-44%), and Kaktovik (13-22%). (See Tables III.C-8, III.C-9, III.C-10, III.C-11, III.C-

12, III.C-13, III.C-15, and III.C-16; S.R. Braund and Assocs. 1989b; State of Alaska, Dept. of Fish and Game, 1995d; Brower and Opie, 1997; Opie, Brower, and Bates, 1997; Brower, Olemaun, and Hepa, 2000).

Subsistence-hunting areas overlap for many species harvested by Barrow, Nuiqsut, and Kaktovik.

Hunting and fishing are cultural values that are central to the Inupiat way of life and culture. Barrow, Nuiqsut, and Kaktovik all are Inupiat villages chiefly depending on subsistence resources. In 1990, the population of Barrow was 3,469; Nuiqsut, 354; and Kaktovik, 224; in 2000, the population of Barrow was 4,581; Nuiqsut, 433; and Kaktovik, 293.

IV.C.11.a(3) The Cultural Importance of Subsistence

Eugene Brower testified in Barrow at the public teleconference for our draft EIS on the 1997-2002 5-Year Oil and Gas Leasing Program for the OCS. He asserted the importance of the subsistence harvest to Inupiat lifeways in the Chukchi and Beaufort Seas:

> These two oceans produce the main food supply for the Inupiat people living off the two oceans. And these two oceans are our garden. They may not produce oranges or apples or sauerkraut or cauliflower, cattle, or chicken, but they produce the food that keeps us alive. You may not like how we eat it, but the good Lord put these animals in this region so that we, The Inupiat, can live off these animals (Brower, 1996, as cited in USDOI, MMS, 1996e).

Frank Long, Jr., President of the Nuiqsut Whaling Captains Association, expressed the importance of the bowhead whale hunt to the Inupiat way of life at an Arctic Synthesis Meeting we convened in Anchorage, Alaska, in 1995:

> We know that whaling is dangerous, but it is our livelihood. We have to supply our community's nutritional needs for the winter. The captain doesn't get the whole whale; after it is harvested, it belongs to the whole community. We share it? (Long, 1996).

In 1994, Glenn Roy Edwards, whaler and Arctic Slope Regional Corporation official, related:

> Without whaling, there would be no purpose to Barrow. I depend on my job; I like my job. But if it came down to a choice, I'd leave it to come out here and go whaling. I am first a whaler (Balzar, 1994).

IV.C.11.a(4) Effects Definitions and Effects Levels

The assessment of effects levels derives from a set of effects-level definitions that have been developed over many years by MMS anthropologists and socioeconomic specialists and have withstood many professional and legal reviews. These definitions follow a two-tiered approach in that they account for effects to subsistence resources in addition to effects to subsistence harvests. Disturbance to subsistence is measured by the duration of effect to resources and harvests and by changes in availability, in desirability, and in resource population levels. The definitions used in this analysis consider periodic (short-term) effects to resources that have no consequent effects to harvests as the lowest level of effect (very low effect). The next level of effect has resources being affected for a period up to 1 year (1 harvest season); but none of these resources would become unavailable, undesirable, or experience population reductions and, therefore, would not alter subsistence harvests (low effect). The third gradation of effect has resources becoming unavailable, undesirable for use, or experiencing population reductions for a period up to 1 year (1 harvest season), with subsistence harvests being affected for that period (moderate effect). The next level of effect is similar to the previous definition, except resources would become unavailable, undesirable for use, or experience population reductions for a period of 1-2 years (2 harvest seasons), with subsistence harvests affected for a longer period (high effect). The highest level of effect follows the structure of the previous two effects levels with resources becoming unavailable, undesirable for use, or experiencing population reductions for a period of from 2-5 years (5 harvest seasons), with subsistence harvests affected for a much longer period (very high effect).

IV.C.11.b. Effects Common to All Alternatives

IV.C.11.b(1) Effects from Routine Operations

IV.C.11.b(1)(a) Effects from Disturbances, Discharges, and Small Oil Spills

The noise-producing exploration and construction activities are those most likely to produce disturbance effects on critical subsistence species that include bowhead and beluga whales, caribou, fish, seals, and birds. Another detailed narrative of the effects from these activities on important subsistence species can be found in Section IV.B.10 of the Beaufort Sea Sale 144 final EIS (USDOI, MMS, 1996a). Disturbance effects would be associated with aircraft and vessel noise, construction activities, and oil spills; specifically: (1) seismic surveys that occur prior to an oil and gas lease sale; (2) aircraft support of exploration and development activities; (3) possible vessel supply and support of exploration and development activities; (4) drilling activities during the exploration and development and production phases; and (5) onshore construction, including pipeline, road, support-base, landfall, and pump-station construction. Noise and traffic disturbance would be a factor throughout the life of the sale.

Disturbance from construction activities could cause some animals to avoid areas in which they normally are harvested or to become more wary and difficult to harvest. The latter could be a concern during the bowhead whale migration offshore, although possible supply-barge traffic to coastal staging areas would tend to follow a nearshore route and likely would occur during the summer, when whales are not present. Current Western scientific research indicates bowheads do not seem to travel more than a few kilometers out of their original swimming direction due to noise-disturbance events, and that these changes in swimming direction are temporary, lasting from a few minutes for aircraft and vessel noise to up to 1 hour in response to seismic activity. Traditional Inupiat observation and experience affirms that whales are affected by noise at greater distances and alter their swimming directions for longer periods. In some instances, as in the case of nesting birds, construction activities may decrease the biological productivity of an area. Restrictions may be placed on the use of firearms in areas surrounding new oil-related installations (such as roads, landfalls, and pipelines) to protect oil workers and valuable equipment from harm. Structures such as pipelines may limit hunter access to certain active hunting sites.

IV.C.11.b(1)(b) Specific Effects on Subsistence Resources

IV.C.11.b(1)(b)1) Bowhead Whales

Aircraft flying above 300 meters (984 feet) have little effect on bowhead whales. Below this altitude, some changes in whale behavior may occur, depending on the type of plane and the responsiveness of the whales present in the vicinity of the aircraft. The effects from an encounter with either fixed-wing aircraft or helicopters generally are brief, and the whales normally resume their activities within minutes. Bowheads may exhibit temporary avoidance behavior if approached by vessels at a distance of 1-4 kilometers (0.62-2.5 miles). Marine-vessel traffic also may include seagoing barges transporting equipment and supplies from Southcentral Alaska to the drilling location, most likely between mid-August and mid- to late September. If barge traffic continues into September, some bowheads may be disturbed. Fleeing behavior from vessel traffic generally stops within minutes after the vessel passes, but scattering may persist for a longer period. In some instances, at least some bowheads return to their original locations. In many cases, vessel activities are likely to be in shallow, nearshore waters outside the main bowhead-migration route.

Many studies indicate that most bowheads exhibit avoidance behavior when exposed to sounds from seismic activity at a distance of a few kilometers but rarely show avoidance behavior at distances of more than 7.5 kilometers (4.7 miles). Under these conditions, bowheads also exhibit tendencies for reduced surfacing and dive duration, fewer blows per surfacing, and longer intervals between successive blows. Bowheads appear to recover from these behavioral changes within 30-60 minutes after seismic activity stops. However, recent monitoring studies (1996-1998) indicate that during the fall migration, most bowhead whales avoid an area around a seismic vessel operating in nearshore waters by a radius of about 20 kilometers. The sighting rates of whales at a radius of 20 and 30 kilometers was higher than the sighting rate within the 20-kilometer radius, but it varied annually from no evidence of a reduced sighting rate in 1996 to a reduced sighting rate in 1998. This is a larger avoidance radius than was observed from scientific studies conducted in the 1980's. Avoidance did not persist beyond 12 hours after the end of seismic operations.

Exploratory drilling from gravel islands generally is conducted during the winter. Should these activities occur during the bowhead migration, noise produced is not expected to affect whales, because gravel islands are constructed in fairly shallow water shoreward of the main migration route, and noise from operations on gravel islands generally is not audible beyond a few kilometers. Exploratory drilling from bottom-founded structures also generally is conducted during the winter. Bowheads have been sighted within 0.2-5 kilometers (0.12-3 miles) from drillships, although some bowheads probably change their migration speed and swimming direction to avoid a close approach to noise-producing activities. A few bowheads may avoid drilling noise at 20 kilometers (12.4 miles) or more. If icebreakers attend drillships, as is typically the case during the fall in the U.S. Beaufort Sea, drillship noise frequently may be masked by icebreaker noise, which often is louder. There are no observations of bowhead reactions to icebreakers breaking ice, but it has been predicted that roughly half of the bowheads would respond at a distance of 4.6-20 kilometers (2.86-12.4 miles) when the signal-to-noise ratio is 30 decibels. Whales appear to exhibit less avoidance behavior with stationary sources of relatively constant noise than with moving sound sources.

Island-construction activities likely would be conducted during the winter and generally are in nearshore shallow waters shoreward of the main bowhead whale-migration route. These activities are not expected to affect bowhead whales. Some whales may be displaced seaward, if cleanup activities occurred outside the barrier islands or in the channels between the barrier islands during the whale migration.

Bowheads do not seem to travel more than a few kilometers in response to a single disturbance incident, and behavioral changes are temporary, lasting from few minutes, in the case of vessels and aircraft, to up to 30-60 minutes, in the case of seismic activity in earlier seismic studies. In recent studies, avoidance of an area within 20 kilometers of seismic operations did not persist beyond 12 hours after seismic operations had stopped. Occasional and brief interruption of feeding by a passing vessel or aircraft probably is not of major significance. Similarly, the energetic cost of traveling a few additional kilometers to avoid closely approaching a noise source is very small in comparison with the cost of migration between the central Bering and eastern Beaufort seas. We do not believe these disturbance or avoidance factors will be significant, because the level of industrial activity anticipated is not sufficiently intense to cause repeated displacement of specific whales. Reactions are less obvious in the case of industrial activities that continue for hours or days, such as distant seismic exploration and drilling. Behavioral studies have suggested that bowheads habituate to noise from distant ongoing drilling or seismic operations (Richardson et al., 1985a), but there still is some apparent localized avoidance (Davis, 1987). There is insufficient evidence to indicate whether or not industrial activity in an area for a number of years would adversely impact bowhead use of that area (Richardson et al., 1985b), but there has been no documented evidence that noise from OCS operations would serve as a barrier to migration.

Overall, bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects, and some avoidance behavior could persist up to 12 hours.

Nuiqsut whaling captain Frank Long, Jr., stated that oil-industry activity offshore has affected not only whales but also seals and birds (Long, as cited in National Marine Fisheries Service, 1993). Expressing concern about aircraft disturbance, a Nuiqsut resident and whaling captain said in recent testimony for an offshore lease sale that seismic traffic and helicopter overflights "were the cause of whales migrating farther north out to the ocean, 20 miles farther north than their usual migration route" (USDOI, MMS, 1995a). Earlier, Patsy Tukle from Nuiqsut had expressed this same sentiment. He explained that ships and helicopters are interfering with whale hunting even though they are not supposed to. He affirmed the need to enforce controls so whaling may go on unimpeded (Tukle, 1986, as cited in USDOI, MMS, 1986a). To show that aircraft disturb bowhead whales, Kaktovik resident Susie Akootchook related her observations while counting whales in Barrow:

> I worked with the whale census and worked with Chris Clark that time they did the whale census over at Barrow. And I was with the acoustic crew listening in with speakerphones and those microphones were like a 100, 75 to 50 feet under. And if you guys are planning on using your choppers, there is going to be a lot of noise. One time I was on a ship, and I had the headsets on and then heard an airplane. Mind you, from under the water, listening in, I can hear an airplane

> flying over. From that end of the mike to that end of the mike, I could hear it all the way clear. And when I went out there and checked, it was way up there. And that noise, whether you use choppers or airplanes, it's going to be disruptive" (Akootchook, 1996, as cited in Dames and Moore, 1996b).

Thomas Napageak, President of the Native Village of Nuiqsut and Alaska Eskimo Whaling Commission Chairman, related in 1979 that he had not seen one whale while going to Cross Island every year and believes it is the result of seismic activity in the area (Napageak, 1979, as cited in USDOI, Bureau of Land Management, 1979a). Maggie Kovalsky from Nuiqsut, testifying in 1984 on Endicott development, explained that with all the noise and activities, bowhead whales that migrate not far from that area all the way to Canada probably will be hurt (Kovalsky, 1984). In a Statewide survey by the Alaska Department of Fish and Game, Division of Subsistence from 1992-1994, 86.7% of the respondents in Nuiqsut believed that there were fewer marine mammals as a result of development on the outer continental shelf (State of Alaska, Dept. of Fish and Game, 1995a). At a village meeting for the Northstar Project in 1996, Nuiqsut residents said they feared effects from the project, because it was in the migratory path of the bowhead whales. They made it clear that seismic and transportation noise are of primary concern to Beaufort Sea residents for their impacts on bowhead whales (Dames and Moore, 1996a).

The MMS is conducting long-term environmental monitoring in the region and, as part of this effort, has begun a multiyear collaborative project with Nuiqsut whalers that will describe present-day subsistence whaling practices at Cross Island to empirically verify any changes to whaling due to weather, ice conditions, and oil and gas activities. After the first field season in 2001, Nuiqsut whalers reported the following changes in whale behavior and whaling practices:

- fewer whales in smaller groups were seen;
- the need to travel farther from Cross Island to find whales;
- whales observed were more skittish than in previous years and stayed more in the ice than in open water, spent more time on the surface, and followed more unpredictable paths underwater;
- whales were more difficult to spot because blows were not as observable as in past years; and
- whales appeared to be skinnier.

Possible causes suggested by the whalers for these behavioral changes were:

- Offshore seismic survey work for the natural gas-pipeline route;
- Barge supply traffic to Kaktovik for a water- and sewer-construction project;
- The presence of killer whales offshore and to the east of Cross Island;
- Ice conditions in Canadian waters; and
- Air and water traffic to the east of Cross Island (Galginaitis, 2003).

In 1979, Kaktovik residents were concerned about disturbance of migrating whales from drilling noise. Whaling captain James Killbear expressed this concern (Killbear, 1979, as cited in USDOI, Bureau of Land Management, 1979b). Herman Aishanna, former mayor, vice mayor, and head of Kaktovik's Whaling Captains' Association, maintained that in 1985 the single steel drilling caisson did affect the whale subsistence hunt even though it was idle. He reported: "We got no whales that year" (Aishanna, as cited in National Marine Fisheries Service, 1993). Fenton Rexford, President of Kaktovik Inupiat Corporation (KIC; Kaktovik's village corporation), stated that during exploratory drilling in Canadian offshore waters, "We were not successful or had a very hard time in catching our whale when there was activity with the single steel drilling caisson, the drilling rig off Canada. And it diverted [bowhead whales] way offshore; made it very difficult for our whalers to get our quota" (Rexford, as cited in USDOI, MMS, 1996d). At the MMS Information Update Meeting held March 29, 2000, in Barrow, the Alaska Department of Fish and Game made a presentation on a draft study of subsistence economics and oil development in Nuiqsut and Kaktovik, which affirmed a strong connection to anthropogenic effects as the cause of Kaktovik's unsuccessful whaling season in 1985 (Pedersen et al., In prep.). Sometimes grounded ice can keep whalers from reaching bowhead whales—such a situation was reported in September 1985; but the timing of such events is critical. A blockage before or after most of the whales have migrated past the community would have less effect on the success of the hunt than a blockage during the peak migration. Speaking about the disappointing spring hunt in 1978, when only four whales were caught, Thomas Brower, Sr., from Barrow explained:

> The gravel island drilling at this time may make it impossible for the [whaling] captains to supply [the village] with needed winter food supplies. The gravel island drilling at this time may make it impossible for the captains to fill this need for adequate nutrition for the long Arctic winter (North Slope Borough, Commission on History and Culture, 1980).

Charles Okakok from Barrow spoke out against drilling because he believed, as many Inupiat subsistence whalers believe and have observed that the noise may be detrimental to the bowhead whale hunt (Okakok, 1990, as cited in USDOI, MMS, 1990b). Barrow resident Arthur Neakok maintained that ice presents an extreme hazard to ships and drilling (Neakok, 1990, as cited in USDOI, MMS, 1990b). At the same hearing, Eugene Brower expressed concern that multiyear ice would cause problems during drilling (Brower, 1990, as cited in USDOI, MMS, 1990b).

Herman Rexford from Kaktovik recounts that oil ships affect the migration of the whales. He would like to see no ships or exploration at Kaktovik during the fall whaling time. He knows that the ships are noisy and can affect whaling routes (Rexford, 1986, as cited in USDOI, MMS, 1986b. Herman Aishanna, Kaktovik vice mayor, recounted that "tugs make a lot of noise in the summertime" (Aishanna, 1996, as cited in Dames and Moore, 1996c). Thomas P. Brower, Sr., from Barrow, began whaling as a boy in 1917. He stated in a 1978 interview that:

> The whales are very sensitive to noise and water pollution. In the spring whale hunt, the whaling crews are very careful about noise. In my crew, and in other crews I observe, the actual spring whaling is done by rowing small boats, usually made from bearded sealskins. We keep our snow machines well away from the edge of the ice so that the machine sound will not scare the whales. In the fall, we have to go as much as 65 miles out to sea to look for whales. I have adapted my boat's motor to have the absolute minimum amount of noise, but I still observe that whales are panicked by the sound when I am as much as 3 miles away from them. I observe that in the fall migration the bowheads travel in pods of 60 to 120 whales. When they hear the sound of the motor, the whales scatter in groups of 8 to 10, and they scatter in every direction. (North Slope Borough, Commission on History and Culture, 1980).

The recently published study Bowhead Whale Feeding in the Eastern Beaufort Sea: Update of Scientific and Traditional Information, contracted by the MMS, records a great deal of traditional knowledge of the local Kaktovikmiut (Kaktvik) whalers. Whaling knowledge pointed out the following:

- The historic core whaling area extends from the Hulahula River in the west to Tapkaurak Point in the east and offshore as far as 20 miles;
- Most whales are taken within 18-19 miles of the village;
- The mean distance of harvest locations from Kaktovik has not changed from the 1970's to the present;
- Whaling captains select small whales over large whales;
- Whalers have noted a significant decrease in the average size of whales harvested from the 1970's to the present;
- Two whale-feeding areas are traditionally recognized, one to the east in the Demarcation Point/Icy Reef area and the other near Arey Island must west of Kaktovik;
- Whales can occur near Kaktovik in July and August, although they are more common in Canadian water at this time; and
- Kaktovik's main hunting period for bowheads is in September, but whales can remain near Kaktovik as late as mid-October (Richardson and Thomson, 2002).

IV.C.11.b(1)(b)2) Seals, Beluga Whales, and Polar Bears

The effects from exploration only are expected to be less than those from development and production, with only brief disturbances of small numbers of seals, polar bears, and beluga whales from air and vessel traffic, with recovery from any disturbance event occurring within less than 1 day. For Beaufort Sea oil and gas exploration and development, noise and disturbance and habitat alterations from drill-platform installation, pipeline laying, and other construction could have some adverse effects on seals, polar bears, and beluga whales found in the lease-sale area. Scientific and local Native knowledge of the behavior of nonendangered marine mammals and the nature of noise associated with offshore oil and gas activities suggest that intense noise causes startle, annoyance, and flight responses of seals, polar bears, and beluga whales. Helicopter trips and supply-boat traffic to and from the one to two exploration-drilling platforms and the three to five production platforms could disturb some hauled out ringed, bearded, and spotted seals, causing them to panic and charge into the water, resulting perhaps in the injury, death, or abandonment of small numbers of seal pups. Because nursing seals and pups are widely distributed along the ice front, aircraft moving to and from drill platforms are likely to temporarily disturb only a small portion of these seal populations. Aircraft disturbance of seals and polar bears is likely to cause short-term displacement (a few minutes to less than a few days) of small numbers of these animals (less than a few hundred) within about 1 kilometer of the air-traffic route. Vessel traffic (7-14 trips per year) associated with exploration-drilling units, production platforms, and seismic vessels operating during the open-water season temporarily could displace or interfere with marine mammal migration and change local distribution for a few hours to a few days. Such short-duration and local displacement (within 1-3 kilometers [0.62-1.9 miles] is expected to have a short-term (less than a few days') effect on the distribution of seals, polar bears, and beluga whales. The installation of eight production platforms and the laying of 115 miles of offshore pipelines within a few square kilometers of benthic habitat likely would have a short-term and local effect on these marine mammals.

In the unlikely event of a large oil spill occurring and contacting and extensively oiling coastal habitats, the presence of cleanup personnel, boats, and aircraft operating in the cleanup area is expected to displace seals, polar bears, and other marine mammals in the oiled areas and to contribute to increased stress and reduced pup survival of ringed seals, if operations occur during the spring. This effect is expected to persist for perhaps 1 or 2 years and to affect seals, polar bears, and other marine mammals within about 1.6 kilometers (1 mile) of the activity.

IV.C.11.b(1)(b)3) Caribou and Other Terrestrial Mammals

Exploration is expected to have very brief (few minutes to less than 1 hour) disturbance effects on caribou, muskoxen, grizzly bears, and arctic foxes, with recovery occurring within a day or less and to have no effect on these populations.

Under development, the primary source of disturbance to caribou, muskoxen, grizzly bears, and arctic foxes is air and ice-road traffic that would be associated with onshore construction and transportation of oil from offshore leases. Disturbance of caribou, muskoxen, grizzly bears, and arctic foxes along onshore pipelines to the Trans-Alaska Pipeline System would be most intense during the construction period (perhaps 6 months), when ice-road traffic is highest, but would subside after construction is complete. Caribou and muskoxen are likely to successfully cross the pipeline corridor within a short period of time (a few minutes to a few hours) during breaks in the traffic flow, even during high traffic periods, with little or no restriction in movements. Because oil transportation for development of Federal offshore leases east of the Canning River is expected to be located offshore of the Arctic National Wildlife Refuge, caribou of the Porcupine Caribou Herd that calve on the Refuge are not likely to be affected by the development activity.

The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 1-2 kilometers (0.62-1.2 miles) along onshore pipelines, with local effects persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect overall population movements and distributions.

In the unlikely event of a large oil spill occurring and contacting and extensively oiling coastal habitats containing herds or bands of caribou during the insect season, the presence of cleanup personnel, boats, and aircraft operating in the area of cleanup activities is expected to cause displacement of some caribou in the oiled areas and contribute temporarily to seasonal stress on some animals. This effect likely would occur during cleanup operations (perhaps 1 or 2 seasons) but is not expected to significantly affect caribou herd movements or foraging activities of the populations. Cleaning up a large oil spill also would disturb some muskoxen, grizzly bears, and arctic foxes. An oil spill could result in the loss of small numbers of grizzly bears and arctic foxes through ingestion of contaminated prey or carrion. However, such losses are not expected to be significant to their populations on the Arctic Slope.

In 1979, Nuiqsut resident Nannie Woods talked about fish and caribou being less abundant at the Sagavanirktok River since the development at Prudhoe Bay. She explained that the river's tributaries also did not have as many fish, and that fewer caribou were there now than there used to be in the summer (Woods, 1979, as cited in USDOI, Bureau of Land Management, 1979a).

At the MMS Information Update Meeting held March 29, 2000, in Barrow, the Alaska Department of Fish and Game made a presentation on a draft study of subsistence economics and oil development in Nuiqsut and Kaktovik, which affirmed a strong connection to anthropogenic effects as the cause for the displacement of subsistence hunters from traditional caribou-hunting areas near Nuiqsut during the 1993 and 1994 harvest seasons (Pedersen et al., In prep.).

Mayor Leonard Lampe said at an MMS Liberty Project Information Update Meeting in November 1999 that they do not see as many calving caribou as they did before. The Tarn Project well has changed their south/north migration, and the Alpine development may affect their east/west migration. Caribou now have to cross three pipelines. At the same meeting, Elder Ruth Nukapigak stated she believed contamination is happening to the caribou from air pollution. They smell the smoke from Alpine and scatter.

IV.C.11.b(1)(b)4) Fish

Noise, disturbance, and discharges from dredging, gravel mining, island construction, island reshaping, pipeline trenching, and abandonment are expected to have no measurable effect on fish populations, including incidental anadromous species. While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are expected to be short term and sublethal, with no measurable effects on overwintering fish populations.

Because of the low density of fish in the Beaufort Sea, and the low probability that they would be harmed by cleanup equipment, oil-spill-cleanup activities in open water or in broken ice are not expected to adversely affect fish populations. Reducing the amount of oil in the marine environment is expected to have a beneficial effect by reducing the possibility of hydrocarbons contacting fish and their food resources. The extent of that benefit would depend on the actual reduction in the amount of oil contacting fish and their food resources, as compared to not reducing the amount of contact.

Subsistence hunter Isaac Nukapigak, from Nuiqsut, observed that cisco are not spawning out near the Colville Delta anymore, explaining that oil activities in State waters there are having an effect (Nukapigak, 1995, as cited in USDOI, MMS, 1995d). Nuiqsut resident Joan Taleak maintained reservations about local traffic by industrial vessels during her 1983 testimony for a proposed OCS sand and gravel lease sale. She was concerned about the barges hauling gravel conflicting with fishing that had been her way of life since childhood. She recounted her worry that there would be no more whitefish if the sale activities occurred (Taleak, 1983, as cited in USDOI, MMS, 1983a).

Native concern about the effects of development on fish stocks has been evident since the Endicott Project. In 1984, Thomas Napageak, Nuiqsut whaling captain and Chairman of the Alaska Eskimo Whaling Commission, said: “The causeway sticking out into the ocean will change currents along the coast. Furthermore, it will change the migration route of the fish we depend on” (Napageak, as cited in U.S. Army Corps of Engineers, 1984). Complaints about reduced size of the fish harvested persist in Nuiqsut, and fish are an important subsistence resource, accounting for 33% of the community’s total subsistence harvest in 1993 (Pedersen, 1996) and 25% in 1995 (Brower and Opie, 1997). Nuiqsut fish harvesters have noted that Arctic cisco have decreased, coinciding with the operation of Endicott’s water-treatment plant (Dames and Moore, 1996a). Wilber Ahtuangaruak, from Nuiqsut, maintained almost 2 decades ago that there “aren’t as many whitefish since the oil companies started drilling at Flaxman Island” (Ahtuangaruak, 1979, as cited in USDOI, Bureau of Land Management, 1979a); Joseph Akpik, from Nuiqsut, asserts that offshore exploration would affect the cisco population (Akpik, 1995, as cited in USDOI, MMS, 1995a).

At an MMS Liberty Project Information Update Meeting in November 1999 in Nuiqsut, Elders Lloyd Ipalook, Alice Ipalook, and Ruth Nukapigak said that fish stocks were very low. Alice Ipalook and Ruth Nukapigak both noted that they had seen a decrease in whitefish since the work at Kalubik, and that there used to be 100-200 fish caught per day versus 6-9 per day now.

IV.C.11.b(1)(b)5) Birds

Disturbance from all sources, especially helicopter traffic, is expected to result primarily in short-term displacements of birds from the local areas where disturbance events are occurring; disturbance of local nesting birds probably would have little effect on Arctic Slope bird populations as a whole. Little direct mortality is expected, but losses of eggs and young to predators when adults are displaced is likely to occur. Routinely disturbed adults may experience lowered fitness with resulting declines in survival and productivity over the life of the field. Recovery of losses to bird populations adversely affected by discharges, all sources of disturbance, and habitat alteration is expected to occur within a few generations. The overall potential effect of disturbance and habitat alteration on marine and coastal birds would be the short-term displacement of nesting, feeding, molting, and staging birds and a decline in fitness, requiring 1 generation (about 2-4 years) for population recovery.

The presence of large numbers of workers, boats, and aircraft following a spill is expected to displace eiders foraging in affected offshore or nearshore and coastal habitats during open-water periods for one to several seasons. Disturbance during the initial season, possibly lasting 6 months, is expected to be frequent. Cleanup in coastal areas late in the breeding season may disturb broodrearing, juvenile, or staging birds. However, staging or migrating flocks of most species generally are dispersed and, thus, would not necessarily occur in the vicinity of cleanup activity; as a result, relatively few flocks are likely to be displaced from favored habitats and expend energy stores accumulated for migration. However, large flocks of long-tailed ducks molting in lagoons, and common eiders occupying barrier islands or lagoons are particularly susceptible if they are nesting, broodrearing, or flightless. Although little direct mortality from cleanup activity is expected, predators may take some eggs or young while females are displaced off their nests if located near a site of operation. Survival and fitness of individuals may be affected to some extent, but this infrequent disturbance is not expected to result in significant population losses.

Kaktovik resident Mike Edwards stated in public testimony that he thought noise would harm the waterfowl, an important springtime source of food (Edwards, 1979, as cited in USDOI, Bureau of Land Management, 1979b).

IV.C.11.b(1)(c) Additional Native Concerns About Noise and Disturbance

IV.C.11.b(1)(c)1) Access

Local residents have voiced concerns about access restrictions. Sarah Kunaknana, talking about local subsistence hunters, stated that others say they do not hunt near Prudhoe Bay anymore because of oil development (Kunaknana, as cited in Shapiro, Metzner, and Toovak, 1979). Billy Oyagak from Nuiqsut said supply ships, choppers, and drilling interfered with whale hunting, making it difficult to find any animals. That year, the hunt required 5 weeks to complete (Oyagak, 1986, as cited in USDOI, MMS, 1986a). Nelson Ahvakana, from Nuiqsut, was concerned that areas that are supposed to be left open for subsistence hunting effectively will be closed because of increased security at the new drill sites, and access to subsistence resources will be restricted (Ahvakana, 1990, as cited in USDOI, MMS, 1990d).

This concern takes on even more substance as the Northstar Project, development at the Alpine field, and leasing in the National Petroleum Reserve-Alaska become realities. During a 1996 meeting on the Northstar Project in Nuiqsut, two Nuiqsut men described being denied access to fishing and hunting areas around Prudhoe operations even though they have traditional rights to be there. They do not want new projects to restrict or deny access (Dames and Moore, 1996b). A whaler voiced concern that BPXA or the Federal Government would block the whalers from taking their traditional whaling route to Cross Island if a production facility were developed at Liberty Island. They prefer to travel within the barrier islands, because they are more protected from the sea (Dames and Moore, 1996b).

Barrow resident Charles Brower stated in 1986 that an onshore pipeline could interfere with subsistence access; additional hunting restrictions would occur, requiring a permit (Brower, 1986, as cited in USDOI, MMS, 1986c).

IV.C.11.b(1)(c)2) Construction

Native residents expressed concern at a Northstar public meeting about the possibility of steel and concrete fatigue over the 15-year project life of the Northstar Project (Dames and Moore, 1996b).

IV.C.11.b(1)(c)3) Dredging

Speaking at public hearings in Nuiqsut, Edward Nukapigak, Sr., declared: "If they want gravel, they should not get it from the paths of the animals that we eat" (Nukapigak, 1983, as cited in USDOI, MMS, 1983a). At village meetings in August 1996 for the Northstar Project, Natives stated that currents can change the bottom contours, potentially affecting the buried pipeline, particularly from river overflow (Dames and Moore, 1996a). Nuiqsut whaling captains believe that Seal Island, as planned for Northstar, needs more protection from natural elements to be considered safe by the community (Dames and Moore, 1996b).

Testifying at public hearings for a proposed offshore sand and gravel lease, Othniel Oomittuk from Barrow explained that the "water from the dredge operation would also [dis]place the bowhead from their normal fall migration pattern. It drives the whales out, as whalers can't get to them with their small whaling boats" (Oomittuk, 1983, as cited in USDOI, MMS, 1983a).

IV.C.11.b(2) Large Oil Spills

IV.C.11.b(2)(a) General Effects from Oil Spills

General effects from oil exploration and development could be expected from potential oil spills and tainting and the cleanup disturbance that could occur after such a spill event. An oil spill affecting any part of the migration route of the bowhead whale could taint a resource that is culturally pivotal to the subsistence lifestyle. Even if whales were available for the spring and fall hunts, tainting concerns could leave bowheads less desirable and alter or stop the subsistence hunt. Communities unaffected by a potential spill would share bowhead whale products with impacted villages, and the harvesting, sharing, and processing of other resources should continue. Concerns about tainting would apply also to polar bears and seals and, in the unlikely event of a large oil spill, it could cause potential short-term but serious adverse effects to some bird populations. A potential loss of a small number of polar bears would reduce their local availability to subsistence users. Oil-spill-cleanup activities could produce additional effects on subsistence activities, potentially causing displacement of subsistence resources and subsistence hunters.

Although a spill could originate within the Beaufort Sea multiple-sale area, its indirect impacts might be felt by communities remote from the sale area and far removed from the spill. Essentially, concerns about subsistence harvests and subsistence food consumption would be shared by all Inupiat and Yup'ik Eskimo communities in the Chukchi and Bering seas adjacent to the migratory corridor used by whales and other migrating species. Tainting concerns in these communities about resources initially and secondarily oiled could seriously curtail traditional practices for harvesting, sharing, and processing important subsistence species, because all communities would share concerns over the safety of subsistence foods in general and whale food products and the health of the whale stock, in particular.

IV.C.11.b(2)(b) Specific Effects on Subsistence Resources

IV.C.11.b(2)(b)1) Bowhead Whales

In the unlikely event of a large oil spill, the probability of oil contacting whales is likely to be considerably less than the probability of oil contacting bowhead habitat. If a spill occurred and contacted bowhead habitat during the fall migration, it is likely that some whales would be contacted by oil. It is unknown what effects an oil spill would have on bowhead whales, but some conclusions can be drawn from studies that have looked at the effects of an oil spill on other types of whales. It is likely that some whales would experience temporary, nonlethal effects, including one or more of the following symptoms: (1) oiling of their skin, causing irritation; (2) inhaling hydrocarbon vapors; (3) ingesting oil-contaminated prey; (4) fouling of their baleen; (5) losing their food source; and (6) temporary displacement from some feeding areas.

Some whales could die as a result of contact with spilled oil. Geraci (1990) reviewed a number of studies on the physiologic and toxic effects of oil on whales and concluded there was no evidence that oil contamination had been responsible for the death of a cetacean. Nevertheless, the effects of oil exposure to the bowhead whale population are uncertain, speculative, and controversial. The effects would depend on how many whales contacted oil, the duration of contact, and the age and degree of weathering of the spilled oil. The number of whales contacting spilled oil would depend on the location, size, timing, and duration of the spill and the whales' ability or inclination to avoid contact. If oil got into leads or ice-free areas frequented by migrating bowheads, a large portion of the population could be exposed to spilled oil. Prolonged exposure to freshly spilled oil could kill some whales, but the number likely would be small. Whales exposed to spilled oil are likely to experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. Traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales or their feeding areas from an oil spill.

Barrow elder Thomas Brower, Sr., observed an oil spill from a U.S. Navy vessel in the Plover Islands east of Barrow in 1944 where about 25,000 gallons were spilled. According to Brower: "for four (4) years after that oil spill, the whales made a wide detour out to sea from these islands. Those Native families could no longer hunt whales during these years at that location" (Brower, as cited in North Slope Borough, Commission on History and Culture, 1980).

Although this spill event reveals that species can experience recovery from an oil spill in the Arctic after 4 years without cleanup, the event is remembered more importantly as a time of devastation and deprivation by those who directly witnessed the effects of the spill or those who were told of the event by witnesses. Not only were whales absent for 4 years following the spill, but other resources were absent or occurred in reduced numbers. The people of Barrow who remember the spill consider it evidence that even a relatively small oil spill in a defined area can have lasting effects on subsistence resources and harvests.

IV.C.11b(2)(b)2) Seals, Beluga Whales, and Polar Bears

The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss due to an oil spill (0.11% chance) of small numbers of seals (perhaps 300 ringed, probably fewer than 10-20 spotted, and 30-50 bearded seals; fewer than 100 walruses; perhaps 5-30 polar bears; and fewer than 10 beluga and gray whales, with populations recovering (the replacement of individuals killed as a consequence of exploration and development) within about 1 year.

Thomas Brower, Sr. stated that:

> In the cold, Arctic water, the oil formed a mass several inches thick on top of the water. Both sides of the barrier islands in that area—the Plover Islands—became covered with oil. That first year, I saw a solid mass of oil six (6) to ten (10) inches thick surrounding the islands. On the seaward side of the islands, a mass of thick oil extended out sixty (60) feet from the islands, and the oil slick went much further offshore than that. I observed how seals and birds who swam in the water would be blinded and suffocated by contact with the oil. It took approximately four (4) years for the oil to finally disappear (Brower as cited in North Slope Borough, Commission on History and Culture, 1980).

Again, it should be noted that some species' recovery was seen after 4 years.

IV.C.11.b(2)(b)3) Caribou and Terrestrial Mammals

A possible oil spill (1,500 or 4,600 barrels) could cause the loss of perhaps a few hundred caribou. The numbers of muskoxen, grizzly bears, and arctic foxes affected are expected to be fewer than 10 individuals per species, based on their scattered distribution on the North Slope.

Coastline habitats from Dease Inlet, Cape Simpson east to the Atigaru Point-Kogru River area (Land Segments 26, 28-33, and 47), and coastline habitats in the Kaktovik area (land segment 47) have the highest risks of spill contact: from 15% up to 21% from either LA1-LA18 or P1-P13, assuming spills occur during the summer season and contact the coastline within 30 days (Table A.2-27). An estimated 29-49 kilometers of coastline could be oiled by the 1,500- or 4,600-barrel spill. Some caribou from the Teshekpuk Lake, Western Arctic, Central Arctic, or Porcupine Caribou herds could contact oil in these areas, as they move into these areas to escape insects. Even in a severe situation, perhaps 10 to a few hundred animals from one of these herds could get oil on their coats and die from toxic hydrocarbon inhalation and absorption. This loss probably would be small for any of these caribou herds and would be replaced within about 1 year.

For the most part, the effect of onshore pipeline spills would be very local and would contaminate tundra in the immediate vicinity of the pipeline; these spills would not be expected to significantly contaminate or alter caribou and muskox range within pipeline corridors.

In the unlikely event that a large oil spill occurred in the Beaufort Sea, it is expected to result in the loss of no more than perhaps a few hundred caribou, and probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

IV.C.11.b(2)(b)(4) Fish

Likely effects on arctic fishes, including incidental anadromous species, from a large oil or diesel fuel spill would depend primarily on the season and location of the spill, the lifestage of the fish (adult, juvenile, larval, or egg), and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are expected on fish in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fish concentrate to feed and migrate. If an offshore spill did occur and contacted the nearshore area, some marine and migratory fish could be harmed or killed. However, it would not be expected to have a measurable effect on fish populations, and recovery would be expected within 5-7 years. In general, the effects of fuel spills on fish are expected to be less than those of crude-oil spills.

If a pipeline spill occurred onshore and contacted a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and had restricted water exchange, it would be expected to kill or harm most of the fish within the affected area. Recovery would be expected in 5-7 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies that contain many fish or fish eggs, an onshore spill of this kind is not expected to have a measurable effect on fish populations on the Arctic Coastal Plain.

IV.C.11.b(2)(b)5) Birds

The loss of several thousand long-tailed ducks on the regional population is difficult to determine but probably would not have a significant long-term adverse effect on the regional population because recruitment could replace the loss within several generations unless the population is in fact declining significantly, in which case we would not expect recovery. The recovery period required for a loss from the suite of species typically occupying the nearshore and offshore Beaufort Sea of up to about 10,000 individuals is difficult to estimate, because species will recover at different rates. Some species with low reproductive rates or population levels (for example, loons, black guillemot) may not suffer high mortality as a result of an oil spill, because they are not abundant in most of the proposed the sale area and do not occur in large feeding flocks, although any losses would recover slowly due to relatively low reproductive rates.

The relatively small losses of most species, other than the long-tailed duck, likely to result from an oil or fuel spill in the Beaufort Sea may be difficult to separate from natural variation in population numbers. This has been found for other waterbird populations under similar circumstances. Regardless of the factors involved in causing mortality, complete recovery of Arctic Coastal Plain populations of some species (for example, eiders) from even small losses in the proposed lease area would not occur until their populations are stable or increasing, as they apparently have been declining since 1992. This probably is due to these species' low reproductive rates. Recruitment of individuals into the population under such circumstances is likely to be low and losses from spill mortality, intensified by low productivity or lowered survival of any age groups, is expected to increase the length of time required for recovery to former population levels. Because the amount of information on rates of productivity, survival, and recruitment currently available makes it difficult to determine the recovery rate of either local or entire coastal plain populations from incidents causing mortality, the long-term effect of oil-spill mortality is uncertain. Also, different rates of decline could be ongoing in various parts of the population but undetected between individual survey years by current survey methodology. Currently, eider numbers on the coastal plain generally appear to be stable, or increasing or declining at a nonsignificant rate. When the population is declining, the rate of recovery from any substantial oil spill or other mortality associated with oil and gas development is likely to be negatively affected. In addition, any recovery from mortality associated with the first sale, which is likely to involve the largest numbers of individuals of the three due to the presence of two drill sites in the relatively small Near Zone where bird activity is concentrated, is expected to be delayed by any mortality resulting from the subsequent two sales. With any substantial mortality, the potential exists for a significant adverse effect on these populations. Losses from oil spills likely would include the loss of several thousand birds due to oil contamination, with population recovery expected within a few generations.

IV.C.11.b(2)(c) How Oil-Spill Contact May Affect Subsistence-Harvest Patterns

No oil spills are assumed to occur during exploration activities. For the development and production phase, a 1,500-barrel spill from a platform, or a 4,600-barrel spill from a pipeline are assumed in this EIS. The probabilities of either spill contacting specific environmental resource areas would be the same. The 1,500-barrel spill would cover a smaller area (181 square kilometers) than the 4,600-barrel spill (320 square kilometers) after 30 days. Only the 4,600-barrel spill is discussed below, as it represents the highest range of potential contact and impact from an oil spill.

A 4,600-barrel spill could contact environmental resource areas where important subsistence resources are present. The following discussion presents conditional and combined probabilities estimated by the Oil-Spill-Risk Analysis model (expressed as a percent chance) of a spill contacting subsistence-resource areas. Conditional probabilities are based on the assumption that a spill has occurred and makes contact. Combined probabilities, on the other hand, factor in the chance of the spill occurring. Oil-spill contact in winter could affect polar bear hunting and sealing. During the open-water season, a spill could affect bird hunting, sealing, and whaling, as well as netting of fish in the ocean.

For conditional probabilities, the oil-spill model estimates a 7-74% chance of a 4,600-barrel oil spill starting at LA1-LA8 contacting important Barrow (ERA's 2 (Point Barrow) and 42 (Bowhead Whaling Area) within 30 days during the summer, and a 5-75% chance of contact from LA1-LA10 over a 360-day period. There is a 9-58% chance of contact from P1-P9 within 30 days and a 7-58% chance of contact in 360 days. Land Segments 25 (Elson Lagoon), 26 (Dease Inlet), 27 (Kurgorak Bay), 28 (Cape Simpson), and 29 (Smith Bay) have a 5-17% chance of contact from a summer spill originating at LA1-LA6 for 30 days and 5-18% chance of contact for 360 days. From a spill originating at PA1, PA2, or PA8, there is a 5-21% chance of contact for both 30 days and 360 days.

Winter-contact percentages generally are less. For a 30-day period, they range from 0-9% starting at LA8-LA9, and 5-16% over a 360-day period from LA1-LA13. For 30 days, there is a 0-6% chance of contact from P1 and P8, and a 5-20% chance of contact from P1-P10 for 360 days (see Tables A.2-21, A.2-24, A.2-45, and A.2-48). Only Land Segment 28 has a chance of contact within 30 days—5% from a spill origination at P8.

The oil-spill model estimates a 6-53% chance of a 4,600-barrel oil spill starting at LA6-LA15 contacting important Nuiqsut ERA's 3 (Thetis, Jones, and Spy islands), 4 (Cottle and Return islands), 5 (Reindeer Island), 6 (Cross Island Vicinity), 10 (Tigvariak Island), 12 (Flaxman Island/Brownlow Point), 43 (Cross Island Whaling Area), and 69 (Harrison Bay/Colville Delta) within 30 days during the summer and a 5-54% chance of contact from LA5-LA15 over a 360-day period. There is a 5-32% chance of contact from P1-P6 and P10-P12 within 30 days and a 5-33% chance of contact in 360 days from P2-P6 and P9-P13. Land Segments 35 (Colville River Delta), 36 (Oliktok Point), 37 (Milne Point), and 38 (Kuparuk River) have a 5-7% chance of contact from a summer spill originating at LA8, LA10, or LA12 for 30 days and a 5-8% chance of contact for 360 days from LA7-LA13. From a spill originating at P4, P10, or P11, there is a 5-15% chance of contact for 30 days and from P3-P5 and P10-P12, there is a 5-16% chance of contact within 360 days. Land segments from the Colville River Delta to Bullen Point-Tigvariak Island include areas historically used by Nuiqsut subsistence hunters to harvest caribou, waterfowl, marine fish, polar bears, and small furbearers. This is not an area of high subsistence use at the present time. More recently, hunting appears to take place nearer to the community and onshore areas of primary importance on the Colville River Delta.

Winter-contact percentages for a 30-day period range from 5-15% starting at LA12, and 5-33% over a 360-day period from LA10-LA15. For 30 days, there is a 6-14% chance of contact from P10-P12 and a 5-34%

chance of contact from P3-P6 and P9-P13 for 360 days (see Tables A.2-21, A.2-24, A.2-45, and A.2-48). Only LS 36 has a chance of contact within 30 days—6% from a spill origination at P10.

Environmental resource areas for Kaktovik contain crucial harvest areas for caribou, waterfowl, fish, and seals. The oil-spill model estimates a 6-42% chance of a 4,600-barrel oil spill starting at LA14-LA18 contacting important Kaktovik ERA's 12 (Flaxman Island/Brownlow Point), 16 (Jago Spit Area), and 44 (Kaktovik Whaling Area) within 30 days during the summer, and a 11-34% chance of contact from LA4-LA18 over a 360-day period. There is an 8-48% chance of contact from P6, P7, or P13 within 30 days and a 5-39% chance of contact in 360 days from P6, P7, P12, or P13. Land Segments 42 (Point Hopson), 43 (Brownlow Point), 46 (Arey Island/Barter Island), 47 (Kaktovik), 48 (Griffin Point), 49 (Beaufort Lagoon), and 50 (Icy Reef) have a 5-12% chance of contact from a summer spill originating at LA16, LA17, or LA18 for 30 days and a 5-13% chance of contact for 360 days from LA14-LA18. From a spill originating at P7 or P13, there is a 5-16% chance of contact for 30 days and from P6, P7, P12, or P13, there is a 5-17% chance of contact within 360 days.

Winter-contact percentages for a 30-day period range from no chance of contact from any launch area to any environmental resource area to a 5-12% chance of contact over 360 days from LA16-LA18. For 30 days, there is no chance of contact from any P segment to any environmental resource area and a 10% chance of contact from P7 for 360 days (See Tables A.2-21, A.2-24, A.2-45, and A.2-48). No launch areas have a chance of contact within 30 and 360 days.

Combined probabilities express the percent chance of one or more oil spills greater than or equal to 1,000 barrels occurring and contacting a certain environmental resource area over the production life of the Beaufort Sea multiple-sale area. For combined probabilities, the oil-spill model estimates a 0.5-1% chance that an oil spill would occur from a platform or a pipeline (LA1-LA18 or P1-P13, respectively) and contact subsistence specific ERA's 2, 3, 42, 69, 74, 83, and LS 27 within 360 days (Table A.2-56).

The potential for bowhead whales to be contacted directly from an oil spill from the Beaufort Sea multiple sales is relatively small, but the potential chance of contact to whale habitat, whale-migration corridors, and subsistence-whaling areas is considerably greater. Onshore areas and terrestrial subsistence resources, in general, seem to have a lower potential for oil-spill contact.

IV.C.11.b(2)(d) Effects of Cleanup Activities on Subsistence Resources and Harvests

Disturbance to bowhead whales, seals, polar bears, caribou, fishes, and birds would increase from oil-spill-cleanup activities. Offshore, skimmers, workboats, barges, aircraft overflights, and in situ burning during cleanup could cause whales to temporarily alter their swimming direction. Such displacement would cause some animals, including seals in ice-covered or broken-ice conditions, to avoid areas where they normally are harvested or to become more wary and difficult to harvest. People and boats offshore and people, support vehicles, and heavy equipment onshore, as well as the intentional hazing and capture of animals would disturb coastal resource habitat, displace subsistence species, alter or reduce subsistence-hunter access to these species, and alter or extend the normal subsistence hunt. Deflection of resources, resulting from the combination of a large oil spill and spill-response activities, would persist beyond the timeframe on a single season, perhaps lasting several years. The result would be a major effect on subsistence harvests and subsistence users, who would suffer impacts on their nutritional and cultural well-being.

Identified spill-cleanup strategies potentially would reduce the amount of spilled oil in the environment and tend to mitigate spill-contamination effects. In the case of a winter spill, when few important subsistence resources would be present, cleanup is likely to be fairly effective in dealing with a spill before migrating whales and other species return to the area during breakup and the open-water season. Ringed seals are common during the winter, but they are not harvested by local subsistence hunters during this period. Subsistence hunting also would be impacted by any spill that required the local knowledge, the experience, and the vessels of local whaling captains. This diverting of effort and equipment to oil-spill cleanup would adversely impact the subsistence whale hunt. Far from providing mitigation, oil-spill-cleanup activities more likely should be viewed as an additional impact, potentially causing displacement of the subsistence hunt, subsistence resources, and subsistence hunters (see Impact Assessment, Inc., 1998).

IV.C.11.b(2)(e) Native Views on Oil Spills

IV.C.11.b(2)(e)1) Barrow's Views on Oil Spills

Barrow is very concerned about oil spills, particularly oil-spill response. In 1983, Percy Nusunginya from Barrow related:

> This summer there was supposed to be a demonstration on oil spill response but the weather did not cooperate in the Arctic, so we will expect the industry to have an oil spill on a calm day (Nusunginya, 1983, as cited in USDOI, MMS, 1983b).

Don Long from Barrow stated in 1990:

> Any disruption, whether it be oil spill or noise, would only disturb the normal migration [of bowhead whales], and a frightened or a tense whale is next to impossible to hunt" (Long, 1990, as cited in USDOI, MMS, 1990b).

Eugene Brower from Barrow expressed the general concern that spill-cleanup procedures under ice do not exist (Brower, 1990, as cited in USDOI, MMS, 1990b) and, similarly, in 1995 hearings in Barrow, Edward Hopson asserted that technology is not in place to deal with spills in the Arctic Ocean (Hopson, 1995, as cited in USDOI, MMS, 1995b). Marie Adams, also from Barrow, observed that an oil spill in the "fragile ecosystem" of the Arctic could devastate the bowhead whale because these animals migrate through "narrow open-lead systems," which could be the preferred path of an oil spill (Adams, 1990, as cited in USDOI, MMS, 1990b).

Having been a whaler since 1916, Thomas P. Brower, Sr., from Barrow, in a 1978 interview, gave an extraordinary account of an oil spill in the Arctic and its effects:

> I have also seen how sensitive the whales are to water pollution. The commercial whaling ships would always avoid pumping their bilge tanks in the whaling areas. I observed that if some bilge water had to go over the side, it would always be first strained and cleaned before dumping. In 1944, I saw the effects of an oil spill on Arctic wildlife, including the bowhead. I had been asked to be on the flagship [the *U.S.S. Spica*] of a Navy convoy moving along the Beaufort Sea coast. While I was on the flagship, I saw twenty (20) other ships including several Navy oil tankers. In August 1944 one of the cargo ("Liberty") ships [the S.S. *Jonathan Harrington*] ran aground on a sandbar off Doctor Island in Elson Lagoon, southeast of Utqiagvik [Barrow]. They needed to lighten the ship to get free. To my disgust, instead of bringing up a tanker to transfer the cargo, they simply dumped the oil into the sea. About 25,000 gallons of oil were deliberately spilled into the Beaufort Sea in this operation. In the cold, Arctic water, the oil formed a mass several inches thick on top of the water. Both sides of the barrier islands in that area--the Plover Islands--became covered with oil. That first year, I saw a solid mass of oil six (6) to ten (10) inches thick surrounding the islands. On the seaward side of the islands, a mass of thick oil extended out sixty (60) feet from the islands, and the oil slick went much further offshore than that. I observed how seals and birds who swam in the water would be blinded and suffocated by contact with the oil. It took approximately four (4) years for the oil to finally disappear. I have observed that the bowhead whale normally migrates close to these islands in the fall migration. Native families living in the area of Utqiagvik and Elson Lagoon were accustomed to catching small whales in the fall for the winter food supply. But I observed that for four (4) years after that oil spill, the whales made a wide detour out to sea from these islands. Those native families could no longer hunt whales during these years at that location...If there were a major blowout, all the Inupiat could be faced with the end of their marine hunting, just as those families near Elson lagoon suffered in 1944 through 1948. (North Slope Borough, Commission on History and Culture, 1980).

IV.C.11.b(2)(e)2) Nuiqsut's Views on Oil Spills

Ruth Nukapigak from Nuiqsut spoke in 1983 about the effects she had seen from drilling nearby. She had discovered that fish are afraid of suds or foam and had seen oil in the water. She had heard that when there is an oil spill, it's cleaned up with suds or foam. For those living in Nuiqsut, she believes their food is really going to change from what the oil companies are going to be doing (Nukapigak, 1983, as cited in USDOI, MMS, 1983a). Maggie Kovalsky, also from Nuiqsut, expressed the same fear about effects on

Nuiqsut's subsistence foods. She explained that if a spill ever happened, she thinks it would harm a lot of the food they depend on, such as fish and bowhead whale and duck (Kovalsky, 1984). Nuiqsut elder Sarah Kunaknana was worried that an oil spill could occur and damage the habitat of the bowhead whales and other sea mammals (Kunaknana, 1990, as cited in USDOI, MMS, 1990d).

In a Statewide survey conducted from 1992-1994 by the Alaska Department of Fish and Game, Division of Subsistence, 80% of the respondents in Nuiqsut believed that industry could not contain and clean up a large oil spill. A similar question about containing and cleaning up a small oil spill got negative responses from 60% of the people in Nuiqsut (State of Alaska, Dept. of Fish and Game, 1995a). Ice forces can be unpredictable, and Frank Long, Jr., a whaler from Nuiqsut, expressed local concern that an oil spill could be caused by ice scraping a pipeline or drill pipe, and the resulting spill would damage the entire food chain (Long, 1995, as cited in USDOI, MMS, 1995a). In 1996, people in Nuiqsut reiterated their belief that technology does not exist to clean up an oil spill under the ice; they believe it is a matter of *when* a spill will occur, not *if* it will occur. They want assurance against disaster and impact funds set aside for them in case this happens (Dames and Moore, 1996a).

Issues about using local expertise and people are prevalent in Nuiqsut. Leonard Lampe, Nuiqsut's former mayor, reported:

> As a member of the village oil spill-response team, we were not allowed to go out onto the ice even for drills under certain very dangerous conditions. So what if a spill occurs under those conditions? There will be no way to clean it up (Lampe, 1995, as cited in USDOI, MMS, 1995a).

IV.C.11.b(2)(e)3) Kaktovik's Views on Oil Spills

Over many years, Kaktovik has voiced its concerns over ice hazards to oil rigs and possible oil spills. In 1979, Philip Tiklul from Kaktovik observed that the ice movements are strong enough to damage an oil rig and cause a spill (Tiklul, 1979, as cited in USDOI, BLM, 1979b). Kaktovik subsistence hunter Jonas Ningeok explained that the weather is very unpredictable. Sudden snowstorms can be dangerous. Pressure ridges may form in the ice, damage the oil rig, and cause a spill (USDOI, MMS, 1990c). At the same hearing in 1990, Nolan Soloman expressed a similar concern when he stated that oil rigs may fail under the strain of the ice (Soloman, 1990, as cited in USDOI, MMS, 1990c). Recently, Fenton Rexford, President of Kaktovik Inupiat Corporation and a subsistence hunter, declared that the:

> Inupiat here in Kaktovik are adamantly against offshore production until there is proven technology of a cleanup of an oil spill under ice-infested waters. It wasn't quite proven yet on onshore even. (Rexford, 1996, as cited in Dames and Moore, 1996c).

Kaktovik residents often have spoken about the threat from oil spills to subsistence food resources. Herman Rexford voiced concern in 1982 that an oil spill would damage the food the whales live on (Rexford, 1982, as cited in USDOI, MMS, 1982a). During public hearings in 1995, whaling captain Isaac Akootchook worried that an oil spill could occur under the ice and go unnoticed, causing significant damage to subsistence resources (Akootchook, 1995, as cited in USDOI, MMS, 1995c). At hearings for the Northstar Project, Fenton Rexford said:

> We know there are a lot of waterfowl that come from all over the world that go through this area, so that is one of the issues I would like to see in here [the EIS]. They come from all over the world for only a 3-month period, and if there is a spill, that would have a drastic effect (Rexford, 1996, as cited in Dames and Moore, 1996c).

IV.C.11.b(3) How Stipulations and Mitigating Measures Help Reduce Noise, Disturbance, and Oil-Spill Effects

Several mitigating measures are assumed to be in place for the Beaufort Sea multiple sales, and this assumption is reflected in discussions about effects. Mitigation that would apply to subsistence-harvest patterns includes standard proposed Stipulations 2 - Orientation Program, 4 - Industry Site-Specific Bowhead Whale Monitoring Program, and 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvest Activities. Proposed stipulations developed specifically for this EIS are Stipulation 6a - No Permanent Facility Siting in the Vicinity Seaward of Cross Island, 6b - No

Permanent Facility Siting in the Vicinity Shoreward of Cross Island, and 7 - Pre-booming Requirements for Fuel Transfers.

Stipulation 2 - Orientation Program requires the lessee to educate people working on exploration, development, and production about the environmental, social, and cultural concerns that relate to the area and its communities. The program should increase workers' sensitivity to, and understanding of, values, customs, and lifestyles of local Native communities and help prevent any conflicts with subsistence activities. The overall training program will be submitted to the Regional Supervisor, Field Operations for review and approval. Personnel will receive appropriate training on at least an annual basis, and full training records will be maintained for at least 5 years.

Stipulation 4 - Industry Site-Specific Bowhead Whale-Monitoring Program requires lessees proposing to conduct exploratory drilling operations, including seismic surveys, during the bowhead whale migration to conduct a site-specific monitoring program approved by the Regional Supervisor, Field Operations (RS/FO); unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with the North Slope Borough (NSB) and the Alaska Eskimo Whaling Commission (AEWC), determines that a monitoring program is not necessary. The monitoring program would assess when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these operations.

This stipulation helps to provide mitigation to potential effects of oil and gas activities on the local Native whale hunters and subsistence users. It is considered as positive mitgation under environmental justice. Other positive aspects of this stipulation in terms of subsistence and sociocultural concerns would be the involvement of the Native community in the selection of peer reviewers and in providing observers for the monitoring effort.

Stipulation 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities requires industry to avoid unreasonable conflict with subsistence activities during operations, especially the bowhead whale hunt. Before submitting a plan, the lessee must consult with the subsistence communities of Barrow, Nuiqsut, and Kaktovik; the North Slope Borough; and the Alaska Eskimo Whaling Commission about the proposed operations. These consultations ensure that they coordinate siting and timing with subsistence whaling and other subsistence-harvest activities.

In the event no agreement is reached between the parties, the lessee, the AEWC, the NSB, the National Marine Fisheries Service (NMFS), or any of the subsistence communities that could be affected directly by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the subsistence communities, AEWC, NSB, NMFS, and the lessee(s) to specifically address the conflict and attempt to resolve the issues before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests. Upon request, the RS/FO will assemble this group, if the RS/FO determines such a meeting is warranted and relevant, before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests.

The MMS can restrict uses under the lease, if necessary, to prevent conflicts, but subsistence whalers and industry have been able to negotiate agreements that work for both parties. An example is the agreement coordinating the timing of seismic activity for the Northstar Project and the subsistence whale hunt. BPXA and the North Slope Borough, Alaska Eskimo Whaling Commission, and city of Nuiqsut worked out this agreement. Existing mitigation requires operators to coordinate siting and timing of projects in a Conflict Avoidance Agreement. The Alaska Eskimo Whaling Commission prefers to negotiate a Conflict Resolution Agreement with industry on an annual basis using a regional, rather than a project-specific, approach to address potential impacts from all ongoing development projects.

This stipulation helps to reduce noise and disturbance conflicts from oil and gas operations during specific periods, such as the annual spring and fall whale hunts. It requires that the lessees meet with local communities and subsistence groups to resolve potential conflicts. This stipulation reduces potential adverse effects from proposed sales to subsistence harvest patterns, sociocultural systems, and to environmental justice. This stipulation has proven to be effective mitigation in prelease (primarily seismic activities) and exploration activities and through the development of the annual oil/whaler agreement between the Alaska Eskimo Whaling Commission and oil companies.

Stipulation No. 6a - Permanent Facility Siting in the Vicinity Seaward of Cross Island would prohibit permanent OCS production facility siting within a defined 10-mile radius seaward of Cross Island unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the North Slope Borough and the Alaska Eskimo Whaling Commission, that development would not preclude reasonable subsistence access to whales. In making such a demonstration, the lessee shall follow the processes and requirements for consultation and mitigation of unreasonable conflicts as set out in Stipulation 5.

This stipulation is divided into two parts. Stipulation 6a will apply the 10-mile radius around Cross Island outside of the barrier islands. Stipulation 6b will apply the 10-mile radius only to those blocks within the barrier islands.

This stipulation would reduce the potential conflict between subsistence hunting activities and oil and gas development and operational activities with the key areas seaward of Cross Island where subsistence whaling for the community of Nuiqsut occurs. This stipulation could also reduce potential noise from a facility in this area that could deflect bowhead whales further offshore.

Stipulation No. 6b, Permanent Facility Siting in the Vicinity Shoreward of Cross Island, would prohibit permanent OCS production facility siting within a defined 10-mile radius shoreward of Cross Island unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the North Slope Borough and the Alaska Eskimo Whaling Commission, that development would not preclude reasonable subsistence access to whales.

This stipulation would reduce the potential conflict between subsistence hunting activities and oil and gas development and operational activities within the area shoreward of Cross Island. However, the whale migration and most whale hunting (based on the whale-strike data) occur outside the Barrier Islands. This stipulation would provide little or no additional protection to subsistence whaling or bowhead whales from that provided by Stipulation 5.

Stipulation 7 Pre-booming Requirements for Fuel Transfers, would require pre-booming of the fuel barges for fuel transfers (excluding gasoline transfers) of 100 barrels or more that occurred 3 weeks prior to or during the bowhead whale migration. The fuel barge would be surrounded by an oil-spill-containment boom during the entire transfer operation. This would help reduce any adverse effects from a potential spill.

This stipulation would lower the potential effects to subsistence resources and sociocultural systems by providing additional protection to the bowhead whale from potential fuel spills that could occur prior to or during the bowhead whale-migration period. This stipulation would be an added caution in reducing potential harm to migrating bowhead whales and to any tainting of the whales from a spill.

Conclusion. For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt.

The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik.

Overall, oil spills could affect subsistence *resources* periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations.

All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.

IV.C.11.c. Effects of Alternatives and Sales

Activities would concentrate in three geographic zones—Near, Midrange, and Far (Map 4)—based on water depth and their location to existing infrastructure. The Near Zone extends from the Colville River on the west to the Canning River on the east in waters from 0-10 meters deep. The Midrange Zone includes waters from 10-30 meters deep and extends from Cape Halkett on the west to Barter Island on the east. The Far Zone includes water depths greater than 40 meters and extends from just east of Barrow on the west to the U.S./Canadian Border on the east. Leasing and subsequent exploration and development activities would be concentrated in the Near Zone near existing infrastructure at Prudhoe Bay/Deadhorse for all three lease sales, especially Sale 186, but activities are projected to expand into deeper water and more remote areas in for Sales 195 and 202.

IV.C.11.c(1) Effects of Alternative I for Sale 186

The sale-specific effects from noise and disturbance and from oil spills under Alternative I for Sale 186 for subsistence resources generally are expected to be similar to those discussed under effects common to all alternatives earlier in this section.

Bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. Potential disturbance from seismic surveys in the central Beaufort Sea conducted during the open water season likely would be limited to areas west of Cross Island after September 1 under the provisions of a negotiated Conflict Avoidance Agreement between the operator and subsistence whalers and likely would have negligible effect on bowhead whales. Similar agreements between the operator and subsistence whalers are likely to be established for any seismic surveys proposed near Kaktovik or Barrow. Conflict avoidance agreements are primarily for the protection of the subsistence-whale hunt and allow for seismic work to proceed after the hunt is completed. Although the potential for seismic disturbance may be high, operators normally have concluded their seismic operations by this time (See Section IV.C.5 - Effects on Endangered and Threatened Species). Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals although most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects. Overall, leasing, exploration, and production activities associated with Beaufort Sea Sale 186 are expected to have minimal effects on bowhead whales.

Effects associated with Alternative I for Sale 186 oil and gas exploration and development on other marine mammals are estimated to include the loss of perhaps 300 ringed seals, but probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walrus, perhaps 5-30 polar bears, and fewer than 10 beluga and gray whales, with populations recovering within about 1 year.

Effects of Sale 186 Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 0.62-1.2 miles along onshore pipelines, with local effects persisting during construction activities. Brief disturbances of groups of caribou and muskoxen from a few minutes to a few days could occur along pipeline corridors during periods of high ice-road and air traffic, but these disturbances are not expected to affect the movements and distribution of caribou, muskoxen, grizzly bears, and arctic foxes. In the unlikely event that a large oil spill occurs in the Beaufort Sea, it is expected to result in the loss of no more than a few hundred caribou and fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

Measurable effects associated Alternative I for Sale 186 from oil exploration and development disturbance and oil spills are not expected on fish populations.

The effects of normal activities on marine and coastal birds under Alternative I for Sale 186 from oil and gas exploration and development are expected to be about the same as those described under effects common to all alternatives earlier in this section. The effects from activities associated with Alternative I for Sale 186 include nonsignificant disturbance and the potential loss of small numbers of birds from collision with structures. The risk of oil-spill contact is expected to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by marine and coastal birds that have higher oil-spill contact probabilities. Recovery from substantial oil-spill mortality is not likely to occur in any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects are expected to be somewhat less than those that could occur as a result of Sale 186, but still could result in significant effects for long-tailed ducks and common eiders.

Conclusion: Based on the sale-specific effects on subsistence resources mentioned above from noise, disturbance, and oil spills, the consequent effects on subsistence-harvest patterns under Alternative I for Sale 186 are expected to be similar to those discussed in effects common to all alternatives earlier in this section. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. For the communities of Barrow, Nuiqsut, and Kaktovik, disturbances periodically could affect these subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt.

IV.C.11.c(2) Effects of Alternatives III, V, and VI for Sale 186

Because these deferral areas are relatively far removed from primary support facilities in the vicinity of Deadhorse, it is less likely that leasing and development would occur there than in the central Beaufort area. Consequently, the effects of noise, disturbance, and oil spills on bowhead whales, seals, polar bears, and beluga and gray whales are expected to be about the same as described for Alternative I for Sale 186. The same would hold true for caribou, muskoxen, grizzly bears, and arctic foxes in addition to fish resources and birds. Differences in noise and oil spill effects to bowhead whales from these deferrals as compared to Alternative I for Sale 186 would likely be difficult to measure.

Conclusion: Effects on subsistence-harvest patterns are expected to be about the same as described under Alternative I for Sale 186.

IV.C.11c(3) Effects of Alternative IV for Sale 186

Under Alternative IV (Nuiqsut Subsistence-Whaling Deferral) for Sale 186, the effects of noise, disturbance, and oil spills on seals, polar bears, and beluga and gray whales are expected to be about the same as described for Alternative I for Sale 186. The same is true for caribou, muskoxen, grizzly bears, arctic foxes, and fishes.

Alternative IV for Sale 186 potentially could reduce noise and oil-spill effects to bowhead whales somewhat compared to Alternative I for Sale 186; however, any differences in effects between these deferrals and Alternative I for Sale 186 likely would be difficult to measure; therefore, the effects of noise and oil spills on bowhead whales are likely to be essentially the same as described for Alternative I for Sale 186. The effects from activities and any oil spill associated with Alternative IV for Sale 186 on spectacled eiders are expected to be somewhat less than under Alternative I for Sale 186. Effects on several marine and coastal bird species are expected to be somewhat less than under Alternative I for Sale 186; however, effects of an oil spill on regional populations of several species could be lowered substantially. Effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the Oil-Spill-Risk Analysis scenario.

Conclusion: Even though effects on subsistence resources with Alternative IV for Sale 186 would be essentially the same as described for Alternative I for Sale 186, effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the Oil-Spill-Risk Analysis scenario.

IV.C.11c(4) Effects of the Alternative I for Sale 195

The sale-specific effects from noise and disturbance and from oil spills under Alternative I for Sale 195 for subsistence resources generally are expected to be similar to those discussed under effects common to all alternatives earlier in this section.

Potential disturbances to bowhead whales would result from seismic surveys, drilling operations, vessel and air traffic, and construction activities. Because there would be no spill from launch areas or pipeline segments in the Far Zone, the chance of oil-spill contact for Alternative I for Sale 195 would be the same or slightly less for some environmental resource areas than those presented in the effects common to all alternatives section. Nevertheless, effects of exploration and production activities on bowhead whales under this Alternative are likely to be similar to those described under effects common to all alternatives and in effects of Alternative I for Sale 186. Although more activities are expected to occur in deeper water, the differences in effects to bowhead whales between the two sale scenarios probably are not measurable.

Effects associated with Alternative I for Sale 195 on other marine mammals are estimated to include the loss of perhaps 300 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 5-30 polar bears, and fewer than 10 beluga and gray whales, with populations recovering within about 1 year.

Effects of Alternative I for Sale 195 on caribou, muskoxen, grizzly bears, and arctic foxes are estimated to include local displacement within about 0.62-1.2 miles along onshore pipelines, with local effects persisting during construction activities. Brief disturbances of groups of caribou and muskoxen from a few minutes to a few days could occur along pipeline corridors during periods of high ice-road and air traffic, but these disturbances are not expected to affect the movements and distribution of caribou, muskoxen, grizzly bears, and arctic foxes. In the unlikely event that a large oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a few hundred caribou and fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

Measurable effects associated with Alternative I for Sale 195 from oil exploration and development disturbance and oil spills are not expected on fish populations.

The effects of normal activities on marine and coastal birds under Alternative I for Sale 195 from oil and gas exploration and development are expected to be about the same as those described under effects common to all alternatives earlier in this section. The effects from activities associated with Alternative I for Sale 195 include nonsignificant disturbance and the potential loss of small numbers of birds from collision with structures. Disturbance of birds in the Near Zone likely would be lower than under Alternative I for Sale 186, because a lower proportion of leasing and exploration is expected to occur there, while lease activity in the Midrange Zone is somewhat greater but the number of development projects is the same. The risk of oil-spill contact is expected to be somewhat lower than for Alternative I for Sale 186, which proposes one more development project than Alternative I for Sale 195, or if developments were spread throughout the planning area, which could include some areas used by marine and coastal bird species that have higher probabilities of oil-spill contact. Recovery from substantial oil-spill mortality likely would occur in any species whose population is in a declining status; however, the determination of status may be obscured by natural variation in population numbers. Overall effects likely would be somewhat less than those expected for Alternative I for Sale 186 but still could result in significant effects for long-tailed ducks and common eiders.

Conclusion: Based on the sale-specific effects on subsistence resources from noise, disturbance, and oil spills, the consequent effects on subsistence-harvest patterns under Alternative I for Sale 195 are expected to be similar to those discussed under effects common to all alternatives earlier in this section. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. For the communities of Barrow, Nuiqsut, and Kaktovik, disturbances periodically could affect these subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt.

IV.C.11.c(5) Effects of Alternative III, V, and VI for Sale 195

Because these deferral areas are relatively far removed from primary support facilities in the vicinity of Deadhorse, it is less likely that leasing and development would occur there than in the central Beaufort area. The difference in effects from noise, disturbance, and oil spills on bowhead whales from these deferrals as compared to Alternative I for Sale 195 likely would be difficult to measure. Similarly, effects on seals, polar bears, and beluga and gray whales are expected to be about the same as described for Alternative I for Sale 195. The same is true for caribou, muskoxen, grizzly bears, and arctic foxes in addition to fish resources and birds.

Conclusion: Effects on subsistence-harvest patterns are expected to be about the same as described for Alternative I for Sale 195.

IV.C.11.c(6) Effects of Alternative IV for Sale 195

Under Alternative IV for Sale 195, the effects of noise, disturbance, and oil spills on seals, polar bears, and beluga and gray whales are expected to be about the same as described for Alternative I for Sale 195. The same is true for caribou, muskoxen, grizzly bears, arctic foxes, and fishes.

Alternative IV for Sale 195 potentially could reduce noise and oil spill effects to bowhead whales somewhat compared to Alternative I for Sale 195; however, any differences in effects between this deferral and Alternative I for Sale 195 likely would be difficult to measure; therefore, the effects of noise and oil spills on bowhead whales are likely to be essentially the same as described in effects of Alternative I for Sale 195. The effects from activities and any oil spill associated with Alternative IV for Sale 195 on spectacled eiders are expected to be somewhat less than under Alternative I for Sale 195. Effects on several bird species are expected to be somewhat less than under Alternative I for Sale 195; however, effects of an oil spill on regional populations of several species could be lowered substantially. Effects on subsistence-harvest patterns in Nuiqsut are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the Oil-Spill-Risk Analysis scenario.

Conclusion: Even though effects on subsistence resources with Alternative IV for Sale 195 would be essentially the same as described for Alternative I for Sale 195, effects on subsistence-harvest patterns in Nuiqsut are expected to be reduced, because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the Oil-Spill-Risk Analysis scenario.

IV.C.11.c(7) Effects of Alternative I for Sale 202

The sale-specific effects from noise and disturbance and from oil spills under Alternative I for Sale 202 for subsistence resources generally are expected to be similar to those discussed under effects common to all alternatives.

The effects of noise, disturbance, and oil spills on bowhead whales are likely to be essentially the same as described under effects common to all alternatives and in effects of Alternative I under Sales 186 and 195. Although more activities are expected to occur in deeper waters than in Alternative I for Sales 186 and 195, the differences in effects to bowhead whales between Alternative I for Sale 202 and Alternative I for Sales 186 and 195 probably are not measurable.

Effects associated with Alternative I for Sale 202 on other marine mammals are estimated to include the loss of perhaps 300 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 5-30 polar bears, and fewer than 10 beluga and gray whales, with populations recovering within about 1 year.

Effects of Sale 202 on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 0.62-1.2 miles along onshore pipelines, with local effects persisting during construction activities. Brief disturbances of groups of caribou and muskoxen from a few minutes to a few days could occur along pipeline corridors during periods of high ice-road and air traffic, but these disturbances are not expected to affect the movements and distribution of caribou, muskoxen, grizzly bears, and arctic foxes. In the unlikely event that a large oil spill occurred in the Beaufort Sea, it is expected to result in the loss of no more than a few hundred caribou, and less than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.

Measurable effects associated with Alternative I for Sale 202 from oil exploration and development disturbance and oil spills are not expected on fish populations.

The effects on marine and coastal birds from activities associated with Alternative I for Sale 202 include a small amount of nonsignificant disturbance and the potential loss of small numbers of birds from collision with structures. The risk of oil-spill contact is relatively low, because only one development is expected, most likely located where most species are relatively scarce. Effects are expected to be considerably less than those that could occur as a result of Alternative I for Sales 186 or 195.

Conclusion: Based on the sale-specific effects on subsistence resources from noise, disturbance, and oil spills, the consequent effects on subsistence-harvest patterns for Alternative I for Sale 202 are expected to be similar to those discussed previously in this section under effects common to all alternatives. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. For the communities of Barrow, Nuiqsut, and Kaktovik, disturbances periodically could affect these subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt.

IV.C.11.c(8) Effects of Alternative III for Sale 202

Effects on bowhead whales, caribou, muskoxen, grizzly bears, arctic foxes, fish resources, and birds are expected to be about the same as described for Alternative I for Sale 202. Differences in noise and oil-spill effects to bowhead whales from this deferral as compared to Alternative I for Sale 202 likely would be difficult to measure.

This alternative is not expected to potentially reduce noise, disturbance, and oil-spill effects on seals, polar bears, and gray and beluga whales from air and vessel traffic, drill platforms or reduce habitat effects from platform and offshore pipeline installation in this area, and effects are expected to be the same as for Alternative I for Sale 202. However, potential risks of oil-spill contact to the Barrow subsistence whaling area (ERA 42) would be reduced with the partial removal of the highest conditional risk, a 64% chance of contact to this area from launch area LA2. Spill-contact risks to other habitat areas would not be reduced under this alternative for Sale 202. Potential noise and oil-spill effects east of Cape Halkett would be the same as described for Alternative I for Sale 202.

Conclusion: Because no exploration or production activities would occur in this deferral area under Alternative III for Sale 202, potential oil-spill, chronic noise, and disturbance effects under Alternative IV for Sale 202 on subsistence whaling and on Barrow's traditional subsistence-whaling area would be reduced.

IV.C.11.c(9) Effects of Alternative IV for Sale 202

Effects on bowhead whales, seals, polar bears, beluga and gray whales, caribou, muskoxen, grizzly bears, arctic foxes, and fish resources are expected to be about the same as described for Alternative I for Sale 202. Differences in noise and oil-spill effects to bowhead whales from this deferral compared to Alternative I for Sale 202 are not likely to be measurable.

Alternative IV for Sale 202 would defer leasing and development in central Beaufort Sea areas, where several species of marine and coastal birds are relatively abundant. Although this deferral would lower the probability of eider contact from oil in this area if an oil spill were to occur, most spectacled eiders occur west of the Sagavanirktok River, and the deferred area is located east of the primary area of eider distribution. As a result, the effects from noise, disturbance, and any oil spill associated with Alternative IV for Sale 202 on spectacled eiders are expected to be somewhat less than under Alternative I for Sale 202.

Conclusion: Although effects on subsistence resources under Alternatives V and IV for Sale 202 would be essentially the same as described for Alternative I for Sale 202, effects on subsistence-harvest patterns in Nuiqsut are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the Oil-Spill-Risk Analysis scenario.

IV.C.11.c(10) Effects of Alternative V for Sale 202

Effects on bowhead whales, seals, polar bears, beluga and gray whales, caribou, muskoxen, grizzly bears, arctic foxes, fish resources, and birds are expected to be about the same as described for Alternative I for Sale 202. Differences in noise and oil-spill effects to bowhead whales from this deferral alternative compared to Alternative I for Sale 202 are not likely to be measurable.

Conclusion: Even though effects on subsistence resources with Alternative V for Sale 202 would be essentially the same as described for Alternative I for Sale 202, effects on subsistence-harvest patterns in Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling and the western half of Kaktovik's traditional subsistence-whaling area.

IV.C.11.c(11) Effects of Alternative VI for Sale 202

Effects on bowhead whales, fish resources, and birds are expected to be about the same as described for Alternative I for Sale 202. Differences in oil-spill and noise effects to bowhead whales from this deferral alternative as compared to Alternative I for Sale 202 are not likely to be measurable.

This alternative potentially could reduce oil-spill effects on seals, polar bears, gray and beluga whales, caribou, muskoxen, grizzly bears, and arctic foxes from about Barter Island east to Demarcation Bay. Potential oil-spill contact to offshore habitats for seals, polar bears, and beluga whales from about Barter Island east to Herschel Island would be reduced somewhat, if oil exploration and development were deferred under this alternative. Potential oil-spill risks to habitats west of Beaufort Lagoon would be the same as described under effects common to all alternatives earlier in this section.

Conclusion: Potential reductions in oil-spill contact to seals, polar bears, gray and beluga whales, caribou, muskoxen, grizzly bears, and arctic foxes from about Barter Island east to Demarcation Bay would reduce effects on these important subsistence resources and on important Kaktovik subsistence harvest areas.

IV.C.12. Sociocultural Systems

IV.C.12.a. Effects of Noise, Disturbance, and Oil Spills on Sociocultural Systems

This discussion is concerned with those communities that potentially could be affected by activity generated by the Beaufort Sea multiple sales. These include the communities of Barrow, Nuiqsut, and Kaktovik. The primary aspects of the sociocultural systems covered in this analysis are (1) social organization, (2) cultural values, and (3) social health as described in Section III.C.3. For purposes of analysis, it is assumed that effects on social organization and cultural values could be brought about at the community level by increased population, by increased employment, and by effects on subsistence-harvest patterns predominantly from oil and gas leasing and associate exploration, development, and production associated with the sale. Potential effects are evaluated relative to the tendency of introduced social forces to support or disrupt existing systems of organization, relative to how rapidly they occur and their duration (see Langdon, 1996).

North Slope Inupiat continue to express concern about the differences in how they and the dominant culture relate to the land and waters. Rex Okakok from Barrow expressed the problem when he said "Our land and sea are still considered and thought by outsiders to be the source of wealth, a military arena, a scientific laboratory, or a source of wilderness to be preserved, rather than as a homeland of our Inupiat" (USDOI, MMS, 1987a). Considering such use of Inupiat territory, Robert Edwardson from Barrow said that he would like to see revenues paid to the Inupiat for mineral rights (USDOI, MMS, 1995b).

IV.C.12.a(1) General Effects from Noise and Disturbance

IV.C.12.a(1)(a) Social Organization

An analysis of the effects on sociocultural systems must first look at the social organization of a society that involves examining how people are divided into social groups and networks. Social groups generally are based on kinship and marriage systems and on nonbiological alliance groups formed by such characteristics as age, sex, ethnicity, community, and trade. Kinship relations and nonbiological alliances serve to extend and ensure cooperation within the society. Social organization could be affected by an influx of new population that causes growth in the community and change in the organization of social groups and networks.

Disruption of the subsistence cycle also could change the way these groups are organized. The sharing of subsistence foods is profoundly important to the maintenance of family ties, kinship networks, and a sense of community well-being. In rural Alaskan Native communities, task groups associated with subsistence harvests are important in defining social roles and kinship relations: the individuals one cooperates with help define kin ties, and the distribution of specific tasks reflects and reinforces the roles of husbands, wives, grandparents, children, friends, and others. Disruption of these task groups can damage social bonds that hold a community together. Any serious disruption of sharing networks can appear as a threat to the established way of life in a community and can trigger an array of negative emotions—fear, anger, and frustration—in addition to a sense of loss and helplessness. Because of the psychological importance of subsistence in these sharing networks, perceived threats to subsistence activities from oil development are a major cause for anxiety.

An Alaska Department of Fish and Game social-effects survey administered by the Division of Subsistence Management in 1994 in Nuiqsut included questions on effects from OCS development. One question asked was: "How do you think the offshore development of oil and gas in this area would affect the following resources available for harvest; would the resource decrease, not change, or increase?" Eighty-percent of Nuiqsut respondents answered that fish resources would decrease, 87% said marine mammals would decrease, 43% said land mammals would decrease, and 55% said that birds would decrease; 67% were not in favor of the search for oil, and 42% believed the search for oil would have an adverse impact on subsistence; 68% were not in favor of the development and production of oil, and 52% believed that oil development and production would have an adverse impact on subsistence (Fall and Utermohle, 1995).

An analysis of cultural values shows those values that are shared by most members of a social group. Generally, these values reflect what is desirable and represent what is accepted, explicitly or implicitly, by members of a social group. Forces powerful enough to change the basic values of an entire society would include a seriously disturbing change in the physical conditions of life—a fundamental cultural change imposed or induced by external forces. One example would be an incoming group that demands that residents accept their intrusive culture's values. Another would be a basic series of technological inventions that change physical and social conditions. Such changes in cultural values can occur slowly and imperceptibly or suddenly and dramatically (Lantis, 1959). Disturbance from oil development may be such a change that could bring about dramatic changes to cultural values on the North Slope, including strong ties to Native foods, to the land and its wildlife, to the family, to the virtues of sharing the proceeds of the hunt, and to independence from institutional and political forces outside the North Slope (see Section III.C.3). A serious disruption of subsistence-harvest patterns could alter these cultural values.

For the system of sharing to operate properly, some households must be able to produce, rather consistently, a surplus of subsistence goods; it is obviously more difficult for a household to produce a surplus than to simply satisfy its own needs. For this reason, sharing, and the supply of subsistence foods in the sharing network, often is more sensitive to harvest disruptions than the actual harvest and consumption of these foods by active producers. Thus, when oil-development disturbance occurs, it may disrupt a community's culture, even though it does not cause "biologically significant" harm to a subsistence species' overall population.

IV.C.12.a(1)(b) Population and Employment

Employment projections as a consequence of Beaufort Sea multiple-sale activities are provided in Section IV.C.10 - Economic Effects.

There may be some degree of development-induced local employment, but these changes, particularly as they translate into Native employment, historically have been and are expected to continue to be insignificant. Even though Native employment in oil-related jobs on the North Slope is low, Native leaders continue to push for programs and processes with industry that encourage more Native hire. The North Slope Borough has attempted to facilitate Native employment in the oil industry at Prudhoe Bay and is concerned that the industry has not done enough to accommodate training of unskilled laborers or to accommodate their cultural needs in participating in subsistence hunting. The North Slope Borough also is concerned that industry recruits workers using methods more common to Western industry practices and would like to see the oil industry make a more concerted effort, and one that is more appropriate to the Inupiat, to hire North Slope Borough residents. Few village residents currently are employed by the oil industry, even though recruitment efforts are made and training programs are available.

Many of the contractors hired by the oil industry in the Oil Patch are either North Slope Native corporations (Arctic Slope Regional Corporation et al.), subsidiaries of such corporations, or otherwise affiliated with such corporations through joint ventures and other relationships. This situation provides significant local economic benefit. One slope operator, BPXA, has instituted its Itqanaiyagvik hiring and training program, designed to put more Inupiat into the oil field workforce. It is a joint venture with the Arctic Slope Regional Corporation and its oil-field subsidiaries and is coordinated with the North Slope Borough and the North Slope Borough School District. Other initiatives are an adult "job-shadowing" program, and an effort called Alliances of Learning and Vision for Under Represented Americans, developed with the University of Alaska to prepare candidates for degree programs in technical and engineering professions. Most graduates of the adult job-shadowing program already are working in oil-field jobs (BPXA, 1998c). Iligsavik College in Barrow was specifically established to train young Natives for work in the oil fields.

IV.C.12.a(2) Specific Effects of Noise and Disturbance

Because staging would be from existing infrastructure in Deadhorse, social systems in the communities of Barrow, Nuiqsut, and Kaktovik would experience little direct disturbance from the staging of people and aircraft transportation for exploration and development for the Beaufort Sea multiple sales. These activities are expected to have little effect on sociocultural systems. Oil workers likely would not interact with

Barrow, Nuiqsut, or Kaktovik residents, and there would be no expected displacement of social systems. Also, changes in population and employment are not likely to disrupt sociocultural systems.

Stress would occur if a village were not successful in the bowhead whale harvest, with potential disruption of sharing networks and task groups. This stress could disrupt the community's social organization but likely would not displace the long-term social processes of whaling and sharing. Other more successful villages would share with a village having an unsuccessful whaling season. More recently, there have been no unsuccessful whaling seasons for Nuiqsut since 1994 and Kaktovik since 1991 (Braund, Marquette, and Bockstoce, 1988; Alaska Eskimo Whaling Commission, 1987-1995). Negotiated conflict resolution agreements between the Alaska Eskimo Whaling Commission, subsistence-whaling communities, and the oil industry have successfully served as a means to coordinate whaling activities and potential disturbance to whaling from industry activities.

Any effects on social health would have ramifications on social organization. On the other hand, North Slope Borough Native communities have, in fact, proven quite resilient to such effects with the Borough's continued support of Inupiat cultural values and its strong commitment to health, social service, and other assistance programs. Health and social-service programs have attempted to meet the needs of alcohol- and drug-related problems by providing treatment programs and shelters for wives and families of abusive spouses and by placing greater emphasis on recreational programs and services. However, in comments before the Department of the Interior's OCS Policy Committee's May 2000 meeting, North Slope Borough Mayor George Ahmaogak stated that Borough residents are extremely concerned that a lack of adequate financing for local North Slope Borough city governments has hampered the development of these programs, and declining revenues from the State of Alaska have seriously impaired the overall function of these city governments. Partnering together, Tribal governments, city governments, and the North Slope Borough government have been able to provide some programs, services, and benefits to local residents. For several years, all communities in the Borough have banned the sale of alcohol, although alcohol possession is not banned in Barrow, and many communities are continually under pressure to bring the issue up in local referendums (North Slope Borough, 1998).

Effects on social health in Nuiqsut would have direct consequences on sociocultural systems but would not tend toward the displacement of existing systems above the displacement that has already occurred with the current level of development. Effects in Barrow and Kaktovik would be periodic and would not displace existing sociocultural systems.

Native Views on Disturbance. At hearings in 1982, Mark Ahmakak from Nuiqsut stated that there should be economic benefits to Nuiqsut, such as cheaper diesel (Ahmakak, 1982, as cited in USDOI, MMS, 1982b). The consensus is that some benefit should come to the community from nearby oil activities. Nuiqsut resident Joseph Ericklook expressed the community's wish to see employment opportunities for local people result from development (Ericklook, 1990, as cited in USDOI, MMS, 1990d). In a 1996 public meeting for the Northstar Project, a Nuiqsut elder stated that she wanted potential human-health issues that could result from the project looked into beforehand. These issues could be found in information from other projects. She specifically expressed concern about cancers, health problems related to air pollution, and shortened lifespans (Dames and Moore, 1996d). As early as 1983, Nuiqsut residents asked to be part of industry activities in the region. Mark Ahmakak stated: "I think that if you are going to go ahead with this sale that you should utilize Natives in the areas affected by this lease sale; then utilize some of these Natives as monitors on some of your projects" (Ahmakak, 1983, as cited in USDOI, MMS, 1983a). There are concerns about protecting traditional sites from development. Nannie Woods expressed her opposition to leasing in the Colville River Delta because of her concern that her husband's burial site might be disturbed by development (Woods, 1982, as cited in USDOI, MMS, 1982b). Recently, a Nuiqsut elder had her "home place" at Prudhoe Bay desecrated by an oil company. Her house was looted and built over. She emphasized that graves of family members are in the area and that she has been denied access there (Dames and Moore, 1996d). At a November 1999 MMS Liberty Project Information Update Meeting in Nuiqsut, Elders told MMS to be aware of gravesites on the shoreline of Foggy Island Bay.

Former Mayor Lon Sonsalla of Kaktovik believes that to keep up with development activities, the village needs an impact office there to review EIS documents and monitor offshore activities (Sonsalla, 1996, as cited in USDOI, MMS, 1996d). During MMS scoping meetings for Sale 170, in November 1996, Susie Akootchook, Village Coordinator for Kaktovik, commented that traditional fishing and hunting sites need protection, and that a contingency plan needs to be developed to protect them (Burwell, 1996, pers. commun.).

Rex Okakok from Barrow expressed a fundamental problems for Inupiaq culture from outside interests, saying: “Our land and sea are still considered and thought by outsiders to be the source of wealth, a military arena, a scientific laboratory, or a source of wilderness to be preserved, rather than as a homeland of our Inupiat” (Okakok, 1987, as cited in USDOI, MMS, 1987a). Considering such use of Inupiat territory, Robert Edwardson from Barrow said that he would like to see revenues paid to the Inupiat for mineral rights (Edwardson, 1995, as cited in USDOI, MMS, 1995b). All three communities believe that some form of impact assistance should be forthcoming to compensate them for absorbing the social impacts from oil development that have occurred and that are to come.

IV.C.12.a(3) Effects from Oil Spills

IV.C.12.a(3)(a) General Effects from Oil Spills

Effects on the sociocultural systems of local communities could come from disturbance from small changes in population and employment, periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup, and stress due to fears of a potential spill and the disruptions it would cause. Traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term if there are concerns over the tainting of bowhead whales from an oil spill, but overall effects from these sources are not expected to displace ongoing sociocultural systems. Oil-spill employment (response and cleanup) could disrupt subsistence-harvest activities for at least an entire season and disrupt some sociocultural systems, but most likely, it would not displace these systems. The sudden employment increase could have sudden and abnormally high effects, including inflation and displacement of Native residents from their normal subsistence-harvest activities by employing them as spill workers. Cleanup employment of local Inupiat also could alter normal subsistence practices and put stresses on local village infrastructures by drawing local workers away from village service jobs.

IV.C.12.a(3)(b) Specific Effects on Sociocultural Systems

Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from small changes in population and employment and periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Effects from these sources are not expected to displace ongoing sociocultural systems, but community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill.

Because development and production activities would be enclave based, stresses to the local village infrastructure, health care, and emergency response systems are expected to be minimal. Demands on local village infrastructures from construction, operation, maintenance, and abandonment activities would not be expected, because all these activities would be staged out of Prudhoe Bay.

Stress created by the fear of an oil spill also is a distinct predevelopment impact-producing agent within the human environment. Stress from this general fear can be broken down to the particular fears of:

- being inundated during cleanup with outsiders who could disrupt local cultural continuity;
- the damage that spills would do to the present and future natural environment;
- drawn out oil-spill litigation;
- contamination of subsistence foods;
- lack of local resources to mobilize for advocacy and activism with regional, State, and Federal agencies;
- lack of personal and professional time to interact with regional, State, and Federal agencies;
- retracing the steps (and the frustrations involved) taken to oppose offshore development;
- responding repeatedly to questions and information requests posed by researchers and regional, State, and Federal outreach staff; and
- having to employ and work with lawyers to draft litigation in attempts to stop proposed development.

A State of Alaska Department of Fish and Game social-effects survey administered by the Division of Subsistence Management in 1994 in Nuiqsut included questions on effects from OCS development. Sixty-percent of the respondents did not believe a small oil spill could be contained or cleaned up, and 80% did not believe a large oil spill could be contained or cleaned up. The overall study on 21 Alaskan communities concluded that impacts persist from the *Exxon Valdez* oil spill on subsistence use and the social and cultural system that subsistence activities support (Fall and Utermohle, 1995; Impact Assessment, Inc., 1998; Field et al., 1999).

A study by Picou et al. (1992) showed that 18 months following the *Exxon Valdez* spill, residents of Cordova had experienced long-term negative social effects—disruption to work roles and increased personal stress. Additionally, they observed that:

> work disruption was correlated with intrusive stress and fishermen experienced more work disruption than other occupations. It may be possible that other natural resource community activities such as participation in subsistence harvests may identify subpopulations more vulnerable to long-term negative social impacts (Picou et al., 1992).

Another good source of information on spill effects is *the Social Indicators Study of Alaskan Coastal Villages, Volume VI: Analysis of the Exxon Valdez Spill Area, 1988-1992* (Human Relations Area Files, Inc., 1994). The summary of findings section affirmed that, immediately after the spill and continuing into early 1990, Native people decreased their harvests of wild resources and relied on preserved foods harvested before the spill. By the winter of 1991, the Natives' normal harvesting activities had begun to resume, but the proportions of wild foods in their diets remained below those of 1989. The study also demonstrated in its analysis that non-Natives and Natives "define the environment and resources within the environment very differently. Commodity valuation takes precedence" for non-Natives and "instrumental use and cultural and spiritual valuation take precedence" for Native people (Human Relations Area Files, Inc., 1994).

IV.C.12.a(3)(c) Effects of Cleanup Activities on Sociocultural Systems

The likelihood of an oil spill from the Beaufort Sea multiple sales is low. However, if one occurred, oil-spill employment (response and cleanup) could disrupt subsistence-harvest activities for at least an entire season and disrupt some sociocultural systems. Most likely, it would not displace these systems. If a large spill contacted and extensively oiled coastal habitats, the presence of hundreds of humans, boats, and aircraft would displace subsistence species and alter or reduce access to these species by subsistence hunters. Employment generated to clean up an oil spill of 1,500 or 4,600 barrels could call for 60 or 190 cleanup workers. This rapid employment increase could have sudden and abnormally high effects, including inflation and displacement of Native residents from their normal subsistence-harvest activities by employing them as spill workers. Cleanup is unlikely to add population to the communities, because administrators and workers would live in separate enclaves; cleanup employment of local Inupiat could alter normal subsistence practices and put stresses on local village infrastructures by drawing local workers away from village service jobs.

Industry oil-discharge prevention and cleanup-contingency plans would be expected to include scenarios for cleaning up oil in open water, solid ice, and broken ice. These scenarios would have to identify logistics, equipment, and tactics for the various cleanup responses. Spill cleanup would reduce the amount of spilled oil in the environment and tend to mitigate spill effects. A decline in the certainty about the safety of subsistence foods, potential displacement of subsistence resources and hunters, and changes in sharing and visiting could lead to a loss of community solidarity. Far from providing mitigation, oil-spill cleanup activities more likely should be viewed as an additional impact, causing displacement and employment disruptions (see Impact Assessment, Inc., 1998).

Native Allotments. Native allotments are considered Indian trust resources (lands). These allotments are small land parcels (up to 160 acres) given to families for private use in accordance with the Alaska Native Allotment Act of 1906. The use or lease of these allotments requires consensus of all family heirs and the approval of the Bureau of Indian Affairs. If Native allotments were in the vicinity of proposed onshore infrastructure (pipelines, landfalls, pump stations), allotment holders would be identified and notified about local public hearings on sale activities and sent copies of the draft EIS for review and comment.

Environmental Justice. For a discussion of Environmental Justice, see Section IV.C.16.

IV.C.12.a(4) How Stipulations or Mitigating Measures Help Reduce Disturbance Effects

See Section IV.C.11 Effects on Subsistence-Harvest Patterns, for a discussion of mitigating measures that would help reduce disturbance and oil-spill effects on sociocultural systems. We assume 5 standard stipulations and 16 standard ITL clauses are in place for Beaufort Sea multiple sale activities, and this assumption is reflected in discussions about effects.

At a town meeting for the Northstar Project, Nuiqsut residents reiterated that they do not believe the technology exists to clean up an oil spill under the ice; they believe it is a matter of when a spill will occur, not if it will occur. They want assurance against disaster and want impact funds set aside for them if a spill occurs (Dames and Moore, 1996a). Earlier village comments expressed the same attitude.

In 1979, Gordon Rankin from Kaktovik suggested that a compensation fund be set aside for villages, in case there is a devastating oil spill (Rankin, 1979, as cited in USDOI, Bureau of Land Management, 1979b).

Barrow resident Charles Okakok said that subsistence users should be compensated by the oil industry in case of an oil spill (Okakok, 1995, as cited in USDOI, MMS, 1995b). Natives living on the North Slope often have repeated this sentiment.

Nuiqsut residents clearly want to be active in any spill response and cleanup. At a community meeting for the Northstar Project, the people of Nuiqsut said they wanted to be part of a newly formed village oil-spill-response team, so that they could positively contribute in an emergency situation (Dames and Moore, 1996d). Their involvement in the past has not always gone smoothly. At the same community meeting, two Nuiqsut men felt their skills and knowledge were not respected when asked to participate in an oil-spill-response drill on a rig near the Northstar Project in February 1991. They believed their skills and knowledge could have been better used by the command structure of that team (Dames and Moore, 1996d).

Conclusion of Noise, Disturbance, and Oil-Spill Effects from Beaufort Sea Multiple-Sale Exploration and Development: Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant. All subsistence whaling communities and other communities that trade for and receive whale products and other resources from the whaling communities could be affected. A large spill anywhere within the habitat of bowhead whales or other important migratory subsistence resources could have multiyear impacts on the harvest of these species by all communities that use them. In addition, harvests could be affected by the International Whaling Commission to limit harvest quotas in response to a perceived increased threat to the bowhead whale population. Beyond the impacts of a large spill, long-term deflection of whale migratory routes or increased skittishness of whales due to increased industrialization in the Beaufort Sea would make subsistence harvests more difficult, dangerous, and expensive. To date, no long-term deflections of have bowheads have been demonstrated.

IV.C.12.b. Effects by Alternatives and Sales

Activities would concentrate in three geographic zones—Near, Midrange, and Far—based on water depth and their location to existing infrastructure. The Near Zone extends from the Colville River on the west to the Canning River on the east in waters from 0-10 meters deep. The Midrange Zone includes waters from 10-30 meters deep and extends from Cape Halkett on the west to Barter Island on the east. The Far Zone includes water depths greater than 40 meters and extends from just east of Barrow on the west to the U.S./Canadian Border on the east. Leasing and subsequent exploration and development activities would be concentrated in the Near Zone near existing infrastructure at Prudhoe Bay/Deadhorse for all three lease sales, especially Sale 186; however, activities are projected to expand into deeper water and more remote areas in for Sales 195 and 202.

IV.C.12.b(1) Alternatives

IV.C.12.b(1)(a) Effects of Alternative I for Sale 186

Sale-specific effects from population and employment, noise and disturbance, and oil spills under Alternative I for Sale 186 for sociocultural systems generally are expected to be similar to those discussed under effects common to all alternatives.

Conclusion: Based on the sale-specific effects on subsistence resources discussed in Section IV.C.11 - Subsistence-Harvest Patterns, the consequent effects on sociocultural systems under Alternative I for Sale 186 are expected to be similar to those discussed under effects common to all alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.

IV.C.12.b(1)(b) Effects of the Alternative I for Sale 195

Sale-specific effects from population and employment, noise and disturbance, and oil spills under Alternative I for Sale 195 for sociocultural systems generally are expected to be similar to those discussed under effects common to all alternatives earlier in this section.

Conclusion: Based on the sale-specific effects on subsistence resources discussed in IV.C.11 - Subsistence-Harvest Patterns, the consequent effects on sociocultural systems under Alternative I for Sale 195 are expected to be similar to those discussed under effects common to all alternatives and effects of Alternative I for Sale 186.

IV.C.12.b(1)(c) Effects of Alternative I for Sale 202

Sale-specific effects from population and employment, noise and disturbance, and oil spills under Alternative I for Sale 202 for sociocultural systems generally are expected to be similar to those discussed under effects common to all alternatives.

Conclusion: Based on the sale-specific effects on subsistence resources discussed in Section IV.C.11 Subsistence-Harvest Patterns, the consequent effects on sociocultural systems under Alternative I for Sale 202 are expected to be similar to those discussed under effects common to all alternatives and effects of Alternative I for Sale 186.

IV.C.12.b(1)(d) Effects of Alternatives III, V, and VI for Sales 186 and 195

The volume of oil and the activities the would affect sociocultural systems associated with the development of that oil are essentially the same for all these alternatives, the effects on sociocultural systems are expected to be about the same as described for Alternative I for Sale 186.

Conclusion: Because effects on subsistence-harvest patterns for these Alternatives are expected to be about the same as described for Alternative I for Sale 186, subsequent effects on sociocultural systems are expected to be about the same as described for Alternative I.

IV.C.12.b(1)(e) Effects of Alternative IV for Sales 186, 195, and 202

Even though effects on subsistence resources with Alternative IV would be essentially the same as described under Alternative I for Sale 186, effects on subsistence-harvest patterns in Nuiqsut likely would be reduced, because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the Oil-Spill-Risk Analysis scenario.

Conclusion: Because effects to subsistence-harvest patterns are expected to be reduced under these alternatives, subsequent effects reductions to sociocultural systems also would be expected.

IV.C.12.b(1)(f) Effects of Alternative III, V for Sale 202

Even though effects on subsistence resources with Alternatives III and V for Sale 202 would be essentially the same as described under Alternative I for Sale 202, effects on subsistence-harvest patterns in Barrow and Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on Barrow's and Kaktovik's subsistence whaling and the western half of Kaktovik's traditional subsistence-whaling area.

Conclusion: Because effects to subsistence-harvest patterns are expected to be reduced in Barrow and Kaktovik under these alternatives, subsequent effects reductions to sociocultural systems also would be expected.

IV.C.12.b(1)(g) Effects of Alternative VI for Sale 202

Potential reductions in oil-spill contact to seals, polar bears, gray and beluga whales, caribou, muskoxen, grizzly bears, and arctic foxes from about Barter Island east to Demarcation Bay would reduce effects on these important subsistence resources and on important Kaktovik subsistence-harvest areas.

Conclusion: Because effects to subsistence-harvest patterns are expected to be reduced under this alternative, subsequent effects reductions to sociocultural systems also would be expected.

IV.C.13. Archaeological Resources

IV.C.13.a. Effects Common to All Alternatives

IV.C.13.a(1) Effects of Exploration

IV.C.13.a(1)(a) Effects from Routine Operations

IV.C.13.a(1)(a)1) Disturbances

Physical disturbance of resources could damage or destroy buildings, shipwrecks, sites, or artifacts, or cause a loss of site context with resulting loss of historical data or artifacts. Archaeological resources are nonrenewable. Archaeological surveys conducted before any activity onshore or offshore will identify potential resources, and they will be avoided or detrimental effects mitigated.

Any offshore activity that disturbs the seafloor in water depths of 2-20 meters has the potential to affect marine archaeological resources. Any activity that disturbs the seafloor in water deeper than 50 meters has the potential to affect historic resources such as shipwrecks, abandoned relics of historical importance, or airplanes. Any onshore activity that removes or disturbs soil and/or causes shallow permafrost to thaw has the potential to disturb archaeological resources. Any activity that brings development in contact with remote areas has the potential to expose archaeological resources to disturbance from construction or from vandalism.

Activities such as installation of rigs for extended-reach drilling, construction of gravel pads, year-round roads, pipeline construction and installation, gravel mining, or oil-spill-cleanup activities in the unlikely event that a large spill occurs, could damage previously unidentified onshore archaeological resources. Activities such as anchoring, pipeline trenching, excavating, emplacement of bottom-founded platforms or man-made islands, have the potential to disturb offshore archaeological resources.

Prehistoric archaeological sites could be affected by activities that disturb the surface or shallow subsurface area. Such activities include:

- Removal of conductor casing (about 1-meter in diameter), which extends from the surface down to depths of 75-100 meters, disturbs all soil inside the casing.
- Constructing a gravel pad or year-round road construction that removes soil layers or causes shallow permafrost to thaw.
- Gravel mining, particularly along the trend of paleo-riverbanks or buried over-bank deposits.
- Constructing offshore ice or gravel islands compresses Holocene sediments, releasing water and possibly biogenic gas, which could disturb the host and overlying strata. In the unlikely event that an ice-island structure fails, and sliding or shearing occurs, the seabed and shallow subsurface could be affected to depths of a few meters.

Offshore, in the unlikely event that an island is constructed directly over an archaeological resource at the seafloor, such as a historic shipwreck, the resource likely would be disturbed or destroyed. However, geophysical and archaeological surveys would identify any such resource before construction begins and the resource would be avoided or potential effects will be mitigated.

Bottom-founded structures could damage or disturb potential shallow archaeological resources, if dragging and sliding of the base-plate or skirt occurs on the seafloor when the structure is set down or removed. Penetration of the skirt could occur to a depth of approximately 2 meters.

Floating drilling platforms could disturb the sea floor and buried archaeological resources by anchor-drag during the setting of anchors or movement of the drillship or support vessels over the anchor-spread area. In addition, floating drilling platforms require the excavation of a glory hole for burying of the blowout preventor stack beneath the seafloor surface, which could affect an archaeological site.

Historic sites, such as hunting, fishing, and whaling camps, or structures associated with settlements or the Defense Early Warning system could be affected by increased human activity and construction in remote areas and the increased possibility for vandalism. Prehistoric sites, though often not as visible as historic sites, also might be subjected to increased vandalism.

IV.C.13.a(1)(a)2) Small Oil Spills

The potential effects on archaeological resources resulting from small oil spills would be from disturbance of soil and structures associated with spill-cleanup activities.

IV.C.13.a(1)(b) Effects of a Large Oil Spill

The greatest effects to onshore archaeological sites would be from cleanup activities resulting from accidental oil spills. The most important understanding from past cleanups of large oil spills is that the spilled oil usually did not directly affect archaeological resources (Bittner, 1993). The State University of New York at Binghamton evaluated the extent of petrochemical contamination of archaeological sites as a result of the *Exxon Valdez* oil spill (Dekin, 1993). Researchers concluded that the three main types of damage to archaeological deposits were oiling, vandalism, and erosion, but that fewer than 3% of the resources would suffer significant effects.

In February 2002, an agreement ensuring the protection of Alaska archaeological resources when responding to oil or hazardous-material spills was signed by representatives of the U.S. Coast Guard, U.S. Environmental Protection Agency, U.S. Department of the Interior, U.S. Department of Agriculture, Alaska Department of Natural Resources, and the Alaska Inter-Tribal Council. The agreement establishes guidelines and procedures for gathering pertinent information about archaeological sites that may be at risk in an emergency-response to a spill and institutionalizes a process for reconciling the requirements of the National Historic Preservation Act with the emergency response requirements of the Clean Water Act and the Oil Pollution Act of 1990 (www.akrrt.org/plans.shtml).

Cleanup and support activities, such as mobilizing equipment and personnel, removing soil, washing, etc., would have the greatest potential for damaging or destroying archaeological resources. Exposure of undocumented sites increases the possibility of vandalism. Increased human presence and activity increases the potential for archaeological sites to be recognized, resulting in the site having a higher chance of being vandalized. The discovery and reporting of archaeological sites during cleanup activities also would result in their being documented and protected.

Effects of an oil spill on offshore archeological resources would be minimal and limited to activities associated with oil-spill-response support vessels such as anchoring. In the unlikely event of a large offshore oil spill, effects on onshore archaeological resources could occur at sites in the Near Zone.

IV.C.13.a(2) Effects of Development and Production

IV.C.13.a(2)(a) Effects from Routine Operations

IV.C.13.a(2)(a)1) Disturbances

Any activity that removes or disturbs soil and/or causes shallow permafrost to thaw has the potential to disturb archaeological resources. Any activity that brings development to remote areas has the potential to expose archaeological resources to disturbance from construction or from vandalism.

All development drilling, constructing, and mining activities, similar to those noted for exploration, have the potential to affect prehistoric and historic archaeological resources. Development activities increase the potential for effects, because they are more frequent and occur over larger areas. In addition, development would require the construction of pipelines offshore and onshore.

The construction of a gravel island compresses Holocene sediments, releasing water and possibly biogenic gas, which could disturb the host and overlying strata, including potential prehistoric archaeological resources. Potential archaeological resources in water depths less than 20 meters where there is no indication of intense ice gouging, could be affected, if there is offshore dredging to build protective berms or for island construction.

We assume that onshore pipelines would be elevated with vertical support members (pilings) about 12 inches (30 centimeters) in diameter, which are spaced approximately 55-70 feet (17-21 meters) apart (about 90-100 beams per mile [56-62 beams/kilometer]). Each vertical beam probably would disturb less than 2 square feet (0.2 square meter) of soil to a depth of several tens of feet (tens of meters), which could penetrate soil horizons of potential archaeological significance. The potential for disturbance of archaeological resources is directly related to the distance of the development to the existing pipeline infrastructure. Any archaeological site beneath or near the pipeline right-of-way has the potential for being disturbed by the construction of roads and installation of the pipelines. Road construction has the potential to disturb archaeological sites through the removal of potential layers of concern, or by thawing of shallow permafrost. Increased human activities in the area increase the potential for vandalism.

Potential offshore archaeological resources possibly could be disturbed by pipeline trenching, vessel anchors, and installation and removal of bottom-founded drilling platforms. These types of disturbance could affect the seafloor and shallow subsurface, where archaeological resources are most likely to occur. Prehistoric archaeological resources may exist in the zone landward of the 20-meter-water depth contour line, where floating shorefast ice possibly has protected sites from destruction by ice gouging. In water depths greater than 50 meters, no prehistoric archaeological resources are expected to have existed. In water depths between the 20-meter and the 50-meter contours, ice gouging has probably severely disturbed any prehistoric archaeological sites that existed. Archaeological analysis of shallow geologic and marine geophysical survey data would identify any areas of possible archaeological resources, which would be avoided or potential effects mitigated before any activities are permitted.

IV.C.13.a(2)(a)2) Small Oil Spills

The potential effects on archaeological resources from small oil spills are the same as for the Exploration phase (Section IV.C.13.a(1)(a)2)).

IV.C.13.a(2)(b) Effects of a Large Oil Spill

The effects on archaeological resources from large oil spills would be the same as described in the section above on Exploration (Section IV.C.13.a(2)).

Conclusion. Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated.

IV.C.13.a(3) Number of Blocks with Archaeological Potential by Alternative

Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area.

- Alternative III would remove 9 (1.8%) leaving 493 blocks or partial blocks
- Alternative IV would remove 17 (3.4%) leaving 485 blocks or partial blocks
- Alternative V would remove 20 (4%) leaving 482 blocks or partial blocks
- Alternative VI would remove 48 (9.6%) leaving 454 blocks or partial blocks

If these blocks or partial blocks are considered for lease, then the MMS regulations requiring archaeological surveys and analyses would apply.

IV.C.13.b. Effect of Alternatives and Sales

IV.C.13.b(1) Effects of Alternative I for Sale 186

The potential effects of disturbance of archaeological resources during the exploration phase would be the same as discussed under general effects, with activity concentrated in the Near Zone, close to existing infrastructure. Activities probably would take place during the winter with little or no permanent road or drilling-pad construction. Drilling offshore probably would be from ice islands or bottom-founded drilling units. Some drilling may take place from shore using extended-reach drilling techniques. Potential effects from oil-spill cleanup activities would be the same as discussed under general effects, limited to small releases or an unlikely blowout.

The potential for disturbance of archaeological resources during development activities would be the same as discussed for general effects, but activities would be concentrated in the Near Zone, close to existing infrastructure. Drilling and production activities probably would continue year-round. For offshore operations, manmade gravel islands probably would serve as production and drilling platforms, in which case offshore pipelines would be built. These offshore pipelines would be buried deeper than the deepest ice and current scour depths. Offshore pipelines would come ashore to existing landfalls and facilities. Some production drilling may take place from shore using extended-reach drilling techniques. Effects from oil-spill cleanup activities would be the same as discussed for general effects, increasing slightly from the exploration phase because of inherent potential for an oil spill during production activities.

Conclusion: The potential effects of Alternative I for Sale 186 on archaeological resources are essentially the same as discussed for general effects, with activity concentrated in the Near Zone, close to existing infrastructure. If extended-reach drilling techniques are used instead of offshore platforms or islands, possible offshore effects would be minimized. More potential effects could occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Although all the projected development for Alternative I Sale 186 is in the Near and

Midrange zones where there is a higher potential for archaeological resources to occur, prehistoric and historic resources both onshore and offshore will be identified by archaeological surveys and avoided or mitigated.

IV.C.13.b(2) Effects of Alternatives IV, V, and VI for Sale 186

The exclusion of tracts in these alternatives would decrease the potential of encountering offshore prehistoric sites or shipwrecks in the deferral area and archaeological resources in adjacent onshore areas. The likely effects would be essentially the same as those discussed under effects common to all alternatives.

Conclusion: The potential effects of Alternative IV, V, and VI for Sale 186 on archaeological resources are essentially the same as discussed for effects common to all alternatives, with activity concentrated in the Near Zone, close to existing infrastructure. If extended-reach drilling techniques are used instead of offshore platforms or islands, possible offshore effects would be minimized. More potential effects could occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Although all the projected development for Sale 186 is in the near-zone and midrange zone where there is a higher potential for archaeological resources to occur, prehistoric and historic resources both onshore and offshore will be identified by archaeological surveys and avoided or mitigated.

IV.C.13.b(3) Effects of Alternatives I, IV, V, and VI for Sale 195

Activities in Alternatives I, IV, V, and VI for Sale 195 probably would occur farther from the main infrastructure of existing fields. Activities in the Midrange Zone would involve some exploration farther offshore from existing infrastructure, in combination with nearshore and possible extended-reach drilling from onshore, in areas farther away from existing infrastructure. Potential effects on resources are likely to be the same as discussed under effects common to all alternatives, with activities ranging into areas father away from existing infrastructure and in deeper water. For the exploration phase, this means that more drilling could occur offshore, slightly increasing the possibility of encountering possible archaeological resources, with less potential effect on onshore resources.

Potential effects from disturbance of archaeological resources during development activities would be the same as discussed under effects common to all alternatives, but activities would take place in the Midrange Zone, farther away from existing infrastructure. Drilling and production activities probably would continue year-round. For offshore operations, manmade gravel islands or bottom-founded structures probably would serve as production and drilling platforms, which means that offshore pipelines would be necessary. These offshore pipelines would be buried deeper than the deepest ice and current scour depths. Offshore pipelines would come ashore and connect with existing infrastructure via onshore pipelines. Some production drilling may take place from shore using extended-reach drilling techniques. Onshore pipelines would have to be built, which would require construction along the pipeline right-of-way.

Conclusion: The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities may be farther away from existing onshore infrastructure. Exploration activities probably would be conducted from offshore facilities, which would reduce the potential impact on onshore archaeological resources. Marine archaeological surveys in areas where offshore archaeological resources may exist would identify likely resources that would be avoided or effects mitigated. In the development phase, the potential for effects to archaeological resources increases with distance from existing infrastructure, primarily because of onshore pipeline distances and associated construction and right-of-way access and the increased possibility for oil-spill-cleanup activities. Onshore archaeological surveys would identify any potential resources, which will be avoided or possible effects mitigated.

IV.C.13.b(4) Effects of Alternatives I, IV, V, and VI for Sale 202

Activities in Alternatives I, IV, V, and VI for Sale 202 are envisioned to be the farthest from the existing infrastructure. Activities in the Far Zone would involve exploration in relatively deeper water and in more remote locations. Potential effects on resources likely would be the same as discussed for effects common to all alternatives, with activities ranging into areas farther away from existing infrastructure. For the exploration phase, this means that more drilling could occur offshore, increasing the possibility of encountering possible archaeological resources while excavating the glory hole that shields the blowout-preventer stack. Potential effects from oil-spill-cleanup activities would be the same as discussed for effects common to all alternatives, except that spills, even an unlikely large spill, from offshore drilling farther from shore may pose less of a threat for oil reaching the coast.

The effects from disturbance of archaeological resources during development activities would be the same as discussed under effects common to all alternatives, but activities would be in the Far Zone, farther away from existing infrastructure and possibly in deeper water. If activities take place in water depths greater than 50 meters, there probably would be no effect on prehistoric archaeological resources. According to relative sea level data for the Beaufort Sea, areas of the shelf deeper than 50 meters would have been below sea level at 13,000 Before Present when prehistoric human populations may have been in the area. Drilling and production activities probably would be conducted year-round. For offshore operations, floating platforms, ships, or bottom-founded facilities probably would serve as production and drilling platforms. These offshore facilities may use subsea production systems and blowout preventors buried beneath the seafloor. Offshore pipelines would be built and would be unburied in deepwater and buried deeper than the deepest ice and current scour depths in shallower water. Onshore pipelines would have to be built, which would require construction along the right-of-way. Potential effects on archaeological resources of oil spills would be the same as discussed for effects common to all alternatives. Where production is from deeper water, there possibly may be less onshore pipeline infrastructure, and cleanup activities associated with a spill would be limited to the shoreline. Where production is from shallow water, pipelines likely would need a new landfall and shore crossing and could require construction of a new processing facility and shore base. The new construction associated with these activities increase the chance of encountering prehistoric and historic resources. New onshore pipelines inherently increase the possibility of a spill and associated cleanup activities.

Conclusion: The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities would be more dispersed. In the exploration phase, some drilling could take place in deeper water, using floating drilling platforms or ships. These drilling units would use anchors and would probably have their blowout preventor buried, which could disturb potential archaeological resources in the immediate area. No impact is expected to prehistoric archaeological resources from activities in water depths greater than 50 meters. In the development phase, floating drilling and production platforms and possibly subsea production well-head assemblies would have the same disturbance effect to the seafloor as in the exploration phase: anchor dragging and digging the glory hole. The effect of gravel islands or bottom-founded production systems would be the same as discussed under effects common to all alternatives, compression and skirt penetration of sediments. The effect of oil-spill cleanup activities depend on the size of the spill and would probably be limited to the Near Zone, but the response area would be larger and more difficult for response personnel to access, potentially exposing unknown archaeological resources to risk of damage. Onshore and offshore archeological surveys and analyses would be conducted and would identify potential archaeological resources, which will be avoided or possible effects would be mitigated.

IV.C.13.b(5) Effects of Alternative III for Sales 186, 195, and 202

Alternative III for Sales 186, 195, and 202 would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

Conclusion. Alternative III for Sales 186, 195, and 202 would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

IV.C.14. Land Use Plans and Coastal Management Programs

All of the alternatives, except Alternative II No Lease Sale, for each of the proposed sales (186, 195, and 202) assume the same amount of oil and, for purposes of land use planning and review with Coastal Management Programs, the levels of activity between alternatives and sales are very similar. Therefore, the effects to land use plans and coastal management plans are essentially the same. The analysis that follows focuses on the effects to the plans and programs and it does not follow the format used by the other resources evaluated in this section.

The analysis that follows is common to all alternatives and sales.

Onshore activities and some offshore activities resulting from OCS oil and gas lease sales will be subject to the North Slope Borough Comprehensive Plan and Land Management Regulations and the Alaska Coastal Management Program (ACMP), as amended by the North Slope Borough Coastal Management Plan (NSB CMP). The North Slope Borough's Land Management Regulations are applied to all developments occurring on private and State lands. These developments include portions of road/pipeline corridors, including offshore portions within the North Slope Borough boundary. All development that occurs within the coastal management boundaries identified in the approved NSB CMP or affects uses or resources of the coastal zone, including activities described in Exploration Plans and Development and Production Plans, will be subject to the Statewide standards and North Slope Borough district policies of the ACMP. The policies of the Land Management Regulations and the ACMP are examined for potential conflicts with the potential effects identified in Sections IV.C.1 through IV.C.12.

Development on the coastal plain of the Arctic National Wildlife Refuge has not been authorized by Congress. No pipeline routes are assumed to traverse the Refuge; no conflict with Refuge policy is inherent in the scenarios.

IV.C.14.a. North Slope Borough Comprehensive Plan and Land Management Regulations

During exploration, most onshore support would be based in existing facilities in the Prudhoe Bay area. Any permits that are requested probably would be conditional-use permits for specific temporary activities; these are permissible in the Conservation District. The more permanent development associated with production would require that a master plan be prepared describing anticipated activities. Use of non-Federal land may require rezoning from the Conservation District to the Resource Development District or Transportation Corridor.

Areawide policies in the revised Land Management Regulations are the same as those for the NSB CMP policies. The primary difference would be the process used for implementation and the geographic areas covered. The Land Management Regulations have been applied to all lands within the North Slope Borough that are not in Federal ownership. Policies in the ACMP cover only activities within the coastal zone but can be applied to Federal lands in many instances (see Section IV.C.13(b)). Therefore, development assumed to occur following a lease sale usually would be subject both to the Land Management Regulations areawide policies and the ACMP policies. To avoid a redundant analysis, potential conflicts with the Land Management Regulations areawide policies are included with the NSB CMP policies in the analysis of the ACMP rather than here.

Policies considered in this section are those in the other Land Management Regulation policy categories: Villages, Economic Development, Offshore Development, and Transportation Corridors. Potential conflict with these policies is limited to some extent by the locations assumed for the development that accompanies a lease sale.

No development is anticipated to occur within village boundaries; therefore, the four policies directly related to developing within North Slope Borough communities would not be applicable.

Economic Development policies afford special consideration for projects during land use reviews that have features the North Slope Borough considers beneficial impacts (NSBMC [NSB Municipal Code]

19.70.030(A) through (G). Economic Development policies foster hiring practices favorable to North Slope Borough businesses and residents, including special work schedules for those who pursue subsistence activities, and generate excess tax revenues over demand for expenditures.

Offshore Development policies are intended to guide the approval of development and uses in the portion of the Beaufort Sea within the North Slope Borough. Policy 19.70.040.E is the only one of these that applies to activities other than drilling. This policy requires that "(a)ll nonessential boat, barge and air traffic associated with drilling activity…occur prior to or after the period of whale migration through the area." Moreover, essential traffic is required to avoid disrupting the migration and subsistence activities and be coordinated with the Alaska Eskimo Whaling Commission. This policy will be especially applicable during development.

The last category of policies covers the Transportation Corridor. New offshore pipelines will be routed to connect to existing onshore pipelines using existing landfalls when it is feasible. It is assumed that if additional pipeline corridors are built, (1) the area would become zoned as a Transportation Corridor, and (2) these policies would apply as the pipeline crossed land subject to North Slope Borough Land Management Regulations. Developers would be held responsible for minimizing airport use, ensuring proper sand and gravel extraction and reclamation, buffering stream banks, locating away from active floodplains, avoiding sensitive habitats, and identifying and documenting archaeological sites prior to construction (NSBMC 19.70.060.C, D, E, F, G, H, I, and J, respectively).

In conducting reviews for other development projects in the North Slope Borough that have some features comparable to those for the pipeline corridors, the North Slope Borough has established special conditions to ensure conformance with several land use policies. Policy areas of concern in the past related to deposition of toxic materials and untreated solid wastes, emissions, subsistence resources, sensitive areas, pollution, habitat changes and disturbance, and permafrost.

IV.C.14.b. Alaska Coastal Management Program

Section 307(c)(3)(B) of the Federal Coastal Zone Management Act, as amended, requires lessees to certify that each activity that is described in detail in the lessee's exploration and development and production plans that affects any land use or water use in the coastal zone complies with, and will be implemented consistent with, the State's coastal program. The State has the responsibility to concur with or object to the lessees' certification. Activities that could occur within the coastal zone include pipeline landfalls, offshore pipelines within 3 miles of the coast, and transportation facilities. In addition, the State reviews all OCS exploration and development and production plans to certify that activities that affect any land or water use or natural resource of the coastal zone are consistent with the ACMP.

This analysis is not a consistency determination pursuant to the Coastal Zone Management Act nor should it be used as a local planning document. It is highly unlikely that all the events that are hypothesized will occur as assumed in this EIS. The leasing of tracts does not mean that exploration will occur or that commercial discoveries will be made on these tracts. Most tracts leased are never explored and most discoveries are too small to support commercial development. Leasing in the Beaufort Sea OCS began in 1979. A total of 688 Federal leases were issued as a result of the 7 sales; only 54 leases remain. Thirty exploration wells have been drilled as a result of those sales; those wells have been plugged and abandoned. Two leases are part of a production unit (Northstar). Only 4% of all leases issued to date have been explored. In addition, changes made by lessees if they explore, develop, or produce petroleum products could affect the accuracy of this analysis.

Lessees must certify that each activity that is described in detail in an Exploration or Development and Production Plan that affects any land use, water use, or coastal resource within the coastal zone complies with, and will be implemented consistent with, the State's coastal program. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.

In the following paragraphs the standards of the ACMP are related to the hypothetical scenarios developed for this EIS and to the potential for effects as identified in other sections of this EIS. Policies of the NSB

CMP are assessed in conjunction with the most closely associated Statewide standard. As noted in Section IV.C.13.a, the NSB CMP policies have been incorporated into the Land Management Regulations. Therefore, the corresponding Land Management Regulation policy number is listed following that of the NSB CMP policy.

IV.C.14.b(1) Coastal Development (6 AAC 80.040)

Water dependency is a prime criterion for development along the shoreline (6 AAC 80.040 [a]). The intent of this policy is to ensure that onshore developments and activities that can be placed inland do not displace activities dependent upon shoreline locations. The only OCS developments or activities hypothesized in the scenarios that require a shoreline location are landfall sites for pipelines.

State standards also require that the placement of structures and discharges of dredged material into coastal waters comply with the regulations of the U.S. Army Corps of Engineers (6 AAC 80.040 [b]). All offshore and much of the onshore development hypothesized in the scenarios would be subject to Corps of Engineers regulations. Hypothetical developments along the Beaufort Sea coast that would require Corps of Engineers permits include constructing a berm for shoreline approaches for pipelines, dredging for and possibly burying offshore pipelines, and placing pipelines and any associated roads onshore. None of these projects necessarily is allowed or disallowed under the provisions of the Corps of Engineers regulations. Site-specific environmental changes pursuant to such development would be assessed and permitted depending on the attendant effects.

It is unlikely that the hypothetical development scenarios will conflict with this coastal development policy.

IV.C.14.b(2) Geophysical Hazard Areas (6 AAC 80.050)

This Statewide standard requires coastal districts and State agencies to identify areas in which geophysical hazards are known and in which there is a substantial probability that geophysical hazards may occur. Development in these areas is prohibited until siting, design, and construction measures have been provided for minimizing property damage and protecting against the loss of life. The following discussion addresses activities inside and outside the coastal zone.

Several hazards are evident in area. Sea ice is the principal physical hazard in the development of oil and gas resources in the Beaufort Sea. However, drilling and completing wells in the Arctic is possible with existing technology (Section IV.A.6). In the EIS, permafrost, storm surges, faults and earthquakes, hydrates and shallow gases, and factors affecting the geotechnical characteristics of the seafloor sediments are related specifically to offshore activities. The summary in Section IV.A.6 identifies three measures that can be taken to lessen the effects of these hazards. These include scheduling activities appropriately, conducting surveys for best locations, and designing facilities to withstand a range of environmental forces. Through these strategies and conformance with the MMS regulations of 30 CFR 250, Oil and Gas and Sulphur Operations in the OCS, hazards can be effectively addressed.

The MMS regulations, including the platform verification program, regulate lessees to ensure that geophysical hazards, such as those identified, are accommodated in the exploration and development and production plans that must be approved before lessees may commence activities. Conformance with these regulations also should alleviate conflict that could occur with respect to two NSB CMP policies. Policy 2.4.4(b) (NSBMC 19.70.050. I.2) requires that "offshore structures must be able to withstand geophysical hazards and forces which may occur while at the drill site." These structures also "must have monitoring programs and safety systems capable of securing wells in case unexpected geophysical hazards or forces are encountered." Policy 2.4.4(h) (NSBMC 19.70.050.I.8) requires that "Offshore oil transport systems (for example, pipelines) must be specially designed to withstand geophysical hazards, specifically sea ice."

Any onshore development and some offshore development will be sited in areas of permafrost. Development in these areas must "maintain the natural permafrost insulation quality of existing soils and vegetation" (NSB CMP 2.4.6(c) and NSBMC 19.70.050.L.3). Some of the onshore development (for example, pipelines) may be located in wetlands, in floodplains subject to a 50-year recurrence level, and in geologic-hazard areas identified on Map 22 of the NSB CMP Resource Atlas. These last two areas are specifically identified in the NSB CMP policies (NSB CMP 2.4.5.1(k) and NSBMC 19.70.050.J.11). For developments to proceed in these areas, there would have to be a significant public need, no feasible and prudent alternatives, and all feasible and prudent steps taken to avoid the adverse effects the policy is intended to prevent. A final requirement is that development in floodplains, shoreline areas, and offshore areas be "sited, designed, and constructed to minimize loss of life or property" due to geologic forces (NSB CMP 2.4.6[f] and NSBMC 19.70.050.L.6). Safeguards offered by these policies are enforced at the time an activity or project is proposed and locational information is available.

There are no inherent conflicts with the Statewide standard or with the North Slope Borough policies related to geophysical hazards.

IV.C.14.b(3) Energy Facilities (6 AAC 80.070)

The State CMP requires that decisions on the siting and approval of energy-related facilities be based, to the extent feasible and prudent, on 16 standards. The following discussion addresses only those that are applicable to the scenarios presented in this EIS.

The ACMP standards require that facilities be sited to (1) minimize adverse environmental and social effects while satisfying industrial requirements and (2) be compatible with existing and subsequent uses (6 AAC 80.070 (1) and (2)). Any pipeline landfalls along the Beaufort Sea coast are expected to tie into existing nearby production lines and to use the existing support infrastructures located at Kuparuk and Prudhoe Bay. A landfall hypothesized at Point Thomson would use infrastructure planned for development in the Point Thomson area. Flaxman Island, commonly used by subsistence hunters for their base camp, is offshore of the landfall. It is likely that construction activities would occur during the whaling season. However, disturbance from these construction activities would be temporary and conducted in a manner that would minimize or eliminate any disturbance.

Other ACMP standards require that facilities be consolidated and sited in areas of least biological productivity, diversity, and vulnerability (6 AAC 80.070 (3)). The NSB CMP also requires that "transportation facilities and utilities must be consolidated to the maximum extent possible" (NSB CMP 2.4.5.2(f) and NSBMC 19.70.050. K.6). Onshore activities hypothesized for OCS oil and gas activities are, with the possible exception of one additional landfall site, consolidated at existing sites where pipelines come onshore. Existing facilities can accommodate the support services, thereby conforming with another standard (6 AAC 80.070 (7)). These locational decisions conform to NSB CMP policy 2.4.5.2(c) (NSBMC 19.70.050.K.3) that requires facilities not absolutely required in the field be located in designated compact service bases that are shared to the maximum extent possible.

Facilities must be designed to permit free passage and movement of fish and wildlife with due consideration for historic migratory patterns (6 AAC 80.070 (12), NSB CMP 2.4.4 (I), and NSBMC 19.70.050.I.9). As is evidenced by the Endicott development, this standard does not preclude causeways or berms, but it does require careful consideration of the effects on circulation and fish populations before approval can be obtained. The short length of shore-approach berms or causeways may result in localized, short-term effects on the movement and migration of fish populations (Section IV.C.3). Offshore pipelines should pose no barriers to migrating fish and wildlife. Conflict is not anticipated.

Finally, the Statewide standard requires that facilities be sited "so as to minimize the probability, along shipping routes, of spills or other forms of contamination which affect fishing grounds, spawning grounds, and other biologically productive or vulnerable habitats..." (6 AAC 80.070 [b][11]). Landfall sites will conform with this requirement. For example, oil spills pose the greatest threat of all possible effect agents; however, the analysis in Section IV.C indicates that these sites do not accentuate the potential for adverse effects in the unlikely event of an oil spill.

The NSB CMP has two additional requirements associated with this standard. Policy 2.4.4(f) (NSBMC 19.70.050.I.6) requires that plans for offshore drilling include "a relief well drilling plan and an emergency countermeasure plan" and describes the content of such plans. Policy 2.4.4(g) (NSBMC 19.70.050.I.7) requires "offshore drilling operations and offshore petroleum storage and transportation facilities...have an oilspill control and clean-up plan" and describes what the plan should contain. Conformance with these policies is ensured through the implementation of MMS regulations in 30 CFR 250 Subpart B - Exploration and Development and Production Plans and 30 CFR 254 - Oil-Spill Response Requirements for Facilities Located Seaward of the Coastline.

No conflicts with the Statewide standards or with the North Slope Borough policies related to the siting and approval of energy related facilities are anticipated.

Construction associated with energy-related facilities resulting from sales also must comply with siting standards that apply to all types of development. These more general standards are discussed under (g) Habitats and (h) Air, Land, and Water Quality.

IV.C.14.b(4) Transportation and Utilities (6 AAC 80.080)

This Statewide standard requires that routes for transportation and utilities be compatible with district programs and sited inland from shorelines and beaches. Assuming that after an offshore pipeline crossed the beach it would continue inland of the beaches, conformance with this policy is possible.

The NSB CMP contains several additional policies related to transportation that are relevant to this analysis. All but one of the policies are "best-effort policies" and subject to some flexibility if (1) there is a significant public need for the proposed use and activity; (2) the development has rigorously explored and objectively evaluated all feasible and prudent alternatives to the proposed use or activity and cannot comply with the policy; and (3) all feasible and prudent steps have been taken to avoid the adverse effects the policy was intended to prevent. "Transportation development, including pipelines, which significantly obstructs wildlife migration" is subject to these three criteria (NSB CMP 2.4.5.1(f) and NSBMC 19.70.050.J.7). Section IV.C.8 indicates that interference with wildlife movement and distribution would be temporary and brief; caribou migrations and overall distribution are not expected to be affected.

As noted in the previous standard for energy facilities, transportation facilities are expected to be consolidated to the maximum extent possible. Therefore, there should be no conflict with either NSB CMP 2.4.5.1(h) (NSBMC 19.70.050.J.9), which discourages duplicative transportation corridors from resource-extraction sites, or NSB CMP 2.4.5.2(f) (NSBMC 19.70.050.K.6), which requires that transportation facilities and utilities be consolidated to the maximum extent possible. Although the NSB CMP limits support facilities for tankering oil to market, the scenario indicates that pipelines will be used; therefore, the policy is not relevant.

The final policy falls under the category of "Minimization of Negative Impacts." NSB CMP 2.4.6(b) (NSBMC 19.70.050.L.2) requires that alterations to shorelines, water courses, wetlands, and tidal marshes and significant disturbance to important habitat be minimized. In the discussion of habitats, it is recognized that alterations to wetland habitat and ponds and lakes could occur, and birds could be disturbed during construction. This policy also requires that periods critical for fish migration be avoided. However, it is anticipated that development will be able to proceed in accordance with this policy by conforming to the requirements for siting, design, construction, and maintenance of the facilities.

The NSB CMP 2.4.6(e) requires a means of providing for unimpeded wildlife crossing to be included in the design and construction of structures such as roads and pipelines that are located in areas used by wildlife. Pipeline design must be based on the best available information and include adequate pipeline elevation, ramping, or burial to minimize disruptions of migratory patterns and other major movements of wildlife. Aboveground pipelines must be elevated a minimum of 5 feet from the ground to the bottom of the pipe, except at those points where the pipeline intersects a road, pad, or caribou ramp, or is constructed within 100 feet of an existing pipeline that is elevated less than 5 feet. It is anticipated that development will be able to proceed in accordance with this policy by conforming to requirements stated in the policy. No conflicts are anticipated with this Statewide standard or the North Slope Borough policies related to Transportation and Utilities.

IV.C.14.b(5) Mining and Mineral Processing (6 AAC 80.110)

Extraction of sand and gravel is a major concern on the North Slope. Gravel resources are needed for construction pads for all onshore development to protect the tundra, including roadbeds, berms or causeways, and docks. The ACMP Statewide standards require that mining and mineral processing be compatible with the other standards, adjacent uses and activities, State and national needs, and district programs (6 AAC 80.110 (a)). Sand and gravel may be extracted from coastal waters, intertidal areas, barrier islands, and spits when no feasible and prudent noncoastal alternative is available to meet the public need (6 AAC 80.110 (b)). Substantial alteration of shoreline dynamics is prohibited (NSB CMP 2.4.5.1(i) and NSBMC 19.70.050.J.10). Constraints may be placed on extraction activities to lessen environmental degradation of coastal lands and waters and to ensure floodplain integrity (NSB CMP 2.4.5.2(a) and (d) and NSBMC 19.70.050.K.1 and 4).

Although industry's preferences for gravel sources and removal procedures and the Statewide standards and NSB CMP policies may diverge on occasion from those that are deemed consistent, it is anticipated that sand and gravel extraction activities will be conducted consistent with the policies related to mining and mineral processing. Conflict is not inherent in the hypothesized scenarios.

IV.C.14.b(6) Subsistence (6 AAC 80.120)

The Statewide standard for subsistence guarantees opportunities for subsistence use of coastal areas and resources. Subsistence uses of coastal resources and maintenance of the subsistence way of life are primary concerns of the residents of the North Slope Borough.

North Slope Borough Policy 2.4.3(d) (NSBMC 19.70.050.D) requires that development not preclude reasonable subsistence-user access to a subsistence resource.

Several important NSB CMP policies relate to adverse effects to subsistence resources. The NSB CMP policy 2.4.3(a) (NSBMC 19.70.050.A) relates to "extensive adverse impacts to a subsistence resource" that "are likely and cannot be avoided or mitigated." In such an instance, "development shall not deplete subsistence resources below the subsistence needs of local residents of the Borough." Policy 2.4.5.1(a) (NSBMC 19.70.050.J.1) relates to "development that will likely result in significantly decreased productivity of subsistence resources or their ecosystems."

Disturbance and noise resulting from the hypothesized post-lease activities periodically could affect subsistence resources, but no resource would become unavailable and no resource population would experience an overall decrease. Disturbances and noise could occur as a result of disturbance from seismic surveys, aircraft and vessel traffic, drilling activities, and construction activities that include onshore construction such as pipeline, road, support-base, landfall, and pump-station construction; and offshore dredging; pipeline construction; and structure placement. These effects are expected to be local, nonlethal, and temporary.

Accidental small oil spills periodically could affect subsistence resources. In the unlikely event of a large accidental spill during development and production, some harvest areas and some subsistence resources could become unavailable for use until such time as resources and harvest areas were perceived as safe by local subsistence hunters. The duration of avoidance by subsistence users would vary depending on the amount of oil spilled, the persistence of oil in the environment, the degree of impact on the resources, the time necessary for recovery and the confidence in assurances that resources were safe to eat. The potential for bowhead whales to be contacted directly from an oil spill is small, but the potential chance of contact to whale habitat, whale-migration corridors, and subsistence-whaling areas is relatively greater. Onshore areas and terrestrial subsistence resources have a lower potential for oil-spill contact to the species and the habitat. Such effects are not expected from routine activities and operations, but could occur in the unlikely event of an accidental large spill.

Oil-spill-cleanup activity related to a large spill would increase noise and disturbance effects to all subsistence species; could result in the displacement of subsistence species; and could alter or reduce access to subsistence species by subsistence hunters, thereby having the potential to temporarily alter or extend normal subsistence hunts.

North Slope Borough policy 2.4.3(a) relates to "extensive adverse impacts to a subsistence resource" that "are **likely** and cannot be avoided or mitigated." Policy 2.4.5.1(a) relates to "development that will **likely** result in significantly decreased productivity of subsistence resources or their ecosystems." The policies address "likely" events. A large spill is an unlikely event.

No conflicts with this Statewide standard or with the North Slope Borough policies related to subsistence are anticipated. However, in the unlikely event of a large oil spill and associated oil-spill-cleanup activities some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use until they were perceived as safe by subsistence users.

Caribou could be disturbed temporarily during construction of pipelines and roads but are expected to habituate to the traffic following construction (Section IV.C.7). This conclusion is based partially on the established policy that roads and pipelines are constructed to provide for unimpeded wildlife crossings. The NSB CMP policy 2.4.6(e) (NSBMC 19.70.050.L.5) emphasizes this practice and provides a set of guidelines and an intent statement specifically to implement the policy.

Standard mitigating measures included as part of the proposed sales (186, 195, and 202) address subsistence harvesting activities. They include the stipulations on the Industry Site-Specific Bowhead Whale-Monitoring Program and the Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities. The Information to Lessees clause on the Availability of Bowhead Whales for Subsistence-Hunting Activities advises lessees that MMS may limit or require that operations be modified if they could result in significant effects on the availability of the bowhead whale for subsistence use.

IV.C.14.b(7) Habitats (6 AAC 80.130)

The Statewide standard for habitats contains an overall standard policy plus policies specific to eight habitat areas: offshore areas; estuaries; wetlands and tideflats; rocky islands and sea cliffs; barrier islands and lagoons; exposed high-energy coasts; rivers, streams, and lakes; and important upland habitat (6 AAC 80.130 (a), (b), and (c)). Activities and uses that do not conform to the standards may be permitted if there is significant public need and no feasible prudent alternatives to meet that need, and all feasible and prudent measures are incorporated to maximize conformance (6 AAC 80.030 (d)). The NSB CMP contains a district policy that reiterates the applicability of the Statewide standard (NSB CMP 2.4.5.2(g) and NSBMC 19.70.050.K.7), plus several others that augment the overall policy or can be related to activities within a specific habitat.

The ACMP Statewide standard for all habitats in the coastal zone requires that habitats "be managed so as to maintain or enhance the biological, physical, and chemical characteristics of the habitat which contribute to its capacity to support living resources" (6 AAC 80.130 (b)). This overall policy is supported by an NSB CMP district policy requiring development "to be located, designed, and maintained in a manner that prevents significant adverse impacts on fish and wildlife and their habitat, including water circulation and drainage patterns and coastal processes" (NSB CMP 2.4.5.2(b)] and NSBMC 19.70.050.K.2). In addition, "vehicles, vessels, and aircraft that are likely to cause significant disturbance must avoid areas where species that are sensitive to noise or movement are concentrated at times when such species are concentrated" (NSB CMP 2.4.4 [a] and NSBMC 19.70.050.I.1). Some disturbances associated with exploration and development would be mitigated by the Stipulation on Protection of Biological Resources and the ITL clauses concerning Bird and Marine Mammal Protection and Areas of Biological and Cultural Sensitivity (Section II.E). The analyses in Sections IV.C.2 through 7 indicate that resources would not be subject to significant disturbance from these activities. If they are, however, the policy requires that, consistent with human safety, horizontal and vertical buffers will be required where appropriate. Although there are no inherent conflicts with the assumed activities at this point, some may appear as specific exploration or development proposals are brought forward. It is anticipated that the concerns related to this policy can be effectively addressed at that time.

Activities may affect several of the habitats identified in the Statewide standard, including offshore; barrier islands and lagoons; wetlands; and rivers, lakes, and streams. Potential effects in each habitat are related to the applicable policies in the following paragraphs.

The offshore habitat is designated a fisheries conservation zone (6 AAC 80.130. (c)(1)). In the Arctic, marine mammals are an important offshore resource and are included in the analysis of the offshore habitat. Some effects in the offshore habitat can be expected in the unlikely event that an oil spill occurred in a sensitive area, or in specific coastal areas during critical periods for several fishes. Effects identified in Sections IV.C.2 through IV.6 would not preclude offshore development, assuming the developer has undertaken all feasible and prudent steps to maximize conformance. Offshore seismic exploration is subject to specific constraints; NSB CMP 2.4.6(g) (NSBMC 19.70.050.L.7) requires that seismic exploration be conducted in a manner that minimizes its impact on fish and wildlife. Several mitigating measures address concerns related to these habitat policies: the stipulation of Protection of Biological

Resources; and the ITL clauses on Bird and Marine Mammal Protection, River Deltas, and Sensitive Areas to be Considered in Oil-Spill-Contingency Plans.

It is anticipated that seismic exploration can proceed in conformance with this policy.

Barrier islands and lagoons characterize the Beaufort Sea coast where some of the development associated with OCS oil and gas leasing is assumed to occur (NSB CMP Map 16). These habitats are managed to ensure sediment and water conditions are maintained so neither infilling of lagoons nor erosion of barrier islands occurs. Activities that might decrease the use of the barrier islands by coastal species, including polar bears and nesting birds, are discouraged (6 AAC 80.130 (c)(5)). Although disruptive activities could occur in this habitat during the laying of pipelines and construction of landfall sites, effects of offshore construction on birds and marine mammals, potential effects on abundance and distribution of a population or portion of a population would be localized and would last for only a short period of time. Consequently, no conflict with this habitat policy is anticipated.

Much of the uplands in the North Slope Borough are considered wetlands. Because any development of wetlands might affect navigable waters, development of any kind on those wetlands necessarily falls under the oversight of the U.S. Army Corps of Engineers. Therefore, onshore development would need to be designed and constructed to avoid (1) adverse effects to the natural drainage patterns, (2) destruction of important habitat, and (3) the discharge of toxic substances (6 AAC 80.130 (c)(3)). Pipelines and roadways would transect this habitat both to the east and to a very limited extent to the west of the Trans-Alaska Pipeline. Water impoundments created by pipeline/road corridors would carry both positive and negative effects. They would benefit some waterfowl but displace some nesting shorebirds in localized areas near a pipeline-road complex (Section IV.C.5).

It is expected that any onshore development will proceed in keeping with this wetland policy; no conflicts are anticipated.

Restrictions on storing toxic substances are covered more completely by policies related to the following topics: air, land, and water quality.

Rivers, lakes, and streams are managed to protect natural vegetation, water quality, important fish or wildlife habitat, and natural water flow (6 AAC 80.130 [c][7]). The probability of an oil spill occurring and contacting the nearshore waters of the river deltas is small. However, pipeline/road construction, including gravel extraction, also could affect these waterways and would need to be conducted to ensure the protection of riverine habitat and fish resources. Gravel extraction also is regulated under policies that are described in the section on mining. Activities occurring as a result of OCS oil and gas lease sales are anticipated to be in compliance with this policy, and conflicts are not expected.

No conflicts are anticipated with the Statewide standard or with the North Slope Borough policies related to Habitats.

IV.C.14.b(8) Air, Land, and Water Quality (6 AAC 80.140)

The air-, land, and water-quality standard of the ACMP incorporates by reference all the statutes pertaining to, and regulations and procedures of, the Alaska Department of Environmental Conservation in effect on August 18, 1992. The North Slope Borough reiterates this standard in its district policies and emphasizes the need to comply with specific water- and air-quality regulations in several additional policies.

The agents associated with petroleum exploitation that are most likely to affect water quality are hydrocarbons from oil spills; trace metals in permitted discharges of drilling muds and cuttings; and turbidity from permitted dredging, filling and other construction activities. No oil spills are assumed to occur during exploration activities. In the unlikely event of an accidental spill for the development and production phase, the Oil-Spill-Risk Analysis model, for purposes of analysis, uses a 1,500-barrel spill from a platform or a 4,600-barrel spill from a pipeline. Hydrocarbons from small accidental spills could result in local hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5-parts per million-acute toxic criterion during the first several days of a spill and the 0.015-ppm-chronic criterion for about a month in an area of about 400 square kilometers. Other effects of postlease-sale activities would not affect regional water quality. The increased turbidity from permitted construction activities such as dredging would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels but over only a few square kilometers

As a precaution against accidental spills, the NSB CMP requires the use of impermeable lining and diking for fuel-storage units with a capacity greater than 660 gallons (NSB CMP 2.4.4(k) and NSBMC 19.70.050.I.11). In addition, development within 1,500 feet of the coast, a lakeshore, or river "that has the potential of adversely impacting water quality (for example, landfills, or hazardous-materials storage areas, dumps, etc.)" must comply with the conditions of the best-effort policies (NSB CMP 2.4.5.1(d) and NSBMC 19.70.050.J.4). These conditions are: (1) there is a significant public need, (2) the development has rigorously explored and objectively evaluated all feasible and prudent alternatives and cannot comply with the policy, and (3) all feasible and prudent steps have been taken to avoid the adverse effects the policy was intended to prevent.

Some discharges and emissions would occur during exploration and development, and the NSB CMP policy 2.4.4(c) (NSBMC 19.70.050.I.3) requires that "development resulting in water or airborne emissions ...comply with all state and federal regulations." Discharges of muds, cuttings, and drilling fluids are regulated closely. Given the rate of discharge, changes in water quality during exploratory drilling would be local and temporary (only during active discharges) and remain within an area of 0.03 square kilometers. During development, effects from muds and cuttings would be local and short term. Formation waters produced from the wells along with the oil are regulated through an Environmental Protection Agency permit and, depending on the conditions of the permit, may be disposed of above or below ground. To date, for exploration in the Beaufort Sea, the Environmental Protection Agency has prohibited discharge of formation waters into waters less than 10 meters deep; reinjection and injection projects have been the standard. If formation waters were discharged in the water, the effect on water quality would be local and would be regulated by an Environmental Protection Agency National Pollution Discharge Elimination System permit. If formation waters were reinjected or injected into a different formation, as is expected, no discharge of formation waters would occur and no effect would occur. Recent offshore developments (for example, Endicott and Northstar) have reinjected such wastes rather than discharging them.

Offshore disposal of solid wastes also is regulated through Federal permits and restrained further by Annex V of the MARPOL Convention approved in 1988 by the United States Congress. Because these discharges are so carefully regulated, no conflict is anticipated with the Statewide standard or NSB CMP policy 2.4.4(d) (NSBMC 19.70.050.I.4), which requires that "industrial and commercial development…be served by solid waste disposal facilities which meet state and federal regulations." Onshore development associated with this sale also must meet the Statewide standard and the district policy related to solid-waste disposal. Assuming the regulations are implemented properly, there is no inherent conflict between the proposed activities and the ACMP water-quality provisions.

The district CMP also contains a policy that requires development without a central sewage system to impound and process effluent to meet State and Federal standards (NSB CMP 2.4.4(e) and NSBMC 19.70.050.I.5). This is the current practice aboard drilling vessels and production platforms; there is no inherent conflict with this district policy. This also has been the practice of the major developments on the North Slope.

Sand and gravel may be extracted from coastal waters, intertidal areas, barrier islands, and spits when no feasible and prudent noncoastal alternative is available to meet the public need (6AAC 80.110 (a)). Solid-fill islands may be constructed and used for shallow-water development. Island construction could be completed within one to two summers, and effects on water quality would be short term and local, lasting only while the activity persisted (Section IV.C.1). Air quality also must conform to Federal and State standards (6 AAC 80.140, NSB CMP 2.4.3(I) and 2.4.4(c), and NSBMC 19.70.050.H and I.3). The analysis in Section IV.C.15 indicates that conformance is anticipated, and no conflict between air quality and coastal policies should occur.

The most likely agents to affect water quality are hydrocarbons from oil spills, trace metals in discharges of drilling muds and cuttings, and turbidity from dredging, filling and other construction activities. No spills are assumed to occur during exploration activities. In the unlikely event of a large accidental spill during development and production, hydrocarbons could exceed the acute toxic criterion during the first several days and the chronic criterion for about a month in an area about 400 square kilometers.

Hydrocarbons from small accidental spills could result in local hydrocarbon contamination for a short time period. Effects from the remaining affects agents would also be local and short term. Discharges into the marine environmental are subject to permits issued by the Environmental Protection Agency and are not expected to exceed State standards in the coastal zone or have an effect on coastal resources. In addition, the Federal regulations at 30 CFR Part 250 Oil and Gas and Sulphur Operations in the Outer Continental Shelf and Part 254 Oil-Spill Response Requirements for Facilities Located Seaward of the Coast Line provide for MMS oversight and regulatory authority over these activities.

No conflicts are anticipated with the Statewide standard or with the North Slope Borough policies related to Air, Land, and Water Quality.

IV.C.14.b(9) Statewide Historic, Prehistoric, and Archaeological Resources (6 AAC 80.150)

The ACMP Statewide standard requires that coastal districts and appropriate State agencies identify areas of the coast that are important to the study, understanding, or illustration of national, State, or local history or prehistory.

The North Slope Borough developed additional policies to ensure protection of its heritage. The NSB CMP 2.4.3(e) (NSBMC 19.70.050.E) requires that development that is "likely to disturb cultural or historic sites listed on the National Register of Historic Places; sites eligible for inclusion in the National Register; or sites identified as important to the study, understanding, or illustration of national, state, or local history or prehistory shall (1) be required to avoid the sites; or (2) be required to consult with appropriate local, state and federal agencies and survey and excavate the site prior to disturbance." The NSB CMP 2.4.3(g) (NSBMC 19.70.050.G) goes on to require that "development shall not cause surface disturbance of newly discovered historic or cultural sites prior to archaeological investigation." These NSB CMP policies establish clearly what is required. In the unlikely event such a site is encountered, there is no inherent reason to assume conflict with these policies.

Traditional activities at cultural or historic sites also are protected under the NSB CMP 2.4.3(f) (NSBMC 19.70.050.F) and 2.4.5.2(h) (NSBMC 19.70.050.K.8). As noted in the discussion of policies related to subsistence, the latter is a best-effort policy that requires protection for transportation to subsistence-use areas as well as cultural-use sites.

The MMS regulations at 30 CFR 250.194 require archaeological reports in exploration and development and production plans when it is likely that an archaeological resource exists in the area. If a resource may be present the lessee must comply with specific regulatory requirements to protect the resource. If the lessee discovers any archaeological resource while conducting operations they must immediately halt operations within the area of the discovery and report the discovery to the MMS.

No conflicts with the policies related to Historic, Prehistoric, and Archaeological Resources are anticipated.

Effectiveness of Mitigating Measures: Mitigating measures are assumed to be in place for this analysis; effects levels reflect this assumption. Mitigation that would apply to subsistence-harvest activities includes the Orientation Program stipulation, the Industry Site-Specific Bowhead Whale-Monitoring Program stipulation, and the stipulation on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities.

The Orientation Program stipulation requires the lessee to conduct a program that educates personnel working on exploration or development and production activities about the environmental, social, and cultural concerns that relate to the area and area communities. The program is expected to increase personnel sensitivity and understanding of local Native community values, customs, and lifestyles and to prevent any conflicts with subsistence activities.

The Industry Site-Specific Bowhead Whale-Monitoring Program stipulation requires industry to conduct a whale monitoring program if exploratory drilling or seismic activity is conducted during the bowhead whale migration to assess the behavioral effects on bowheads from these activities. The monitoring plan is subject to the review of the North Slope Borough and the Alaska Eskimo Whaling Commission, invites both Borough and the Commission representatives to serve as observers, and requires the plan be independently peer reviewed. This stipulation provides site specific information about the migration of bowhead whales and any affects that may occur as a result of oil and gas activities. This stipulation helps reduce effects to subsistence-harvest activities by providing immediate information to lessees about the activities of the whales and their response to specific events. This information can be used to determine whether and to whale extent activities may be affecting subsistence activities.

The stipulation on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities requires industry to conduct operations in a manner that prevents unreasonable conflict with subsistence activities, especially the bowhead whale hunt. Prior to submitting a plan, the lessee must consult with potentially affected subsistence communities of Barrow, Nuiqsut, and Kaktovik; the North Slope Borough; and the Alaska Eskimo Whaling Commission about the operations proposed to ensure that they minimize any potential siting and timing conflicts with subsistence whaling and other subsistence-harvest activities. When an operations plan is submitted to the MMS, the Alaska Eskimo Whaling Commission will participate in a concurrent review of the plan. If conflicts between industry and subsistence whalers arise over planned exploration or development and production activities, any of the affected parties can request that MMS convene a conflict-resolution panel composed of members from industry, the subsistence communities, the North Slope Borough, the Alaska Eskimo Whaling Commission, and the National Marine Fisheries Service. Only after this group has convened will MMS make a final decision on the adequacy of measures taken to prevent unreasonable conflicts to subsistence-hunting activities. Lease-related use will be restricted if it is determined necessary to prevent such conflicts with subsistence hunting. Subsistence whalers and industry have established a history for negotiating agreements that work for both parties.

In addition, the ITL clause on the Availability of Bowhead Whales for Subsistence-Hunting Activities advises lessees that MMS may limit or require that operations be modified if they could result in significant effects on the availability of the bowhead whale for subsistence use. The Orientation Program, Industry Site-Specific Bowhead Whale-Monitoring Program, Conflict Avoidance stipulations, and the ITL on the Availability of Bowhead Whales for Subsistence-Hunting Activities will serve collectively to mitigate disturbance effects on Native lifestyles and subsistence practices.

Proposed stipulations on Permanent Facility Siting in the Vicinity Seaward of Cross Island, Permanent Facility Siting in the Vicinity Shoreward of Cross Island, and Pre-booming Requirements for Fuel Transfers are not expected to decrease the potential for conflict with the enforceable policies of the ACMP and the NSB CMP. The intent of the proposed stipulations on permanent facility siting in the vicinity of Cross Island is met by the stipulation on Conflict Avoidance.

Summary: Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection. The NSB CMP policy 2.4.3(a) relates to "extensive adverse impacts to a subsistence resource" that "are likely and cannot be avoided or mitigated." Paragraph (d) of the same policy requires that development not preclude reasonable subsistence-user access to subsistence resources. Policy 2.4.5.1(a) relates to "development that will likely result in significantly decreased productivity of subsistence resources or their ecosystems." These policies address "likely" events. Although a large oil spill is not a "likely" event, for analysis purposes the EIS examines a hypothetical large spill and its potential consequences. In the unlikely event of a large oil spill during development and production, some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. The duration would vary depending on the volume of the spill, the persistence of oil in the environment, degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. In the unlikely event of a large spill, impacts to subsistence resources and subsistence-user access could occur. However, this would be an accidental event and is considered unlikely.

Conclusion: No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

IV.C.14.c. Effects by Alternatives and Sales

Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202. The potential for conflict with the Statewide standards of the ACMP and the enforceable policies of the NSB CMP are the same for all alternatives and sales – no conflicts are anticipated. Although each of the alternatives would defer portions of the proposed sale areas, activity outside the deferral areas would still be subject to the ACMP standards and NSB CMP enforceable policies. Activities described in all exploration and development and production plans must be reviewed for consistency with the enforceable policies of the ACMP and NSB CMP.

Conclusion: No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

IV.C.15. Air Quality

IV.C.15.a. Introduction

This discussion analyzes the potential impacts on air quality that could be caused by the activities and developments induced by Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202. Impacts to air quality would result from discharges (air emissions). Because disturbances and noise do not cause air quality impacts, they will not be discussed further. Supporting materials and discussions are presented in Section III.A.6 (description of existing air quality in the Beaufort Sea). Mitigation of adverse air quality impacts would result from operators' use of the best available technology to control discharges. None of the standard or proposed stipulations and ITL clauses is particularly applicable to air quality impacts.

Air pollutants discussed include nitrogen oxides, carbon monoxide, sulfur dioxide, particulate matter, and volatile organic compounds. Ozone is not emitted directly by any source but is formed in a series of complex photochemical reactions in the atmosphere involving volatile organic compounds and nitrogen oxide.

Nitrogen oxides consist of both nitric oxide and nitrogen dioxide. Nitrogen oxide is formed from the oxygen and nitrogen in the air during combustion processes, and the rate of the formation increases with combustion temperature. Nitric oxide, the major component of the combustion process, will slowly oxidize in the atmosphere to form nitrogen dioxide; nitrogen dioxide and volatile organic compounds perform a vital role in the formation of photochemical smog. Nitrogen dioxide breaks down under the influence of sunlight, producing nitric oxide and atomic oxygen, which then combine with diatomic oxygen to form ozone or with volatile organic compounds to form various gaseous and particulate compounds that result in the physiological irritation and reduced visibility typically associated with photochemical smog.

Carbon monoxide is formed by incomplete combustion. It is a problem mainly in areas having a high concentration of vehicular traffic. High concentrations of carbon monoxide present a serious threat to human health, because they greatly reduce the capacity of the blood to carry oxygen.

Sulfur dioxide is formed in the combustion of fuels containing sulfur. In the atmosphere, sulfur dioxide slowly converts to sulfate particles. Sulfates in the presence of fog or clouds may produce sulfuric-acid mist. It generally is recognized that entrainment of sulfur oxides or sulfate particles into storm clouds is a major contributor to the reduced pH levels observed in acid-rain precipitation.

Emissions of particulate matter associated with combustion consist of particles in the size range less than 10 microns in diameter (PM_{10}). Emissions of particulate matter associated with combustion, especially particles in the size range of 1-2 microns, can cause adverse health effects. Particulates in the atmosphere also tend to reduce visibility.

The type and relative amounts of air pollutants generated by offshore operations vary according to the phase of activity. There are three principal phases: exploration, development, and production. For a more detailed discussion of emission sources associated with each phase, refer *to Air Quality Impact of Proposed*

OCS Lease Sale No. 95 (Jacobs Engineering Group, Inc., 1989). Significant emission sources are summarized below.

Federal and State statutes and regulations define air quality standards in terms of maximum allowable concentrations of specific pollutants for various averaging periods (see Table III.A.5). These maxima are designed to protect human health and welfare. However, one exceedance per year is allowed, except for standards based on an annual averaging period. The standards also include Prevention of Significant Deterioration (PSD) provisions for nitrogen dioxide, sulfur dioxide, and PM_{10} to limit deterioration of existing air quality that is better than that otherwise allowed by the standards (an attainment area). Maximum allowable increases in concentrations above a baseline level are specified for each PSD pollutant. There are three classes (I, II, and III) of PSD areas. Class I allows the least degradation and also restricts degradation of visibility. The areas adjacent to the sale area are Class II, which allows a moderate incremental decrease in the air quality of the area. Baseline PSD pollutant concentrations and the portion of the PSD increments already consumed are established for each location by the Environmental Protection Agency and the State of Alaska before issuance of air quality permits. Air quality standards do not directly address all other potential effects, such as acidification of precipitation and freshwater bodies or effects on nonagronomic plant species.

With the enactment of the Clean Air Act Amendments of 1990, the Environmental Protection Agency has jurisdiction for air quality over this Beaufort Sea program area. The lease operators must comply with that agency's requirements for OCS sources, including the provisions of Title I, Part C, of the Clean Air Act (Prevention of Significant Deterioration of Air Quality). Section 328 states that for a source located within 25 miles of the seaward boundary of a State, requirements would be the same as those that would apply if the source were located in the corresponding onshore area.

IV.C.15.b. Effects Common to All Alternatives

IV.C.15.b(1) Discharges (Air Emissions)

IV.C.15.b(1)(a) Exploration Phase

For the exploration phase, emissions would be produced by (1) vessels used in gathering seismic and other geological and geophysical data; (2) diesel power-generating equipment needed for drilling exploratory and delineation wells; (3) tugboats, supply boats, icebreakers, and crew boats in support of drilling activities; and (4) intermittent operations such as mud degassing and well testing. Pollutants generated would primarily consist of nitrogen oxide (these would consist of nitric oxide and nitrogen dioxide; ambient air standards are set only for nitrogen dioxide), carbon monoxide, and sulfur dioxide. For each of the three sales, we assume that exploration activity would begin in the year following that sale. Emissions from exploration would be from seismic surveys and from drilling one to two exploration wells and two to four delineation wells from one rig at each discovery (one to three per sale). Drilling would continue at a rate of one or two exploration wells each year thereafter. Please see the Exploration and Development Scenarios in Appendix F to this EIS for more details.

IV.C.15.b(1)(b) Development and Production Phase

For the development phase, including temporary construction operations and drilling, the main sources of emission offshore would be the following:

- gas turbines used to provide power for drilling;
- reciprocating engines for electrical power, including rig generator (during construction phase only; standby only during commissioning);
- heavy construction equipment used to install facility and pipelines (including gravel-hauling dump trucks);
- construction and commissioning support equipment, including cranes, pumps, generators, compressors, pile drivers, welders, heaters, and flare;

- tugboats (needed to move equipment and supply barges) and support vessels; and
- drill-rig-support equipment, including boilers and heaters.

For all these operations, the best available control technology would be applied under the Environmental Protection Agency's air quality regulations. The main emissions would be nitrogen oxides, with lesser amounts of sulfur dioxide, carbon monoxide, and particulate matter. Once in the atmosphere, nitric oxide gradually converts to nitrogen dioxide.

For the production phase, the main source of offshore emissions would be from turbines for power generation and gas compression, and from power generation for oil pumping and water injection. The emissions would consist mainly of nitrogen oxides, with smaller amounts of carbon monoxide and particulate matter. Another source of emissions would be evaporative losses (volatile organic compounds) from oil/water separators, from pump and compressor seals and valve packing; using seal systems designed to reduce emissions would minimize these sources. Produced water and slop-oil tanks would be equipped with a vapor-recovery system, which would recover emissions of volatile organic compounds from these tanks and return them to the process. Operators would probably have a flare available 24 hours a day, 365 days a year. If there were venting (unexpected), it would emit volatile organic compounds. However, flaring largely would burn up any emissions of volatile organic compounds, and they should not create a pollution problem. Flaring mostly would produce some nitrogen oxides, sulfur dioxide, particulate matter, and carbon monoxide. Venting or flaring would probably produce only a very small amount of sulfur dioxide, because we expect that sulfur in the produced gas should be very low (but never completely absent).

Abandonment of facilities developed after the proposed sales would cause much higher vehicular traffic by trucks and barges, and also more heavy equipment operations than during the production phase of operations, but effects probably would be quite similar to the construction portion of the development phase of operations. Because abandonment operations would last perhaps a maximum of 10-15% of total operations time and would include no activities that should affect air quality more significantly than previously discussed, we conclude that these operations would cause insignificant effects on air quality.

Other sources of pollutants related to outer continental shelf operations are accidents such as blowouts and oil spills. Typical emissions from such accidents consist of hydrocarbons (volatile organic compounds); only fires associated with blowouts or oil spills produce other pollutants.

Emissions from development under Alternative I for Sale 186 would be from the installation of a maximum of three platforms and 40 miles of pipeline, and the drilling of a maximum of 69 production wells and 33 injection wells. In the peak years, a probable maximum of 20 wells per year would be drilled from two rigs. Peak-year production emissions would result from operations producing about 43.8 million barrels of oil and from transportation of that oil. See Appendix F Exploration and Development Scenarios, and Table F-2 for more details of the expected infrastructure.

The proposal for Sale 144 was, to some extent, roughly comparable in area with the area of Alternative I for Sales 186, 195, and 202 being analyzed in this current EIS, although the assumed level of development for each individual Beaufort Sea sale is lower than that associated with Sale 144. The projected production for each lease sale is 460 million barrels, compared with 1,200 million barrels for Sale 144. The peak production rate is 43.8 million barrels per year, compared with 101 million barrels per year for Sale 144. The number of platforms installed is two or three, while eight platforms were projected for Sale 144. Thus, the impacts from a Beaufort Sea sale likely would be somewhat lower than the impacts predicted from the analysis for Sale 144. Additional information and discussion from the EIS for Sale 144 (USDOI, MMS, 1996a) provides some details relevant to the current analysis. Table IV.B.12-1 of the Sale 144 final EIS lists estimated uncontrolled-pollutant emissions for the peak-exploration, peak-development, and peak-production years from that sale proposal. That EIS also has additional relevant discussion, especially in the last paragraph of Section IV.B.12.(1). Modeling discussed there shows that nitrogen dioxide had the highest concentration of the modeled pollutants, but that all pollutant contributions would be well within the PSD increments and Federal ambient air quality standards.

We refer also to the air quality analyses performed for the Northstar and Liberty projects. These projects would be typical of development in the Near Zone (about half of the projects assumed for Sales 186, 195, and 202). The projected peak production rate per platform in the current Alternative I for Sale 186 is

40,000-60,000 barrels per day, which is comparable to the 65,000 barrels per day that was assumed for the Northstar and Liberty development projects. For Liberty, the highest predicted concentrations for nitrogen dioxide, sulfur dioxide, and PM_{10} occurred just outside the facility boundary and were close to the PSD Class II maximum allowable increments. The highest onshore concentrations would be considerably less because of their dispersion over distance. The combined facility concentrations plus background were well within the ambient air quality standards (between 2 and 30% of the standards).

Because Alternative I for Sale 186 being analyzed in this EIS should have impacts that are lower than those predicted for Sale 144 and similar to those predicted for Northstar or Liberty, we conclude that for Alternative I for Sale 186, the expected pollutant contributions also would be well within PSD increments and Federal ambient air quality standards.

IV.C.15.b(2) Oil Spills

IV.C.15.b(2)(a) Details on How an Oil Spill May Affect Air Quality

Based on modeling work by Hanna and Drivas (1993), the volatile organic compounds from offshore facility or pipeline oil spills likely would evaporate almost completely within a few hours after the spill occurred. The article cited discusses the rate or evaporation and ambient concentrations of 15 different volatile organic compounds. Several of these compounds, such as benzene, ethylbenzene, toluene, and n-xylenes, are classified by the Environmental Protection Agency as hazardous air pollutants. The study results showed that these compounds evaporate almost completely within a few hours after the spill occurs. Ambient concentrations peak within the first several hours after the spill starts and are reduced by two orders of magnitude after about 12 hours. The heavier compounds take longer to evaporate and may not peak until about 24 hours after spill occurrence. Total ambient concentrations of volatile organic compounds are significant in the immediate vicinity of an oil spill, but concentrations are much reduced after the first day. If there were a continuing release of oil, the volatile organic compounds obviously would be released over the longer period of time during which the spilled oil itself was being released. These volatile emissions could impede response to the spill, depending on the type of release, wind speed and direction, and other incident-specific factors.

Diesel fuel oil could be spilled either while being transported or from accidents involving vehicles, vessels, or equipment. A diesel spill would evaporate faster than a crude oil spill. Ambient hydrocarbon concentrations would be higher than with a crude oil spill but also would persist for only a shorter time. Also, because any such spill probably would be smaller than some potential crude oil spills, any air quality effects from a diesel spill likely would be even lower than for other spills.

Oil or gas blowouts may catch fire. In addition, in situ burning is a preferred technique for cleanup and disposal of spilled oil. Burning could affect air quality in two important ways. For a gas blowout, burning would reduce emissions of gaseous hydrocarbons by 99.98% and very slightly increase emissions of other pollutants. If an oil spill were ignited immediately after spillage, the burn could combust 33-67% of crude oil or higher amounts of fuel oil (diesel) that otherwise would evaporate. On the other hand, incomplete combustion of oil would inject about 10% of the burned crude oil as oily soot, plus minor quantities of other pollutants, into the air. In situ burning would be less effective in areas of broken ice than in open water, but it still would reduce the effects of volatile organic compounds on the ambient air quality.

IV.C.15.b(2)(b) Effects of Oil-Spill Cleanup Activities on Air Quality

In situ burning as part of a cleanup of spilled crude oil or diesel fuel would temporarily adversely affect air quality, but the effects would be low. For much greater detail, please see the article by Fingas et al. (1995). Extensive ambient measurements were performed during two experiments involving the in situ burning of approximately 300 barrels of crude oil at sea. During the burn, carbon monoxide, sulfur dioxide, and nitrogen dioxide were measured only at background levels and frequently were below detection levels. Ambient levels of volatile organic compounds were high within about 100 meters of the fire, but were significantly lower than those associated with a nonburning spill. Measured concentrations of polyaromatic hydrocarbons were found to be low, as it appeared that a major portion of these compounds were consumed in the burn. Effects of in situ burning for spilled diesel fuel would be similar to those associated with a crude oil spill.

Over the life of oil exploration and development and production in the sale area, an oil spill could be set on fire accidentally or deliberately. Potential contamination of the shore would be limited, because exploration and development and production activities under Alternative I for Sales 186, 195, and 202 would be at least 4.8 kilometers (3 miles) offshore, with the exception of any oil- or gas-transport pipelines. Also, large fires create their own local circulating winds, toward the fire at ground level, that affect plume motion. Accidental emissions likely would have a minimal effect on onshore air quality.

If an oil spill were ignited immediately after spillage, the burn could combust 33-67% of the crude oil or higher amounts of fuel oil that otherwise would evaporate. On the other hand, incomplete combustion of oil would inject about 10% of the burned crude oil as oily soot, and minor quantities of other pollutants, into the air (see USDOI, MMS, 1996a:Table IV.B.12-4).

Additional work published in an article by McGrattan et al. (1995) reported that smoke-plume models have shown that the surface concentrations of particulate matter does not exceed the health criterion of 150 micrograms per cubic meter beyond about 5 kilometers downwind of an in situ burn. This is quite conservative, as this health standard is based on a 24-hour average concentration rather than a 1-hour average concentration. This appears to be supported by field experiments conducted off of Newfoundland and in Alaska (McGrattan et al., 1995).

Other air quality effects from cleanup activities would include emissions from vessels, vehicles, and equipment used in the cleanup effort; these should be very low.

Summary and Conclusion for Effects of an Oil Spill on Air Quality. In the unlikely event of a large oil spill from an offshore facility or pipeline, such a spill could cause a small, local increase in the concentrations of gaseous hydrocarbons (volatile organic compounds) due to evaporation from the spill. The concentrations of volatile organic compounds concentrations would be very low and normally be limited to only 1 or 2 square kilometers (0.4-0.8 square miles). During open-water conditions, spreading of the spilled oil and action by winds, waves, and currents would disperse the volatile organic compounds, so that they would be at extremely low levels (although over a relatively larger area). During broken-ice or melting-ice conditions, because of limited dispersion of the oil, the concentrations might reach slightly higher levels for several hours, possibly up to 1 day. The effects from a spill occurring under the ice would be similar to but less than those described for broken-ice or melting-ice conditions; the oil would be trapped and essentially remain unchanged until the ice began to melt and breakup occurred. Some of the volatile organic compounds, however, would be released from the oil and dispersed, even from under the ice. In any of these situations, moderate or greater winds further would reduce the concentrations of volatile organic compounds in the air. Concentrations of criteria pollutants would remain well within Federal air quality standards. The overall effects on air quality would be minimal.

IV.C.15.b(3) Effects of Accidental Emissions

Sources of air pollutants related to OCS operations include accidental emissions resulting from gas or oil blowouts. The number of blowouts on the U.S. OCS, almost entirely gas and/or water, averaged 3.3 per 1,000 wells drilled from 1956 through 1982 (Fleury, 1983). Danenberger (1993) determined a frequency of 4.1 blowouts per 1,000 wells drilled from 1971 through 1991. Typical emissions from such accidents consist of hydrocarbons (volatile organic compounds); only fires associated with blowouts produce other pollutants, such as nitrogen oxides, carbon monoxide, sulfur dioxide, and particulate matter. Accidental emissions likely would have little effect on onshore air quality.

A gas blowout could release 20 tons per day of gaseous hydrocarbons, of which about 2 tons per day would be nonmethane hydrocarbons classified as volatile organic compounds. The probability of experiencing one or more blowouts in drilling the wells projected for Alternative I for Sales 186, 195, and 202 is estimated to be low. If a gas blowout did occur, it would be unlikely to persist more than 1 day; and it very likely would release less than 2 tons of volatile organic compounds. Since 1974, 60% of the blowouts have lasted less than 1 day; and only 10% have lasted more than 7 days.

Gas or oil blowouts may catch fire. In addition, in situ burning is a preferred technique for cleanup and disposal of spilled oil in oil-spill-contingency plans. For catastrophic oil blowouts, in situ burning may be the only effective technique for spill control. Please see Section IV.A.6.b for a discussion of in situ burning.

Burning could affect air quality in two important ways. For a gas blowout, burning would reduce emissions of gaseous hydrocarbons by 99.98% and very slightly increase emissions—relative to quantities in other oil and gas industrial operations—of other pollutants (see USDOI, MMS, 1996a:Table IV.B.12-3). For a major oil blowout, setting fire to the wellhead could burn 85% of the oil, with 5% remaining as residue or droplets in the smoke plume in addition to the 10% soot injection (Evans et al., 1987). Clouds of black smoke from a burning 360,000-barrel oil spill 75 kilometers off the coast of Africa locally deposited oily residue in a rainfall 50-80 kilometers inland. Later the same day, clean rain washed away most of the residue and allayed fears of permanent damage.

Based on qualitative information, burns that are two or three orders of magnitude smaller do not appear to cause noticeable fallout problems. Along the Trans-Alaska Pipeline, 500 barrels of a spill were burned over a 2-hour period, apparently without long-lasting effects (Schulze et al., 1982). The smaller volume Tier II burns at Prudhoe Bay had no visible fallout downwind of the burn pit (Industry Task Group, 1983).

Soot is the major contributor to pollution from a fire. This soot, which would cling to plants near the fire, would tend to slump and wash off vegetation in subsequent rains, limiting any health effects. Coating portions of the ecosystem in oily residue is the major, but not the only, potential air quality risk. Recent examination of polycyclic aromatic hydrocarbons in crude oil and smoke from burning crude oil indicates that the overall amounts of polycyclic aromatic hydrocarbons change little during combustion, but the kinds of compounds of polycyclic aromatic hydrocarbons present do change. Benzo(a)pyrene, which often is used as an indicator of the presence of carcinogenic varieties of polycyclic aromatic hydrocarbons, is present in crude-oil smoke in quantities approximately three times larger than in the unburned oil; however, only in very small amounts (Evans, 1988). Investigators have found that, overall, the oily residue in smoke plumes from crude oil is mutagenic but not highly so (Sheppard and Georghiou, 1981; Evans et al., 1987). The Expert Committee of the World Health Organization considers daily average smoke concentrations of greater than 250 micrograms per cubic meter to be a health hazard for bronchitis.

Because of the distance from shore (at least 4.8 kilometers, or 3 miles) and the dispersal of airborne pollutants by winds, accidental emissions likely would have a minimal effect on onshore air quality.

IV.C.15.b(4) Other Effects on Air Quality

Other effects of air pollution from OCS activities and other sources on the environment not specifically addressed by air-quality standards include the possibility of damage to vegetation, acidification of coastal areas, and atmospheric visibility impacts. Effects may be short term (hours, days, or weeks), long term (seasons or years), regional (Arctic Slope), or local (nearshore only). Visibility may be defined in terms of visual range and contrast between plume and background (which determines perceptibility of the plume). For their proposed Liberty Project, BPXA had run the VISCREEN model and found noticeable effects on only a very limited number of days, ones that had the most restrictive meteorological conditions. No effects at all were simulated during average conditions. We expect that those results would be typical of other development projects that could occur after any discoveries following the currently proposed lease sales.

A significant increase in ozone concentrations onshore is not likely to result from exploration, development, or production scenarios associated with any of the proposed sales (186, 195, and 202). Photochemical pollutants such as ozone are not emitted directly; they form in the air from the interaction of other pollutants in the presence of sunshine and heat. Although sunshine is present in the Beaufort Sea Planning Area most of each day during the summer, temperatures remain relatively low (Brower et al., 1988). Also, activities occurring as a result of field development are offshore and separated from each other, diminishing the combined effects from these activities and greatly increasing atmospheric dispersion of pollutants before they reach shore. At a number of air-monitoring sites in the Prudhoe Bay and Kuparuk areas, ozone measurements show that the highest 1-hour-maximum ozone concentrations generally are in the range of 0.05-0.07 parts per million, which is well within the existing maximum 1-hour-average ozone standard of 0.12 parts per million. The highest 8-hour average ozone concentration is always somewhat lower than the maximum 1-hour average. Therefore, ozone levels are expected to be within the revised 8-hour average ozone standard of 0.08 parts per million. (**Note:** The 8-hour Federal ozone standard currently is under litigation. The Environmental Protection Agency cannot enforce the standard until the legal issues are resolved.) Because the projected ozone precursor emissions from any of the proposed sales (186, 195, and 202) are considerably lower than the existing emissions from the Prudhoe Bay and Kuparuk oil fields, the proposed sales (186, 195, and 202) should not cause any ozone concentrations to exceed the 8-hour Federal standard.

Olson (1982) reviewed susceptibility of fruticose lichen, an important component of the coastal tundra ecosystem, to sulfurous pollutants. There is evidence that sulfur dioxide concentrations as low as 12.0 micrograms per cubic meter for short periods of time can depress photosynthesis in several lichen species, with damage occurring at 60 micrograms per cubic meters. In addition, the sensitivity of lichen to sulfate is increased in the presence of humidity or moisture, conditions that are common on coastal tundra. However, because of the small size and number of sources of sulfur dioxide emissions, the ambient concentrations at most locations may be assumed to be near the lower limits of detectability. Because of the distance of the proposed activities from shore, attendant atmospheric dispersion, and low existing levels of onshore pollutant concentrations, the effect on vegetation under Alternative I for Sales 186, 195, and 202 is expected to be minimal. For their proposed Liberty development project, BPXA had found that maximum modeled pollutant concentrations were well below levels that can damage lichens, according to laboratory studies. This likely would also apply to other development projects that could follow the currently proposed lease sales. Research at Prudhoe Bay from 1989 through 1994 showed no effects of pollutants there on vascular plants or lichens (Kohut et al., 1994). That research was conducted in areas typical of much of the Beaufort Sea Planning Area. Monitoring the vascular and lichen plant communities over the 6 years revealed no changes in species composition that could be related to differences in exposures to pollutants.

IV.C.15.b(5) Nuiqsut's Views on Air Emissions

Elder Bessie Ericklook from Nuiqsut maintained that since the oil fields have been established at Prudhoe Bay, the foxes have been dirty and discolored in the area of Oliktok Point (Ericklook, 1979, as cited in USDOI, Bureau of Land Management, 1979a). Leonard Lampe, then Mayor of Nuiqsut, more recently reported further air-pollution problems and habitat concerns, asserting that Nuiqsut has been experiencing such effects for some time: “A lot of air pollution, asthma, bronchitis—a lot with young children. We see smog pollution that goes from Prudhoe Bay out to the ocean and sometimes to Barrow when the wind is blowing that way...” (Lavrakas, 1996:1, 5). Because of the distances from the most likely developments to Nuiqsut and the relatively small sizes of these projects in comparison with the Prudhoe Bay complex, the proposed sales (186, 195, and 202) would have no significant effect with respect to these observations.

Summary and Conclusion for Effects on Air Quality. Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable Prevention of Significant Deterioration Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires.

The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the Prevention of Significant Deterioration Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low.

IV.C.15.c. Effects of Alternatives and Sales

Air quality impacts are determined by atmospheric transport and dispersion patterns and the relative locations of the emission sources and receptors (points where impacts are evaluated). These characteristics will vary to some extent in different locations within the Beaufort Sea. Wind patterns are determined by large-scale circulation systems as well as by local topography and heat exchange between the atmosphere, ocean, and ice. Atmospheric dispersion patterns are very complex as well. The air quality modeling for Sale 144, Northstar, and Liberty used meteorological data from just a few stations, which generally are not representative of the whole Beaufort Sea area. Results for a similar project, such as the Alternative I for Sale 186, are likely to vary from one area to another, depending on local meteorological and topographical conditions. The air quality modeling for the projects mentioned are based on the best available information for the Beaufort Sea; they can be thought of as providing a best “first guess” of conditions anywhere in the proposed sale area. Because the predicted impacts are small, it can be reasonably assumed that the effects from facilities anywhere in the region would fall within the regulatory standards.

Because individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives upon air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales (186, 195, and 202) would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from Alternative I for Sales 186, 195, and 202 would be low.

IV.C.15.c(1) Effects of Alternative I for Sale 186

This action would have the highest potential for impacts to shore, because it has the largest number of development projects in the Near Zone. Potentially affected areas primarily would be locations on the North Slope where current oil development is taking place.

IV.C.15.c(2) Effects of Alternative I for Sale 195

Alternative I for Sale 195 would have relatively lower potential impacts than Alternative I for Sale 186, because the level of activity is shifted more into the Midrange Zone, where distances generally are greater. However, areas to the west (around Harrison Bay) and to the east (a portion of the Arctic National Wildlife Refuge) may experience higher impacts than from Sale 186.

IV.C.15.c(3) Effects of Alternative I for Sale 202

Alternative I for Sale 202 would have lower potential for impacts than Alternative I for Sales 186 and 195, because all of the projected activities would occur in the Far Zone. However, this sale could result in the highest impacts occurring in areas off the National Petroleum Reserve-Alaska and the Arctic National Wildlife Refuge.

IV.C.15.c(4) Effects of Alternatives III, IV, V, and VI for Sales 186, 195 and 202 and Alternatives III and IV for Sale 202

These deferrals would reduce the potential impacts to the adjacent onshore areas.

IV.C.15.c(5) Effects of Alternative V for Sale 202

This alternative would eliminate potential air quality impacts to a portion of the Arctic National Wildlife Refuge.

IV.C.15.c(6) Effects of Alternative VI for Sale 202

This alternative would eliminate potential air quality impacts to a portion of the Arctic National Wildlife Refuge.

IV.C.16. Environmental Justice

IV.C.16.a. Introduction

Alaska Inupiat Natives, a recognized minority, are the predominant residents of the North Slope Borough, the area potentially most affected by the Beaufort Sea multiple sales. Effects on Inupiat Natives could occur because of their reliance on subsistence foods, and exploration and development may affect subsistence resources and harvest practices. Potential effects could be experienced by the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the North Slope Borough. The Environmental Justice Executive Order includes consideration of potential effects to Native subsistence activities.

All of the alternatives for Sales 186, 195, and 202, except Alternative II No Action, assume the same amount of oil and for purposes of environmental justice analysis the same levels of activity for the alternatives and sales. These similarities, along with the unique focus of environmental justice, result in a different analytical structure and format. Therefore, the environmental justice analysis that follows does not mirror the format used for other resource categories.

IV.C.16.b. Demographics

IV.C.16.b(1) Race

In 1993, the North Slope Borough conducted the North Slope Borough Census of Population and Economy. It found that of the 6,538 Borough residents, 4,941 identified themselves as Native and 1,597 identified themselves as non-Native. Of the Native population, 97.71% or 4,828 were Inupiat Eskimo. The 1998 Census conducted by the North Slope Borough identified 7,555 Borough residents, with 5,485 reporting as Native and 2,096 as non-Native. Of the 1998 Native population, 96.83%, or 5,285, were Inupiat Eskimo. For the North Slope Borough as a whole in 1993, the population was 73.9% Inupiat and 26.1% non-Inupiat; in 1998, the population was 72.24% Inupiat and 27.76% non-Inupiat (North Slope Borough, 1995, 1999). The 2000 Census counted 7,385 persons resident in the North Slope Borough; 5,050 identified themselves as American Indian and Alaska Native for a 68.38% indigenous population (USDOC, Bureau of the Census, 2000).

The 1993 figures show that of the Inupiat population, 69% of the North Slope Borough population resided in the three communities of Barrow, Nuiqsut, and Kaktovik (North Slope Borough, 1995); 49.2% lived in Barrow, and 50.8% lived in the other seven villages that comprise the North Slope Borough. In 1998, 61.4% of the North Slope Borough population resided in Barrow, and 38.6% lived in the other seven Borough villages; 70.38% lived in the communities of Barrow, Nuiqsut, and Kaktovik (North Slope Borough, 1995, 1999).

In the potentially affected communities of Barrow, Nuiqsut, and Kaktovik, there are no significant “other minorities.” In Nuiqsut, “other minorities” comprised 1.4% of the total population of 420 in 1998, and in Kaktovik, 2.0% of the total population of 256 in 1998. In Barrow in 1998, “other minorities” constituted 16.8% of the total population of 4,641, but the Inupiat minority population is the only minority population allowed to conduct subsistence hunts for marine mammals. “Other minorities” are not allowed to participate in the subsistence marine mammal hunt and do not constitute a potentially affected minority population (North Slope Borough, 1999).

Because of the North Slope Borough’s homogenous Inupiat population, it is not possible to identify a “reference” or “control” group within the potentially affected geographic area, for purposes of analytical comparison to determine if the Inupiat are affected disproportionately. This is because a non-minority group does not exist in a geographically dispersed pattern along the potentially affected area of the North Slope.

IV.C.16.b(2) Income

According to the U.S. Department of Commerce, the average household income in 1993 for the State of Alaska was $64,652, and the average State per capita income was $23,000. Based on Department of Commerce data, the Alaska Department of Labor has portrayed the North Slope Borough as having one of the highest per capita incomes in the State; but data collected by the North Slope Borough 1993 Census of Population and Economy take exception to these figures based primarily on different methods used in data collection. Federal data use a sampling procedure, but the Borough conducts house-to-house household surveys. Also, Federal figures include “transfer payments” such as unemployment, welfare, Social Security, and Medicare/Medicaid payments. The North Slope Borough survey includes all income reported to the Internal Revenue Service, including Alaska Permanent Fund and Alaska Native Claims Settlement Act corporation dividends. The North Slope Borough figures determined an average household income of $54,645 and a per capita income of $15,218 in 1993. When figured for ethnicity, the average Inupiat household income was $44,551 and for non-Inupiat it was $74,448. The average Inupiat per capita income was $10,765 and the non-Inupiat per capita income was $29,525. Of all the households in the North Slope Borough surveyed, 23% qualified as very low-income households, and another 10% qualified as low-to-moderate-income households. As 66% of the total households surveyed were Inupiat, it would appear that a large part of the households falling in the very low- to low-income range are Inupiat. Poverty-level families in the North Slope Borough numbered 88, or 6% of all households. Poverty-level thresholds used by the North Slope Borough were based on the U.S. Bureau of the Census, March 1996 Current Population Survey; low income is defined by the U.S. Census Bureau as 125% of poverty level (North Slope Borough, 1995, 1999).

The North Slope Borough 1998/1999 Economic Profile and Census Report showed household income increasing from $54,645 in 1993 to $63,884 in 1998. The average Inupiat household income increased by an average of $11,685, from $44,551 to $56,236. The average Inupiat per capita income rose from $10,765 in 1993 to $12,550 in 1998. One hundred five households qualified as poverty level, and 37 qualified as very low income. This translates into a total of 381 individuals living below the poverty level, an increase of 12 individuals since 1993 (North Slope Borough, 1999).

IV.C.16.c. Consumption of Fish and Game

As defined by the North Slope Borough Municipal Code, subsistence is “an activity performed in support of the basic beliefs and nutritional need of the residents of the borough and includes hunting, whaling, fishing, trapping, camping, food gathering, and other traditional and cultural activities” (State of Alaska, Dept. of Natural Resources, 1997). This definition gives only a glimpse of the importance of the practice of the subsistence way of life in Inupiat culture, but it does underscore that it is a primary cultural and nutritional activity on which Native residents of the North Slope depend. For a more complete discussion of subsistence and its cultural and nutritional importance, see Section III.C.2 - Subsistence-Harvest Patterns. For statements of the traditional importance of subsistence practices, see Inupiat traditional knowledge commentary in Sections IV.C.11 - Effects of Noise, Disturbance, and Oil Spills on Subsistence-Harvest Patterns, and IV.C.12 - Effects of Noise, Disturbance, and Oil Spills on Sociocultural Systems. See also the Cumulative Effects and the Affected Environment sections for these resources for more traditional knowledge.

Potential effects focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the North Slope Borough. The sociocultural and subsistence activities of these Native communities could be affected by accidental oil spills. Possible oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health. Interestingly, after the *Exxon Valdez* spill, testing of subsistence foods for hydrocarbon contamination from 1989-1994 revealed very low concentrations of petroleum hydrocarbons in most subsistence foods. In fact, the U.S. Food and Drug Administration concluded that eating food with such low levels of hydrocarbons posed no significant risk to human health (Hom et al., 1999). They recommended avoiding shellfish, which accumulates hydrocarbons. Of course, human health could be threatened in areas affected by oil spills; however, we can reduce these risks through timely warnings about spills, forecasts about which areas may be affected, and even evacuating people and avoiding marine and terrestrial foods that may be affected. Federal and State agencies with health-care responsibilities would have to sample the food sources and test for possible contamination.

Whether subsistence users will use potentially tainted foods is entirely another question that involves cultural "confidence" in the purity of these foods. Based on surveys and findings in studies of the *Exxon Valdez* spill, Natives in affected communities largely avoided subsistence foods as long as the oil remained in the environment. Perceptions of food tainting and avoiding use remained (and remain today) in Native communities after the *Exxon Valdez* spill, even when agency testing maintained that consumption posed no risk to human health (State of Alaska, Dept. of Fish and Game, 1995a; Hom et al., 1999; Burwell, 1999).

The ability to assess and communicate the safety of subsistence resources following an oil spill is a continuing challenge to health and natural resource managers. After the *Exxon Valdez* spill, analytical testing and rigorous reporting procedures to get results out to local subsistence users were never completely convincing to most subsistence users about the safety of their food, because scientific conclusions often were not consistent with Native perceptions about environmental health. According to Peacock and Field (1999), a discussion of subsistence-food issues must be cross-disciplinary, reflecting a spectrum of disciplines from toxicology, to marine biology, to cultural anthropology, to cross-cultural communication, to ultimately understanding disparate cultural definitions of risk perception itself. Any effective discussion of subsistence-resource contamination must understand the conflicting scientific paradigms of Western science and traditional knowledge in addition to the vocabulary of the social sciences in reference to observations throughout the collection, evaluation, and reporting process. True restoration of environmental damage, according to Picou and Gill (1996), "must include the reestablishment of a social equilibrium between the biophysical environment and the human community" (Field et al., 1999; Nighswander and Peacock, 1999; Fall et al., 1999). Since 1995, subsistence restoration resulting from the *Exxon Valdez* oil spill has improved by taking a more comprehensive approach by partnering with local communities and by linking scientific methodologies with traditional knowledge (Fall et al., 1999; Fall and Utermohle, 1999).

IV.C.16.d. Summary of Human Health Effects

In Alaska initiatives researching contaminants in subsistence foods include a 1999 report by the Alaska Native Health Board: *Alaska Pollution Issues.* After assessing the risks from radionuclides, persistent organic pollutants, heavy metals, polychlorinated biphenyls, dioxins, and furans, the Health Board report concluded that the "benefits of a traditional food diet far outweigh the relative risks posed by the consumption of small amounts of contaminants in traditional foods" (Alaska Native Health Board, 1999). A 1998 report, *Use of Traditional Foods in a Healthy Diet in Alaska: Risks in Perspective*, by the Alaska Department of Health and Social Services essentially came to the same conclusion as the Native Health Board report. It did suggest that Alaska has a critical need to examine human biomarkers of polychlorinated biphenyl exposure and that more studies on polychlorinated biphenyl concentrations in the serum of Alaska Natives is needed. Such information would be the most relevant in determining polychlorinated biphenyl exposure through the subsistence food chain. A comprehensive statewide screening study was advocated (Egeland, Feyk, and Middaugh, 1998).

In 2001, The Alaska Native Health Board put out the *Alaska Pollution Issues Update* report. The report was the first real attempt in Alaska to combine contaminant levels in subsistence foods, actual subsistence food consumption levels by Alaska Natives, and Food and Drug Administration and the Environmental Protection Agency action levels in order to come up with actual health advisories. Its overall conclusion was that "a small number of traditional foods contain contaminants with concentrations that are over the Food and Drug Administration action level, but most have levels below the action level. With the wide margin built in, for establishing the Food and Drug Administration action level, the results should be reassuring to consumers of traditional foods. To determine definitively if these low levels are harmful only ongoing research that measures contaminant levels in Native populations will provide the answer" (Alaska Native Health Board, 2002).

IV.C.16.e. Standard and Potential Mitigation and Ongoing Mitigating Initiatives

One overarching way MMS has tried to address Native concerns has been to include local Inupiat Traditional Knowledge in the text of lease-sale and production EIS's. This process was followed for Sale 170, and the Liberty Project EIS's, and these concerns are found in the Subsistence and Sociocultural sections that analyze noise and oil-spill impacts (see Section IV.C.11 - Subsistence-Harvest Patterns and Section IV.C.10 - Sociocultural Systems). Traditional knowledge will be considered by the decisionmakers when they develop their Records of Decision for the proposed activities.

IV.C.16.e(1) Noise and Disturbance-Related Mitigation

Several mitigating measures are assumed to be in place for the Beaufort Sea multiple sales, and this assumption is reflected in discussions about effects. Mitigation that would apply to subsistence-harvest patterns includes standard proposed Stipulation 2 - Orientation Program, Stipulation 4 - Industry Site-Specific Bowhead Whale Monitoring Program, and Stipulation 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities. Proposed stipulations developed specifically for this EIS are Stipulation 6a - No Permanent Facility Siting in the Vicinity Seaward of Cross Island, Stipulation 6b - No Permanent Facility Siting in the Vicinity Shoreward of Cross Island, and Stipulation 7 - Pre-booming Requirements for Fuel Transfers.

Stipulation 2 - Orientation Program requires the lessee to educate people working on exploration, development, and production about the environmental, social, and cultural concerns that relate to the area and its communities. The program should increase workers' sensitivity to, and understanding of, values, customs, and lifestyles of local Native communities and help prevent conflicts with subsistence activities. The overall training program will be submitted to the Regional Supervisor, Field Operations (RS/FO) for review and approval. Personnel will receive appropriate training on at least an annual basis, and full training records will be maintained for at least 5 years.

Stipulation 4 Industry Site-Specific Bowhead Whale-Monitoring Program requires lessees proposing to conduct exploratory drilling operations, including seismic surveys, during the bowhead whale migration to conduct a site-specific monitoring program approved by the RS/FO; unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with the North Slope Borough (NSB) and the Alaska Eskimo Whaling Commission (AEWC), determines that a monitoring program is not necessary. The monitoring program would assess when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these operations.

This stipulation helps reduce effects to subsistence-harvest patterns and to the overall sociocultural systems, which place special value on the bowhead whale harvest and the sharing of this harvest with the other members of the community. This stipulation helps provide mitigation to potential effects of oil and gas activities to the local native whale hunters and subsistence users. It is considered to be a positive action by the Native community under environmental justice. Other positive aspects of this stipulation in terms of subsistence and sociocultural concerns would be the involvement of the Native community in the selection of peer reviewers and in providing observers for the monitoring effort.

Stipulation 5 - Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities requires industry to avoid unreasonable conflict with subsistence activities during operations, especially the bowhead whale hunt. Before submitting a plan, the lessee must consult with the subsistence communities of Barrow, Nuiqsut, and Kaktovik; the NSB; and the AEWC about the proposed operations. These consultations ensure that they coordinate siting and timing with subsistence whaling and other subsistence-harvest activities.

In the event no agreement is reached between the parties, the lessee, the AEWC, the NSB, the National Marine Fisheries Service (NMFS), or any of the subsistence communities that could be affected directly by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the subsistence communities, AEWC, NSB, NMFS, and the lessee(s) to specifically address the conflict and attempt to resolve the issues before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests. Upon request, the RS/FO will assemble this group, if the RS/FO determines such a meeting is warranted and relevant, before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests.

The MMS can restrict uses under the lease, if necessary, to prevent conflicts, but subsistence whalers and industry have been able to negotiate agreements that work for both parties. An example is the agreement coordinating the timing of seismic activity for the Northstar Project and the subsistence whale hunt. BPXA and the NSB, AEWC, and city of Nuiqsut worked out this agreement. Existing mitigation requires operators to coordinate siting and timing of projects in a Conflict Avoidance Agreement. The AEWC prefers to negotiate a Conflict Resolution Agreement with industry on an annual basis using a regional, rather than a project-specific, approach to address potential impacts from all ongoing development projects. With the use of the Conflict Avoidance Agreement methodology, Native subsistence whale hunters generally have been successful in reaching their annual whale "take" quotas. Industry may also be required to consult with subsistence communities when activities could directly affect the availability of polar bears for subsistence use and to develop a Plan of Cooperation as part of the Incidental Take Program.

This stipulation helps to reduce noise and disturbance conflicts from oil and gas operations during specific periods, such as the annual spring and fall whale hunts. It requires that the lessees meet with local communities and subsistence groups to resolve potential conflicts. This stipulation reduces potential adverse effects from proposed sales to subsistence harvest patterns, sociocultural systems, and to environmental justice. This stipulation has proven to be effective mitigation in prelease (primarily seismic activities) and exploration activities and through the development of the annual oil/whaler agreement between the AEWC and oil companies.

Potential Stipulations 6a and 6b, which was adopted in Sale 170 as a single stipulation, is divided into two parts. Stipulation 6a will apply the 10-mile radius around Cross Island outside of the barrier islands. Stipulation 6b will apply the 10-mile radius only to those blocks within the barrier islands.

Stipulation 6a - Permanent Facility Siting in the Vicinity Seaward of Cross Island would prohibit permanent OCS production facility siting within a defined 10-mile radius seaward of Cross Island unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the NSB and the AEWC, that development would not preclude reasonable subsistence access to whales. In making such a demonstration, the lessee shall follow the processes and requirements for consultation and mitigation of unreasonable conflicts as set out in Stipulation 5.

This stipulation would reduce the potential conflict between subsistence hunting activities and oil and gas development and operational activities with the key areas seaward of Cross Island where subsistence whaling for the community of Nuiqsut occurs. This stipulation could also reduce potential noise from a facility in this area that could deflect bowhead whales further offshore.

Stipulation 6b - Permanent Facility Siting in the Vicinity Shoreward of Cross Island, would prohibit permanent OCS production facility siting within a defined 10-mile radius shoreward of Cross Island unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the NSB and the AEWC, that development would not preclude reasonable subsistence access to whales.

This stipulation would reduce the potential conflict between subsistence hunting activities and oil and gas development and operational activities within the area shoreward of Cross Island. However, the whale migration and most whale hunting (based on the whale-strike data) occur outside the Barrier Islands. This stipulation would provide little or no additional protection to subsistence whaling or bowhead whales from that provided by Stipulation 5.

In projects where seismic surveying has been employed, past Conflict Avoidance Agreements have put Inupiat observers on board seismic vessels who, along with biologist observers, are employed by the monitoring contractor to satisfy Conflict Avoidance Agreement and National Marine Fisheries Service requirements. The Inupiat and biologist observers stop seismic operations when they observe marine mammals within the safety radius designated by the National Marine Fisheries Service. Shut down of the airguns occurs if marine mammals are within this radius because of concern about possible effects on hearing sensitivity.

The MMS, along with industry, their contractors, scientists, the North Slope Borough Mayor's Office and the Wildlife Management Department, and the Alaska Eskimo Whaling Commission, participate in the

National Marine Fisheries Service annual Peer Review Workshop in Seattle to deal with monitoring issues as they relate to the National Marine Fisheries Service administration of its responsibilities for Endangered Species Act and Incidental Harassment Authorization processes. Workshop participants review the results of monitoring efforts to determine the effects of industry activities on marine mammals in the Beaufort Sea and review monitoring plans for the upcoming field season. A noise-monitoring program for marine mammals similar to the one being done for the Northstar Project would be expected for similar development projects and would be considered through the Peer Review Workshop meetings. Any potential monitoring program would be designed to: (1) assess when bowhead and beluga whales and bearded seals are present in the vicinity of development operations and the extent of behavioral effects on these species due to project operations; (2) consider the potential scope and extent of effects that the type of operation could have on these species; and (3) address local concerns of subsistence hunters and integrate Inupiat traditional knowledge.

Other coordination meetings concerning noise impacts included the Arctic Seismic Synthesis Workshop in Barrow in 1997 hosted by MMS that brought together Native whalers, the oil industry, and acoustic scientists to discuss the issue of the distance at which bowheads are deflected from their normal migration path by seismic noise. Whaling captains collectively presented information on distances at which bowhead whales react to seismic vessels. Other concerns raised by local subsistence hunters at those meetings involve issues that are best addressed during the project review and approval process. These concerns include: (1) developing an access agreement for subsistence whalers to gravel production islands that would allow whalers to land on them in case of emergency; (2) establishing marine repeater stations on production islands that would provide a communication and safety benefit to local whalers; (3) establishing some protocol for monitoring air quality that would address long-standing local concerns about air quality in the area; (4) developing a plan for minimizing the number of sealifts and making sure they are completed before the fall subsistence whaling season begins; (5) developing a plan for ongoing Native inspection of production island construction and operation; and (6) developing a plan that ensured that local/Native observers are present during drilling to monitor for potential drill-noise disturbance to marine mammals.

Stipulation 5 provides subsistence whales and hunters the process for meeting with the lessors and operators to resolve these issues.

IV.C.16.e(2) Oil Spill-Related Mitigation Initiatives

Potential Stipulation 7 - Pre-Booming Requirements for Fuel Transfers, would require pre-booming of the fuel barges for fuel transfers (excluding gasoline transfers) of 100 barrels or more that occurred 3 weeks prior to or during the bowhead whale migration. The fuel barge would have to be surrounded by an oil-spill-containment boom during the entire transfer operation to help reduce any adverse effects from a potential spill.

This stipulation would lower the potential effects to subsistence resources and sociocultural systems by providing additional protection to the bowhead whale from potential fuel spills that could occur prior to or during the bowhead whale-migration period. This stipulation would be an added caution in reducing potential harm to migrating bowhead whales and to any tainting of the whales from a spill.

As part of the effort to look at all possible ways to minimize the likelihood of an oil spill, industry, MMS, and the Interagency Working Group have undertaken extensive studies of alternative production pipeline designs to address pipeline safety and oil-spill concerns. Extra-thick-walled pipelines, pipe-in-pipe designs, pipeline burial depths more than twice the maximum 100-year ice-gouging event, and an advanced leak-detection system (LEOS) have been explored to address the prevention of oil spills.

In terms of oil-spill-response initiatives, the MMS and the North Slope Borough are participants in the North Slope Spill Response Project Team that was established to provide areawide spill-response planning for local communities on the North Slope. The MMS has provided the North Slope Borough, the Alaska Eskimo Whaling Commission, the Inupiat Community of the Arctic Slope, and local Native villages information on oil-spill planning, response, and cleanup and ongoing spill-response research initiatives. The MMS has invited local communities and tribal groups to scheduled industry oil-response drills at Prudhoe Bay. Additionally, the MMS held an Alaska Arctic Pipelines Workshop on November 8-9, 1999, in Anchorage to facilitate the exchange of technical information and current research on pipelines in the Arctic between the public, regulators, pipeline designers, and operators. The workshop consisted of presentations and breakout sessions on pipeline design, construction, operations, and maintenance. About 150 persons, including North Slope Borough representatives, participated in the workshop.

The MMS encourages initiatives to train village oil-spill-response teams as a way of guaranteeing local participation in spill response and cleanup; this effort allows local Native communities to use their traditional knowledge about sea ice and the environment in the response process. Within the constraints of Federal, State, and local law, operators and Alaska Clean Seas would be encouraged to hire and train residents of the North Slope Borough and the Cities of Barrow, Nuiqsut, and Kaktovik in oil-spill response and cleanup.

The MMS has worked with the oil industry to develop a comprehensive plan for dealing with subsistence claims, should an oil spill occur. At the present time, the U.S. Coast Guard is reworking their claim process to be more responsive to Native subsistence practices in Alaska. The MMS requires all operators to provide financial responsibility through bonds as required by the Oil Pollution Act of 1990, to ensure they have the means to clean up an oil spill.

Other potential mitigation available if activity occurs includes potential staging of oil-spill equipment at critical locations to support any necessary oil-spill-cleanup operations. This initiative would address response-readiness concerns of subsistence users. Also, the staging of boom material and other pertinent response equipment at Barrow, Cross Island, and Kaktovik would provide protection to critical whaling areas and shoreline. These measures could be included in the oil-spill-contingency plan or in the final Condition of Permit approval letter for a production project issued by the Regional Supervisor for Field Operations.

The oil-spill-contingency plan also could include tactics for protecting bowhead whales. Hazing also could divert bowhead whales away from a spill, if they happened to be in the area at the time of an oil spill.

The MMS acknowledges that present mechanical-cleanup technology has not demonstrated cleanup ability in broken-ice conditions. In-situ burning is a nonmechanical response method available for spill response and could be quite effective in ice conditions, where mechanical cleanup techniques have been proven problematic. Collectively, these standard stipulations and ITL clauses, along with the other rules and regulations governing offshore activities permitted by MMS would aid substantively in mitigating against contamination to onshore habitats and subsistence resources.

IV.C.16.e(3) Mitigating Initiatives Related to Sociocultural Impacts

In evaluating potential sociocultural impacts, the MMS has produced a substantial environmental justice analysis for Alaska as it relates to the Native Alaskan subsistence way of life. Environmental justice analyses have been written for OCS Lease Sale 170, the Bureau of Land Management's recent leasing initiative in the National Petroleum Reserve-Alaska, and the Liberty Project EIS. For the Beaufort Sea multiple sales, the MMS held official meetings in Barrow, Nuiqsut, and Kaktovik under the auspices of environmental justice and consulted with the Native villages of Barrow, Nuiqsut, and Kaktovik and the regional tribal government-(the Inupiat Community of the Arctic Slope) on a government-to-government basis. At these meetings, Inupiat translators always were provided. The environmental justice process followed for the Beaufort Sea multiple-sale process included: (1) initial scoping; (2) environmental justice considerations included in local newspaper notices and local cable TV; and (3) followup meetings that were specific to environmental justice concerns. Some meetings were broadcast over local radio. From this process, the MMS received limited interest and feedback on specific environmental justice criteria. Nevertheless, the MMS heard Inupiat concerns, and discussions about mitigation were conducted. Environmental justice concerns were taken back to MMS management and worked into environmental studies and potential mitigating measures.

Environmental justice concerns were solicited from meetings on the North Slope with the communities of Nuiqsut on October 16, 2001; with Barrow on October 18, 2001; and with Kaktovik on October 19, 2001. A Slopewide government-to-government teleconference arranged through the Inupiat Community of the Arctic Slope was held on December 6, 2001, and involved the tribal governments of Point Hope, Point Lay, Wainwright, Atqasuk, Nuiqsut, and Anaktuvuk Pass. Kaktovik chose not to participate in the teleconference, and a separate meeting with the Native Village of Barrow had already been held in Barrow on October 18, 2001; followup meetings to address environmental justice issues were held with the Inupiat

Community of the Arctic Slope and the Alaska Eskimo Whaling Commission on November 15, 2001. Outside of project coordination, the MMS continues to meet with local North Slope communities and the Inupiat Community of the North Slope on environmental justice concerns and maintains a government-to-government working relationship with these local and regional tribal governments.

Part of MMS's sensitivity to the Inupiat way of life is to ask when it can come to villages to hold meetings. The MMS tries to accommodate village schedules. The MMS continues to take a more collaborative approach in its public involvement and has learned the value of spending more time in these local communities. The MMS has hired a Native community liaison who spends a large part of his time maintaining contacts with local North Slope Native communities and making sure that scoping and public meetings are scheduled so they do not conflict with local activities. The MMS also writes executive summaries for its EIS's that it believes make projects easier for the public to assess. For this EIS, we are translating the Executive Summary into Inupiat. We believe this cooperative approach can lessen the stress of our public involvement mandate, and we welcome suggestions on how to make this process better.

Over a number of projects, the MMS has maintained an ongoing dialogue with the North Slope Borough, the Alaska Eskimo Whaling Commission, the Inupiat Community of the Arctic Slope, and local and tribal governments on the language of lease-sale and development-project mitigating measures.

For half a decade, the MMS has included what the local Inupiat are saying in the text of its lease-sale and production EIS environmental analyses. Native traditional knowledge has been solicited from Inupiat sources that include past and more recent testimony from community meetings on lease-sale hearings in addition to other available published sources of traditional knowledge. This traditional knowledge has been included (with the speaker cited in text and in the bibliography) in the effects analyses sections of the Sale 144 and 170 EIS's, the Northeast National Petroleum Reserve-Alaska EIS, the Liberty Project EIS, and this Beaufort Sea multiple-sale EIS. In this way, traditional knowledge is considered in the planning and decision-making processes and in the formulation of new mitigation. Traditional knowledge used in analysis is peer reviewed by local and regional Native groups.

In-place stipulations that address sociocultural impacts include the Orientation Program stipulation that requires the lessee to instruct its workers on exploration, development, and production projects about the environmental, social, and cultural concerns that relate to the area and its Native communities. The program increases workers' sensitivity to, and understanding of, values, customs, and lifestyles of local Native communities and helps prevent conflicts with subsistence activities. Industry-monitoring programs include specific issues of concern related to wildlife interaction, protection of marine mammals, best management practices to minimize the potential for spills, awareness of local sociocultural issues and concerns, and awareness of subsistence resources and activities. The overall training program will be submitted to the MMS for review and approval. Personnel will receive appropriate training on at least an annual basis.

In Nuiqsut, the oil industry, in coordination with the local community, has established and partially funded a Subsistence Oversight Panel to field the concerns of local subsistence hunters and to monitor local subsistence resources. If offshore development occurs, the MMS will explore ways to support this or other similar panels.

Following a policy of community-based research, the Alaska OCS Region, Environmental Studies Section promotes studies that directly address the standing issues and concerns of Native stakeholders. The MMS includes local and tribal governments in its studies planning process and has held meetings in all local communities to assist their participation in this effort.

Particular studies that the MMS has funded to address sociocultural impacts include the *Collection of Traditional Knowledge of the Alaskan North Slope* study, which is collecting, abstracting, and indexing sources of Inupiat traditional knowledge. The study was awarded to Ukpeagvik Inupiat Corporation, a local Native corporation. The study will produce a traditional knowledge database on CD-ROM for local, State, and Federal agency use that will include a protocol approved by Inupiat elders for the proper use of traditional knowledge by Western researchers. The *MMS's Bowhead Whale Feeding Study*, conducted out of the village of Kaktovik, includes local Inupiat in the study design, data gathering, and data analysis. The study *Subsistence Economies and North Slope Oil Development: Case Studies from Nuiqsut and Kaktovik* examines the continuity and change to subsistence activities experienced in these villages. Other ongoing and funded MMS studies that apply to sociocultural impacts are the *Arctic Nearshore Impact Monitoring In Development Areas (ANIMIDA)* study (designed specifically to meet requests from the Inupiat community), *the Quantitative Description of Potential Effects of OCS Activities on Bowhead Whale Hunting Subsistence Activities in the Beaufort Sea* study, the Alaska Marine Mammal Tissue Archival Project, the *Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow*: Past and Present Comparison study, and *the North Slope Borough Economy, 1965 to Present* study. These studies are discussed in detail under the Cumulative Impacts mitigation section that follows.

Other initiatives include an MMS-sponsored Information Transfer Meeting in Anchorage in January 1999 and the Beaufort Sea Information Update Meeting in Barrow in March 2000, which presented updates on research and studies being conducted in the Beaufort Sea. The March 1999 meeting included presentations by Barrow, Nuiqsut, and Kaktovik whaling captains. Future meetings on the North Slope are expected. The MMS, Alaska OCS Region homepage also maintains an Alaska Native Links page that provides information on the MMS traditional knowledge incorporation process, information on Barrow whaling, and MMS assistance with the bowhead whale census, in addition to links to Alaska Native sites and U.S. Government Native-related sites. The MMS's Native liaison, Albert Barros, was instrumental in getting an Alaskawide Department of the Interior Memorandum of Understanding with Alaskan tribes on government-to-government consultation signed by all the Alaska Department of the Interior Agency Regional Directors.

Over the two decades of MMS involvement in the Arctic, local communities have been very vocal about finding a "compensation" source—impact assistance, revenue sharing, bonds, or mitigation payments—to address impacts from OCS activities. By law, the MMS cannot provide or require industry to provide such compensation. Federal Agencies cannot commit to impact assistance, because that is a role of Congress and not the Executive Branch. Only Congress can alter the OCS Lands Act to include provisions for local impact assistance from MMS revenues or provide the authorization for funding such revenues. Nevertheless, in response to this critical concern, Department of the Interior and MMS staff have done extensive work on developing OCS impact assistance and revenue sharing concepts and frequently have drafted legislative language on this subject in response to Congressional requests. Furthermore, the MMS OCS Policy Committee has developed a white paper on impact assistance and revenue sharing options and has shared this paper and its findings with concerned policymakers. In a one-time effort in 2001, Congress appropriated impact-assistance funds for coastal states affected by oil and gas production. Alaska received an appropriation of $12.2 million, $1,939,680 of which went to the North Slope Borough. Twenty-seven percent of all OCS leasing, rental, and royalty receipts, within the first 3 miles of the Alaska OCS, go to the State of Alaska. Also, subsistence impact funds administered by the U.S. Coast Guard under the Oil Pollution Act of 1990 would be available, in the unlikely event of an oil spill, to provide for subsistence-food losses. For a discussion of Environmental Justice cumulative impacts, see Section V.C.16.

IV.C.16.e(4) Development Benefits

The MMS believes there would be some clear benefits derived from production projects: an ad valorem tax would accrue to the North Slope Borough from new onshore infrastructure (landfall infrastructure and pipelines) associated with such development. Oil from these projects would help keep flow capacity up in the Trans-Alaska Pipeline System, a situation that helps the North Slope Borough's tax base, and additional ad valorem tax would accrue to the North Slope Borough because of increased flow of oil through existing pipeline infrastructure taxed by the Borough. The North Slope Borough received almost $2 million from the State under the Coastal Impact Assistance Program. Industry local-hire initiatives are increasing in terms of the variety of programs being offered to train and attract Inupiat workers for long-term employment on the North Slope. The MMS cannot require local hire, but MMS and other Federal Agencies can inform the operator of the Native concerns for more local employment from nearby oil and gas developments.

Potential benefits include indirect and induced employment that would occur in the government sector that are funded through taxation of oil facilities. While there may not be increases in employment, since the current onshore projects are decreasing in production and taxation value, the increases created by OCS development would help to offset these decreases during the life the OCS projects.

IV.C.16.f. Effects to Communities

The Environmental Justice Executive Order includes consideration of potential effects to Native subsistence activities. Our analysis indicates that the only substantial source of potential environmental justice related effects from Beaufort Sea Sales 186, 195, and 202 to the Native villages would occur in the unlikely event of a large oil spill, which could affect subsistence resources.

IV.C.16.f(1) Disturbance

Disturbance effects to the communities of Barrow, Nuiqsut, and Kaktovik periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Our analysis indicates that disturbance and noise from Beaufort Sea multiple sale would not be substantial sources of potential environmental justice effects.

IV.C.16.f(2) Oil Spills

If a spill occurred, oil-spill contact in winter could affect polar bear hunting and sealing. During the open-water season, a spill could affect bird hunting, sealing, and whaling, as well as netting of fish in the ocean. Only the tainting or the potential contamination of the bowhead whale would be considered significant; effects on polar bears and seal would be less so. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. However, effects are not expected from routine exploration and development activities and operations. Because the chance of one or more large spills [greater than or equal to 1,000 barrels] occurring and entering offshore waters is low, on the order of 10%); it is unlikely that disproportionately high adverse effects to Alaskan Natives would occur from Beaufort Sea multiple-sale activities. Any potential effects on subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated.

IV.C.16.g. Effects by Alternatives and Sales

Effects of Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202. Disturbance effects to the communities of Barrow, Nuiqsut, and Kaktovik periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Our analysis indicates that disturbance and noise from Alternative I, III, IV, V, and VI for Sales 185, 196, and 202 would not be substantial sources of potential environmental justice effects.

Our analysis indicates that the only substantial source of potential environmental justice related effects from Sales 185, 196, and 202 to the Native villages would occur in the unlikely event of a large oil spill, which could affect subsistence resources.

If a spill occurred, oil-spill contact in winter could affect polar bear hunting and sealing. During the open-water season, a spill could affect bird hunting, sealing, and whaling, as well as netting of fish in the ocean. Only the tainting or the potential contamination of the bowhead whale would be considered significant; effects on polar bears and seal would be less so. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. However, effects are not expected from routine exploration and development activities and operations. When we consider the low likelihood of a large spill event (the chance of one or more large spills [greater than or equal to 1,000 barrels] occurring and entering offshore waters is low, on the order of 10%); disproportionately high adverse effects would not be expected on Alaskan Natives from Alternatives I, III, IV, V, and VI for Sales 186, 195, or 202 activities. Any potential effects on subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated.

Conclusion: Environmental justice effects levels under Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202 are expected to be similar to those discussed under effects common to all alternatives. Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice related effects to Native villages from Alternatives I, III, IV, V, and VI for Sales 185, 195, and 202 would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

IV.D. Comparison of the Effects of the Alternatives and the Cumulative Effects

The cumulative effects analysis is presented in the next section (Section V). However, a comparative presentation by resource of the effects of the alternatives and the cumulative effects, including the contribution of Alternative I for Sale 186, is found in Table IV. The table provides summary information for the environmental effects of Alternative I with that of the Barrow Subsistence Whaling Deferral (Alternative III), the Nuiqsut Subsistence Whaling Deferral (Alternative IV), the Kaktovik Subsistence Whaling Deferral (Alternative V), and the Eastern Deferral (Alternative VI) for Sales 186, 195, and 202. The table is based on the conclusions reached for each resource topic.

Following the comparisons of the alternatives is the cumulative-effects conclusion. Not included in this analysis is Alternative II (No Sale Alternative), which represents no action and no direct effects on area resources and, accordingly, is not evaluated. However, there could be effects related to alternative energy sources, as discussed in Section IV.C. The deferral conclusions for the alternatives discuss the effects of the alternative assuming the designated blocks are deferred and standard mitigation listed in Section II.H is in place.

IV.E. Unavoidable Adverse Effects

This section summarizes the unavoidable adverse effects of Alternative I for Sales 186, 195, and 202. Many of the adverse effects identified in Sections IV and V of this EIS would happen only if a large (greater than 1,000-barrel) oil spill occurred; however, such an event is unlikely to happen. The effects of large and very large oil spills are discussed in Section IV.C and IV.I, but they are not included in this analysis because they are not expected to happen. The following analysis identifies unavoidable adverse effects that would occur, if the Sales 186, 195, and 202 are held as scheduled and result in exploration, development, and production.

IV.E.1. Water Quality

Drilling discharges and construction disturbances would have to be permitted (approved) during subsequent environmental reviews and, therefore, could be avoided.

IV.E.2. Lower Trophic-Level Organisms

Permitted drilling discharges and pipeline and platform construction could adversely affect 1% of the benthic organisms in the proposed sale area for Sales 186, 195, and 202, but the organisms would recover within a year.

IV.E.3. Fishes

A few fish could be harmed or killed due to disturbances associated with exploration and production. However, most fish in the immediate area would avoid these activities and would otherwise be unaffected. None of the above effects are expected to be measurable at the population level.

IV.E.4. Essential Fish Habitat

Unavoidable effects on essential fish habitat would be habitat loss due to gravel islands built as drilling platforms, temporary disturbance due to seismic surveys, and turbidity during open-water construction seasons.

IV.E.5. Endangered and Threatened Species

Many of the effects on bowhead whales from noise and disturbance are likely to be unavoidable, but some effects perhaps could be reduced through voluntary compliance with appropriate stipulations and ITL clauses. Unmitigated, uncontrolled noise and other forms of disturbance associated with routine activities (i.e., noise due to seismic surveys, vessel activity, aircraft overflight, drilling activities, or construction activities) likely would cause temporary behavioral responses. These behavioral responses are most likely to occur during the bowhead whale migration or during feeding activities but are not expected to preclude migrations or to disrupt feeding activities on a long-term basis.

Most human disturbance of nesting, staging, or migrating spectacled and Steller's eiders associated with routine activities is considered avoidable through voluntary compliance with the recommendations on aircraft and vessel operation and advisory notes in the proposed ITL on Bird and Marine Mammal Protection, and attention to the exploration/development plan review process that will be followed to ensure eider habitat protection given in the proposed ITL on the Spectacled Eider and Steller's Eider. A small amount of disturbance of spectacled eiders present in the marine environment during the open-water season by helicopters is considered unavoidable. A small amount of offshore habitat used by eiders for staging or foraging would be lost unavoidably if gravel production islands are constructed. Effects on eiders in the unlikely event of a large oil spill are discussed in Sections IV.C.5(b) and (c).

Conclusion. Some unavoidable adverse effects are likely to occur. Bowhead whales exposed to noise-producing activities likely would experience temporary, nonlethal effects. Because alternate habitat areas for foraging and staging are available and disturbance effects temporary and mostly avoidable through compliance with ITL's, effects from these factors on spectacled and Steller's eiders are likely to be insignificant.

IV.E.6. Marine and Coastal Birds

Most human disturbance of nesting, staging, or migrating marine and coastal birds associated with routine activities is considered avoidable through voluntary compliance with the recommendations on aircraft and vessel operation and advisory notes in the proposed ITL on Bird and Marine Mammal Protection. A small amount of disturbance of birds present in coastal and/or marine environments during the open-water season by helicopters is considered unavoidable. A small amount of offshore habitat used by marine and coastal birds for staging or foraging would be lost unavoidably if gravel production islands were constructed.

Conclusion. Because alternate habitat areas for foraging and staging are available and disturbance effects temporary and mostly avoidable through compliance with ITL clauses, effects from these factors on marine and coastal birds are likely to be insignificant.

IV.E.7. Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales)

Provisions under the Marine Mammal Protection Act that require the lessees to get Letters of Authorization that direct them to avoid disturbing polar bears dens and require the use of nonlethal means to avoid human-bear interactions. Air, vessel, and ice road traffic and construction activities would unavoidably disturb small numbers of seals and perhaps a few polar bears but this effect would be very brief and not affect seal and bear population abundance and or overall distribution in the Beaufort Sea Planning Area

IV.E.8. Terrestrial Mammals

Some disturbance of terrestrial mammals by air and ice-road traffic and by construction activities is considered unavoidable but short-term and local and would not affect population distribution and abundance.

IV.E.9. Vegetation and Wetlands

Small acreage of tundra habitat would be unavoidably destroyed or altered at gravel mine sites and pad locations.

IV.E.10. Economy

Unavoidable effects would be on employment; associated personal income; and revenues to the North Slope Borough, State of Alaska, and Federal Government. However, most observers consider these effects as positive. Unavoidable effects include the following: Alternative I for Sale 186 would generate increases in North Slope Borough property taxes that would average about 1% above the level of Borough revenues without the sales in the early years, and taper off to less than 0.5% in the later years. Alternative I for Sale 186 in the early years of production would generate increases in revenues to the State of Alaska of less than 0.25% above the level without Sale 186. The increases would taper off to an even smaller percent in the later years of production. The change in total employment and personal income is less than 2% over the 1999 baseline for the North Slope Borough and the rest of Alaska.

Conclusion. Unavoidable effects would be on revenues to the North Slope Borough, State of Alaska, and Federal Government and on employment and associated personal income. However, most observers consider these effects as positive.

IV.E.11. Subsistence-Harvest Patterns

Seals, polar bears, caribou, fish, birds, and especially bowhead whales are important subsistence resources. Noise and disturbance from exploration and development activities, should it occur, could affect subsistence resources periodically in the communities of Barrow, Nuiqsut, and Kaktovik. Additionally, disturbance could cause potential short-term but adverse effects to long-tailed ducks and some eider populations. No harvest areas would be come unavailable for use.

IV.E.12. Sociocultural Systems

Disturbance effects are not expected to displace ongoing sociocultural systems or community activities. However, the inability to harvest sufficient quantities of bowhead whales due to disturbance could cause unavoidable effects on Inupiat traditional practices of harvesting and sharing. Such effects would not displace ongoing sociocultural systems or community activities.

IV.E.13. Archaeological Resources

There may be historic and preserved prehistoric archaeological sites within the proposed lease sale area. Because the exact locations of the sites are not known, the possibility of their disturbance cannot be entirely avoided. The MMS will require archaeological analysis and reports for those blocks where historical or prehistoric resources might exist. Based on the results of this analysis, we will require that any areas identified as containing potential archaeological resources either be investigated further to determine conclusively whether a site exists at the location, or be avoided by all bottom-disturbing activities. The additional investigations will help to ensure that there are no unavoidable effects on archaeological resources.

IV.E.14. Land Use Plans and Coastal Management Programs

The hypothetical scenarios assume that transportation networks between sites on the Beaufort Sea coast will tie into existing infrastructure. As a result, unavoidable adverse effects related to major changes in land use are not anticipated; neither are they expected as a result of disturbance. Unavoidable adverse effects that are related to the scenarios usually would be caused by an oil spill. To the extent that facilities are sited to minimize the effect of an oil spill on the environment, conflicts with the Statewide standards and the North Slope Borough policies of the ACMP are avoidable; therefore, it is expected that activities generally will conform with existing land use and with policies of local, State, and Federal coastal management programs and land use plans.

IV.E.15. Air Quality

Alternative I for Sales 186, 195, and 202 would cause small, local increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Air Quality Standards.

IV.E.16. Environmental Justice

Disturbance effects on subsistence resources could occur over the lifetime of Sales 186, 195, and 202 but would never reach a significant threshold.

IV.F. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The short-term effects and uses of various components of the environment in and adjacent to the Beaufort Sea area offered in Sales 186, 195, and 202 are related to long-term effects and the maintenance and enhancement of long-term productivity. The effects of the proposed action would vary in kind, intensity, and duration, beginning with preparatory activities (seismic-data collection and exploration drilling) of oil and gas development, and ending when natural environmental balances might be restored.

In general, “short term” refers to the useful lifetime of the proposed action as determined by Alternative I for Sales, 195, and 202; some even shorter-term uses and effects also are considered. “Long term” refers to that time beyond the estimated lifetime of the proposed action. The producing life of the field development in the multiple-sale area has been estimated to be about 28 years; this estimate is based on the resource estimate for Alternative I. In other words, short term refers to the total duration of oil and gas exploration and production, whereas long term refers to an indefinite period beyond the termination of oil and gas production.

Many of the effects discussed in Section IV are considered to be short term (being greatest during the construction, exploration, and early production phases) and could be further reduced by the mitigating measures discussed in Section II.H.

Short-term, localized, adverse effects on biological populations and habitats are expected in the event an unlikely large oil spill occurred in either the marine or terrestrial environments. These potential effects include mortality of individuals, physiological stresses in surviving individuals, reduction in the number of species or species populations in the affected area, changes in the distribution of species or individuals, and changes in behavior or migration patterns. Long-term, cumulative, oil-pollution effects also might occur if recovery from the short-term effects extended beyond the estimated useful life of the proposed action. Some species might have difficulty repopulating physically altered habitats and could be permanently displaced.

The production of oil and gas from the Beaufort Sea multiple-sale area would provide short-term energy and, perhaps, provide time either for the development of long-term alternative-energy sources or substitutes for petroleum feedstocks. Economic, political, and social benefits would accrue from the availability of oil and gas. Most benefits would be short term and would decrease the Nation's dependency on oil imports. Regional planning would aid in controlling changing economics and populations and, thus, in moderating any adverse effects. If additional supplies were discovered and developed, the proposed production system would enhance extraction. However, consumption of this offshore oil and gas would be a long-term use of nonrenewable resources.

After completion of oil production, oil spills and their effects would not occur, and the marine environment generally would be expected to remain at or return to its normal long-term productivity level. To date, there has been no discernible decrease in long-term productivity in OCS areas where oil and gas have been produced for many years. In areas that have experienced apparent increases in oil pollution, such as the North Sea, some long-term effects appear to have taken place. Populations of pelagic birds have decreased markedly in the North Sea in recent years—prior to the beginning of North Sea oil production. However, in the Prince William Sound, 12 years after the *Exxon Valdez* oil spill, many of the species affected by the spill appear to be well on their way to recovery. In the long term, the species affected by the *Exxon Valdez* Oil Spill may make a full recovery. Although two species are listed as recovered and eight species plus intertidal/subtidal communities as recovering, six species are listed as not recovering and four species with status unknown (*Exxon Valdez* Oil Spill Trustee Council, 2001). Until more reliable data become available, however, the long-term effects of chronic and major spillage of hydrocarbons and other related discharges cannot accurately be projected. In the absence of such data, it must be concluded that the possibility of decreased long-term productivity exists, if chronic spills or a major large oil spill occurred as a result of the proposed action.

IV.F.1. Water Quality

Water quality may be affected by drilling discharges, turbidity from construction activities, and oil spills. The effects of all these activities on water quality would be short-term, recovering within a month.

IV.F.2. Lower Trophic-Level Organisms

Lower trophic-level organisms may be affected by drilling discharges, platform and pipeline construction, and oil spills. The effects of most of these activities would be short-term with populations recovering within a month from large spills, within a year from drilling discharges, and within 3 years from construction. Unusual kelp communities could be affected for a long-term (a decade or longer by construction, as discussed in the Liberty EIS (USDOI, MMS, Alaska OCS Region, 2002a:Section

III.C.3.e). However, the requirement for benthic surveys near special biological habitats (Stipulation 1) would help to prevent the unintentional disturbance of kelp.

IV.F.3. Fishes

Disturbances associated with construction, seismic surveys, drilling operations, and vessel and aircraft traffic may harm or kill a few fish. However, most fish would avoid these short-term activities and would be otherwise unaffected. Disturbances are not likely to result in long-term effects on fish populations.

IV.F.4. Essential Fish Habitat

Disturbances associated with construction, seismic surveys, drilling operations, vessel traffic, and oil spills are expected to be short term with no long-term consequences. Salmon, salmon habitats, and salmon prey are expected to recover within one generation.

IV.F.5. Endangered and Threatened Species

Bowhead whales may be affected by noise from exploration activities, including construction, seismic surveys, drilling operations, vessel and aircraft traffic, and oil spills on a short-term basis, over the life of the project. Most of these activities are relatively temporary. However, in the unlikely event of a large oil spill, residual oil remaining after cleanup operations and any cleanup operations continuing on after the useful life of the project could result in long-term effects to the bowhead population, primarily from noise and disturbance from continuing cleanup activities.

Spectacled and Steller's eiders may experience short-term adverse effects from any factors that disturb their normal daily and seasonal pattern of activities. During normal exploration and development operations, aircraft (helicopter) and vessel traffic are the most important disturbance-causing agents. Foraging and staging habitat lost where production islands are constructed is a long-term effect, but alternative habitat is widespread and, thus, effect on eiders would be short term. The duration of effects resulting from mortality-causing factors, principally collision of eiders with structures, likely will be determined by the magnitude of the loss and the size and status of the regional population. Small losses from the spectacled eider population, currently declining at a nonsignificant rate, are expected to be short-term effects while any substantial loss is likely to be long term. The Steller's eider population, although currently stable or increasing at a nonsignificant rate, is likely to experience a long-term effect from any loss because of the small size of the regional population. Effects on eiders in the unlikely event of a large oil spill are discussed in Sections IV.C.5(b) and IV.C.5(c).

Conclusions: Bowhead whales may be temporarily affected by noise from exploration activities and oil spills on a short-term basis over the life of the project. In the unlikely event of a large oil spill, there could be long-term effects to the bowhead population from residual oil and cleanup activities that continue past the useful life of the project. Effects of disturbance on spectacled and Steller's eiders are expected to be short term. Habitat-modification effects are likely to be short-term, although loss of habitat will be a long-term effect. Any substantial mortality of eiders colliding with structures is likely to be long term, particularly when their populations are in a declining status.

IV.F.6. Marine and Coastal Birds

Marine and coastal birds may experience short-term adverse effects from any factors that disturb their normal daily and seasonal pattern of activities. During normal exploration and development operations, aircraft (helicopter) and vessel traffic are the most important disturbance-causing agents. Foraging and staging habitat lost where production islands are constructed is a long-term effect, but alternative habitat is widespread and effect on birds would be short term. The duration of effects resulting from mortality-causing factors, principally collision of birds with structures, likely will be determined by the magnitude of the loss and the size and status of the regional population. Small losses from populations currently increasing, stable, or declining at a nonsignificant rate are expected to be short-term effects, while a substantial loss experienced by a population in a nonsignificant decline, or any loss experienced by a population declining at a significant rate, is likely to be long term. Any mortality experienced by species whose populations are very small, whether increasing or decreasing at a nonsignificant rate, may result in a long-term effect because of their small size. Effects on marine and coastal birds in the unlikely event of a large oil spill are discussed in Section IV.C.6.

Conclusion: Effects of disturbance on marine and coastal birds is expected to be short term. Habitat-modification effects are likely to be short term, although loss of habitat will be a long-term effect. Any substantial mortality of birds colliding with structures is likely to be long term, particularly when their populations are in a declining status.

IV.F.7. Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales)

Noise and disturbance, and habitat alteration from offshore construction activities, and potential oil spills temporarily would affect some individual marine mammals and their habitats. These effects are expected to be local. Disturbances and altered habitat possibly may result in local displacement, mortality, stress, decreases, or reductions in local abundance of some species. Effects possibly could last over the long term, if recovery from the short-term effects extended beyond the field's estimated useful life.

IV.F.8. Terrestrial Mammals

Noise and disturbance, habitat alteration from onshore construction activities, and potential oil spills temporarily would affect some individual terrestrial mammals and their habitats. These effects are expected to be local. Disturbances and altered habitat possibly may result in local displacement, mortality, stress, decreases, or reductions in local abundance of some species. Effects possibly could last over the long term, if recovery from the short-term effects extended beyond the field's estimated useful life.

IV.F.9. Vegetation and Wetlands

Onshore construction activities and potential oil spills would affect some vegetation and wetlands. These effects are expected to be local. Oil spills and construction activities would result in local damage or destruction of a few acres of wetlands. Effects are expected to last over the long term, with recovery of vegetation and wetlands to extend beyond the field's estimated useful life.

IV.F.10. Economy

Increases in employment and associated personal income would occur over the life of the OCS activities. Revenue increases to the North Slope Borough, the State, and the Federal Government would occur during production years. However, none of these increases would be long term. Development activity would result in infrastructure that would enhance long term productivity of oil and gas exploration, development, and production. Economic benefits would accrue from the availability of oil and gas. Most benefits would be short term and would decrease the Nation's dependency on oil imports. Alternative I for Sale 186 would generate increases in North Slope Borough property taxes that would average about 1% above the level of Borough revenues without the sales in the early years and taper off to less than 0.5% in the latter years. Alternative I for Sale 186 in the early years of production would generate increases in revenues to the State of Alaska of less than 0.25% above the level without Alternative I for Sale 186. The increases would taper off to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 2% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity. The three major phases are exploration, development, and production. The employment and personal income increase includes workers to cleanup a possible large oil spill of 1,500 barrels or 4,600 barrels. Increases in employment and personal income for Sales 195 and 2002 would be less than 3% over the 1999 baseline. Sales 186, 195, and 202 would probably extend the lifespan of the Trans-Alaska Pipeline.

Conclusion. Increases in employment and associated personal income would occur over the life of the OCS activities. Revenue increases to the North Slope Borough, the State, and the Federal Government would occur during production years. However, none of these increases would be long term. Development activity would result in infrastructure that would enhance long term productivity of oil and gas exploration, development, and production.

IV.F.11. Subsistence-Harvest Patterns

In the short term, redistributing, reducing, tainting, or displacing subsistence species could affect regional subsistence-harvest patterns. Such short-term effects should not have long-term consequences.

IV.F.12. Sociocultural Systems

Short-term effects on subsistence resources would disrupt social systems if they continue over the lifetime of the project. Destroying habitat would locally reduce subsistence species, a long-term effect on the regional subsistence economy and the sociocultural system.

IV.F.13. Archaeological Resources

Archaeological resources finds discovered as a result of the surveys required prior to development of a lease, would enhance long-term knowledge. Overall, such finds could help fill gaps in our knowledge of the history and early inhabitants of the area; but any destruction of archaeological sites or unauthorized removal of artifacts would represent long-term losses.

IV.F.14. Land Use and Coastal Management Programs

Land use changes would occur at shore-base sites and along pipeline routes. In potentially affected areas, short-term changes include a shift in land use from subsistence-based activities to industrial activities throughout the life of the proposed action. Land use changes could be short term in nature if, after production ceased, use of the land reverted to previous uses. Long-term effects on land use could result if use of the infrastructure or facilities continued after the estimated useful life of the proposed action. Potential users could be other resource developers or residents or nonresidents who had become accustomed to the convenience of using existing facilities, such as roads.

IV.F.15. Air Quality

Air pollution resulting from activities under Alternative I for Sales 186, 195, and 202 would be a short-term and local effect. The analysis of air quality effects of the proposal indicates that, although the pristine air quality of the study area may be impaired temporarily and very locally, long-term effects for air quality would be insignificant (see Section IV.C.15).

IV.F.16. Environmental Justice

Short-term effects on subsistence resources that in turn chronically affected the sociocultural system over the lifetime of the project would be considered disproportionate high adverse effects on the Inupiat people. Such an effect is expected to occur only in the unlikely event of a large oil spill.

IV.G. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This section discusses the irreversible and irretrievable commitment of resources. Many of the adverse effects and all of the significant effects identified in Sections IV and V of this EIS would happen only if a large (1,000 barrels or more) oil spill occurred, but such an event is unlikely to happen. The effects of large and very large oil spills are discussed in Sections IV.C and IV.I, but they are not included in this analysis because they are not expected to happen. The following analysis identifies irreversible and irretrievable commitment of resources that would occur, if Sales 186, 195, and 202 are held as scheduled and result in exploration, development, and production.

The undiscovered, economically recoverable resources assumed to be leased for each lease sale are assumed to be 460 million barrels of oil. Should these resources be recovered, they would be irretrievably consumed. Following are discussions of the assumed effects of this commitment of resources.

IV.G.1. Water Quality

Effects on water quality would be short term, recovering within a month and, therefore, reversible.

IV.G.2. Lower Trophic-Level Organisms

Most effects on lower trophic-level organisms would be reversible, but unusual kelp communities could be buried as a result of construction of islands and pipelines (USDOI, MMS, Alaska OCS Region, 2002a:Section III.C.3.e). However, the magnitude of kelp effects would be moderated by required benthic surveys.

IV.G.3. Fishes

No measurable effects on fish populations are likely due to disturbances, discharges, or noise. Hence, no irreversible or irretrievable commitment of fish resources is likely.

IV.G.4. Essential Fish Habitat

Effects on salmon essential fish habitat are short term, recovering within one generation and, therefore, reversible.

IV.G.5. Endangered and Threatened Species

Some bowhead whales could be subjected to temporary nonlethal effects of disturbance due to noise from seismic activities, vessel and aircraft traffic, and drilling activities. In addition, there could be some loss and/or deterioration of habitat due to facility developments, although these would be very minor. It is unlikely that such effects would lead to permanent (irreversible) losses of these resources for bowhead whales (see Section IV.C.5). The bowhead population is increasing, so any mortality is likely to be relatively temporary and reversible.

It is possible that habitats used by spectacled and Steller's eiders for nesting, staging, or foraging could be irretrievably or irreversibly altered by activities associated with petroleum exploration and development (e.g., burial by gravel), and there may be some localized but temporary disturbance effects on eiders. However, there are alternate habitat areas available in which these activities may take place, and disturbance effects are expected to be temporary. Collision of broodrearing, staging, or migrating eiders with offshore or onshore structures may result in the death of some individuals. Such losses may affect the regional population trend of spectacled eiders, which shows a non-significant downward trend in the past decade, and Steller's eider, which shows a nonsignificant upward trend over the same time period. Effects on eiders in the unlikely event of a large oil spill are discussed in Sections IV.C.5(b) and IV.C.5(c).

Conclusion. Because the bowhead whale population is increasing and effects from noise are likely to be temporary, no irreversible losses to bowhead whales are likely. Because alternate habitat areas for critical activities are available and disturbance effects would be temporary, no irretrievable or irreversible effects on spectacled or Steller's eiders from these factors are likely. However, losses of individual eiders through collision mortality are irretrievable, and such losses may result in an irreversible effect while the regional population of spectacled eiders, for example, is declining.

IV.G.6. Marine and Coastal Birds

It is possible that habitats used by marine and coastal birds for nesting, staging, or foraging could be irretrievably or irreversibly altered by activities associated with petroleum exploration and development (for example, burial by gravel), and there may be some localized but temporary disturbance effects on birds. However, there are alternate habitat areas available in which these activities may take place, and disturbance effects are expected to be temporary. Collision of broodrearing, staging, or migrating birds with offshore or onshore structures may result in the death of some individuals. Such losses may affect the regional population trend of any species, whether such trends are upward or downward or significant or nonsignificant over the period of measurement.

Conclusion. Because alternate habitat areas for critical activities are available and disturbance effects temporary, no irretrievable or irreversible effects on marine and coastal birds from these factors are likely. However, losses of individual birds through collision mortality are irretrievable, and such losses may result in an irreversible effect while the regional population of a species is declining.

IV.G.7. Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales)

Seals, walruses, polar bears, and beluga and gray whales could be subjected to disturbance due to noise and movement of aircraft and vessels and other human activities, or losses and/or deterioration of habitat due to facility developments. It is unlikely that such effects would lead to permanent (irreversible) losses of these resources (see Sec. IV.C.7 - Effects on Pinnipeds, Polar Bears, and Beluga, and Gray Whales).

IV.G.8. Terrestrial Mammals (Caribou, Muskox, Grizzly Bear, and Arctic Fox)

Caribou, muskoxen, grizzly bears, and arctic foxes could be subjected to direct and indirect effects disturbance due to noise and movement of aircraft and motor vehicles and other human activities, or losses and/or deterioration of habitat due to facility developments. It is unlikely that such effects would lead to permanent (irreversible) losses of these resources (see Section IV.C.7 - Effects on Caribou, Muskox, Grizzly Bear, and Arctic Fox).

IV.G.9. Vegetation and Wetlands

A small acreage of tundra habitat would be irreversibly altered by gravel fill at the pipeline-valve pads and at gravel mine sites on the North Slope.

IV.G10. Economy

Increases in employment and personal income would occur over the life of the OCS activities. Revenue increases to the North Slope Borough, the State, and Federal Government would occur during production years. These would constitute irreversible and irretrievable commitment of resources. Development activity would result in infrastructure, but that infrastructure could be removed.

Sales 186, 195, and 202 would generate increases in North Slope Borough property taxes that would average about 1% above the level of Borough revenues without the sales in the early years, and taper off to less than 0.5% in the later years. Sale 186 in the early years of production would generate increases in revenues to the State of Alaska of less than 0.25% above the level without Sale 186. The increases would taper off to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 2% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity. Increases in employment and personal income for Sales 195 and 2002 would be less than 3% over the 1999 baseline. Sales 186, 195, and 202 probably would extend the lifespan of the Trans-Alaska Pipeline.

Conclusion. Increases in employment and personal income would occur over the life of the OCS activities. Revenue increases to the North Slope Borough, the State, and Federal Government would occur during production years. These would constitute irreversible and irretrievable commitment of resources. Development activity would result in infrastructure, but that infrastructure could be removed.

IV.G.11. Subsistence-Harvest Patterns

Subsistence resources could be subjected to direct and indirect effects from noise, disturbance, and oil spills. It is unlikely that such effects would lead to permanent (irreversible) losses of these resources.

IV.G.12. Sociocultural Systems

Sociocultural systems could be subjected to the indirect effects of noise, disturbance, and discharge as they affected subsistence resources. It is unlikely that such effects would lead to permanent (irreversible) losses to sociocultural systems or community practices.

IV.G.13. Archaeological Resources

Archaeological resources could be subjected to the effects of seafloor disturbance and onshore construction. Although the effects of offshore activity would be greatly mitigated by archaeological surveys and avoidance, any damage or destruction to archaeological resources would be irreversible and the archaeological information lost would be irretrievable.

IV.G.14. Land Use Plans and Coastal Management Programs

No conflicts with the Statewide standards of the Alaska Coastal Management Plan or the enforceable policies of the North Slope Borough Coastal Management Plan are anticipated.

IV.G.15. Air Quality

The modeling analyses for oil and gas development projects indicate that the highest pollutant concentrations would be confined to areas within a short range of the facility. Because of shifting winds and changing meteorological conditions, the concentrations at any one particular location would be quite variable, with the higher concentrations lasting for a short duration (typically a few hours up to a day). However, these episodes could reoccur throughout the life of the project. The predicted concentrations are below the levels considered to be harmful to health and welfare and would meet the ambient air quality standards set by the Environmental Protection Agency. Thus, no adverse impacts would be expected and, thus, they would be reversible.

IV.G.16. Environmental Justice

Subsistence resources and sociocultural systems would be subjected to direct and indirect effects from noise, disturbance, and discharges. It is unlikely that such effects would lead to permanent (irreversible) losses to these resources, to the sociocultural system, or to Inupiat culture.

IV.H. EFFECTS OF NATURAL GAS DEVELOPMENT AND PRODUCTION

Natural gas may be discovered in the Alternative I for Sales 186, 195 and 202 areas during exploration drilling. Although gas resources are not considered economic to exploit at this time or in the foreseeable future (see Appendix A), they could be developed and produced at some undetermined future time. Under such circumstances, natural gas production probably would not occur until after oil production had begun. Thus, leases containing unassociated natural gas that could be recoverable in the future probably could be retained by the leaseholder. (Associated and dissolved gases that are recovered along with the crude oil are expected to be reinjected or used as fuel, depending on the amount recovered.) The effects of potential gas development and production on the environment of Alternative I for Sales 186, 195, and 202 and adjacent areas that would be additional to the effects associated with oil development and production are described in this section.

Additional facilities and infrastructure would be needed if and when the nonassociated natural gas is developed and produced. The gas could be produced through wells drilled from gas-production platforms.

A large-diameter pipeline would be installed to transport the produced gas from the production platform(s) to an onshore gas-processing facility most likely located in the Prudhoe Bay area; the gas pipeline would be separate from any oil pipelines to the extent necessary to minimize the risks that would arise during installation and operation; however, the main trunk gas pipeline would be constructed parallel to the trunk oil pipeline. No offshore booster-pump stations would be required between the platforms and the gas facility; however, in the Far Zone, with unknown reservoir pressures and distance from onshore gas processing facilities, gas flow still is an unknown.

After processing, the gas would be transported to the continental U.S. via pipeline. The gas pipeline would follow a route paralleling the Trans-Alaska Pipeline System to the Fairbanks area. From there the pipeline route would travel east along the Alaska-Canada Highway into Canada; it would parallel the existing highway system and follow a pipeline corridor permitted in 1976 for gas transport. Another route under consideration is a subsea Beaufort Sea pipeline from the Prudhoe Bay area to the Canadian Mackenzie River, then south through Canada to tie into Canadian gas production before being distributed in the lower 48 states. Both these routes are still under economic and engineering feasibility studies. Effects of natural gas development and production on the biological resources, social systems, and physical regimes of the Alternative I for Sales 186, 195, and 202 area and adjacent areas could be caused by gas blowouts; installing offshore pipelines and gas-production systems; drilling gas-production wells; installing onshore pipelines and a gas-processing facility; marine-, surface-, and air-traffic noise and disturbance; construction activities; and growth in the local economy, population, and employment.

Accidental emissions of natural gas could result from a gas-well blowout or a pipeline rupture. In the unlikely case that such an event occurred, a gas-well blowout probably would not persist for more than 1 day and would release perhaps 20 metric tons of gaseous hydrocarbons; 60% of all blowouts since 1974 have lasted 1 day or less. From such a blowout, a hazardous plume of gas could extend downwind for about a kilometer but would dissipate quickly once the blowout ceased. The amount of volatile organic compounds released by such a blowout would be less than that evaporated from an oil spill greater than or equal to 1,000 barrels.

The rupture of a gas pipeline would result in a short-term release of gas. A sudden decrease in gas pressure automatically would initiate procedures to close those valves that would isolate the ruptured section of the pipeline and thus prevent a further escape of gas.

IV.H.1. Water Quality

Drilling discharges and construction of offshore platforms and pipelines for natural gas exploration and development are expected to affect water quality. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers.

IV.H.2. Lower Trophic-Level Organisms

Natural gas exploration and development is expected to affect lower trophic level organisms because of the construction of offshore platforms and pipelines. Construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the Alternative I Sales 186, 195, and 202 areas. Recovery is expected within 3 years. Unusual kelp communities could be affected longer, but effects would be moderated by required benthic surveys. The communities are expected to slowly colonize and to benefit from some new gravel islands.

IV.H.3. Fishes

Natural gas exploration and development could adversely affect arctic fish from either a natural gas blowout or the construction of overland gas pipelines. In the unlikely event of a natural gas blowout occurred, some fish in the immediate vicinity might be killed. Natural gas and condensates that did not burn in the blowout would be hazardous to any organisms exposed to high concentrations. In general, very few fish are likely to be affected by a blowout, and any effects would not be measurable at the population level. The construction of overland gas pipelines through waters supporting fish is likely to displace small numbers of fish short distances. However, those affected would soon reoccupy that habitat upon completion of the activities and would be otherwise unaffected. For these reasons, natural gas exploration and development is not likely to have a measurable effect on fish populations.

IV.H.4. Essential Fish Habitat

Drilling discharges and construction of offshore platforms and pipelines for natural gas exploration and development is expected to affect water quality in estuarine and marine essential fish habitat and prey habitat for salmon. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. Recovery is expected within one generation.

IV.H.5. Endangered and Threatened Species

Development and production of natural gas fields in the Beaufort Sea likely would have temporary, nonlethal effects on bowhead whales. Installation of gas-production platforms and construction of gas pipelines would be similar to the installation of oil-production platforms and construction of oil pipelines as described in Section IV.C.5. Most effects would result from air and vessel traffic associated with construction and operation of production platforms and offshore-pipeline installation during the open-water season. Most bowhead whales are likely to avoid these activities by swimming around them during their migration. Much of the construction activity associated with the development and production of natural gas fields may occur during the winter and would have little effect on bowhead whales.

If a natural gas blowout occurred, some bowhead whales in the immediate vicinity of the blowout could be injured or killed. Emissions of gaseous hydrocarbons from the blowout would be hazardous to any organisms exposed to high concentrations. However, the blowout would likely not persist more than a day and gaseous hydrocarbons would be dispersed very rapidly from the blowout site. It is likely that few bowhead whales would be affected by these hydrocarbons from the blowout. The bowhead population is increasing, so any mortality is likely to be relatively short-term.

Likewise, development and production of natural gas fields likely would have temporary, nonlethal effects on spectacled and Steller’s eiders. Most effects would result from air and vessel traffic associated with construction and operation of production platforms and offshore-pipeline installation during the open-water season. Most spectacled and Steller’s eiders are likely to avoid the sites of these activities by altering their routes of movement in the vicinity. Much of the construction activity associated with the development and production of natural gas fields may occur during the winter and would have little effect on eiders, but could destroy a small amount of foraging habitat.

If a natural gas blowout occurred, some eiders in the immediate vicinity could be injured or killed, although this is not very likely given their generally dispersed distribution. Emissions of gaseous hydrocarbons from the blowout would be hazardous to any organisms exposed to high concentrations. However, the blowout likely would not persist more than a day and gaseous hydrocarbons would be dispersed very rapidly from the blowout site. It is likely that few spectacled and Steller’s eiders would be affected by these hydrocarbons from the blowout.

Conclusion. Development and production of natural gas fields in the Beaufort Sea likely would have temporary, nonlethal effects on bowhead whales. If a natural gas blowout occurred, some bowhead whales in the immediate vicinity of the blowout could be injured or killed. It is likely that few bowhead whales would be affected by these hydrocarbons from the blowout. The bowhead population is increasing, and any mortality is likely to be relatively short-term. The effect of natural gas field development on spectacled and Steller’s eiders also is likely to be temporary and nonlethal. If a natural gas blowout occurred, some eiders in the immediate vicinity of the blowout could be injured or killed, but it is likely that few would be affected by hydrocarbons from the blowout. No population-level effects on eiders are expected.

IV.H.6. Marine and Coastal Birds

Development and production of natural gas fields likely would have temporary, nonlethal effects on marine and coastal birds. Most effects would result from air and vessel traffic associated with construction and operation of production platforms and offshore-pipeline installation during the open-water season. Most birds are likely to avoid the sites of these activities by altering their routes of movement in the vicinity. Much of the construction activity associated with the development and production of natural gas fields may occur during the winter and would have little effect on migratory birds, but could destroy a small amount of foraging habitat.

If a natural gas blowout occurred, some birds in the immediate vicinity could be injured or killed. Emissions of gaseous hydrocarbons from the blowout would be hazardous to any organisms exposed to high concentrations. However, the blowout likely would not persist more than a day and gaseous hydrocarbons would be dispersed very rapidly from the blowout site. It is likely that few marine and coastal birds would be affected by these hydrocarbons from the blowout.

Conclusion. Effect of natural gas field development on marine and coastal birds also is likely to be temporary and nonlethal. If a natural gas blowout occurred, some birds in the immediate vicinity of the blowout could be injured or killed, but it is likely that few would be affected by hydrocarbons from the blowout. No population-level effects on birds are expected.

IV.H.7. Marine Mammals (Pinnipeds, Polar Bear, and Beluga and Gray Whales)

The most likely effect of natural gas development and production on pinnipeds, polar bears, and beluga and gray whales would come from air traffic to and from the production platforms and the support facility (probably at Deadhorse) and from platform and offshore-pipeline installation. The air traffic associated with gas production would be an additive source of noise and disturbance of marine mammals. However, the effect of this noise and disturbance is likely to be very brief and result in only a temporary displacement of some marine mammals along the flight paths (a short-term effect).

The effect of installing gas-production platforms and laying gas pipelines would be similar to the effect of installing oil-production platforms and laying oil pipelines. These activities would temporarily (1-3 seasons) alter the availability of some food organisms of marine mammals near the gas-production platforms and along the pipeline routes. Although this effect could be additive to the habitat alterations associated with oil development, the changes in availability of some food organisms of marine mammals would likely be short term and local (within about 1.6 kilometers [1 mile] of the activity).

If a natural gas blowout occurred, with possible explosion and fire, marine mammals in the immediate vicinity of the blowout could be killed, particularly if the explosion occurred below the water surface. Natural gas and gas condensates that did not burn in the blowout would be hazardous to any organisms exposed to high concentrations. However, natural gas vapors and condensates would be dispersed very rapidly from the blowout site; it is not likely that these pollutants would affect any marine mammals except individuals present in the immediate vicinity of the blowout (the loss of probably fewer than 100 animals with such losses replaced within 1 year). For any marine mammals to be exposed to high concentrations of gas vapors or condensates, the blowout would have to occur below or on the surface of the water, not from the top of the platform or gravel island.

Conclusion. The effects of natural gas development on pinnipeds, polar bears, and beluga and gray whales would likely be short term (1 year or less) and local (within about 1.6 kilometers [1 mile] of blowouts, noise and disturbance, and platform- and pipeline-installation activities).

IV.H.8. Terrestrial Mammals (Caribou, Muskox, Grizzly Bear, and Arctic Fox)

The most likely effects of natural gas development and production on caribou, muskoxen, grizzly bears, and arctic foxes would come from motor-vehicle traffic and construction activities associated with installing the onshore part of the pipeline systems that connect the production platforms with the onshore-processing facility. Onshore, the gas pipelines would run parallel to the oil pipelines and would be serviced by the same roads. The gas pipelines probably would be buried. Road-traffic disturbance of caribou, and muskox along the gas-pipeline routes would be most intense during the construction period, when motor-vehicle traffic is highest, but would subside after construction is complete. Caribou, muskoxen, grizzly bears, and arctic foxes are likely to successfully cross the pipeline corridor within a short period of time (perhaps within a few hours or no more than a few days) during breaks in the traffic with little or no restrictions in general movements and no effect on their distribution and abundance. Effects to terrestrial mammals would be local, within 1-2 kilometers [0.62-1.2 miles] of the pipeline-road corridor. As with construction of the oil pipeline, the construction of the gas pipeline would alter only a small fraction of caribou, muskox, grizzly bear, and arctic fox habitat.

Conclusion: The level of effects on caribou, muskoxen, grizzly bears, and arctic foxes resulting from natural gas development and production would likely be local (within 1-2 kilometers [0.62-1.2 miles] of the pipeline-road corridor) and have no effect on their distribution and abundance.

IV.H.9. Vegetation and Wetlands

The most likely effects of natural gas development and production on vegetation-wetlands would come from construction activities associated with installing the onshore part of the pipeline systems that connects the production platforms with the onshore-processing facility. Effects to vegetation would be local, within 1-2 kilometers [0.62-1.2 miles] of the pipeline-road corridor. Onshore, the gas pipelines would run parallel to the oil pipelines and would be serviced by the same roads. The gas pipelines probably would be buried. As with construction of the oil pipeline, the construction of the gas pipeline would alter only a small fraction of vegetation-wetland tundra habitat on the North Slope.

Conclusion: The level of effects on vegetation-wetlands resulting from natural gas development and production would likely be local (within 1-2 kilometers [0.62-1.2 miles] of the pipeline-road corridor) and have no effect on the distribution and abundance of vegetation-wetlands on the North Slope.

IV.H.10. Economy

The construction and operation of a large-diameter pipeline from production platforms(s) to onshore and a pipeline from the Prudhoe Bay area to Valdez would generate employment, taxes, and royalty revenues. During 5 years of construction, employment will peak at 7,200 direct jobs and 3,300 indirect and induced jobs, for a total of 10,500 jobs annually. During operations, employment would be 550 direct jobs and 1,250 indirect and induced jobs annually, for a total of 1,800 jobs annually. During production, operations will generate $188 million in property tax (for all local jurisdictions and the State), $64 million State severance tax, and $125 million royalty revenue annually. We derive these figures from the projections for the Northeast National Petroleum Reserve-Alaska final Integrated Agency Plan/EIS cumulative-case analysis (USDOI, Bureau of Land Management and MMS, 1998). This in turn derives the figures for the Trans-Alaska Gas System as analyzed in USDOI, Bureau of Land Management, and U.S. Army Corps of Engineers (1988).

Conclusion. During 5 years of construction, employment will peak at 10,500 direct, indirect, and induced jobs annually. During operations, employment would be 1,800 direct, indirect, and induced jobs annually. During production, operations will generate $188 million in property tax (for all local jurisdictions and the State), $64 million State severance tax, and $125 million royalty revenue annually.

IV.H.11. Subsistence-Harvest Patterns

Effects of natural gas development and production on the subsistence resources and harvest patterns could be caused by gas blowouts; installing offshore pipelines and gas-production systems; drilling gas-production wells; installing onshore pipelines and a gas-processing facility; marine-, surface-, and air-traffic noise and disturbance; construction activities; and growth in the local economy, population, and employment.

A natural gas accident could be caused by a gas-well blowout or a pipeline rupture. If such an unlikely event occurred, a gas-well blowout probably would not persist for more than 1 day and would release perhaps 20 metric tons of gas hydrocarbons in a hazardous plume of gas, which could extend downwind from the source for about a kilometer but would quickly dissipate once the blowout stopped. The amount of volatile organic compounds released by such a blowout would be less than what evaporates from an oil spill greater than or equal to 1,000 barrels. The effects of gas line construction activities with the development and production of natural gas fields are expected to occur during the winter and would have little effect on bowhead whales. If a natural gas blowout occurred, some bowhead whales in the immediate vicinity of the blowout could be injured or killed. Emissions of gaseous hydrocarbons from the blowout would be hazardous to any organisms exposed to high concentrations. However, the blowout would likely not persist more than a day and gaseous hydrocarbons would be dispersed very rapidly from the blowout site. It is likely that few bowhead whales would be affected by the emissions produced from a blowout. Effects of natural gas development on seals, polar bears, and beluga and gray whales are likely to be short term from noise and disturbance from construction activities and local–within about 1 mile of blowouts. The level of effects on caribou, muskoxen, grizzly bears, and arctic foxes resulting from natural gas development and production is expected to be local, within 0.62-1.2 miles of the pipeline road corridor and have no effect on their distribution and abundance.

If a natural gas blowout occurred, some fish in the immediate vicinity might be killed, but, in general, very few fish are likely to be affected by a blowout, and any effects would not be measurable at the population. Development and production of natural gas fields likely would have temporary, nonlethal effects on marine and coastal birds. Most effects would result from air and vessel traffic associated with construction and operation of production platforms and offshore-pipeline installation during the open-water season. Most birds are likely to avoid the sites of these activities by altering their routes of movement in the vicinity. Much of the construction activity associated with the development and production of natural gas fields may occur during the winter and would have little effect on migratory birds, but could destroy a small amount of foraging habitat. In the event of a natural gas blowout, some birds in the immediate vicinity of the event could be injured or killed, but it is likely that few marine and coastal birds would be affected by these hydrocarbons emissions.

Conclusion: Because effects on primary subsistence resources from gas line construction and a blowout event are expected to be local and short-term, effects on subsistence-harvest patterns are expected to be periodic and not curtail the overall seasonal subsistence harvest.

IV.H.12. Sociocultural Systems

Because subsistence harvests would not be curtailed by gas-pipeline construction or by the short-term effects of a gas blowout, effects could periodically disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources.

IV.H.13. Archaeological resources

The most likely effects of natural gas development and production on archaeological resources would come from construction activities associated with installing the offshore and onshore part of the pipeline systems. Offshore, a trench would have to be excavated for the buried pipeline. Onshore, the gas pipelines would run parallel to the oil pipelines and would be serviced by the same roads, limiting possible effects to within 1-2 kilometers (0.62-1.2 miles). Gas pipelines probably would be buried.

Conclusion. Offshore, trenching activities may have a potential effect on archaeological resources, which would be mitigated by predevelopment marine archaeological surveys. Onshore, effects of natural gas development and production, is expected to be local of the pipeline-road corridor) but, where pipe is buried, there are potential effects on prehistoric archaeological resources.

IV.H.14. Land Use Plans and Coastal Management Programs

Natural gas development and production are assumed to occur in the same area and follow the same transportation routes as oil production. Effects would be comparable to those addressed in Section IV.C. The greatest potential for conflict relates to subsistence resources and access. Any effects to subsistence resources and access to subsistence resources would be periodic, short-term, and local and not curtail the overall seasonal subsistence harvest.

Conclusion. No conflicts with existing land use plans and coastal management programs are anticipated.

IV.H.15. Air Quality

Emissions from gas production would be primarily nitrogen oxides, due to increased power requirements for turbines for gas compression. The emissions from any gas blowouts would be principally volatile organic compounds, which, if not burned, would be dissipated very quickly by winds. This would result in minimal effects on air quality.

Development drilling and platform and pipeline installations associated with natural gas resources would result in additional emissions of carbon monoxide, sulfur dioxide, nitrogen oxides, and volatile organic compounds. These emissions would be produced from the same sources producing emissions in oil development and oil production activities. During the construction phase, emissions would be higher because of gas pipelines that would be installed. Also, during the production phase, there would be increased power requirements and, therefore, increased emissions, from compressors needed to pipe the natural gas to shore. These emissions would be offset to a certain extent by the reduced need to reinject produced gas into the formation.

Conclusion. Only a minimal effect on air quality would be expected. Principally because of the distance of emissions from land, the other effects of air-pollutant concentrations onshore due to exploration, development, and production activities, or to accidental emissions, would not be sufficient to harm vegetation.

IV.H.16. Environmental Justice

Because subsistence harvests would not be curtailed by gas-pipeline construction or by the short-term effects of a gas blowout, and because ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence might be periodically disrupted but not displaced, effects on environmental justice are not expected to produce significant effects on the Inupiat people or reach the disproportionate, high adverse effects threshold.

IV.I. Low-Probability, Very Large Oil Spill

Introduction: A very large oil spill is an issue of concern to everyone. We define a very large oil spill as greater than or equal to 150,000 barrels of oil. A very large oil spill is a low-probability event with the potential for very high effects. In this section, we analyze the potential effects to resources from an oil spill in the nearshore Beaufort Sea. Very large spills happen infrequently, and we have limited historical data for use in our statistical analysis and predictive efforts.

The largest spill from a blowout in Federal waters is 80,000 barrels. One other spill greater than 50,000 barrels has happened since offshore drilling began in the United States. Because there are no spills greater than 150,000 barrels in U.S. waters, we must look elsewhere for data on spills of that size. Therefore, we use worldwide historical spill data to estimate the chance of very large spills occurring. The spill information we use is based on spills from other countries that do not have the regulatory standards that are enforced on the OCS. In addition, some drilling practices used elsewhere either are not practiced here or are against OCS regulations.

Internationally from 1979 through 2000, five oil-well blowouts greater than or equal to 10 million gallons (238,000 barrels) have occurred (*, International Oil Spill Statistics; Oil Spill Intelligence Report,* 1996; Cutter Information Corp., 1997; DeCola, 2001). Five of the blowouts greater than 10 million gallons mostly were the result of either war or drilling practices that oil companies do not now use and may not use under MMS regulations in the United States. During this same time period, there were roughly 470,506 billion barrels of oil produced worldwide (British Petroleum, 2001; *Statistical Review of World Energy,* 1997, and earlier issues). These data provide a rate of about 0.01 blowouts greater than or equal to 10 million gallons per billion barrels produced. If this rate is applied to Alternative I for Sale 186, the estimated probability of one or more oil spills of 10 million gallons (238,000 barrels) is 0.0046, or 0.5%.

S.L. Ross Environmental Research Ltd. (1998) calculated the chance of an extremely large oil spill (greater than 150,000 barrels) from a blowout for an average of the Northstar and Liberty projects using worldwide spill frequencies similar to the previous paragraph.

Scandpower (2001) recently completed a blowout-frequency assessment of Northstar. This analysis modified statistical blowout frequencies to reflect specific conditions and operating systems at Northstar for the drilling process. The estimated blowout frequency for drilling into the oil-bearing zone and spilling greater than 130,000 barrels is 9.4×10^{-7}.

The State of Alaska prohibits the drilling of new wells or sidetracks from existing wells into major liquid-hydrocarbon zones at its drill sites during the defined period of broken ice and open water (BPXA, 2001). This period begins on June 13 of each year and ends with the presence of 18 inches of continuous ice cover for one-half mile in all directions from the Northstar Island. This drilling moratorium eliminates the environmental effects associated with a well blowout during drilling operations in the Beaufort Sea during broken-ice or open-water conditions.

Although the drilling prohibition during broken ice and open water reduces the chance of a blowout, it is not completely eliminated during the time the field is producing oil and, as noted in the following section, the State of Alaska requires the greatest possible discharge that could occur from a blowout as a planning standard. Thus, this EIS evaluates the potential effects of a very large oil spill.

Effects to Resources from a 180,000-Barrel Blowout Oil Spill: We analyze the potential effects of a very large, but extremely unlikely, oil spill of 180,000 barrels from the nearshore area on sensitive resources in the Beaufort Sea region. We derive this spill size from previous development and production plans in the Beaufort Sea that estimate the greatest possible discharge. For the Northstar and Liberty development projects, BPXA estimates a 15,000-barrel flow rate per day for 15 days, totaling 225,000 barrels. Computer model runs simulating a blowout by S.L. Ross Environmental Research Ltd., Dickens and Associates, and Vaudrey and Associates (1998) estimate that 20% of the oil would evaporate in the air; this amount equals 45,000 barrels. An additional 3,400 barrels remain on the gravel island (BPXA, 1999). A total of 176,600 barrels reaches the water or ice. For purposes of analysis, we round this number to 180,000 barrels.

IV.I.1. Blowout Assumptions

In the extremely unlikely event of a large blowout, we assume it would occur in the nearshore area and release crude oil into the environment for 15 days. The three general environments into which the oil could discharge are solid ice, broken ice, and open water.

The following blowout assumptions are from modeling (S.L. Ross Environmental Research Ltd., Dickens and Associates, and Vaudrey and Associates, 1998). A blowout spill rises into the air at an average rate of 500 barrels per hour (BPXA, 2000b). Oil droplets fall to the gravel island and surrounding area. Approximately 20% of the 225,000 barrels evaporates into the air, leaving 180,000 barrels on the island's surface and surrounding area (Tables IV.I-1 and IV.I-2).

Within 15 days from the start of the spill:

- 3,400 barrels remain on the gravel island,
- 86,600 barrels drain from the island into the environment, and
- 90,000 barrels fall to the surrounding environment at a rate of 10,000-12,000 barrels a day.

Of the oil falling to the surrounding environment:

- 84% of the oil falls out approximately 4,500 feet from the source within a 975-foot wide area, and
- 16% of the oil falls out approximately 13,000 feet from the source within a 2,000-foot wide area.

IV.I.1.a. Behavior of a Blowout Oil Spill in Solid Ice

Oil would drain from the gravel island to the solid sea ice and would fall to the solid sea ice in a scattered pattern. No oil would enter open water as long as the ice was solid. Alaska Clean Seas estimates it would take 122 days to recover the oil from the blowout after the flow is stopped (Alaska Clean Seas, 1998).

There would be little or no change in the oil's physical properties at very low temperatures and when buried under a snow cover. Blowing snow would tend to combine with pooled oil, until the oil is effectively saturated with snow crystals. The oil would not penetrate the ice surface. Table IV.I-3 shows the fate of oil on solid ice.

IV.I.1.b. Behavior of a Spill in Broken Ice

Broken ice occurs in the Beaufort Sea during fall freezeup and spring breakup. This scenario assumes that oil would drain from the gravel island into broken ice and would fall to the broken ice in a scattered pattern. The ice would contain the oil somewhat and reduce spreading. Unless the oil is frozen into the ice, the evaporation rate would not change. Dispersion and emulsification rates are lower in broken ice than in open water.

IV.I.1.b(1) Fall Freezeup through Meltout

During fall freezeup, the oil would freeze into the grease ice and slush before ice sheeting occurs. Winds and storms could break up and disperse the ice and oil until the next freezing cycle. These freezing cycles can be hours or days. Before freezeup, the oil could move at a rate of 5 nautical miles per day (S.L. Ross Environmental Research Ltd., Dickens and Associates, and Vaudrey and Associates, 1998).

In late spring and summer, the unweathered oil would melt out of the ice at different rates, depending on whether it is encapsulated in multiyear or first-year ice and when the oil was frozen into the ice. In first-year ice, most of the oil spilled at any one time would percolate up to the ice surface over about a 10-day period. About mid-July, the oil pools would drain into the water among the floes of the opening ice pack. Thus, in first-year ice, oil would be pooled on the ice surface for up to 30 days before being discharged from the ice surface to the water surface. The pools on the ice surface would concentrate the oil, but only to about 2 millimeters thick, allowing evaporation of 5% of the oil, the part of the oil composed of the lighter, more toxic components of the crude. By the time the oil is released from the melt pools on the ice surface, evaporation has almost stopped, with only an additional 4% of the spilled oil evaporating during an additional 30 days on the water. Tables IV.I-4 and IV.I-5 show specific estimates of the fate of a spill into broken ice.

IV.I.1.b(2) Spring Breakup through Meltout

For purposes of analysis, we assume that a spill during spring breakup would have the same effects as an open-water spill. At spring breakup, the ice concentrations are variable. With high concentrations of ice, oil would spread between icefloes. As the ice concentrations eventually decrease to less than three-tenths, the oil on the water behaves as an open-water spill, with local oil patches temporarily trapped by the wind against floes. Oil that is on the icefloes would move with the ice as it responds to nearshore currents (S.L. Ross Environmental Research Ltd., 1998). Table IV.I-6a shows the specific estimates of the fate of a spring spill into broken ice. Table IV.I-6b shows our estimate of the length of coastline oiled.

IV.I.1.c. Behavior of Spills in Open Water

This scenario assumes oil would drain from the gravel island into open water. Oil also would fall to open water adjacent to the gravel island. The oil would move with the currents and the winds. The fate of an open-water spill is shown in Tables IV.I-7 and IV.I-8. Table IV.I-6b shows our estimate of the length of coastline oiled.

IV.I.1.d. The Chance of an Oil Spill Contacting Resources of Concern

We estimate how much oil would reach specific shorelines or other environmental resources from the conditional probabilities for a spill from the spill areas LA10 and LA12 (Map A-4b). For a full discussion of the Oil-Spill-Risk Analysis model and how we derive the oil-spill modeling simulations and supporting tables, see Appendix A.

Tables IV.I-9a, IV.I-9b, and IV.I-9c summarize the conditional probabilities that a spill starting at spill areas LA10 and LA12would contact individual land segments or environmental resources within 1, 3, 10, 30, and 360 days during summer or winter.

IV.I.2. Analysis of Effects to Each Resource from a 180,000-Barrel Blowout Oil Spill

IV.I.2.a. Water Quality

Hydrocarbon contamination from a very large spill during summer could exceed the 1.5 parts per million acute toxic criterion during the first several days in an area of several hundred square kilometers (a hundred square miles) (USDOI, MMS, Alaska OCS Region, 2002a:Section IX.A.l). The contamination could exceed 0.015 parts per million chronic criterion for several months in an area over ten thousand square kilometers (about 5,000 square miles). This amount of oil in the water with broken ice could exceed the 1.5-parts per million acute-toxic criterion for more than 3 days in an area of about 100 square kilometers (less than 50 square miles) and the 0.015-parts per million chronic criterion for several months in an area of about 8,000 square kilometers (3,000 square miles). In other words, a large spill of crude oil would affect water quality by increasing the concentration of hydrocarbons in the water column in a large area to levels that greatly exceed background concentrations. However, the chance of such a large spill occurring is extremely low.

The contamination estimates may represent an upper range of concentrations of dispersed oil reached during the first several days following a large spill. Both the summer and broken-ice concentrations of oil that are estimated to be dispersed in the water column after 30 days, 0.11 and 0.14 parts per million, respectively, are greater than petroleum hydrocarbons concentrations of 0.001-0.006 parts per million that were observed in Prince William Sound 21-41 days after the *Exxon Valdez* oil spill. The estimated concentration of dispersed oil in the water 30 days after both the summer and broken-ice/meltout spills is greater than 0.015 parts per million and indicates a relatively long period of time, perhaps several months or more, before dilution of the dispersed oil reduces the concentrations below the chronic criterion. Applicable ambient-water-quality standards for marine waters of the State of Alaska are noted in Section III.C.2.l.of the Liberty EIS (USDOI, MMS, Alaska OCS Region, 2002a).

Oil-spill-cleanup activities are not expected to affect water quality by adding any new or additional substances to the water. Removing oil from the environment would help reduce the amount of oil that gets dispersed into the water. However, the amount of oil removed depends on environmental conditions during cleanup operations. As the oil is removed, the amount contributing oil to dispersion decreases and, as the oil is dispersed, the concentration decreases. The effect of removing oil would be to reduce the concentration in the water relative to the amounts estimated in the above analysis for a given time interval or given area.

IV.I.2.b. Lower Trophic-Level Organisms

This analysis considers the effects of an assumed 180,000-barrel oil spill into offshore waters on lower trophic-level organisms during the summer and winter months. The specific effects of petroleum on lower trophic-level organisms are discussed under the Alternative I for Sales 186, 195 and 202 (Section IV.C.2). The spill would adversely affect some lower trophic-level organisms by exposing them to petroleum-based hydrocarbons.

IV.I.2.b(1) Kelp and Other Marine Plants

Large-scale effects on marine plants from oil spills have been observed in the intertidal and subtidal zones of other regions. Because of the predominance of shorefast ice in the affected area, there is no resident marine flora in waters less than 6 feet deep; therefore, there would be no effects. The oil spill also is not expected to have any measurable effect on subtidal marine plants (such as those of the Boulder Patch kelp habitat), because they live below the zone where toxic concentrations of oil can reach them.

IV.I.2.b(2) Coastal and Benthic Marine Invertebrates

Large-scale effects on marine invertebrates from oil spills have been observed in the intertidal and subtidal zones of other regions. There are limited intertidal and nearshore subtidal zones in the Beaufort Sea. Instead, it is a highly disturbed area that is seasonally recolonized by a small number of opportunistic faunas during the summer (about 3 months). The nearshore area does support mobile epibenthic invertebrates (amphipods, mysids, copepods, clams, snails, crab, and shrimp), which are fed on by vertebrate consumers during the summer. If contacted by surface oil, these invertebrates are likely to die or be sublethally affected.

If oil enters the coastal waters, the recovery of seasonal benthic invertebrates would be expected within 2 months, after water quality in the nearshore water column returns to prespill conditions and other opportunistic marine invertebrates move into the area. Oil incorporated by wave action into shoreline bottom sediments is expected to remain there for several years. In the areas where bottom sediments are heavily oiled, some lethal and sublethal effects could occur each summer, when seasonal benthic invertebrates return to those areas. However, this is not expected to affect a measurable percentage of the seasonal benthic invertebrate population in Stefansson Sound. The recovery of resident benthic invertebrates would be expected within 5 years, but it could require up to 10 years in areas where water circulation is significantly reduced. Oil mixed into shoreline bottom sediments would have the greatest effect on resident benthic fauna, because they are not seasonally restocked from deeper waters as are seasonal fauna. Subtidal marine organisms deeper than 2 meters (including those of the Boulder Patch area) are not likely to be affected, because they live below the zone where toxic hydrocarbon concentrations can reach them.

Other lower trophic-level organisms likely to be contacted by oil in the water column are the plankton. These include phytoplankton; zooplankton (copepods, euphausiids, mysids, and amphipods); and the larval stages of marine invertebrates such as annelids, mollusks, and crustaceans. Because of similarities in habitat use and distribution, the percentage of marine-invertebrate larva contacted by floating or dispersed oil is likely to be similar to that expected for plankton. The method of assessment is the same as the one used in the Sale 170 EIS (USDOI, MMS, 1998:IV-B-8) and Liberty EIS (USDOI, MMS, Alaska OCS Region, 2002a:Section IX.A.6.e). During the winter/spring (about 10 months), the very large oil spill probably would not have a measurable effect on plankton, because few are present during this time and oil would not be dispersed in the water column. However, effects are likely to occur during the summer when plankton is abundant.

To summarize, a very large oil spill probably would affect half of the planktonic organisms in about half of the sound, or a total of about one-quarter of the Stefansson Sound plankton. Because of their wide distribution, large numbers, and rapid rate of regeneration (12 hours), there would be only a temporary, local effect on the planktonic community. The recovery of the community would be complete within 1-2 weeks (the estimated flushing time for Stefansson Sound).

IV.I.2.b(3) Oil-Spill Prevention and Response

Spill-response manuals, such as the Alaska Clean Seas technical manuals, identify sensitive sections of the Beaufort Sea coastline on which oil might persist for a decade, including some within the project area (Alaska Clean Seas, 1998:Index Sheets 1 and 2). The most sensitive types of shoreline, such as river deltas and sheltered lagoons, are listed clearly in the manual as "areas of major concern" (Alaska Clean Seas Tactic W-6). The manual also describes several tactics for protecting sensitive sections of the coastline. Intertidal and exclusion booms would be used along the shoreline in marshes and inlets. Deflection booms would be used to divert oil to sections of the coast waters that are less sensitive or more suitable for oil recovery; the oil would be collected by booms and pumped by skimmers to local storage tanks. Some lower trophic-level organisms on the shorelines would be adversely affected by these and other response tactics. Use of dispersants on a spill near benthic kelp communities would mix the oil farther down into the water column and could affect the kelp community. However, the use of dispersants is not essential for spill response; their use would require further approval by the Coast Guard.

IV.I.2.c. Fishes

Due to their very low numbers and wide area of distribution, no measurable effects are expected on fishes in winter. Effects would be more likely to occur from an oil spill moving into nearshore waters in summer, where fishes concentrate to feed and migrate. Based on the Oil-Spill-Risk Analysis model (Table IV.I-9a), the nearshore areas of highest chance of contact include Land Segments 31-37. If a 180,000-barrel oil spill occurred, these land segments would have a 0.5-8% chance of being contacted in 30 days. According to Tables IV.I-6a and IV.I-6b, a 180,000-barrel oil spill would contact about 300 kilometers of coastline, which is about seven times that estimated for the 4,600-barrel oil spill associated with Alternative I for Sales 186, 195, and 202. However, the combined probability of one or more spills occurring and contacting the nearshore area is very low (less than 0.5%). If it did occur, some marine and migratory fish might be harmed or killed. The number affected would depend on the size of the area affected, the concentration of petroleum present, the time of exposure, and the stage of fish development involved (eggs, larva, and juveniles are most sensitive). If lethal concentrations were encountered, or sublethal concentrations were encountered over a long-enough period, fish mortality would be likely to occur. However, mortality due to petroleum-related spills is seldom observed outside of the laboratory environment. This is because the zone of lethal toxicity is very small and short lived under a spill, and fishes in the immediate area typically avoid that zone. Mortality would be expected only in cases where fishes were somehow trapped in a lethal concentration and could not escape. Because this would be very unlikely outside of the laboratory environment, little to no mortality due to lethal concentrations would be expected.

If oil were to reach the shore and become buried in intertidal and/or subtidal sediments, it likely would be released back into the water column at a later time. However, the amounts of oil released in that manner are likely to be relatively small over time, and fish density in Beaufort Sea coastal waters also is relatively low most of the year. While a 180,000-barrel oil spill would be expected to affect about 300 kilometers of nearshore waters and coastline, it would be likely to have mostly sublethal effects (for example, changes in growth, feeding, fecundity, and temporary displacement) on marine and migratory fish. Juvenile fish (for example, arctic cod), which are common in the nearshore area during summer, or nearshore spawners (for example, capelin) are among those most likely to be adversely affected. Some fish in the immediate area of a spill may be killed; however, it is not expected to be a measurable effect on marine and migratory fish populations. Recovery of the number of fish harmed or killed would be expected within 10 years.

Oil-spill-cleanup activities, whether on ice or for oil entrained in the ice, are not expected to adversely affect fish populations. It is possible that a containment boom could trap some oil in a shoreline area and temporarily contaminate that area long enough to affect fishes or their food resources. In general however, reducing the amount of oil in the marine environment is expected to have a beneficial effect on fishes, because it reduces the possibility of hydrocarbons contacting them and their food resources. The extent of that benefit would depend on the actual reduction in the amount of oil contacting fish and their food resources, as compared to that of not reducing the amount of contact.

IV.I.2.d. Essential Fish Habitat

Over a 15-day period, about half to three-quarters the amount of oil from a blowout spill (about 176,600 barrels a day) would fall on the water or sea ice within 2-3 kilometers of the blowout. About 4,100 barrels likely would fall to the sediments and about 36,000 barrels likely would wash onshore along approximately half of the 900 kilometer coastline. That portion falling through the water column is expected to make salmon essential fish habitat unusable for those 30 days. Oil falling to the sediment in the estuarine habitat, especially that very shallow area used by salmon smolt adjacent to the shore, likely would have some lethal and sublethal effects on salmon prey (see IV.I.2.c - Fishes) for up to several years. Because salmon must feed within several days of entering the estuarine areas, they also could experience lethal and sublethal effects for up to several years. Oil contacting the coastline also would be likely to affect short sections of freshwater habitat in any anadromous streams contacted, possibly causing sublethal and genetic effects for one generation of salmon eggs and juveniles.

IV.I.2.e. Endangered and Threatened Species

IV.I.2.e(1) Bowhead Whales

The Oil-Spill-Risk Analysis model estimates a 35% probability (expressed as a percent chance) that a large oil spill (180,000 barrels) starting at LA10 during the summer will contact Ice/Sea Segment 4, an important bowhead whale-habitat area in the fall, within 30 days. The oil-spill model estimates a 21% chance that a large oil spill starting at LA12 during the summer will contact Ice/Sea Segment 4, an important bowhead whale-habitat area, within 30 days. During the open-water season, there would be an estimated 71,900 barrels of oil remaining in the slick after 30 days (Table IV.I-7), covering a discontinuous area of about 5,700 square kilometers (Table IV.I-8).

The oil-spill model estimates an 8% chance and a 3% chance that a large oil spill starting at LA10 and LA12, respectively, during the winter will contact Beaufort Spring Lead 10, an important bowhead whale-habitat area in the spring, within 30 days. During the broken-ice season and the solid-ice season there would be an estimated 120,900 barrels and 168,000 barrels of oil, respectively, remaining in the slick after 30 days (Table IV.I-7). These spills would cover a discontinuous area of about 3,200 square kilometers 30 days after meltout (Table IV.I-8).

The probability of oil contacting whales is likely to be considerably less than the probability of oil contacting bowhead whale habitat.

The fall migration through the Beaufort Sea generally occurs in relatively open-water conditions. The migration area is less confined than during the spring migration and whales migrate over a broader area. A spill during the open-water season would not be continuous over the entire area. It is unlikely that the spill would cause an impediment to the migration. The migrating whales could come in contact with oil, but such contact likely would be brief. In some years, bowheads have been observed feeding near shore between Point Barrow and Cape Halkett. If bowheads were feeding in that area when spilled oil was present, some of the oil could be ingested.

A major concern for bowhead whales is an oil spill that contacts the spring-lead system, where bowheads could be concentrated during their spring migration. In this large-spill scenario, a portion of the spring-lead system would be contacted by the spill after the spill melted out of the ice. However, a broken-ice or solid-ice winter spill likely would melt out in July; therefore, it is not likely that a winter spill would be melted out of the ice in time to contact the spring leads during the spring whale migration. For the fall migration, oil from a meltout spill would be somewhat weathered and the toxic hydrocarbons at least partially evaporated before the oil entered the water. As a result of the weathering, the spill would be less likely to cause respiratory distress to bowheads surfacing to breathe.

Effects of an oil spill on bowheads would be as described previously in Section IV.C.5: oiling of the skin, inhaling hydrocarbon vapors, ingesting contaminated prey, fouling of their baleen, reduced food source, displacement from feeding areas, and possibly death. The number of whales contacting spilled oil would depend on the timing and duration of the spill, ice conditions, effectiveness of cleanup and containment operations, how many whales were near the spill, and the whales' ability or inclination to avoid contact. Based on conclusions from studies presented in Section IV.C.5 that have looked at the effects of oil spills on cetaceans, exposure to spilled oil is unlikely to have serious direct effects on baleen whales. Most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects. Exposure of bowhead whales to spilled oil could result in lethal effects to some individuals.

Conclusion: Based on conclusions from studies that have looked at the effects of oil spills on cetaceans, exposure to spilled oil is unlikely to have serious direct effects on baleen whales. Most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects from oiling of the skin, inhaling hydrocarbon vapors, ingesting contaminated prey, fouling of their baleen, reduced food source, and displacement from feeding areas. Exposure of bowhead whales to spilled oil could result in lethal effects to some individuals.

IV.I.2.e(2) Spectacled and Steller's Eiders

IV.I.2.e(2)(a) Effects of a Blowout Oil Spill on Spectacled and Steller's Eiders

From early June to early July (males) and late June to early September (failed females or females with young), flocks of spectacled eiders may be present in coastal lagoons and offshore waters (Fischer, Tiplady, and Larned, 2002; Fisher, 2002; Troy Ecological Research Assocs., 1995b, 1999); in late summer females with fledged young move from coastal habitats to nearshore or offshore areas. Realistic values for densities of spectacled eiders present in these areas that would allow the estimation of potential mortality from oil-spill contact are unavailable. However, in the unlikely event of a 180,000-barrel spill covering a discontinuous area of 5,700 square kilometers after 30 days (Table IV.I-8), some of these flocks, or females with young along the 275-300 kilometers (100-130 miles [Table IV.I-6]) of coast (maximum distance is equivalent approximately to the coastline from Camden Bay to western Harrison Bay) where oil is likely to contact or become stranded, are expected to be contacted and may experience substantial mortality. A spill occurring in winter and released from the ice in spring could contact eiders in open water near river deltas. For the spectacled eider, with a relatively small regional population and low productivity, the loss that could result from such a spill of perhaps tens of locally nesting individuals plus an unknown number of migrants would represent a significant loss. Because there is no clear population trend in the coastal plain population, and there is a lack of certain data required to model population fluctuations, an estimate of recovery time from such a loss currently would be speculative. Also, losses may be difficult to separate from natural variation in population numbers (see the discussion in Section IV.C.5.b(1)(b)3)). If a spill of this size occurred in August or September, there is a potential for small numbers of Steller's eiders that nest on the western Arctic Coastal Plain to be contacted while staging in the western Beaufort Sea. This could represent a substantial proportion of the coastal plain population. Little information is available concerning presence, timing, or numbers in marine waters (but see Map 9; Fischer, 2002; Fischer, Tiplady, and Larned, 2002; Larned, et al., 2001; Martin, 2001, pers. commun.; Quakenbush, et al., 1995).

Oil contacting or mixed into bottom sediments and mudflat areas (an estimated 4,100 barrels [Table IV.I-4]), or affecting species-rich foraging areas such as boulder patches, is expected to kill substantial numbers of eider food organisms. It is difficult to determine the actual effect that such indirect effects as a decline in food organisms would have on bird populations. Decreased food availability might adversely affect the ability of juvenile birds to develop as rapidly as they would normally, decrease adult fitness, or might delay the accumulation of fat reserves for migration. Any mortality from such indirect effects would be additive to the loss of oiled individuals.

IV.Ii.2.e(2)(b) Effects of Oil-Spill Prevention and Response

IV.I.2.e(2)(b)1) Blowout During Open-Water Conditions

Despite the potential for effective spill containment, recovery, and cleanup under ideal weather conditions, these may not exist during a spill incident, and some eider habitats are likely to be contacted by oil. Most detections of satellite-tagged spectacled eiders have been in or offshore of Simpson Lagoon and west. The Oil-Spill-Risk Analysis model estimates the chance of contact by spilled oil within 30 days in summer in nearshore or offshore areas ranges up to 55%; along the shoreline contact probability is less than 8% (Tables IV.I-9a and IV.I-9c). These areas would need to be surveyed for eider presence to plan an adequate response strategy. If the spill is not contained before reaching these areas, the most effective response may involve hazing. The probability of a large spill occurring is extremely small.

Although spectacled eiders apparently spend little time in nearshore coastal habitats, females with broods may occupy them briefly before moving to offshore staging areas. Containment, recovery, and cleanup activities for a large spill are expected to involve hundreds of workers and numerous boats, aircraft, and onshore vehicles operating over an extensive area for more than 1 year. The presence of such a workforce is likely to act as a general hazing factor, displacing any eiders from the immediate area of activity, perhaps within a few kilometers, which potentially might be viewed as a positive result, given birds' extreme vulnerability to oil in the environment. If a reliable system of locating eiders in a specific area can be devised, specific birds or groups in danger of oil contact could be targeted with specific hazing tactics.

Currently, no important specific foraging areas for eiders are identified, although numerous satellite transmitter locations and visual observations during aerial surveys suggest that in and offshore of Harrison Bay may be an important area. Because spectacled eiders nest at low density, and there appears to be little tendency for them to nest near the coast (Troy Ecological Research Assocs., 1999), disturbance of nesting eiders by onshore cleanup activities is not expected to result in significant increases in nest abandonment or loss of eggs or young to predators or exposure to weather, or overall decreases in productivity. Displacement by cleanup activity of females with broods from coastal habitats may have a negative effect, if it prematurely forces them into the offshore marine environment where the high salinity could increase stress on the ducklings, which have a relatively low tolerance to salt (USDOI, Fish and Wildlife Service, 1996). Helicopter support traffic and human presence probably would be the most disturbing factors associated with oil-spill-cleanup activity. If their presence forces eiders from a marine area where oil contact is imminent, it may be considered a positive factor. However, overland flights and off-road personnel activity during the nesting season may displace females from their nests or broods and result in egg or duckling losses from predation or exposure.

Prompt containment and removal of oil from offshore areas, accompanied by hazing tactics targeting high-use areas, is likely to result in a substantial reduction of spectacled eider mortality from a large oil spill. Cleanup also would decrease the amount of oil available for uptake by bottom-dwelling organisms that are the principal food of eiders. This could reduce the potential for oil uptake by eiders and associated adverse physiological side effects, although the benefit of this indirect effect on the eider population cannot be quantified at present.

IV.I.2.e(2)(b)2) Blowout During Broken-Ice Conditions

Containment and oil recovery following a blowout spill that enters the marine environment under broken-ice conditions at meltout or freezeup is expected to be less effective than for an open-water spill. Although under these conditions the area covered by the spill would be smaller than a spill in open water (3,200 versus 5,700 square kilometers [Tables IV.I-5 and IV.I-8]), spectacled eiders are not expected to occupy broken ice in either period, unless areas of open water are available. Many arriving spring migrants likely would occupy open overflow areas off river mouths that are available early and are in the vicinity of nesting areas; the greatest benefit of spill cleanup may result from containment and cleanup in such areas. In this season, the hazing effect of cleanup activity or actively hazing birds out of areas that oil is expected to enter may be counterproductive, because there are few alternative habitats that flushed birds can occupy.

If most spectacled eiders arrive in the area via overland routes (Troy Ecological Research Assocs., 1999), the benefit of spill containment and cleanup would be minimal, until they begin reentering the marine environment following the breeding period. By this time, the oil would have weathered likely would have become a decreasing hazard for plumage fouling. Indirect adverse effects resulting from the intake of contaminated prey organisms may be higher under broken-ice than open-water conditions, because reduced cleanup capability would provide a longer interval for exposure and uptake by such organisms. Entrapment of large quantities of oil in coastal marsh and adjacent habitats could present a hazard to departing males following breeding and females with young following nesting as they move to offshore waters. In fall, spectacled eiders are not likely to be present in numbers beyond late September, and oil present in broken ice at this time likely would not contact eiders.

Conclusions for Spectacled and Steller's Eiders. The 180,000-barrel blowout oil spill in open water assumed for this analysis is expected to cause spectacled eider mortality, if females with recently fledged young contact stranded oil in coastal habitats, or flocks of adult eiders or females with young feeding in lagoons and offshore waters are contacted by a spill sweeping over thousands of square kilometers. A winter spill released from the ice in spring could contact eiders concentrated in open water of river deltas. Substantial mortality that could result from such a large spill would represent a significant loss for the relatively small Arctic Coastal Plain spectacled eider population, requiring many generations for recovery. Recovery is not likely to occur while the regional population is in declining status. Any mortality, or decreased fitness or productivity from indirect effects such as decreased availability of food organisms or physiological effects from oil ingestion would be additive to the loss of oiled individuals. Although Fish and Wildlife Service survey data do not show a significant decline in the coastal plain spectacled eider population, the potential exists for a significant adverse effect from an oil spill on this regional population. Mortality of a few Steller's eiders also would represent a significant loss to its small regional population.

IV.I.2.f. Marine and Coastal Birds

IV.I.2.f(1) Effects of a Blowout Oil Spill on Marine and Coastal Birds

In mid- to late summer, up to 3,200 brant, 2,000 lesser snow geese, tens of tundra swans, and thousands of shorebirds are present in Beaufort Sea shoreline habitats; many tens of thousands of long-tailed ducks, large numbers of king and common eiders and other waterfowl, and substantial numbers of seabirds are present in coastal lagoons and offshore waters (Fisher, 2002; Fischer, Tiplady, and Larned, 2002; Johnson, 1994a,b; Johnson and Gazey, 1992; Johnson and Noel, 1996; Larned, et al., 2001; Noel, Johnson, and Wainwright, 2000; Noel and Johnson, 1996; Stickney and Ritchie, 1996; Stickney et al., 1994; Troy, 1995). A spill during this period could result in mortality exceeding a few thousand individuals, if broodrearing waterfowl or shorebirds contact stranded oil along a substantial proportion of the estimated 275-300 kilometers (100-130 miles [Table IV.I-6]) of affected shoreline (maximum distance is equivalent approximately to the coastline from Camden Bay to western Harrison Bay). In lagoon habitats, long-tailed duck densities averaging 40-275 birds per square kilometer (Noel, Johnson, and Wainwright, 2000; Stehn and Platte, 2000) suggest that when large concentrations of molting individuals are present, tens of thousands could be contacted by a spill representing a significant loss from the regional population. Significant losses also would be experienced by postbreeding common eiders concentrated near barrier islands and in lagoons. In addition, a 180,000-barrel spill covering a discontinuous area of 5,700 square kilometers after 30 days (Table IV.I-8) would be expected to contact several other species present in substantial numbers, including the king eider, scoters, northern pintail, Pacific loon, and glaucous gull. A large spill occurring in August or September and contacting a substantial proportion of the thousands of Ross' gulls that gather east of Point Barrow to feed each fall (Divoky et al., 1988), could result in a significant loss for this species whose world population probably does not exceed 50,000. Losses resulting from any aspect of development may be difficult to separate from natural variation in population numbers (see the discussion in Section IV.C.5.b(1)(b)3)).

A spill occurring in winter and released in spring could contact loons and other migrant waterfowl concentrated in open water near river deltas. For species such as yellow-billed and red-throated loons, with relatively small populations and low productivity, this could represent a significant loss.

Oil entrained in bottom sediments and mudflat areas, or affecting species-rich foraging areas such as boulder patches, is expected to kill substantial numbers of waterfowl and shorebird food organisms. The actual effect on bird populations of such indirect effects on food organisms is difficult to determine. Presumably, decreased food availability would adversely affect the ability of young to develop as rapidly as they would normally, decrease fitness or survival, or the ability of individuals to accumulate fat reserves for migration. Any mortality from such indirect effects would be additive to the losses of oiled individuals.

IV.I.2.f(2) Effects of Oil-Spill Prevention and Response

IV.I.2.f(2)(a) Blowout During Open-Water Conditions

Despite the potential for effective spill containment, recovery, and cleanup under ideal weather conditions, these may not exist during a spill incident and some loon, waterfowl, shorebird, and seabird habitats are likely to be contacted by oil. Recent aerial surveys (Fischer, 2002; Fischer, Tiplady, and Larned, 2002; Larned, et al., 2001) recorded substantial numbers of loons, waterfowl, and seabirds from Mikkelsen Bay west to Harrison Bay and Point Barrow. In this area, the Oil-Spill-Risk Analysis model estimates that the probability of contact by spilled oil in 30 days in summer in nearshore or offshore areas ranges up to 55%; along the shoreline, the probability of contact is less than 8% (Tables IV.I-9a and IV.I-9c). Although some species exhibited concentrations in Harrison Bay and Simpson and other lagoons, as a group, this suite of species was surprisingly widespread in its offshore distribution, ranging from the coastal shoreline to 50 kilometers offshore. If a large spill is not contained before reaching these areas, the most effective response may involve hazing. The probability of a large spill occurring is extremely small.

Containment, recovery, and cleanup activities for a large spill are expected to involve hundreds of workers and numerous boats, aircraft, and onshore vehicles operating over an extensive area for more than 1 year. The presence of such a workforce is likely to act as a general hazing factor, displacing birds from the immediate area of activity, perhaps within a few kilometers, which potentially may be viewed as a positive result given the extreme vulnerability of birds to oil in the environment. If a reliable system of locating bird concentrations in a specific area can be devised, specific birds or groups in danger of oil contact could be targeted with specific hazing tactics.

Displacement of female waterfowl with broods from coastal habitats by cleanup activity may have a negative effect if it prematurely forces them into the offshore marine environment where foraging may be more difficult for the ducklings, and other stresses may increase. Disturbance of nesting sea ducks by onshore cleanup activities is not expected to significantly affect their productivity. There appears to be little tendency for most of these species to nest near the coast, where there is the highest probability of disturbance by cleanup activity. Because of low nesting density, few nesting birds are likely to be displaced and potentially lose their clutches or broods to predators or exposure to weather as a result of disturbance by cleanup operations. Helicopter support traffic and human presence probably would be the most disturbing factors associated with oil-spill-cleanup activity. If their presence forces ducks from a marine area where oil contact is imminent, it may be considered a positive factor. Lesser snow geese nesting on Howe Island, brant nesting colonies along the coast, and both species broodrearing in coastal habitats are likely to be disturbed by summer cleanup activity in nearby areas.

Prompt containment and removal of oil from offshore areas, accompanied by hazing tactics targeting high-use areas, is likely to result in a substantial reduction of sea duck and shorebird mortality from a large oil spill. Cleanup also would decrease the amount of oil available for uptake by bottom-dwelling organisms that are the principal food of sea ducks and shorebirds. This could reduce the potential for oil uptake by these species, and associated adverse physiological side effects.

IV.I.2.f(2)(b) Blowout during Broken-Ice Conditions

Containment and oil recovery following a blowout spill that enters the marine environment under broken-ice conditions at meltout or freezeup is expected to be less effective than for an open-water spill. Although under these conditions the area covered by the spill would be smaller than a spill in open water (3,200 versus 5,700 square kilometers [Tables IV.I-5 and IV.I-8]), some bird species are not expected to occupy broken ice in either period unless areas of open water are available. However, Pacific loons, long-tailed ducks, king eiders, common eiders, and glaucous gulls have been observed in small areas of open water available under these conditions (Dau and Taylor, 2000; USDOI, Fish and Wildlife Service, 2000, unpublished data). Even after spring melting provides areas of open water, most arriving spring migrants likely would occupy overflow areas off river mouths, because those are available earlier and are in the vicinity of nesting areas. The greatest benefits may result from containment and cleanup in such areas. In this season, the hazing effect of cleanup activity or actively hazing birds out of areas that oil is expected to enter may be counterproductive, because there are few alternative habitats that flushed birds can occupy. For sea ducks arriving via overland routes, the benefit of spill containment and cleanup would be minimal until they begin reentering the marine environment following breeding. By this time, the oil would have weathered and is expected to have become a decreasing plumage-fouling hazard. Indirect adverse effects resulting from intake of contaminated prey organisms may be higher under broken-ice than open-water conditions, because reduced cleanup capability would provide a longer interval for exposure and uptake by such organisms. Entrapment of large quantities of oil in coastal marsh and adjacent habitats could present a hazard to departing males following breeding and females with young following nesting as they move to offshore waters. In fall, beyond late September, most sea ducks and other waterfowl and shorebirds are not likely to be present in great numbers, and oil present in broken ice at this time may have weathered and become less of a plumage-fouling hazard. Long-tailed ducks and eiders are at risk until later in the fall than most other species.

Conclusion for Marine and Coastal Birds. A 180,000-barrel oil spill in open water assumed for this analysis is expected to result in the loss of thousands of broodrearing and young waterfowl and shorebirds if they contact stranded oil along a substantial proportion of the affected shoreline. In lagoon habitats, observed high densities of long-tailed ducks suggest that on some occasions, tens of thousands of molting individuals could be contacted by a spill sweeping over thousands of square kilometers, representing a significant loss from the regional population. Likewise, contact of substantial numbers of postbreeding common eiders in the vicinity of barrier islands or Ross' gulls in the vicinity of Point Barrow, August through September could result in significant losses. Recovery is not expected to occur while specific populations are in declining status. A winter spill entering the environment after the ice melts in the spring could contact loons and other migrant waterfowl concentrated in open water near river deltas. Any mortality, or decreased fitness or productivity from indirect effects such as decreased availability of food organisms or physiological effects from oil ingestion would be additive to the losses of oiled individuals.

IV.I.2.g. Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales)

The potential effect of a very large (pipeline) oil spill (180,000 barrels) on young seals, walrus calves, and polar bears would be short term (see discussion of the general effects of oil on these marine mammals in Section IV.C.5). Within 30 days of spill release under broken-ice conditions, about 20% (36,000 barrels) of the oil would contact coastline from about Pitt Point (Land Segment 31) east to about the Canning River Delta (Land Segment 43) (Table IV.I-9c, LA12, 30 days). A portion of the ringed seal-pupping habitat in shorefast ice could at least partially be exposed to oil-spill contamination at the end of the pupping season in June. Prior to that time, most of the oil is expected to be encapsulated in the ice.

After meltout of the oil spill in mid- to late June. The density of 0.81 ringed seals per square kilometer times the area swept by the spill (3,200 square kilometers) equals about 2,590 seals exposed to the spill during spring meltout. This number of ringed seals that would be exposed to the spill represents about 6% of the resident population of 40,000. This exposure could result in the contamination and possible death of ringed seals through inhalation and absorption of toxic hydrocarbons in the oil fouling the seals' fur. This potential loss of ringed seals could take more than one generation (4-5 years) but probably less than two generations for population recovery (about 10 years).

About 67% of the oil spill likely would contact seal and polar bear ice-front habitats offshore from about Cape Halkett east to Mikkelsen Bay (represented by Ice/Sea Segments 3-5 or ERA's 31-33 [Table IV.I-9b, LA10, 30 days]). Several thousand walruses and bearded seals and perhaps up to a maximum of 128 polar bears (assuming a very high bear density of 1 bear per 25 square kilometers and a total surface area of 3,200 square kilometers swept by the discontinuous oil slick from the 180, 000-barrel oil spill) could be exposed to the oil spill (Table IV.I-5). Assuming that all young ringed and bearded seals, and all polar bears exposed to the oil died because of absorption (through the skin), inhalation, and/or ingestion of toxic hydrocarbons in the oil, this loss could take these marine mammal populations more than one to two generations to recover (up to about 15 years). Although some beluga whales might encounter some of the spill during the spring migration and summer, few if any whales are likely to be adversely affected (loss of fewer than 20 whales with population recovery in 1 year).

Conclusion. The effect of a very large oil spill is expected to be fairly long term (1-2 generations, about 15 years) on pinnipeds and polar bears and short term (about 1 year) on beluga whales.

IV.I.2.h. Terrestrial Mammals

The potential effect of a very large pipeline oil spill (180,000 barrels) on caribou, muskoxen, grizzly bears, and arctic foxes is likely to be limited to caribou groups occurring during the spring and during the insect-relief periods in coastal waters near shorelines with extensive oil contamination. Although the oil spill is estimated to contact over 480 kilometers of shoreline and muskoxen, grizzly bears, and arctic foxes frequenting coastal areas from Pitt Point east to about the Canning River Delta, the majority of the coastline contamination would occur between Oliktok Point (Land Segment 36) east to about the Staines River delta (Land Segment 42) (Table IV.I-9c, LA12, 30 days). Caribou groups that belong to the Central Arctic, Teshekpuk Lake Herd, and Porcupine herds are the assemblages of caribou likely to encounter oil while in coastal waters or on the beaches.

Heavily oiled caribou might die from absorption and/or inhalation of toxic hydrocarbons. Several hundred caribou of the Central Arctic, Teshekpuk Lake, and Porcupine herds could die from the oil spill. Small numbers of muskoxen, grizzly bears, and arctic foxes may encounter oil and be adversely affected. Potential losses would represent a short-term effect, with populations recovering within about 1 year.

Conclusion. The effects of a very large oil spill on caribou, muskoxen, grizzly bears, and arctic foxes are expected to be short term (recovery expected within about 1 year).

IV.I.2.i. Vegetation and Wetland Habitats

Coastal wetland from about Pitt Point east to about the Canning River Delta, the majority of the coastline contamination would occur between Oliktok Point (Land Segment 36) east to about the Staines River Delta (Land Segment 42) (Table IV-I-9c, LA12, 30 days). Most of the oiled shorelines would be within and along the coast of Cape Halkett east to Milne Point area (Table IV.I-9c, LA12, 30 days Land Segments 32-37). Coastal saltmarshes located in this area would be the most oiled by the spill.

Cleanup efforts would recover some of the oil. Marshy wetland habitats could be partially rehabilitated by using fertilizers to aid in biological weathering-breakdown of the oil, but recovery would be slow due to cool temperatures in summer and the short growing season. Complete recovery of oiled coastal wetlands probably could take several decades.

IV.I.2.j. Economy

In the event a very large (180,000 barrels) oil spill occurred, it would generate approximately 3,000 cleanup jobs for 1-2 years, declining to zero by the third year following the spill. The 180,000-barrel spill is about two-thirds the size of the 240,000-barrel *Exxon Valdez* oil spill in Prince William Sound. That spill generated 10,000 cleanup-related jobs for one or two seasons that declined to zero by the fourth year following the spill. Two-thirds of 10,000 is approximately 6,500 jobs. However the Beaufort Sea, its shoreline, and current cleanup capabilities on the North Slope are different from the *Exxon Valdez* oil spill in Prince William Sound in 1989. These differences, explained in the following, would reduce the 6,500 figure by more than half, resulting in 3,000 jobs.

A blowout release occurs over an extended period of time, 15 days or more. The volume released is 14,000 barrels a day. Equipment staged on the North Slope has sufficient capacity to contain, control, and recover this amount of oil on a daily basis as required by 18 ACC 430. Personnel also are readily available on the Slope to respond almost immediately (within the first 12 hours) and begin recovery operations. The location of the spill is known. Spill-response equipment, such as exclusion boom and other response supplies, has already been positioned at key locations around the North Slope. Responders would go immediately to those locations and deploy the equipment to protect sensitive environments from contamination.

The *Exxon Valdez* release essentially was an instantaneous release of more than 240,000 barrels of oil into the environment. There was considerable delay before a response was mounted, which allowed the oil to come in contact with the shore more rapidly that it would on the North Slope.

The shoreline along the Beaufort Sea coast is different in important ways from that of Prince William Sound. The Beaufort Sea shoreline is composed primarily of sand and mud, which can readily be removed with heavy equipment, low-pressure washing, or in situ burning. Wiping down rocks along the rocky shorelines and cleaning up the heavily cobbled beaches, which predominate in Prince William Sound, required substantial labor. On the North Slope, there is a huge industrial infrastructure in place to process and dispose of collected oil and wastes as generated, thereby reducing personnel required for waste management.

A very large oil spill could adversely impact the subsistence lifestyle of the North Slope Borough economy. Because a significant segment of the Borough's economy depends on subsistence resources, a loss of those resources would translate into a substantial decline in noncash household income. Limited job opportunities in the villages of the North Slope Borough make substitution of market activities for nonmarket activities difficult. The exception to this would be jobs in cleanup activities, as previously described. Some residents might find work cleaning up the spilled oil.

Conclusion. In the event a very large (180,000 barrels) oil spill occurred, the subsequent cleanup would generate approximately 3,000 jobs for 1-2 years, declining to zero by the third year following the spill. Disruptions to the harvest of subsistence resources would affect the economic well-being of North Slope Borough residents primarily through the direct loss of subsistence resources. See the next subsection for the effects on subsistence-harvest patterns.

IV.C.2.k. Subsistence-Harvest Patterns

IV.C.2.k(1) Effects of a Blowout Oil Spill

The effects on subsistence resources are provided in the discussions in the previous sections. Oil-spill contact in winter could affect polar bear hunting and sealing. Bird hunting, sealing, whaling, and the ocean netting of fish could be affected by a spill during the open-water season.

Based on conditional probabilities, a very large blowout oil spill could threaten subsistence-harvest patterns, because the oil spill could contact subsistence-resource and harvest areas important to Barrow, Nuiqsut, and Kaktovik. How much oil reaches specific shorelines or other environmental resources is estimated from the conditional probabilities. A very important consideration is that this spill is both very large and of a very long duration.

We estimate how much oil would reach specific shorelines or other environmental resources from the conditional probabilities for a spill from the spill areas LA10 and LA12. For a full discussion of the Oil-Spill-Risk Analysis model and how we derive the oil-spill modeling simulations and supporting tables, see Appendix A. Tables IV.I-9a, IV.I-9b, and IV.I-9c summarize the conditional probabilities that a spill starting at spill areas LA10 and LA12 would contact individual land segments or environmental resources within 1, 3, 10, 30, and 360 days during summer or winter. For spills starting in the summer months (July through September) after 30 days, the general transport of oil from spill areas LA10 and LA12 would be to the west and north. For spills starting in the winter months (October through June) from spill areas LA10 and LA12 and melting out into open water after 360 days, the general transport of oil would be similar to the summer pattern. The Oil-Spill-Risk Analysis probabilities should be considered as the percentage of the total spill contacting a particular environmental resource area rather than how likely that contact would be.

For conditional probabilities, the oil-spill model estimates a 1-3% chance of a very large 180,000-barrel oil spill starting at LA10 contacting important Barrow ERA's 2 (Point Barrow) and 42 (Bowhead Whaling Area) within 30 days during the summer, and a 4-5% chance of contact from LA10 over a 360-day period. Land Segments 25 (Elson Lagoon), 26 (Dease Inlet), 27 (Kurgorak Bay), 28 (Cape Simpson), and 29 (Smith Bay) have a less than 0.5-1% chance of contact from a summer spill originating at LA10 for 30 days and 1-2% chance of contact for 360 days. There is a less than 0.5% chance of a very large oil spill starting at LA12 contacting important Barrow ERA's 2 (Point Barrow) and 42 (Bowhead Whaling Area) within 30 days during the summer, and a 2-3% chance of contact from LA12 over a 360-day period. Land Segments 25 (Elson Lagoon), 26 (Dease Inlet), 27 (Kurgorak Bay), 28 (Cape Simpson), and 29 (Smith Bay) have a less than 0.5-% chance of contact from a summer spill originating at LA12 for 30 days and 1-2% chance of contact for 360 days.

Winter contact percentages for the same environmental resources areas mentioned for the summer spill generally are less. For a 30-day period, they are less than 0.5% starting at LA10, and 2-3% over a 360-day period. The same land segments as listed for the summer spill have a less than 0.5% chance of contact within 30 days, and a 1-2% chance of contact within 360 days. Starting at LA12, for a 30-day period, contact percentages for the same environmental resource areas are less than 0.5%, and 2-3% over a 360-day period. The same land segments have a less than 0.5% chance of contact within 30 days, and a 1-3% chance of contact within 360 days.

The oil-spill model estimates a 1-23% chance of a very large spill starting at LA10 contacting important Nuiqsut ERA's 3 (Thetis, Jones, and Spy islands), 4 (Cottle and Return islands), 5 (Reindeer Island), 6 (Cross Island Vicinity), 10 (Tigvariak Island), 12 (Flaxman Island/Brownlow Point), 43 (Cross Island Whaling Area), and 69 (Harrison Bay/Colville Delta) within 30 days during the summer, and a 1-26% chance of contact from LA10 over a 360-day period. Land Segments 35 (Colville River Delta), 36 (Oliktok Point), 37 (Milne Point), and 38 (Kuparuk River) have a 2-7% chance of contact from a summer spill originating at LA10 for 30 days and 3-8% chance of contact for 360 days. There is a less than 1-40% chance of a very large spill starting at LA12 contacting ERA's 3, 4, 5, 6, 10, 12, 43, and 69 within 30 days during the summer, and a 1-41% chance of contact from LA12 over a 360-day period. Land Segments 35, 36, 37, and 38 have a 1-6% chance of contact from a spill originating at LA12 for 30 days and a 3-8% chance of contact for 360 days. Land segments from the Colville River Delta to Bullen Point and Tigvariak Island include areas historically used by Nuiqsut subsistence hunters to harvest caribou, waterfowl, marine fish, polar bears, and small furbearers. This is not an area of high subsistence use at the present time. More recently, hunting appears to take place nearer to the community, and onshore areas of primary importance on the Colville River Delta.

Starting at LA10, winter contact percentages for the same environmental resource areas as mentioned for the summer spill for a 30-day period, range from less than 0.5-3%, and less than 0.5-20% over a 360-day period. The same land segments as for the summer spill have a less than 0.5-1% chance of contact within 30 days, and a 1-6% chance of contact within 360 days. Starting at LA12, for a 30-day period, contact percentages for the same environmental resource areas are less than 0.5%, and 2-3% over a 360-day period. The same land segments have a less than 0.5-1% chance of contact within 30 days and a 2-6% chance of contact within 360 days.

Environmental resource areas for Kaktovik contain crucial harvest areas for caribou, waterfowl, fish, and seals. The oil-spill model estimates a less than 0.5-1% chance of a very large oil spill starting at LA10 contacting important Kaktovik ERA's 12 (Flaxman Island/Brownlow Point), 16 (Jago Spit Area), and 44 (Kaktovik Whaling Area) within 30 days during the summer, and a 1% chance of contact from LA10 over a 360-day period. Land Segments 42 (Point Hopson), 43 (Brownlow Point), 46 (Arey Island/Barter Island), 47 (Kaktovik), 48 (Griffin Point), 49 (Beaufort Lagoon), and 50 (Icy Reef) have a less than 0.5% chance of contact from a summer spill originating at LA10 for 30 days and less than 0.5-1% chance of contact for 360 days. There is a 1-3% chance of a very large oil spill starting at LA12 contacting ERA's 12, 16, and 44 within 30 days during the summer, and a 2-4% chance of contact from LA12 over a 360-day period. Land Segments 42, 43, 46, 47, 48, 49, and 50 have a less than 0.5-3% chance of contact from a summer spill originating at LA12 for 30 days and 1-4% chance of contact for 360 days.

Starting at LA10, winter contact percentages for the same environmental resource areas mentioned for the summer spill for a 30-day period are less than 0.5%, range from less than 0.5-1% over a 360-day period.

The same land segments listed for the summer spill have a less than 0.5% chance of contact within 30 days, and a less than 0.5-1% chance of contact within 360 days. Starting at LA12, for a 30-day period, contact percentages for the same environmental resource areas are less than 0.5%, and less than 0.5-2% over a 360-day period. The same land segments have a less than 0.5% chance of contact within 30 days, and a less than 0.5-2% chance of contact within 360 days.

Because bowheads migrate through the Beaufort Sea during June, biological effects on bowhead whales from the exposure to massive amounts of spilled oil could result in lethal effects to a few individuals, with the population recovering in 1-3 years. By this time, spilled oil will have weathered and would appear in the form of tarballs that are widely dispersed on the sea surface. It is possible, although not very likely, that Barrow, Nuiqsut, and Kaktovik would not be allowed to harvest bowhead whales as the migration moved east through the Beaufort Sea the following fall. It also is possible that while the bowhead whale harvest might not be curtailed, the quota could be reduced for possibly 2 years, resulting in significant effects on the bowhead whale harvests of these three communities, making the bowhead less available for use or undesirable for an extended period.

Lethal biological effects on seals, polar bears, and fishes would result from a very large oil spill. Population changes in abundance and/or distribution of many of these species would require up to one or two generations for recovery to their former status. Bearded seal harvests at Barrow, Nuiqsut, and Kaktovik are not likely to occur at all for the season in which the spill occurred. In following years, harvests would be expected to occur in greatly reduced numbers. Marine and coastal bird harvests by Barrow, Nuiqsut, and Kaktovik could be reduced. Barrow, Nuiqsut, and Kaktovik fish harvests, particularly in river delta areas and along the coast, would be expected to be available but in reduced numbers for 1 year. It also is likely that for all subsistence resources, there could be reluctance to harvest any marine resources because of perceived tainting from oil. Tainting could affect a wider area than the actual area of contact, because seals and whales move among resource areas; an animal oiled in one location potentially could be harvested in another area, even though the harvest location had never been oiled.

IV.I.2.k(2) Effects of Cleanup Activities on Subsistence Resources and Harvests

Disturbance to bowhead whales, seals, polar bears, caribou, fish, and birds potentially could increase from oil-spill-cleanup activities. Offshore, skimmers, workboats, barges, aircraft overflights, and in situ burning during cleanup could cause whales to temporarily alter their swimming direction. Such displacement could cause some animals, including seals in ice-covered or broken-ice conditions, to avoid areas where they are normally harvested or to become more wary and difficult to harvest. Nearshore, workers and boats, and onshore, workers, support vehicles, heavy equipment, and the intentional hazing and capture of animals could disturb coastal resource habitat, displace subsistence species, alter or reduce subsistence hunter access to these species, and alter or extend the normal subsistence hunt.

The MMS requires the operator to provide an oil-spill-contingency plan that includes scenarios for cleaning up oil in open water, solid ice, and broken ice. These scenarios identify logistics, equipment, and tactics for the various cleanup responses. Spill cleanup would reduce the amount of spilled oil in the environment and would tend to mitigate spill effects. In the case of a winter spill, when few important subsistence resources are present, cleanup is likely to be fairly effective in dealing with a spill before migrating whales and other species return to the area during breakup and the open-water season. The response plan would include specific provisions for the communication of information about spill responses to local communities, and would include, as well, the input of community considerations through an Incident Management System. The inclusion of information on community considerations would be described in the Situation Status Summary. Overall, oil-spill-cleanup activities, far from providing mitigation, more likely should be viewed as adding additional impacts to subsistence harvests, potentially causing displacement of subsistence resources and subsistence hunters (see Impact Assessment, Inc., 1998).

Conclusion for Subsistence Resources and Harvest Patterns. Overall effects from a very large oil spill on subsistence-harvest patterns in the areas around the communities of Barrow, Nuiqsut, and Kaktovik would be significant because one or more important subsistence resources could become unavailable. This would result from their displacement; undesirability for use from contamination or perceived tainting;

reduced numbers or their pursuit becoming more difficult because of increased hunter effort; and increased risk or cost for a period of 1-2 years.

Biological effects to subsistence resources might not affect species distributions or populations, but disturbance could extend the subsistence hunt in terms of miles to be covered, making more frequent and longer trips necessary to harvest enough resources in a harvest season. The loss of waterfowl populations to oil spills would cause harvest disruptions that would be significant to subsistence hunters who regard the spring waterfowl hunt to be of primary importance. In the event of a large spill contacting and extensively oiling habitats, the presence of hundreds of humans, boats, and aircraft would increase the displacement of subsistence species and alter or reduce access to subsistence species by subsistence hunters.

IV.I.2.I. Sociocultural Systems

IV.I.2.I(1) Details on How an Oil Spill from a Blowout Might Affect Sociocultural Systems

A very large oil spill would affect sociocultural systems in a number of ways. First, overall effects on subsistence-harvest patterns could be significant, because one or more important subsistence resources could become unavailable, undesirable for use, or available only in greatly reduced numbers for a period of 1-2 years. Any perceived disruption of the bowhead whale harvest from oil spills or from actual or perceived tainting of the meat anywhere during the bowhead inmigration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season, even though whales would not be rendered unavailable. In the event of a large spill contacting and extensively oiling habitats, the presence of hundreds of humans, boats, and aircraft present for oil-spill cleanup activities would increase the displacement of subsistence species and alter or reduce access to subsistence species by subsistence hunters. High effects levels on subsistence-harvest patterns could cause disruptions that could lead to a breakdown of kinship networks and sharing patterns and increased social stress in the community. Participating in the oil-spill cleanup, as local residents did in the *Exxon Valdez* oil spill in 1989, could cause residents to (1) not participate in subsistence activities, (2) have a surplus of cash to spend on material goods as well as drugs and alcohol, and (3) not seek or continue employment in other jobs in the community (as oil-spill-cleanup wages are higher than average). Indications are that the sudden, dramatic increase in income earned from working on cleaning up the *Exxon Valdez* spill and being unable to pursue subsistence harvests because of the spill caused a tremendous amount of social upheaval. This was particularly revealed with increases in depression, violence, and substance abuse (Picou et al., 1992; Cohen, 1993; Picou and Gill, 1993; Fall, 1992; Impact Assessment, Inc., 1990c; Fall and Utermohle, 1995; Human Relations Area Files, Inc., 1994).

A disruption of the kinship networks (i.e., social organization) could lead to a decreased emphasis on the importance of the family, cooperation, and sharing. Multiyear disruptions of subsistence-harvest patterns, especially to the bowhead whale, an important species to the Inupiat culture, could disrupt sharing networks, subsistence-task groups, and crew structures and could cause disruptions of the central Inupiat cultural value: subsistence as a way of life. These disruptions also could cause a breakdown in sharing patterns, family ties, and the community's sense of well-being and could damage sharing linkages with other communities. Other effects might be a decreasing emphasis on subsistence as a livelihood, with an increased emphasis on wage employment, individualism, and entrepreneurism. Effects on the sociocultural system, such as increased drug and alcohol abuse, breakdown in family ties, and a weakening of social well-being, could lead to additional stresses on the health and social services available. Effects on the sociocultural systems described above would be for 1-2 years, with a tendency for additional stress on the sociocultural systems but without tendencies toward displacement of existing institutions.

IV.I.2.I(2) Effects of Cleanup Activities on Sociocultural Systems

If a large oil spill occurred, employment for oil-spill response and cleanup could disrupt subsistence-harvest activities for at least 1-2 harvest seasons and disrupt some institutions and sociocultural systems. Most likely, it would not displace institutions. If a large spill contacted and extensively oiled coastal habitats, the presence of hundreds of humans, boats, and aircraft would displace subsistence species and alter or reduce access to these species by subsistence hunters. Cleanup of a 180,000-barrel spill could generate approximately 3,000 jobs for 1-2 years, declining to zero by the third year following a spill (see Section IV.C.10 - Economy). This dramatic employment increase could have sudden and significant effects, including inflation and displacement of Native residents from their normal subsistence-harvest activities by employing them as spill workers. Cleanup is unlikely to add population to the communities because administrators and workers would live in separate enclaves, but cleanup employment of local Inupiat could alter normal subsistence practices and put stresses on local village infrastructures by drawing local workers away from village service jobs.

Far from providing mitigation, oil-spill-cleanup activities more likely should be viewed as an additional impact, causing displacement of subsistence resources and subsistence hunters and employment disruptions (see Impact Assessment, Inc., 1998).

Conclusion for Sociocultural Systems. The effects of a very large oil spill on sociocultural systems would cause chronic disruption to sociocultural systems for a period of 1-2 years, with a tendency for additional stress on the sociocultural systems but without a tendency toward the displacement of existing institutions.

IV.I.2.m. Archaeological Resources

Offshore archaeological resources would likely not be disturbed by an offshore oil spill or from cleanup activities associated with an offshore oil spill. Following the *Exxon Valdez* spill, the greatest effects came from vandalism because more people knew about the locations of the resources and were present at the sites. Known and previously undiscovered archaeological sites would be vulnerable to vandalism. This type of damage increases with added population and activities during cleanup. Some workers directly disturbed archaeological sites during cleanup. However, effects from the *Exxon Valdez* cleanup were slight because the work plan and techniques changed as needed to protect archaeological and cultural resources (Bittner, 1993). To help protect archaeological sites during oil-spill cleanup, we can use various mitigating measures including avoidance (preferred), consulting on and inspecting the site, onsite monitoring, site mapping, scientifically collecting artifacts, and promoting awareness of cultural resources (Haggarty et al., 1991).

Two studies of the numbers of archaeological sites damaged by the *Exxon Valdez* spill had similar findings. In the first study by Mobley et al. (1990), of 1,000 archaeological sites in the area affected by the *Exxon Valdez* oil spill, about 24 sites (less than 3%) were damaged. In the second study by Wooley and Haggarty (1993), of 609 sites studied, 14 sites (or 2-3%) suffered major effects.

The significance of an archaeological site is more important than numbers of sites disturbed. Disturbing 20 archaeological sites that contain no significant or unique information may not be as harmful as disturbing one very significant site. However, after the *Exxon Valdez* spill, the Advisory Council on Historic Preservation declared all archaeological sites were to be treated as if they were significant and eligible for the *National Register of Historic Places.*

Conclusion. The greatest effects to onshore archaeological sites would be from cleanup activities resulting from accidental oil spills. The most important understanding from past cleanups of large oil spills is that the spilled oil usually did not directly affect archaeological resources (Bittner, 1993). The State University of New York at Binghamton evaluated the extent of petrochemical contamination of archaeological sites as a result of the *Exxon Valdez* oil spill (Dekin, 1993). Researchers concluded that the three main types of damage to archaeological deposits were oiling, vandalism, and erosion, but fewer than 3% of the resources would suffer significant effects. Offshore archaeological resources would most likely not be affected by an oil spill.

IV.I.2.n. Land Use and Coastal Management Programs

The policies that were relevant for Section IV.C remain relevant for this analysis. A spill of this magnitude (greater than or equal to 150,000 barrels of oil) is very unlikely. Policies related to oil spills (NSB CMP

2.4.4 (f) and (g) state that all plans must include requirements for a relief well, identification of support equipment, and specify the estimated time required to commence drilling and completing a relief well. An emergency countermeasure plan must identify steps that will be taken to protect human life and minimize environmental damage in the event of loss of drilling rig, ice override, or loss or disablement of support craft or other transportation systems. The policy also states that all offshore drilling operations and offshore petroleum storage and transportation facilities are required to have an oil-spill control and cleanup plan that must address specifics stated in the policy.

The MMS operating regulations at 30 CFR 250 Subpart B - Exploration and Development and Production Plans and 30 CFR 254 - Oil-Spill Response Requirements for Facilities Located Seaward of the Coastline address these issues and enforcement of these regulations should assure that there is not conflict with these oil-spill policies.

The very unlikely event of a spill of this size and the resulting cleanup activities would have significant effects on one or more subsistence resources and access to those resources. The NSB CMP policies discussed in Section 1V C.14.b(6) relate to impacts that “are likely and cannot be avoided or mitigated” and “development that will likely result in significantly decreased productivity of subsistence resources of their ecosystems.” An oil spill of this size would be accidental and the probability of such an event is very low. Therefore, this is not considered to be a “likely” event that would introduce conflict.

The NSB CMP Best Effort Policy 2.4.5.1(b) states that Access (to subsistence resources) can be restricted when there is no feasible and prudent alternative. This policy may come into play as a result of oil-spill cleanup activity. If it is determined that there are no feasible and prudent alternatives, there would be no conflict with this policy.

Conclusion. Based on the low-probability of a very unlikely event such as this, and on compliance with existing MMS regulations for spill prevention and response, no conflicts are anticipated. For NEPA purposes such an event and its potential impacts must be analyzed, even though it is recognized to be very unlikely. This conclusion recognizes the very unlikely and accidental nature of such an event.

IV.I.2.o. Air Quality

Accidental emissions resulting from an unlikely very large oil spill could affect onshore air quality, but the effects would be low. Typical emissions from outer continental shelf accidents consist of hydrocarbons (volatile organic compounds); only fires associated with blowouts or oil spills produce other pollutants, such as nitrogen oxides, carbon monoxide, sulfur dioxide, and particulate matter. Please see Section IV.C.15.a(2) for a discussion of how an oil spill and oil-spill cleanup activities might affect air quality. Section IX.B.3.m of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a) also contains a more detailed discussion of how a large oil spill might affect air quality; we incorporate that section here by reference. That section discusses evaporation of spilled oil, in situ burning, and the pollutants released by the evaporation and burning. The conclusion drawn there is that the concentrations of criteria pollutants would remain well within Federal air quality standards. Although that section discusses the effects of a very large spill from a tanker, the effects on air quality of a spill from any cause would be essentially the same.

The cleanup of a very large oil spill would require the operation of some equipment, such as boats and vehicles. Emissions from their operation would include nitrogen oxides, carbon monoxide, and sulfur dioxide. If some spilled oil should be burned (in situ burning) as part of a cleanup effort, that burning would release pollutants. Please see the reference from the previous paragraph for more details.

Conclusion. An unlikely very large oil spill could cause an increase in the concentrations of gaseous hydrocarbons (volatile organic compounds) which could affect onshore air quality, but any effects would be temporary. Concentrations of criteria pollutants would likely remain will within Federal air-quality standards. Therefore, the effects would be low.

IV.I.2.p. Environmental Justice

As part of the effort to look at all possible ways to minimize the likelihood of an oil spill, industry, MMS, and the Interagency Working Group have undertaken extensive studies of alternative production pipeline designs to address pipeline safety and oil-spill concerns. Extra-thick-walled pipelines, pipeline burial depths more than twice the maximum 100-year ice-gouging event, and an advanced leak-detection system (LEOS) have been explored to address the prevention of oil spills.

New mitigation being considered by MMS is a seasonal drilling restriction. This measure would provide protection to the bowhead whale and other subsistence resources by eliminating the potential for a blowout during periods of broken ice during the development phase of a project. This measure would be similar to the one required by the State of Alaska for the Northstar Project, which prohibits BPXA from drilling the first development well into targeted hydrocarbon formations during the defined broken-ice periods for the site location; drilling subsequent development wells into previously untested hydrocarbon formations during defined broken-ice periods; and is subject to the imposition of additional restrictions on a case-by-case basis. Adopting this mitigating measure for Sales 186, 195, and 202 would reduce the very low chance of a large blowout type oil spill during the development of the prospect and further reduce the already low chance of a large oil spill.

In terms of oil-spill-response initiatives, the MMS and the North Slope Borough are participants in the North Slope Spill Response Project Team that was established to provide area-wide spill response planning for local communities on the North Slope. The MMS Field Operations has an ongoing outreach effort to provide the North Slope Borough, the Alaska Eskimo Whaling Commission, the Inupiat Community of the Arctic Slope, and local Native villages information on oil-spill planning, response, and cleanup and ongoing spill-response research initiatives. MMS has invited local communities and tribal groups to regularly scheduled industry oil-response drills at Prudhoe Bay. Additionally, MMS held an Alaska Arctic Pipelines Workshop on November 8-9, 1999, in Anchorage to facilitate the exchange of technical information and current research on pipelines in the Arctic between the public, regulators, pipeline designers, and operators. The workshop consisted of presentations and breakout sessions on pipeline design, construction, operations, and maintenance. About 150 people, including North Slope Borough representatives, participated in the workshop.

The MMS supports initiatives to train village oil-spill-response teams as a way of guaranteeing local participation in spill response and cleanup; this effort provides a form of control and allows local Native communities to utilize their Traditional Knowledge about sea ice and the environment in the response process. Within the constraints of Federal, State, and local law, operators and Alaska Clean Seas would be encouraged, through a voluntary affirmative action program, to hire and train residents of the North Slope Borough and the Cities of Barrow, Nuiqsut, and Kaktovik in oil-spill response and cleanup.

The MMS Also is working with the oil industry to develop a comprehensive plan for dealing with subsistence claims, should an oil spill occur. The plan would include what constitutes proof of previous subsistence activities, what information is needed to support a claim, and how subsistence losses would be calculated for restitution. The object would be to develop a subsistence claim process manual that sets out the protocol for a subsistence hunter to follow in filing a claim. At the present time, the U.S. Coast Guard, at the urging of MMS, has started to rework their claim process to be more responsive to Native subsistence practices in Alaska. The MMS requires all operators to provide financial responsibility through bonds as required by the Oil Pollution Act of 1990.

Other suggested mitigation initiatives for impacts on subsistence species from oil spills include potential staging of equipment such as ice-hardened barges and/or an icebreaking vessel at critical locations to support any necessary oil-spill cleanup operations. This initiative would address response-readiness concerns of subsistence users. Also, the staging of boom material and other pertinent response equipment at Barrow, Cross Island, and Kaktovik would provide protection to critical whaling areas and shoreline. These measures could be included in the oil-spill-contingency plan or in the final Condition of Permit approval letter for a production project issued by the Regional Supervisor for Field Operations.

The oil-spill-contingency plan also could include tactics for protecting bowhead whales. Hazing could be used to divert bowhead whales away from a spill, if they happened to be in the area at the time of an oil spill. The MMS acknowledges that present mechanical cleanup technology has not demonstrated cleanup ability in broken-ice conditions. In situ burning is a nonmechanical response method available for spill response and could be quite effective in ice conditions where mechanical cleanup techniques have been rendered problematic. Collectively, these stipulations and other proposed mitigation would aid substantively in mitigating against contamination to onshore habitats and subsistence resources.

Conclusion. Alaska Inupiat Natives, a recognized minority, are the predominant residents of the North Slope Borough, the area potentially most affected by a very large oil spill. Effects on Inupiat Natives could occur because of their reliance on subsistence foods, and cumulative effects may affect subsistence resources and harvest practices. Oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health. The MMS believes that serious mitigation for such impacts begins with a commitment to preventing spills in the first place, by employing the highest standards of exploration, development and production technology.

Potential effects would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the North Slope Borough. If a very large spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives. Any potential effects to subsistence resources and subsistence harvests from a large oil spill are expected to be mitigated to some extent, though not eliminated.

SECTION V

CUMULATIVE EFFECTS

Contents of Section V

V. Cumulative Effects

V.A. INTRODUCTION AND GENERAL CONCLUSIONS

V.A.1. Introduction

To help determine the structure and scope of our cumulative-effects analysis, we were guided by our experience in preparing cumulative effects analyses and by the National Environmental Policy Act (40 CFR 1508.7) and 1508.25(a)(2):

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
>
> To determine the scope of environmental impact statements, agencies shall consider…Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

A handbook issued by the Council on Environmental Quality, *Considering Cumulative Effects Under the National Environmental Policy Act, January 1997*, suggests, among other things, that the analyses "determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present, and future actions…identify significant cumulative effects…" and "…focus on truly meaningful effects." As suggested by this handbook, we consider the following basic types of effects that might occur:

- "additive" (the total loss of animals from more than one incident),
- "countervailing" (adverse effects that are compensated for by beneficial effects), and
- "synergistic" (when the total effect is greater than the sum of the effects taken independently).

The publication *Guidelines for Environmental Impact Assessment in the Arctic* (Finnish Ministry of the Environment, 1997) indicates that a "cumulative impact assessment should be kept at reasonable and manageable levels" and, thus, need not be voluminous and exhaustive.

V.A.2. Structure of the Analysis

Based on a consideration of our experience and these references, we designed our cumulative-effects analysis for this EIS as a 5-step process:

1. We identify the potential effects of the Beaufort Sea multiple sale on the natural resources and human environment that may occur in the Beaufort Sea, on the North Slope, and along the oil-transportation route.
2. We analyze other past, present, and reasonably foreseeable future oil-development activity on the North Slope/Beaufort Sea for effects on the natural resources and human environment that we found were potentially affected by the Beaufort Sea multiple sales.
3. We consider effects from other actions (sport harvest, commercial fishing, subsistence hunting, and loss of overwintering range, etc.) on these same natural resources and human environments.
4. We attempt to quantify effects by estimating the extent of the effects (number of animals and habitat affected) and how long the effects would last (population recovery time).
5. To keep the cumulative-effects analysis useful, manageable, and concentrated on the effects that are meaningful, we weigh more heavily other activities that are more certain and geographically in the Near Zone, and we analyze more intensively those effects that are of greatest concern. We also focus our effort by using, where possible, guiding principles from existing standards (see the following), criteria, and policies that control management of the natural resources of concern. Where existing standards, criteria, and policies are not available, our experts use their best judgment on where and how to focus the analysis.

V.A.3. Guiding Principles of the Analysis

The Endangered Species Act of 1973 and the Beaufort Sea multiple-sale scoping process are appropriate vehicles to identify species that are potentially at risk from incremental cumulative effects from the Beaufort Sea multiple sales. Effects on listed species identified for the Beaufort Sea multiple sales by the National Marine Fisheries Service and the Fish and Wildlife Service under Section 7 of the Endangered Species Act are covered by this cumulative-effects analysis. We also review the effects on each of the other species identified through scoping and include them, as appropriate.

We assess cumulative effects on those species listed as “endangered,” “threatened,” “proposed,” or “candidate” on the North Slope, in the Beaufort Sea, and along the transportation corridor to West Coast ports that the National Marine Fisheries Service and the Fish and Wildlife Service indicate that we should assess. We assess endangered and threatened species in more detail than proposed or candidate species. We assess other cumulative effects on natural resources and the human environment in these same areas but in less detail than listed species, unless we find that they are likely to be “significant cumulative effects” under Council on Environmental Quality guidelines. We also include effects along migration routes of species, as appropriate.

The management of seals by the National Marine Fisheries Service and polar bears by the Fish and Wildlife Service under the Marine Mammal Protection Act of 1972 provides for monitoring these species’ populations and managing/mitigating potential effects of development on these species. For example, the Fish and Wildlife Service implements measures to protect polar bear den sites through a Letter of Authorization under the Marine Mammal Protection Act.

The State of Alaska, Department of Fish and Game, monitors caribou, including the Central Arctic Herd, by a census of caribou calving and caribou distribution on the oil fields. These monitoring efforts provide a means of indicating if significant cumulative effects on caribou have occurred or are occurring on the North Slope and help to develop measures to minimize effects.

We assess cumulative effects to all other species over the range that the species may be affected by activities associated with Beaufort Sea Sales 186, 195, and 202 and also include effects along the migration routes of some species, as appropriate.

Water quality on the North Slope is regulated and/or monitored through various permitting and regulatory programs administered by the Environmental Protection Agency; the Alaska Departments of Natural Resources, Environmental Conservation, and Fish and Game; and the North Slope Borough. These programs have been established to protect against the significant degradation of water quality associated with specific human/development activities. In evaluating the cumulative effects to water quality, we consider the collective impacts associated with permitted/regulated activities in addition to other nonregulated activities and/or naturally occurring events.

Air quality is regulated under the Prevention of Significant Deterioration permitting process. For sources located in the OCS (such as the proposed Beaufort Sea multiple sales), the Prevention of Significant Deterioration program is administered by the Environmental Protection Agency. For sources located in State waters and onshore, the Prevention of Significant Deterioration program is administered by the Alaska Department of Environmental Conservation. Minor sources of air pollutants are not subject to Prevention of Significant Deterioration permitting requirements. The analysis of cumulative effects to air quality in this EIS considers the contribution of major and minor sources of air pollution on the North Slope.

Wetlands are mitigated through the Section 404 Regulatory Program under Section 404 of the Clean Water Act, administered by the U.S. Army Corps of Engineers. In addition, the Administration has a No-Net-Loss goal for wetland functions and values, as stated in the White House Office on Environmental Policy entitled *Protecting America's Wetlands: A Fair, Flexible, and Effective Approach,* dated August 24, 1993. The *Memorandum Of Agreement Between The EPA And The U.S. Army Corps of Engineers Concerning The Determination Of Mitigation Under The Clean Water Action Section 404(B)(1) Guidelines* provides a sequence for mitigation that includes avoiding and minimizing of and compensating for wetland losses. Under the Memorandum of Agreement, it is recognized that in areas such as the North Slope of Alaska (where there is a high proportion of wetlands), minimizing wetland losses will be the primary method of mitigation. However, compensatory mitigation could be required for unavoidable losses to high-use wetlands. Minimizing wetland losses also includes selective use of surrounding wetlands over high-use wetlands, for example, minimizing the impact from the placement of fill material into waters of the U.S. Therefore, potential cumulative impacts to wetland resources are tempered through Federal, State, and local regulatory programs. Including appropriate best management practices and environmental conservation conditions to oil and gas leases and exploratory, development, and production phases substantially lowers the likelihood of collective development actions that result in potential significant impacts to wetlands. We analyze the potential impacts resulting from the placement of fill material and the potential impacts resulting from oil-spill scenarios.

For the human environment (subsistence activities, sociocultural systems, and the economy), we focus our evaluation of cumulative effects associated with oil-development activities on the North Slope local environment, because this is where most significant cumulative effects are expected to be concentrated. We consider effects along the bowhead migration route in the Beaufort and Chukchi seas, because these villages share a subsistence resources base and their survival is based on the abundance of game and hunting success. However, we also give some consideration to effects on the human environment along the transportation route.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and an accompanying Presidential memorandum, require each Federal Agency to make the consideration of environmental justice part of its mission. The existing demographics (race, income) and subsistence consumption of fish and game are discussed, disproportionate environmental and health effects on Alaskan Natives are identified, and mitigating measures and their effects are presented.

Executive Order 13084, *Consultation and Coordination with Indian Tribal Governments*, requires the MMS to consult with Inupiat tribal governments on the North Slope on "Federal matters that significantly or uniquely affect their communities," so that an effective process is established that "permits elected officials and other representatives of Indian tribal governments to provide meaningful and timely input." We have met with local tribal governments to discuss subsistence issues relating to the Beaufort Sea multiple sales and have established a dialogue on environmental justice with these communities. Mitigation in place for the Beaufort Sea multiple sales (measures developed for Beaufort Sea Sale 144) evolved through negotiations with local, Borough, and agency representatives, and Inupiat Traditional

Knowledge had a large part in developing mitigation and in the timing of project activities. Conflict avoidance agreements between the oil industry and Inupiat whalers are an important mechanism for overcoming conflicts.

The cumulative effects on archaeological resources can be minimized through required surveys, consultations with the State Historical Preservation Officer to identify potential archaeological sites, and requirements to plan and schedule activities to avoid these locations. We analyze the potential for disturbances of archaeological resources on the North Slope and in the Beaufort Sea in addition to the potential effects from cleanup of oil spills along the transportation route.

V.A.4. Scope of the Analysis

Oil and gas activities occur on the outer continental shelf in Alaska, the Gulf of Mexico, and California and are cited in the most recent 5-year EIS. In this EIS we evaluate the cumulative effects of transporting Alaskan oil along the U.S. West Coast. To be consistent with the 5-Year OCS Oil and Gas Program, the Beaufort Sea multiple sale cumulative analysis also evaluates the effects for transporting oil through the Trans-Alaska Pipeline System and tankering from Valdez to U.S. West Coast ports. Activities other than those associated with oil and gas also are considered. We also include by reference certain cumulative effects that are more national in scope, for example, global warming and alternative energy development.

Oil and gas activities considered in the analysis include past development and production, present development, reasonably foreseeable future development, and speculative development. Some activities beyond the 15- to 20-year life of the Beaufort Sea multiple sales are considered too speculative at this time to include, while other such activities are included in this analysis. Furthermore, we exclude future actions from the cumulative-effects analysis, if those actions are outside the geographic boundaries or timeframes established for the cumulative-effects analysis. We address uncertainty through monitoring, and note that monitoring is the last step in determining the cumulative effects that ultimately might result from an action.

V.A.5. “Significance”

As directed by the Council on Environmental Quality National Environmental Policy Act regulations (40 CFR 1502.16), we discuss direct and indirect impacts (effects) and their significance on physical, biological, and human social resources. The specific resource topics considered (for example, endangered species or water quality) are those listed here in the introductory paragraph. Our analysis considers the “context” and “intensity” of the impact as mentioned by the Council on Environmental Quality in characterizing “significantly” (40 CFR 1508.27). The context aspect considers the setting of the proposed action, what the affected resource may be, and whether the effect on this resource is local or more regional in extent. The intensity aspect considers the severity of the impact taking into account such factors as whether the impact is beneficial or adverse; the uniqueness of the resource (for example, threatened or endangered species); the cumulative aspects of the impact; and whether Federal, State, or local laws may be violated. When considering cumulative effects, the geographic area and timeframe are extended to include past, present, and reasonably foreseeable activities. Overlapping zones of influence and the incremental contribution of the proposed activity also are evaluated in the cumulative case.

V.A.6. General Conclusions

The MMS would agree with a recent synthesis of oil-field development in the Arctic that includes the nearshore anadromous fish habitat and marine invertebrate Boulder Patch kelp community. This historical assessment to the present concluded that the oil-field ecosystem continues to function much as it did prior to development, constrained primarily by the forces of climate, landscape structure, and nutrient availability and cycling. Development actions locally have changed the distribution and abundance of some food-web and vertebrate components of the ecosystem. Whether the sizes and levels of productivity of regional vertebrate populations have been affected by development remains largely unknown; any potential evidence of such effects have been obscured by the much greater changes caused by natural phenomena (Truett, 2000).

Conclusions about effects on specific resources follow later in this section. Our general conclusions of this cumulative analysis that if the resources that, for analytical purposes, we assumed would be developed are indeed developed:

- Potential cumulative effects on the bowhead whale, subsistence, sociocultural systems, spectacled eider, boulder patch, polar bear, and caribou would be of primary concern and warrant continued close attention and effective mitigation practices.
- The incremental contribution of Sale 186 to the cumulative effects likely would be quite small. Construction and operations related to the Beaufort Sea multiple sales primarily would be concentrated in the Near Zone, and oil output would be a small percentage (approximately 7%) of the total estimated North Slope/Beaufort Sea production.
- Sale 186 would contribute a small percentage of offshore oil spills (about 18%) [0.11 spills out of 0.65 total; the most likely number of spills is zero] to resources in State and Federal waters in the Beaufort Sea. Any subsequent spills are not expected to contact the same resources or to occur before those resources recover from the first spill.
- Potential environmental justice effects would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the North Slope Borough. In the unlikely event a large spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives.

V.A.7. Other Information about Cumulative Effects

We recognize the importance of readily available abiotic standards to determine environmental quality. Abiotic measurements (for example, air and water quality) often provide a good indication of the quality of biological and cultural resources. We also recognize that as we move from the abiotic to the biotic to the human condition, the variables increase, making it more difficult to determine cumulative effects on the quality of life. Similarly, as we move from the terrestrial environment to the offshore environment, the variables of environmental quality increase. Migratory species present additional variables that reflect habitat and species condition outside the primary study areas. Humans introduce even more variables with their mobility and behavioral diversity. Hence, as we progress from abiotic to biotic, or from freshwater to marine, or from terrestrial and marine to sociocultural effects, our analysis, by necessity, becomes more difficult and less conclusive (Figure V-1).

We assessed cumulative effects in this EIS to determine whether these effects were additive or synergistic or had some other relationship. Additive or combined effects on specific resources often are difficult to detect and do not necessarily add up in the numeric sense of 1 plus 1 equals 2. It is much more likely that an additive or combined effect would be greater than 1 but less than 2. A synergistic effect, in theory, is a total effect that is greater than the sum of the additive effects on a resource. To arrive at a synergistic effect in this example, we would need to detect a total cumulative effect greater than 2. In the highly variable arctic environment, where natural variations in population levels can exceed the impacts of human activity, such an effect would need to be much greater than 2 to be measurable or noteworthy.

While synergistic impacts have been demonstrated in the laboratory (for certain types of chemical reactions, for example), there is almost no evidence of such impacts occurring when dealing with biological resources in the arctic environment. We recognize that synergistic impacts could occur, but we found none for the Beaufort Sea multiple sales, the EIS alternatives, or in our assessment of cumulative effects. In effects sections, where synergistic impacts were not specifically enumerated, it was because there were neither studies nor information that led us to specifically identify such impacts.

Concern about the potential for cumulative effects should be weighed with the following information:

- Estimated oil and gas activities likely would have fewer impacts on the environment than those activities conducted in the early years of the region's development. More rigorous environmental standards and more environmentally prudent industry practices now exist, which include smaller facility "footprints," fewer roads, directional drilling from onshore, elimination of most discharges into the water, practices that avoid damage to the tundra, and better working relations with the local residents.
- Current industry practices and the environmental state of the North Slope/Beaufort Sea region frequently are observed and assessed, and much of this information is available to the public. This information and the ongoing dialogue about environmental issues among Federal, State, and local government agencies; Inupiat regional and village corporations; industry; interest groups; and the public should continue to increase environmental awareness and encourage environmentally sound practices that, in turn, should help reduce the potential for environmental damage.
- A key element of the transportation system for development of North Slope/Beaufort Sea oil is the Trans-Alaska Pipeline System pipeline. The pipeline is 800 miles long, stretching from Pump Station 1 at Prudhoe Bay to the Valdez Marine Terminal and, if we choose a corridor width of about 100 feet, it represents an area of about 16 square miles. This pipeline is expected to continue to serve as existing infrastructure for all foreseeable future oil production, eliminating the need for the construction of new oil pipelines other than feeder pipelines.
- Following the *Exxon Valdez* oil spill, substantive improvements have been made in tanker safety to reduce the potential for oil spills from tanker accidents. These include a mandatory phase-in of double-hulled tankers, better navigational systems, and tanker escorts. In addition, oil-spill-response capabilities for tanker-related oil spills in Prince William Sound have been increased substantially through additional equipment, personnel, training, and exercises. These initiatives were developed specifically to reduce the potential for future tanker accidents and to lessen effects, should spills occur.
- If a major oil spill occurred, there likely would be a slowdown in new development during which additional safeguards certainly would be put in place and new ideas of pipeline placement and design would be researched. Just as the additional safeguards resulted from the *Exxon Valdez* oil spill, the likelihood of an additional oil spill from the same causative factors and to the same resources would be reduced. This emphasis on preventing a similar incident further would ensure the full recovery of those resources from the initial spill.
- The actual size and location of future oil and gas developments on the North Slope and in the Beaufort Sea are uncertain. The actual effects on natural resources and the human environment that may result from such developments also are uncertain. Nevertheless, we have developed our best estimate of what those activities and effects might be. However, it is likely that projected actions or effects may not happen in a way that fits neatly into the scenarios we have established for this EIS. Therefore, the MMS established a Beaufort Sea monitoring program focused on the Northstar Project and the Liberty Project area. Data have been gathered for 3 years. The program is establishing a baseline data. This program will provide feedback to decisionmakers who could amend mitigation provisions, if appropriate, at a later date.

In Section V.B, we describe the activities and projects we consider in this analysis. These activities include past development and production, present development, reasonably foreseeable future development, and speculative development. Some activities beyond 20 years are considered too speculative at this time. Activities other than oil and gas activities also are considered. In Section V.C, we present the assumptions used by each resource specialist in the remainder of the analysis in that section.

V.B. ACTIVITIES WE CONSIDERED IN THIS CUMULATIVE-EFFECTS ANALYSIS

Oil and gas development is the main agent of industrial-related change on the North Slope. Oil and gas exploration and production activities have occurred on the Alaska North Slope/Beaufort Sea region for more than 50 years. Past industrial development that occurred in association with this historic production included the creation of an industry support community and airfield at Deadhorse and an interconnected industrial infrastructure that includes roadways, pipelines, production and processing facilities, gravel mines, and docks. In 1977, the Trans-Alaska Pipeline System (TAPS) was developed to transport North Slope crude oil to a year-round marine terminal in Valdez, Alaska, and it continues today and for the foreseeable future to transport the entire production from the North Slope. In November 2002, an EIS was written and the TAPS Right-of-Way was renewed for another 30 years by both State and Federal agencies.

For our analysis, we formulate oil and gas scenarios based on our estimate of future activities. Our scenarios are conceptual views of the future. Underlying the cumulative-effects assessment and the assessment of the Alternative I for Sale 186 and the other alternatives, we offer scenarios on the timing and extent of future petroleum activities in the Beaufort Sea and on the North Slope.

Estimates of anticipated production consider many factors, including the economically recoverable resources of the area, past industry leasing and exploration efforts, and future economic conditions. In the Beaufort Sea, only 7 of 23 scheduled Federal sales were held, and a small fraction (692) of the tracts offered for lease (10,280 tracts in the 7 sales) were leased. Few of the leases actually were tested by drilling (30 wells on 20 prospects). Most discoveries (11 wells determined to be producible) are too small or too costly to become viable fields (one field, Northstar, is producing; one, Liberty, recently suspended further development indefinitely). Under optimum conditions, the chance that commercial fields will be discovered could be 10-20%. However, on the North Slope, the success rate for finding new commercial fields is likely to be lower. Consequently, anticipated production volumes and associated environmental effects often turn out to be overstated. For example, we expected that if the Liberty Project was approved in spring 2002, production would start within a couple of years; however, in January 2002, BPXA chose to put the project on the shelf pending a review of costs. BPXA has indicated they likely will submit a modified development plan, but when and if that will actually occur is unknown.

We focus our analysis on the following:

- Oil and gas discoveries that have a reasonable chance of being developed during the next 15-20-years.
- Exploration and development of additional undiscovered resources (onshore and offshore) that could occur during the next 15-20-years.
- Some exploration and development activities that could occur after the 15-20-years from future State and Federal lease sales.
- Transportation of oil in the Trans-Alaska Pipeline System and tankering of oil to western ports.
- Activities other than oil and gas such as sport and subsistence hunting and fishing, commercial fishing, sport harvest, loss of overwintering range, tourism, and recreational activities.

Table V-1a lists North Slope fields and discoveries. Tables V-lb and V-1c list the current and proposed transportation projects and future lease-sale activities we consider in this cumulative analysis. Figure III.A-1 shows the location of fields and discoveries in Table V-1a and areas of exploration. “Fields” refers to a geologic structure with proven reserves that has been developed and is producing crude oil. Fields can contain numerous reservoir pools produced through a common infrastructure. “Discoveries” refers to a pool with potential reserves that has not been developed. Some discoveries require additional drilling to confirm that oil or gas is commercially recoverable. Poor test results in some “discoveries” may be referred to simply as shows. The development timing of resources listed as prospects or shows is speculative and could occur after more than 20 years.

For purposes of this cumulative analysis, we divide oil and gas discoveries into the following categories:

- **Past Development/Production:** 31 fields and satellites, with Endicott, Sag Delta, Sag Delta North, Point McIntyre, Niakuk, Eider, and Northstar located offshore.
- **Present Development/Production:** 3 discoveries that are expected to start up within the next few years, all of which are onshore.
- **Reasonably Foreseeable Future Development:** 16 discoveries that might see some development-related activities (site surveys, permitting, appraisal drilling, or construction) within the next 15-20 years, with Liberty, Kalubik, Gwydyr Bay, Sandpiper, Flaxman Island, Kuvlum, Thetis Island, Stinson, and Hammerhead located offshore. Additional onshore resources (estimated 2.30 billion barrels) and offshore resources (estimated 1.38 billion barrels) currently are undiscovered.

- **Speculative Development:** Additional new discoveries could be made and developed beyond 20 years, with 13 past onshore discoveries. The chance for development is too uncertain for detailed analysis at this time. Additional exploration activities (wells and seismic surveys) are likely to occur and have been factored into the analysis.

We focus on the first three categories and consider exploration activities of the fourth category. We recognize that oil companies may produce oil from pools in the speculative development category. However, there is no way to know this with any degree of certainty, because insufficient information exists to estimate the development activities associated with undiscovered pools. Some discoveries date back to 1946 without subsequent development. It is possible that oil companies also would not develop some prospects in the reasonably foreseeable category within the 15-20-year timeframe. We estimate a total resource amount for the speculative category from industry and government reports. Onshore and offshore undiscovered resource estimates are based on MMS's 1995 National Assessment minus discoveries included as possible outer continental shelf projects (Table V-7d).

V.B.1. Past Development/Production

This category includes producing fields on the North Slope and nearshore areas of the Beaufort Sea. Infrastructure, cumulative production, and remaining reserves are well defined. Individual oil pools can be developed together as fields that share common wells, production pads, and pipelines. Fields can be grouped into production units with common infrastructure, such as processing facilities. Impacts associated with development have occurred over the past three decades, and there are data from monitoring that accurately reflect some of the long-term effects.

This category contains 31 discoveries, all of which are now producing oil (see numbers 1 through 31 in Table V-1a). Table V-2 lists production and reserve data, and Table V-3 lists infrastructure and facilities for these producing fields. All these fields except Northstar, Endicott, Sag Delta North, and Eider are onshore on State leases. Endicott is an offshore State field that began production in 1987 and, through 1996, had produced 330 million barrels of oil. The Niakuk, Point McIntyre, and Badami oil fields are located mainly offshore but are produced from onshore sites. Badami is of particular interest, because the proposed Liberty Project pipeline and Point Thomson proposed pipeline would tie into Badami's common-carrier pipeline. Northstar began producing on October 31, 2001.

During 1996, ARCO announced that the Alpine Prospect locate in the Colville River Delta, was producible and contained an estimated 365 million barrels of oil. More recent estimates of Alpine are over 429 million barrels. It is the largest onshore discover in the United States in more than a decade. Alpine came on line in November 2000 and produces approximately 80,000 barrels of oil per day. Oil is transported via a 34-mile pipeline to the Kuparuk oil field facility. Ice roads and bridges support activities in the winter. There are no gravel roads connecting the Kuparuk infrastructure to Alpine.

The Meltwater discovery is estimated to contain about 50 million barrels of oil. The West Sak field began production in 1997 and Tarn and Tabasco fields began production in 1998. The Meltwater discovery about 10 miles south of Tarn, marks the further extension south for the Kuparuk infrastructure. Palm, an extension of the Kuparuk formation has about 35 million barrels of recoverable oil. BP recently began production at the Northstar Unit. They estimate that Northstar will produce 145 million barrels of oil over a 15-year period. BP has also started production at Aurora and Borealis, two of five Prudhoe Bay satellite fields.

V.B.2. Present Development/Production (Within the Next Few Years)

This category includes fields that are in planning stages for development but that have not begun production. Infrastructure components, scheduling, and reserve estimates are fairly well defined, although reserve volumes could be revised later. Commonly, new planned developments will be tied into existing infrastructure, and they depend on the continued operation of this infrastructure.

This category contains three discoveries: CD North (Fjord), CD South (Nanuk/Nanuq), and Orion (NW Eileen) (Table V-1a). Table V-4 lists reserve estimates, and Table V-5 lists the infrastructure the oil companies propose for these discoveries. All are onshore on State leases. Recent discoveries near the Alpine formation include CD South (Nunuq) is estimated to contain about 40 million barrels of oil. CD North (Fjord), also an Alpine satellite, is estimated to contain about 50 million barrels of oil.

V.B.3. Reasonably Foreseeable Future Development/Production (Within the Next 15-20 Years)

The MMS developed the information about reasonably foreseeable future development and production and considers it the best available information. This category includes activities that are reasonably foreseeable within the next 15-20 years. It is reasonable to expect that these activities would begin with the development of discoveries in close proximity to existing (past and present) fields to share infrastructure. We have attempted to rank the chance of development according to resource size and proximity to existing infrastructure. Resource volumes are uncertain in this category. There generally are inadequate drilling data to define reserves or engineering studies to support development. Also, we cannot predict the development timing for future fields. Many of these discoveries were made decades ago and remain noncommercial today. Without technology advancements and higher petroleum prices, many of these discoveries could remain undeveloped.

While the list of reasonably foreseeable future developments includes only discoveries, there could be significant amounts of oil produced by enhanced oil recovery from existing fields in addition to from undiscovered satellite pools close to infrastructure areas. Enhanced recovery adds additional production from known reservoirs, creating “reserve growth.” For example, the Prudhoe Bay field was originally estimated to hold 9.6 billion barrels of reserves, and now it has reserves approaching 13 billion barrels. More than 3 billion barrels were added by using enhanced recovery technologies. In addition, industry has indicated that they have a large number of prospects very close to existing infrastructure that may become future satellite pools. Although both of these new resources (reserve growth and satellites) are as yet undiscovered, it is reasonable to assume that a significant portion would be brought into production in the next 20 years or sooner. For purposes of analysis, we assume that half of the total (4 billion barrels) estimate for enhanced recovery and satellite fields (or 2 billion barrels) would be brought into production in the foreseeable future. Because satellite fields largely would be developed from existing infrastructure, the incremental addition of new infrastructure is minor.

This category includes 16 discoveries that oil companies may begin to develop in the next 15-20 years (see numbers 35 through 50 in Table V-1a). Table V-6a lists the resource estimates. Offshore discoveries in this category are Liberty, Sandpiper, Flaxman Island, Kuvlum, Hammerhead, Thetis Island, and Stinson. Gwydyr Bay and Kalubik are offshore discoveries that are likely to be developed from onshore sites. Onshore discoveries include Sourdough, Mikkelsen, Yukon Gold, Point Thomson, Pete’s Wicked, and Sikulik (near the existing Barrow gas fields). Sandpiper, Hammerhead, and Kuvlum are on offshore Federal leases; all others are on State leases or North Slope Borough lands. Spark/Rendezvous is a recent discovery in northeastern National Petroleum Reserve-Alaska. Appraisal-well drilling has taken place over two winter seasons since its discovery in 2000; however, reserve estimates and a timetable for development have not been announced by the operator (Phillips Alaska, Inc.). The discussion of reasonably foreseeable future development/production will include the effects of production decline from existing fields, the current proposals for new development, and estimates of potential development associated with recent and proposed lease sales.

Tables V-6a and V-6b indicate the possible development infrastructure, should these discoveries be commercially developed. Oil from the Kalubik and other small accumulations in the Colville Delta could feed into the Alpine pipeline system, should they be developed. Development of the Spark/Rendezvous discovery also could use the Alpine infrastructure. Oil produced from the Gwydyr Bay, Pete’s Wicked, and Sandpiper discoveries could be transported through the Northstar pipeline, while the Badami field trunk pipeline would provide transport for other discoveries in the eastern North Slope listed in Table V-6a. An indication of the infrastructure that may be required if these discoveries are developed is listed in Table V-6b. Outlined on Figure III.A-1 are the geographic boundaries of the Alpine, Northstar, and Badami fields and the discoveries these fields may service.

It is important to recognize the distinction between exploration/development activities and production. The discussion of exploration/development activities is related primarily to disturbance effects, whereas the estimated production volumes relate directly to oil-spill risk. We have attempted to rank the chance for commercial development of these discoveries from highest to lowest (Table V-1a). The ranking also could be viewed as an approximate timetable for production startup. Discoveries near the top of the list are expected to begin production sooner and are more likely to be produced. Discoveries near the bottom of the list are expected to start production much later, and most of their oil production may occur after 20 years.

V.B.4. Speculative Development (After 20 Years)

This category includes small discoveries and undiscovered resources that are very unlikely to be developed in the timeframe of less than 20 years. Some of the discoveries listed in Table V-1a were made 50 years ago and remain noncommercial today. There are a variety of reasons, including very remote locations, low production rates, and lack of gas-transportation systems that will remain in effect in the foreseeable future. With respect to undiscovered resources, it is not reasonable to estimate new infrastructure or predict the effects of development for prospects that have not been located or leased to industry for exploration. Accurate predictions of the location, size, or development schedule are not possible at this time.

Various government and industry groups publish resource estimates that often vary widely for a given area. However, these groups use very different methodologies and reporting criteria. It is difficult to discern how these speculative undiscovered resource estimates would translate in future infrastructure and effects. The resources listed in Table V-7d fall beyond the definition of reasonably foreseeable.

With respect to the offshore resource estimates, the leasing history for the Beaufort Sea suggests that the majority of production is likely to occur before most offshore projects. Any new development or additional oil production is likely to occur in nearshore areas adjacent to existing infrastructure. Development of additional offshore resources in deeper waters of the Beaufort Sea will be largely dependent upon the more nearshore exploration and development success.

Speculative resources include both discovered (uneconomic) and undiscovered (speculative) resources that may be developed after more than 20 years (Tables V-7c and 7d). Future development depends on favorable economic conditions. This category also includes undiscovered oil resources expected to be developed as a result from future State and Federal lease sales (Table V-1c). Table V-7c lists speculative production from three sources: (1) enhanced recovery and satellite onshore accumulations near existing onshore infrastructure (50% of the 4.0-billion barrels total); (2) another 0.3 and 0.37 billion barrels and assumed to be discovered and developed in the northeast and northwest National Petroleum Reserve-Alaska; and (3) a portion of the undiscovered resource base for offshore. Because these resources are undiscovered, no specific location or potential field size can be provided. Although the individual resource volumes are not known, this category also includes 13 discoveries that may be developed after 20 years (see numbers 51 through 63 in Table V-1a). All these discoveries are located onshore.

Development of gas resources on the North Slope is included in the speculative category, because gas has been uneconomic to produce for several decades and may continue to be uneconomic in the future. The largest gas accumulation on the North Slope is in the Prudhoe Bay field (46 trillion cubic feet originally in-place, approximately 25 trillion cubic feet available now for sale). Various plans have been studied to bring North Slope gas to market, but no plan has overcome the high project cost and marketing hurdles. Because known gas resources are uneconomic today, it is difficult to predict the timing or scale of future gas production projects. According to general consensus, gas sales from Prudhoe Bay could start as early as 2010. However, ample supplies exist in the Prudhoe Bay field to supply a large-scale gas export project for at least 20 years. The surrounding oil fields also have available gas resources that could feed into the North Slope gas transportation system. It is very unlikely that development of remote, undiscovered, and higher cost gas resources would occur while there are adequate supplies of known, readily available reserves. The existing North Slope oil infrastructure is capable of handling large amounts of natural gas (38.7 trillion cubic feet have been cycled through its facilities through 1999).

These four development categories represent all known oil and gas sources that potentially could be developed on the North Slope and Beaufort Sea. The analysts preparing this EIS focus on the first three oil and gas development categories and consider the fourth category (speculative) with respect to seismic and associated exploration activities associated with future State and Federal lease sales. Other activities and issues could be analyzed as they apply to particular resource topics. These areas of additional evaluation may include cumulative effects from activities related to development in migratory overwintering ranges, environmental contamination, subsistence harvest, sport harvest, commercial fishing, marine shipping, tourism, and recreational activities.

V.B.5. Oil Production on the North Slope of Alaska

V.B.5.a. Production Through 2000

Since the first production well was drilled on the Prudhoe Bay structure, North Slope developments produced 13.306 billion barrels of oil by the end of 2000 (Table V-7a). Production on the North Slope peaked in 1988 at 2.0 million barrels of oil per day, declining to its current rate of 0.95 million barrels per day. Of the producing fields on the North Slope, the most productive, in order, are Prudhoe Bay, Kuparuk River, Point McIntyre, and Endicott. Figure III.A-1 shows producing fields and potential development areas within the North Slope.

V.B.5.b. Resource Estimates We Used for This Cumulative-Effects Analysis

Tables V-7b and V-7c show the reserve and resource estimates we use for analyzing cumulative effects. We estimate a low range of 6 billion barrels, a mid-range of 11 billion barrels, and a high range of 15 billion barrels of oil reserves and resources that may be produced on the onshore North Slope and in the Beaufort Sea.

V.B.5.b(1) The Low Range-Past and Present Production

The low end of the range for this cumulative analysis is 6 billion barrels (rounded), which includes past and present production (Tables V-7b and V-7c). This includes reserves (5.284 billion barrels) in currently producing fields (Table V-2) and resources (0.305 billion barrels) in discoveries in the planning or development stage (Table V-4). Sale 186 represents approximately 7.0% by reserve volume of the past and present production volumes (Table V-7b).

V.B.5.b(2) The Midrange - Past, Present, and Reasonably Foreseeable Future Production

The midrange for the cumulative analysis is 11 billion barrels (rounded), which includes past, present, and reasonably foreseeable future production. This includes the 6 billion barrels (rounded) from the low range (discussed above) plus discoveries that may be developed in the next 20 years. Reasonably foreseeable future production (5.62 billion barrels) consists of discoveries totaling 0.500 billion barrels onshore and 1.070 billion barrels offshore (Table V-7c). In addition, undiscovered onshore resources of 2.670 billion barrels in satellite accumulations and new fields in the National Petroleum Reserve-Alaska, plus 1.38 billion barrels from tracts expected to be leased on the outer continental shelf (Tables V-7b and 7c). Sale 186 Project represents about 4% by reserve volume of the past, present, and reasonably foreseeable future production (Table V-7b).

V.B.5.b(3) The High Range - Past, Present, Reasonably Foreseeable Future, and Speculative Production

The high range for the cumulative analysis is 15 billion barrels (rounded), which includes existing, planned, possible, and speculative production. This includes 11 billion barrels from the mid-range (discussed above) plus speculative future production (3.59 billion barrels), which includes undiscovered resources that may be developed after 20 years. Speculative production includes an estimated 2.300 billion barrels in currently undiscovered onshore resources in satellite fields and enhanced oil recovery (2.000 billion barrels), plus the remaining half of the leased and undiscovered volume in the northeast and northwest National Petroleum Reserve in Alaska (0.300 and 0.370 billion barrels respectfully) (Table V-7c). It also includes an estimated 0.92 billion barrels of undiscovered offshore resources that could be developed as a result of future Federal lease sales. Sale 186 represents about 3% by reserve volume to the total of past, present, reasonably foreseeable future, and speculative production (Table V-7b).

V.B.6. State Lease Sales We Consider in This Cumulative-Effects Analysis

Since December 1959, the State has held 32 oil and gas lease sales involving North Slope and Beaufort Sea leases. More than 4.6 million acres have been leased; some of the areas have been leased more than once, because some leases had expired or were relinquished. Historically, only about half of the tracts offered in State oil and gas lease sales have been leased. Of the leased tracts, about 10% actually have been drilled, and about 5% have been developed commercially. About 78% of the leased areas are onshore, and about 22% are offshore. From the early 1960’s through 1997, 401 exploration wells were drilled in State onshore and offshore areas. During this period, the number of exploration wells drilled annually has ranged from 2-35. From 1990 through 1998, the number of exploration wells drilled annually has ranged from about 7-12; the average number is about 10. Fifty-three of the exploration wells have resulted in discoveries—a success ratio of about 5%.

The State develops and approves an oil and gas leasing plan for a 10-year period, reassesses the plan, and publishes a schedule every other year. Except Northstar, all of the North Slope and Beaufort Sea’s commercially producible crude oil is on 931 active State leases (as of December 2000): 1.35 million acres onshore along the Slope, 498,000 acres offshore in the Beaufort Sea, and 456,000 acres of active leases that straddle on and offshore acreage. All production to date is from State leases and totals 13.306 billion barrels (Table V-7a). The latest State lease sales, North Slope Area Wide and Beaufort Sea Areawide, were held in November 2002. Between 2001 and 2005, the State is expected to hold the following annual areawide lease sales:

- Beaufort Sea sales extending from Barrow to the Canadian border;
- onshore sales on the Arctic Slope, including unleased State lands between the Arctic National Wildlife Refuge and the National Petroleum Reserve-Alaska; and
- Foothills sale extending into the foothills of the Brooks Range.

The State has not estimated oil and gas resources for these future lease sales (see Table V-1c). As indicated above, we estimate 4.0 billion barrels in undiscovered resources on the North Slope. These include both leased and unleased State properties. Most are expected to be producible only as satellites through future field infrastructure.

V.B.7. Federal Lease Sales We consider in This Cumulative-Effects Analysis

We consider Federal OCS and northeast National Petroleum Reserve in Alaska lease sales in this analysis. Although no significant production has yet occurred from the Federal OCS off Alaska, possible future production from Sale 186 is estimated at 460 million barrels. As indicated, we also estimate speculative future production from the OCS of 3.42 billion barrels of currently undiscovered resources, from the base case of the MMS's 1995 National Assessment of the Beaufort Sea less production from "possible outer continental shelf projects"(Tables V-7b and V-7c). We estimate speculative future production from leases on the northeast National Petroleum Reserve in Alaska would be 0.50 billion barrels.

Since December 1979, the U.S. Department of the Interior has held seven lease sales in Federal waters of the Beaufort Sea. The latest, Sale 170, was held in August 1998. Overall, 660 leases have been issued in the Beaufort Sea totaling 2.8 million acres. About 30 wells have been drilled on these Federal leases, with 9 wells determined to be producible. All wells have been plugged and abandoned, however, because field economics have not favored production. There also are 42 active leases on Federal submerged lands in the Beaufort Sea; the Kuvlum and Hammerhead, which are potentially producible units although they are not currently leased (Figure III.A-1); there are no estimates of available resources. The Northstar Unit contains two Federal tracts. These tracts contain 20-25% of Northstar's estimated 158 million barrels of oil reserves.

Existing outer continental shelf leases in the Beaufort Sea are estimated to contain 220-550 million barrels of oil. The lower number represents potential development at $18/barrel. The higher number assumes a price of $30 per barrel, at which industry is likely to develop discovered but noncommercial fields such as Kuvlum, which is no longer active. Tracts available for lease in Sale 170 but not yet explored may contain 210-450 million barrels of oil.

The Bureau of Land Management held its most recent lease sale in the northeastern part of the National Petroleum Reserve-Alaska in June 2002. Overall, 60 tracts received bids with high bonus bids totaling $63.8 million. Assuming multiple sales, a speculative estimate of Northeast NRP-A production ranges from 130-600 million barrels of oil. Phillips has drilled 10 wells with announced discoveries of gas, oil, and condensate in five of six wells. Four wells, Lookout #2, Mitre, Hunter A, and Altamuna #2, are being drilled this winter.

V.B.8. Classified Drilling

In addition to the discoveries mentioned above, a number of wells have been drilled that are "classified" (or in field jargon, "tight holes"). If a well is termed classified, no information is released to the public. Presumably, some of these may include discoveries that may be developed in the future; however, without data, no useful estimate of their contribution to cumulative effects can be made.

V.B.9. Infrastructure and Transportation

Given the decline of resources in the fields surrounding Prudhoe Bay, the infrastructure and transportation system (including the Trans-Alaska Pipeline System pipeline) should be able to process and transport any oil that Sale 186 and other small projects produce. New fields would use infrastructure at the edge of the core area. These can be envisioned as the western sector or Alpine Group, which would accommodate the National Petroleum Reserve-Alaska; the central or Northstar Group; and the eastern sector or Badami Group (Figure III.A-1; Tables V-6a and V-6b).

The Trans-Alaska Pipeline System terminal at Valdez presently handles about 999,202 barrels of crude daily. At peak production, Sale 186 would produce about 19 million barrels of crude oil annually. The daily production rate from Sale 186 would be approximately 5% of the throughput the pipeline system now handles. If we estimate future production on the North Slope (including offshore) at the high end of projections, oil tankers still could be moving this daily amount of oil (about 1.0 million barrels) from Valdez in 2009.

V.B.9.a. Tanker Traffic and Routes

Potential crude oil (and possibly liquefied natural gas tankerage from Valdez) to the Far East will join existing liquefied natural gas tanker traffic from the liquefied natural gas plant in Nikiski, Alaska. Every

10 days, the Nikiski plant loads a tanker with 80,000-cubic meters of liquefied natural gas for a round trip to Tokyo, which it has been doing since 1968 without significant spillage. Because liquefied gas would boil off and disperse quickly when exposed to normal air temperatures and winds in the North Pacific, it is not a major environmental threat along the tanker route.

On November 28, 1995, President Clinton signed legislation (30 U.S.C. 185(s)) that authorizes exporting crude oil from Alaska's North Slope in U.S. flag tankers, unless the President finds exports are not in the national interest. Figure V-3 shows the probable route that tankers bound from Valdez to the Far East would travel. They could carry up to 1.8 million barrels each; however, such estimates are highly speculative, because they depend on opportunities for short-term contracts. The routing shown in Figure V-3 would bring the tankers more than 200 miles offshore of the Aleutian Islands—a distance that should protect the biological resources of the Aleutian Chain from pollution.

V.B.9.b. Trans-Alaska Gas-Transportation System

If the price per barrel of crude oil remains between $20 and $30, building a gas-transportation system may be viable. A variety of proposed systems could be designed to deliver natural gas from the North Slope at up to 2.3 billion cubic feet per day to a liquefaction plant in Valdez. The natural gas would be moved through a 42-inch pipeline built next to the Trans-Alaska Pipeline. The proposed project would consist of a plant to liquefy about 2 billion cubic feet of natural gas per day, four tanks to store 3,200,000 barrels of liquefied natural gas, a marine loading area, and a dock for loading cargo and personnel. The liquefied natural gas plant most likely would be in Anderson Bay, 3 miles east of the Valdez narrows on the south shore of Port Valdez (other options are being considered). The site is 3.5 miles west of the existing Trans-Alaska Pipeline System terminal and 5.5 miles from Valdez. When completed, it would occupy 390 acres of a 2,630-acre site owned by the State. A fleet of 15 liquefied natural gas tankers is anticipated would be available to carry 125,000 cubic meters of liquefied gas per trip to destinations in Japan, Taiwan, and Korea. Full development would require 275 liquefied natural gas tanker loadings a year (Federal Energy Regulatory Committee, 1995). A final EIS was issued for the plant in March 1995, but no agreements exist with the resource holders.

In the past year, industry has been studying a Trans-Alaska Gas System including proposals for the following: (a) over the northern part of Alaska and down the Mackenzie River through Canada and (b) follow the Haul Road south to Delta Junction and then through Canada. Although not as cost effective, the State Legislature and Congress both passed legislation requiring the gas pipeline to follow the Haul Road through Alaska to create jobs and provide gas to Alaskan communities along with way.

Please see Table V-1b for more information on the Trans-Alaska Gas System and other projects that could move gas from the North Slope to market. However, given the uncertainty associated with construction of such a transportation system in the foreseeable future, its potential effects are not included in this cumulative analysis.

V.B.9.c. Transportation for "Roadless" Development

Ongoing and planned oil-development projects such as Badami, Liberty, Alpine, and Northstar would not have permanent gravel roads connecting to Prudhoe Bay. Transportation to these fields would be by aircraft and marine vessels; in winter, temporary ice roads also would be used (Table V-8).

V.B.10. Water and Gravel Resources

V.B.10.a. Water Resources

The Arctic Coastal Plain is the predominant feature of the North Slope. It is a mosaic of tundra wetlands with extremely low relief and poor drainage and numerous shallow lakes, ponds, marshes, and slow-moving streams. Shallow permafrost is evidenced by polygonal-patterned ground formed by ice wedges that freeze within contraction cracks in the soil. Permafrost prevents water from entering the ground, and the low relief limits runoff. The coastal plain extends south approximately 30 miles into the coastal lowlands, which are dominated by tundra vegetation, meandering streams, and thousands of shallow thaw lakes.

Approximately 26% of the coastal plain is covered by waterbodies (USDOI, Bureau of Land Management, 1979). The onset of snowmelt and subsequent runoff begins earlier in the foothills and moves north as summer progresses. Snowmelt is a dominant factor, because it contributes the majority of the annual runoff and helps maintain a saturated layer of surface soils. Stream flow generally is nonexistent in the winter. It begins in late May or early June as a rapid flood event or “breakup” that, combined with ice and snow damming, can inundate extremely large areas in a matter of days. More than half of the annual discharge from a stream can occur during a period of several days to a few weeks (Sloan, 1987).

On the North Slope, the industry uses in the neighborhood of 1 billion gallons of water annually (Fay, 2001, pers. commun.). Freshwater is used for construction maintenance, on-tundra roads, and to provide a freshwater cap for the established sea-ice road. For example, a tundra ice road 50 feet wide, 6 inches in total thickness, and 6 miles long would require about 4.3 million gallons of water (Table V-9a).

There are numerous permitted water sources that may be used for ice-road construction and other water needs. These sources include existing and abandoned mine sites. Available permitted lakes range in size from approximately 0.1-0.5 square miles in surface area. The 120 million gallons of water would equal 368 acre-feet of surface (1.0 acre-foot = 326,000 gallons). This volume represents a water drawdown of 12 inches from a 368-acre lake or two smaller, 184-acre lakes. Two larger lakes, four smaller lakes, or some combination would accommodate a drawdown of 6 inches. The permitted lakes are available throughout the area and ideally located to minimize travel for construction and maintenance purposes (Maps 14a and 14b).

Water requirements for other onshore exploration and development during the seasonal construction phase have been estimated at about 37 acre-feet for each field, which would require water from an additional 12 acres of lake per field (U.S. Army Corps of Engineers, 1999).

Water volumes for tundra-ice roads are shown in Table V-9a. Total road thickness is about 6 inches, of which two-thirds of the thickness is freshwater and one-third is snow. Water volumes for sea-ice-roads consist primarily of saltwater. The sea-ice brine is capped with a 6-inch layer of freshwater for stability (Table V-9b). Ice roads have not been mapped from past activities. Effects have been described as “green trails,” which may last for one to two seasons. Pressure from the weight of the snow and ice can cause some compression and breaking off of the older tundra vegetation and result in a spring burst or “greening” from the freed-up younger portions of the plant. The short duration of this visual effect has not been recorded, and past “green trails” are no longer visible. Projecting the need for ice roads for reasonably foreseeable projects is difficult at best. Many of these new developments will be developed as roadless sites.

Climatic change in terms of global warming should not be measurable, as any trends in global warming are on a greater scale than 10-15 years and would not be measurable in this shorter timeframe. If ice roads were to experience a shorter season of supportive cold temperature, the operations would be suspended accordingly or supported by helicopter similar to the roadless development sites.

The State of Alaska, Department of Fish and Game has long understood the importance of the overwintering habitat for freshwater fishes and the limitations of this habitat with an extensive ice cover and limited availability of dissolved oxygen for the duration of the extended winter seasons on the North

Slope. Lakes have been cataloged, and studies are continuing on inventorying and investigating lakes that also can accommodate industrial use. When permitting a lake for industrial use, conditions of the permit take into account draw down in relation to overwintering along with other criteria. If the waterbody is fish bearing, the Department of Fish and Game imposes a restriction: "no more than 15% of the total volume of water source may be withdrawn." Ice is excluded from the total volume calculation; therefore, the "15%" is of the available unfrozen water.

Temporary water-use permits are granted for a period of 1 day to 5 years. This usually covers the period of an exploration activity. There is, of course, no permanent designation for a freshwater source, because the environment is somewhat in a flux that could change the conditions of a permit. For its Trailblazer Project in the Petroleum Reserve, BPXA used 84.5 million gallons of water for ice-road and pad construction through April 2001 (Chambers, 2002). For the 1999-2000 and 2000-2001 drilling seasons, Phillips used 51 and 57 million gallons of water, respectively, from permitted sources in constructing roads and drill pads in the Petroleum Reserve. For more long-term needs, such as a production site, a lessee can file for water rights to a specific waterbody, such as the Duck Island mine site. These permitted waters presently are being used only for ice-road construction and, at this time, no other use is anticipated. The Duck Island mine site is expected to provide considerable freshwater, but other small lakes in the area could be permitted if needed. While the Sagavanirktok River would be an additional source of freshwater, the seasonal change in available water and concern for overwintering fish habitat would limit the availability of this resource.

Most of these resources have not been permitted for industrial use. Only those waterbodies in proximity of a construction or production site have been permitted. Most of those permitted sites are not used after the completion of a construction project, which can take from a few months to 1 or 2 years. None of these permitted sites have shown impacts, as the spring snowmelt and flooding restores the condition of these sites each year. There are no associated impacts from past and present activities to freshwater lakes and rivers, and none are projected with the current permitting process to occur in the foreseeable future. As development proceeds to the east and west of the current development sites, additional water resources will be assessed on a project-specific basis. Some construction activities, such as gravel mining, have created new water resources and associated habitat for biota, which has enhanced the diversity and productivity of these areas. Any new agreements or policies from the State Department of Natural Resources will encourage users to coordinate water withdrawals and gravel-extraction with the purpose of using gravel extraction sites as water reservoirs (State of Alaska, Department of Natural Resources, 2000).

Biotic communities present within the permitted freshwater lake systems are not expected to be adversely affected with these fluctuations in water level, as the natural environment and the dynamics of seasonal flux are more rigorous conditions that the biota has accommodated (see SectionV.C.7 Vegetation and Wetlands). Cumulative effects on water resources would not be expected, as local freshwater needs would be replaced by natural processes.

V.B.10.b. Gravel Resources

Permitted Gravel sources are indicated on Map 14a. In all three categories of gravel sources listed in the legend for Map 14a, the total amount of surface covered is 2,743 square miles, or 1,756 acres. Gravel in the area of Alaska north of the Brooks Range has been used for a variety of construction and maintenance purposes. These uses include construction of the following:

- "Haul Road"/Dalton Highway in support of the development of the North Slope oil fields and the Trans-Alaska Pipeline;
- pads for camps, exploration drilling, development and production drilling sites, and operations and maintenance facilities;
- airports in the oil-field area and in the communities of the North Slope Borough;
- roads in the oil-field area and in the communities of the North Slope Borough;
- manmade islands for offshore exploration drilling and development and production facilities;
- docks and causeways; and
- beach nourishment in several of the North Slope Borough communities.

From 1974-1999, more than 205 million tons of gravel have been mined to meet the industrial and community construction and maintenance needs in the area that the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys refers to as the Northern Region. This area is north of 67° N. latitude and includes the Brooks Range, the area north of the Brooks Range to the Beaufort Sea coast (the North Slope and oil-field area), the Chukchi Sea coast north of Cape Krusenstern, and the North Slope Borough communities). Most of the gravel has been mined from the floodplains of the rivers in this area. About 88% (about 180 million tons) of the gravel was mined from 1974-1985. During this time the Haul Road/Dalton Highway and pads, roads, and airfields were constructed for the facilities to develop the Prudhoe Bay, Kuparuk River, Lisburne, Milne Point, and Endicott oil fields. Through 1999, these five fields produced about 12.5 billion barrels of oil; total production from all the North Slope oilfields through 1999 was about 12.9 billion barrels of oil. From 1986-1999, the amount of gravel mined annually in the Northern Region has ranged from 4.5-0.56 million tons.

The amount of gravel used in the State of Alaska from 1980-1985 was about 236 million tons and in the Northern Region from 1974-1985, it was about 180 million tons. Although the time periods are different, the information indicates that a large portion of the State’s gravel usage was in the Northern Region to develop the oil fields. From 1986-1999, gravel usage in the State and on the North Slope was about 197 and 27 million tons, respectively; Northern Region gravel usage was about 14% of the State’s total. From 1986-1999, the amount of gravel used in the State has ranged from about 21-9.8 million tons.

Users of the gravel have included the following:

- petroleum companies with oil and gas leases on the North Slope and in the Beaufort Sea and their contractors
- Bureau of Land Management
- North Slope Borough
- Alaska Department of Public Facilities and Transportation
- Arctic Slope Regional Corporation
- Alyeska Pipeline Service Company
- COMINCO (Red Dog Mine)

The area disturbed by gravel mines and fill placement is a fraction of the area north of the Brooks Range. The Arctic Coastal Plain covers about 230,000 square kilometers (23,000,000 hectares), and the area between the Colville and Canning rivers is about 71,000 square kilometers (7,000,000 hectares) (Gilders and Cronin, 2000). The area disturbed by gravel mines and fill placement is about 8,793 hectares; this is about 0.04% of the coastal plain and about 0.1% of the area between the Colville and Canning rivers.

Most of the area between these two rivers is owned by the State of Alaska. Gravel extraction from this area requires permits, and the Alaska Department of Fish and Game, Habitat and Restoration Division has developed guidelines for siting, design, operation, and reclamation of North Slope gravel pits. In general, North Slope gravel usage for the oil fields has been declining. Large fields, such as Prudhoe Bay and Kuparuk, which cover a large area requiring a large number of production facility pads, are not being discovered. Table V-10 shows that the unit area of the fields that began producing after 1981 or planned for future production ranges in size from about 2,000-34,000 hectares; the unit area for Prudhoe Bay and Kuparuk River fields was larger than 99,000 hectares. There also is a trend toward consolidating facilities and using technological advances that minimize the surface area disturbed (Gilders and Cronin, 2000). Gilders and Cronin (2000) estimate that if the original Prudhoe Bay discovery were to be developed today, the gravel fill required would cover only 617 hectares, and the contractor Deadhorse type service area (302 hectares) would not exist but would be consolidated with oil-company facilities as they are at Kuparuk.

West of the Colville river gravel sources are far more difficult to locate. Surface deposits within the National Petroleum Reserve-Alaska consist mostly of fine-grain clay, silt, and sand. Gravel is located along the slopes of the Brooks Range, the Colville riverbed and some scattered areas along the arctic coast. Long hauls are often required to bring in gravel, and gravel from existing work/drill sites is repeatedly reused (U.S. Geological Survey, 1985). This lack of gravel will be a significant consideration in the development of permanent oil and gas facilities west of the Colville River.

In addition to the production facilities that are designed and constructed for several decades of use, oil and gas activities on the North Slope include exploratory drilling. Exploratory drilling must be done to find oil and gas reservoirs and generally lasts for only a few months at any specific site. From 1944-through 2001 a total of 344 exploratory wells have drilled on state onshore and offshore leases as well as private lands north of 68° N. latitude. Since the beginning of Federal activity in the Beaufort Sea, 30 wells were drilled in Federal Beaufort Sea waters. Since the beginning of drilling operations in the Petroleum Reserve (in 1944) 77 wells have been drilled. These figures are for actual exploratory wells as opposed to wells drilled principally to acquire strata core samples (Ryherd, 2002, pers. commun.). Most of these wells probably were drilled from a gravel pad, and many exploration sites included a gravel airstrip; where freshwater was available, an ice pad and airstrip could have been constructed. Exploratory wells that were drilled in the Federal (OCS) waters of the Beaufort Sea were drilled from a variety of structures that included gravel and/or ice islands, drillships, mobile bottom-founded drilling units (concrete island drilling structure, single steel drilling caisson) and a cone-shaped drilling unit (Kulluk).

Other developments that have reduced the amount of gravel needed to develop or maintain oil and gas production facilities include:

- ice pads instead of gravel for exploratory well-drilling pads (onshore and offshore in shallow waters, where appropriate);
- use of mobile steel or concrete mobile bottom-founded structures to drill exploratory wells in shallow waters;
- use of ice roads instead of gravel roads for pipeline construction;
- developing fields without a gravel road connection to Prudhoe Bay/Deadhorse area (Badami and Alpine);
- reducing the spacing distance between development wells, which reduces the size of the development pads (The Alaska Department of Natural Resources estimates a 76% reduction in development pad size (State of Alaska, Department of Natural Resources, 1991);
- use of extended-reach drilling, which reduces the amount of gravel needed to develop new reservoirs that lie near established facilities;
- recycling of gravel from roads, airfields, or pads that are not used; and
- use of clean drill cuttings in place of gravel.

In addition to reducing the amount of gravel needed, other developments that reduce the amount of surface area disturbed include underground injection of drilling muds and the elimination of reserve pits (may be needed at times on a temporary basis).

In addition to the oil fields and Deadhorse, the boundaries of the North Slope Borough include eight communities with populations that range from about 200 to more than 4,400. All of these communities have airfields and roads constructed with gravel.

V.C. ANALYSIS OF CUMULATIVE EFFECTS BY RESOURCE

Assumptions Used in the Analysis: The analysis of cumulative effects differs from the analysis of Alternative I for Sale 186, in part because it considers an expanded geographic area and extended timeframe. This is needed to include additional effects on the physical, biological, and human environments of development of the oil and gas discoveries and other activities described in Section V. The geographic area is further expanded to include the migratory and transitory nature of many resources. The timeframe includes development of discoveries that may occur during the next 15-20 years and exploration activities for new discoveries over the next 30-40 years.

The cumulative-effects analysis further differs from the alternative effects analysis by assessing the combined effects of past, present, and reasonably foreseeable future activities. To determine the effects of the alternatives (Section IV.C), we used the existing environment (Section III), as a baseline. However, this is not appropriate for cumulative-impact assessments, because it makes the effects of past and present actions part of the baseline rather than contributing to cumulative impacts (McCold and Saulsbury, 1996). The National Environmental Policy Act requires us to describe the incremental contribution of Alternative I for Sale 186 to the existing baseline at the present time. This baseline changes over time with additional uses, and the National Environmental Policy Act also requires an accounting of the environment over time. This means that our baseline for this cumulative-effects analysis must include past, present, and reasonable foreseeable activities. In the cumulative analysis, the incremental contribution of the proposed activity is relatively small and may be further reduced in significance as new activities are factored in. There is, however, greater uncertainty in determining cumulative effects than in determining the individual project-specific effects. We recognize the importance of ongoing environmental change and attempt to quantify the factors causing this change, including recovery, and identify thresholds of environmental response, when possible.

While this EIS evaluates the potential effects of holding three proposed lease sales (186, 195, and 202) in the Beaufort Sea, the decisions that follow the completion of the EIS will focus on each individual sale. The first decision will be whether to hold Sale 186 as proposed, or modify the area offered, or to not hold the sale at all (the No Action Alternative). Therefore, the cumulative analysis that follows will evaluate the contribution of Alternative I for Sale 186 to the cumulative effects. For analysis purposes, Sale 195 and 202, are considered to be part of the reasonable and foresee activities that may occur.

The major focus of the cumulative analysis for Alternative I for Sale 186 will be the contribution to the near shore area, which is expected to see more than 70% of the projected leases and two thirds of exploration activity and development projects (Map 4). This relatively small nearshore area represents only about 4% (0.38 million acres) of the total sale area which, along with Endicott, Northstar, and Liberty, assumes a doubling in activity (see USDOI, MMS, Alaska OCS Region, 2002a:Maps 3a and 3b, North Slope Oil and Gas Fields). However, in some cases this area of greatest potential increase in effects for the cumulative analysis is only a small percentage of the habitat for some wide-ranging resources transient to the area.

The area of medium depth and distance from the present activity base represents about 28% (2.7 million acres), while the far area in deeper water represents about 68% (6.7 million acres) of the total sale area (9.8 million acres). These two much larger areas will increase the range of potential effects for some resources but are not expected to increase present ongoing effects in a cumulative analysis. Any effects to resources occurring in these vast outlying areas as a result of noise and disturbance would be expected to have recovered prior to any subsequent disturbance event in the nearshore area. Most resources would not be expected to encounter two similar disturbance or oil-spill events when considering the unlikelihood of two independent events occurring in time and space to the same resource or prior to recovery.

Alternative I for Sale 186 is expected to add two development projects in the nearshore area of greatest industrial activity. While the incremental concentration of Sales 195 and 202 and other reasonable and foreseeable activities are similar, the resulting activities are fewer and more concentrated as exploration and development activities take place further away from the established infrastructure. In addition to and for the same reasons given, additive or synergistic effects would not be expected to occur as a result of Alternative 1 for Sale 186 to other reasonable and foreseeable developments.

A key element in oil-spill analysis is an assessment of risk. Risks are unarguably contentious. One of the fundamental problems when using quantitative risk analysis is related to the way the results of the analyses are expressed and interpreted. People evaluate risks in incompatible ways, based on their value systems (Thompson and Dean, 1996) and their perceived degree of exposure to a potential risk. Oil spills have high levels of “dread potential” (Slovic, 1987) because of their potential to produce consequences in the event of accidents, even though such occurrences have been estimated to have low occurrence probabilities. The MMS recognizes that some stakeholders may wish to reduce the chance of a spill occurring, while others may consider any chance of a spill occurring as unacceptable. Still others may find the small chance of a spill occurring as an acceptable tradeoff for the benefits derived from oil and gas production.

To calculate the likely number of estimated oil spills in our analysis of cumulative effects, we decided to use the midrange production estimate, which includes our estimate of past, present, and reasonably foreseeable future production for the North Slope/Beaufort Sea (Table V-7b). The incremental contribution of Alternative I for Sale 186 by volume of oil is a small portion (about 4%) of the midrange production estimate. To determine the number of oil spills, we multiply the offshore and onshore reserve estimates by the spill rate per billion barrels produced. While the most likely number of offshore oil spills greater than or equal to 500 barrels from all past, present, and reasonably foreseeable future activities is estimated to be zero, the most likely number of spills from Alternative I for Sale 186 is zero (Table V-12). The mean number of estimated offshore spills for the Beaufort Sea offshore area statistically is 0.65, of which Alternative I for Sale 186 is estimated to contribute statistically only 0.11, or about 17 %. While the number of spills may vary as a result of new resource estimates and assumptions, the relative contribution of Sales 195 and 202 is expected to be the same or proportionally smaller.

The most likely number of onshore oil spills greater than or equal to 500 barrels from all past, present, and future activities is estimated to be five, the most likely number of spills from Alternative I for Sale 186 is estimated to be five (Table V-12). The mean number of estimated onshore spills for the North Slope area statistically is 5.59, of which Alternative I for Sale 186 is estimated to contribute statistically only 0.05 or 0.8%. The most likely number of pipeline oil spills greater than or equal to 500 barrels is estimated to be 1.24; the most likely number of spills from Alternative I for Sale 186 is estimated to be 5 (Table V-12). The mean number of estimated pipeline oil spills statistically is 1.24, of which Alternative I for Sale 186 is estimated to contribute statistically only .05 or 4% (Table V-13).

Analysis of possible oil spills from tankering oil to the West Coast includes consideration of the *Exxon Valdez* oil-spill effects in Prince William Sound, a large spill in the Gulf of Alaska, and smaller spills along the tanker route. The most likely number of oil spills greater than or equal to 1,000 barrels from Trans-Alaska Pipeline System tankers is 10, and the most likely number of spills from Alternative I for Sale 186 is estimated to be zero. The mean number of estimated spills is 10.07, of which Alternative I for Sale 186 is estimated to contribute statistically only 0.41, or about 1.5%. We estimate 6 spills with an average size of 4,000 barrels, four of which occur in port and two at sea. We assume two spills with an average size of 13,000 barrels, both, which occur at sea. Finally, we assume one at-sea spill in the Gulf of Alaska of 250,000 barrels.

In-port spills, where contingency measures are in place, would be cleaned up relatively quickly. Spills originating 80-100 nautical miles offshore would have a 5-10% chance of contacting the shoreline within 30 days (LaBelle and Marshall, 1995). Recent new shipping lanes and port routes have been initiated by the National Oceanic and Atmospheric Administration requiring tankers to travel at least 50 nautical miles offshore central California to better protect three marine sanctuaries of Monterey Bay, the Gulf of the Farallones, and the Channel Islands. The estimated six spills at sea and the one larger spill are not expected to occur within the same location or contact the same resources before recovery of the affected resource. Recovery periods would be lengthened if more than one spill affected the same population within a short interval, an unlikely situation.

Monitoring studies are available of biological populations that have experienced past and are experiencing present industry activities. However, where available, they have been factored into the abundance and distributional status and trends of the populations. Natural population fluctuations also are an important consideration but often are not well defined because of the extensive habitat and wide-ranging migratory patterns of many arctic species. Some populations, such as polar bears and some caribou herds have increased over the past 30 years while others, such as the spectacled eider, have decreased. However, the exact causes of these population changes are difficult to determine.

With the somewhat ubiquitous distribution of many of the resources on the North Slope, an overlap of impact zones from activities of several projects is not well defined. Figures III.B.3a and III.B.3e show the distribution of ringed seals and polar bears. Caribou calving areas in northern Alaska also are shown in Figure III.B-4. Nonmobile populations, such as those comprising the Boulder Patch in the Beaufort Sea, could be more heavily affected by specific projects. In this case, the Endicott and Northstar projects are weighed more heavily. Also, oil spills and disturbance factors are highly unlikely to occur at the same time and place to increase the magnitude of effects. Thus, for the most part, resources are expected to have recovered from a perturbation before providing any measurable increase in cumulative effects.

The analysis of each resource has been weighed with respect to past, present, and future activities, as appropriate, to best predict the effects of Alternative I for Sale 186 on that resource. For instance, the threatened spectacled eider has experienced stress from past and present environmental factors and human activities, and this stress is likely to continue in the future. Thus, the effects from offshore leasing in the Beaufort Sea on these eiders are of concern. Effects from past oil and gas activities and those presently ongoing are part of the present population condition.

As indicated above, future actions resulting from the development of existing discoveries are on a certainty scale of past development (those currently in production), present development (within 10 years), reasonably foreseeable future developments (within 10-20 years), and speculative development (after 20 years). The most heavily weighed are those past and present activities onshore at Prudhoe Bay, the Kuparuk River, Milne Point, and offshore at Badami, Endicott, Sagavanirktok Delta, and Northstar. Next in consideration of offshore activities are the reasonably foreseeable future developments at Kalubik, Liberty, Thetis Island, Sandpiper, Kuvlum, Hammerhead, and Flaxman Island. Reasonably foreseeable future onshore developments could consist of seven relatively small fields of no measurable consequence to the environment at this time (Table V-1a).

Speculative future development after 20 years is highly uncertain and includes 13 smaller onshore discoveries, and some exploration and development activity resulting from future State and Federal lease sales has been included (see Section V.C). While future projections are highly speculative, effects are based on present state-of-the-art technology. Industry has been developing technology and strategies to reduce the impacts associated with exploration and development activity, and it seems reasonable to expect this trend to continue. Thus, future impacts might be less than are estimated in this cumulative analysis. Further, in the event of a major oil spill, additional design criteria, safeguards, and protective measures would be instituted as evidenced by the *Exxon Valdez* oil spill. For purposes of analysis, we have assumed no additional mitigation that would be very unlikely and, in that respect, this analysis overestimates cumulative effects.

Analysis of Cumulative Effects by Alternative: The NEPA Council on Environmental Quality regulations recognize the cumulative problem as complex and requires, along with Alternative I for Sale 186, an analysis of cumulative effects. Because the incremental contribution of a proposed action usually is small and each new project can affect or add to the baseline condition, Congress covered this contingency with the cumulative analysis. The purpose of the analysis was a consideration of where we had been and where we were going with development of our resources. This analysis is on a scale of projects past and present and in the reasonably foreseeable future in the next 15-20 years. This scale puts in perspective the sensitivity of the cumulative analysis. This means that impacts that can be identified in the analysis of a proposed project might, or more than likely, might *not* translate to an effect in the cumulative analysis.

An example of scale is the lease-sale EIS, which usually involves major tract-deletion alternatives. These usually are measurable differences for some resources, but for many resources there is no change in the effects of the alternatives from the proposed action. The cumulative effects for each alternative, even in these large lease-sale areas in Alaska, have never been considered to yield any useful information, because there has never been a measurable effect of an alternative at the cumulative level. The resource levels (460 million barrels) and assumed exploration and development activities for Alternative I for Sales 195 and 202 are the same or less than those assumed for Alternative I for Sale 186. The number of platforms and the number of fields to be developed, in addition to the amount of activities occurring simultaneously, are less for Sales 195 and 202. Therefore, the contribution of those sales to the cumulative effects analysis likely would be very similar in scope and the same or smaller in size than those identified for Alternative I for Sale 186.

The extended geographic scale and timeframe of the cumulative analysis reduces the sensitivity of this analysis and treatment of alternatives. In the case of migratory birds, fishes, and mammals, the extensive geographic range of some of these species includes factors far removed from the site of the proposed action that can be limiting to the resource that spends but a small part of its time in the zone of influence of Alternative I for Sale 186. When projecting the past and future impact on the resource, the extended timeframe further reduces the sensitivity of the cumulative analysis to the importance of the proposed action; it is even less likely to detect a measurable change from the respective alternatives, which are proposed for the Alternative I for Sale 186.

In summary, Alternatives III through VI, evaluated in this EIS have not been analyzed for cumulative effects, because we are confident that there would be very little change in the level of effects identified for the alternatives to the proposed action. This is to be expected, because the level of impacts for Alternative I is very small in absolute terms and even smaller relative to an effect of past, present, and reasonably foreseeable future activities. By comparison, the difference between effects of Alternative I and effects of

Alternatives III through VI are even smaller. The measurable effects of Alternative I for Sale 186 do not necessarily translate to measurable effects in the cumulative analysis because of the larger scale and timeframe required for the cumulative analysis. The alternatives offer some change in the level of effects, but this is not measurable in the cumulative analysis. For these same reasons we use the cumulative analysis for Alternative I for Sale 186 as a very good approximation of the cumulative analysis for Alternative I for Sales 195 and 202. To do a separate but essentially identical cumulative analysis for Alternative I or any of the other alternatives for these two sales would disregard the NEPA mandate to focus on issues of importance.

Supporting Information: The following cumulative analysis builds on information contained elsewhere in this EIS. Section IV.C contains our analyses of potential effects. Section III describes the existing environment. Section IV.I provides analyses of low probability, very large oil spills from blowouts and tankers. Appendix A, Oil-Spill-Risk Analysis, explains and provides information used by the analysts for estimating the probabilities and locations of potential oil spills used in this EIS, including information about the size, location, and distribution of tanker spills.

As noted in Section II.A.4, the revised *Oil Discharge Prevention and Contingency Plan* prohibits the drilling of new wells or sidetracks from existing wells into major liquid hydrocarbon zones at its drill sites during the defined period of broken ice and open water (BPXA, 2001). This period begins on June 13 of each year and ends with the presence of 18 inches of continuous ice cover. This drilling moratorium eliminates the environmental effects associated with a well blowout during drilling operations in the Beaufort Sea during broken-ice or open-water conditions.

We also have evaluated the cumulative effects on the North Slope and from transporting North Slope oil to U.S. West Coast and Asian markets in the Outer Continental Shelf Oil and Gas Leasing Program: 1997-2002 Final EIS (USDOI, MMS, 1996f:IV-264-464); Northeast National Petroleum Reserve-Alaska, Final EIS (USDOI, Bureau of Land Management and MMS, 1998:IV-H-1-26); Beaufort Sea Planning Area Oil and Gas Lease Sale 170, Final EIS (USDOI, MMS, 1998:IV-G-1-31); and, the Beaufort Sea Planning Area Oil and Gas Lease Sale 144 Final EIS, (USDOI, MMS, 1996a:IV-H-1-31).

Significant Cumulative Effects for All Resources: The MMS does not expect any significant cumulative impacts to result from any of the planned activities associated with the exploration and development of North Slope and Beaufort Sea oil and gas fields. Significance thresholds are discussed in Section III.A.1.a and significant impacts are defined in Section III.A. In the event of a large offshore oil spill, some significant adverse impacts could occur to spectacled eiders, long-tailed ducks, common eiders, subsistence resources, sociocultural systems, and environmental justice. However, the probability of such an event combined with the seasonal nature of the resources inhabiting the area make it highly unlikely that an oil spill would occur and contact these resources. Spectacled eiders, long-tailed ducks, and common eiders are present on the North Slope for only 3-5 months out of the year. A resource may be present in the area but may not necessarily be contacted by the oil. An oil spill could affect the availability of bowhead whales, or the resource might be considered tainted and unusable as a food source. The potential for adverse effects to some key resources (bowhead whales, subsistence, the Boulder Patch, polar bears, and caribou) is of primary concern and warrants continued close attention. Effective mitigation practices (winter construction, an advanced leak-detection system, thick-walled pipeline designs, etc.) also should be considered in future projects.

As noted in Section III.A.1, the MMS does not expect any significant impacts to result from any of the planned activities associated with Alternative I for Sale 186 or any of the alternatives. Significant adverse impacts to spectacled eiders, common eiders, long-tailed ducks, subsistence harvests, sociocultural systems, and to environmental justice would occur in the unlikely event of a large oil spill. The contribution to the development of North Slope and Beaufort Sea oil and gas fields is relatively small. For the cumulative analysis, the MMS estimates oil reserves and resources to be 11.1 billion barrels; the contribution of Alternative I for Sale 186 to this estimate is 460 million barrels, or about 7%. Also, the proposed level of infrastructure and facilities proposed for Alternative I for Sale 186 (Table V-5) are low compared to the levels associated with past development (Table V-3).

Summary of Cumulative Effects by Resource: A brief summary of the effects from Alternative I for Sale 186 and the relative contribution of those effects to other past, present, and future activities are presented in Table V-11. The more detailed analyses are found in Sections V.C-1 through 13.

In the following sections, we analyze the potential cumulative effects to individual resources. Each subsection consists of a cumulative analysis; a summary, conclusion, and discussion of incremental contribution; and a discussion of transportation effects along the transportation route.

V.C.1. Water Quality

Cumulative effects on water quality would be due primarily to three factors: discharges of drilling muds, cuttings and produced waters; construction of gravel islands and pipeline trenches; and oil spills. The Liberty Final EIS contains a detailed cumulative assessment of these three factors on water quality (USDOI, MMS, Alaska OCS Region, 2002a:Section V.C.12.b). The following is an updated summary of the cumulative effects on water quality due to the proposed Beaufort Sea lease sales.

The greatest effect on water quality from gravel-island and pipeline construction and pipeline repair would be additional turbidity caused by increases in suspended particles in the water column. Increases in turbidity generally are expected to be considerably less than the 7,500 parts per million suspended solids that are used in the analysis as an acute (toxic) criterion for water; exceptions may occur within the immediate vicinity of the construction activity. Turbidity increases from construction and repair activities generally are temporary and expected to occur during the winter and end within a few days after construction is completed. Material excavated from the pipeline trench but not used for backfill most likely would be left in an area where active erosion of sediment particles could occur during breakup and open water. The contribution of this material to the natural turbidity is expected to be about the same as the sediments existing at the seafloor surface before being covered. Effects of construction and storms would be additive but not synergistic because the turbidity from construction would be similar to the natural turbidity from storms. Future repair activities are not expected to introduce or add any chemical pollutants.

If the discharge of produced waters is permitted, the waters may be a few degrees warmer than the seawater and contain hydrocarbons. The discharged water also may contain some chemicals that have been added to prevent some types of biological and chemical activities. Permitted discharge systems would be designed to ensure rapid mixing and dilution of the discharge.

Oil spills from oil and gas development activities would degrade the marine environment through the release of petroleum hydrocarbons. The spills would increase the concentration of hydrocarbons in the water column. For the assumed oil spill (Table V-12), hydrocarbon concentrations could exceed the 1.5-parts per million acute-toxic criteria for about a day in an area of about 2 square kilometers (0.8 square mile). The 0.015-parts per million chronic criteria also could be exceeded for 10 or more days in an area of about 12-45 square kilometers (4.6-17.4 square miles). Hydrocarbon concentrations could exceed the 1.5-parts per million acute-toxic criterion for less than a day in an area less than a few square kilometers for small spills. The 0.015 parts per million chronic criteria also could be exceeded for less than a month in an area less than 100 square kilometers (39 square miles) for small spills. Therefore, a very large crude oil spill significantly would affect water quality by increasing the concentration of hydrocarbons in the water column to levels that greatly exceed background concentrations; however, the chance is extremely low of a large spill occurring, even in the cumulative case. If a spill did occur, regional (more than 1,000 square kilometers [386 square miles]) and long-term (more than 1 year) degradation of water quality to levels above State and Federal criteria is very unlikely.

Transportation Effects: Oil produced from Alternative I for Sale 186 is expected to contribute only a small fraction of cumulative oil spills from Trans-Alaska Pipeline System tankers (about 1%). However, future tanker spills of arctic oil, which may include oil from Alternative I for Sale 186, would be likely to adversely affect water quality in Prince William Sound, if spills occurred there. If some of these spills were to occur close enough to shore, they also would be likely to adversely affect water quality in the Gulf of Alaska along the tanker route. One of the future oil-tanker spills is assumed to be (for purposes of analysis) at least 250,000 barrels. Based on the assumptions for this EIS, the cumulative effects of tanker spills on water quality are summarized here. Assuming that some of the spilled oil contacts the nearshore areas (Prince William Sound or the Gulf of Alaska) in a relatively nonweathered state, a 250,000-barrel oil spill is estimated to affect up to 10% of the water quality within the affected area. Recovery is expected to take 1 or 2 days in areas with high surf energy and up to 1 week in embayments.

Conclusion: A spill could affect water quality for 10 or more days in a local area. The effects of discharges and offshore construction activities are expected to be short term, lasting as long as the individual activity, and have the greatest impact in the immediate vicinity of the activity.

Contribution of Alternative I for Sale 186 to Cumulative Effects: Levels of activities estimated for Alternative I for Sale 186 are used to estimate the contribution to the cumulative effects. There are more than 40 projects in the past, present, and reasonably foreseeable future development/production projects, 17 of which would be offshore prospects. Most of the 17 projects would be located completely offshore; however, 6 of the projects are or might be developed from onshore facilities. The contribution from Alternative I for Sale 186 to the total number of offshore projects (11) is about 9%. Therefore, we assumed that Alternative I for Sale 186 would contribute about one-tenth of the cumulative effects described in the previous paragraph.

V.C.2. Lower Trophic-Level Organisms

This assessment is based on the cumulative effects of offshore oil spills to coastal plankton and of disturbance and discharges on benthos. One offshore oil spill is estimated for this cumulative analysis (Table V-12). The spill risk to coastal plankton is due partly to two existing developments with offshore facilities—Endicott and Northstar. The risk also would be due to several reasonably foreseeable developments with offshore facilities—Liberty, Sandpiper, Flaxman, Stinson, and Hammerhead/Kuvlum. About half of these developments and prospects would be outside of barrier islands (including Northstar, Sandpiper, and Hammerhead/Kuvlum, slightly reducing the cumulative risk to coastal plankton. Further, one of the prospects (Liberty) inside of the barrier islands would be near the Boulder Patch kelp habitat, and the cumulative spill risk to kelp would be slightly greater than for only the Beaufort Sea Sales 186, 198, and 202.

In the cumulative sense, additional benthos would be buried by construction of offshore pipelines and islands. One of the reasonably foreseeable or proposed developments (Liberty) would be near the Boulder Patch and, therefore, the cumulative risk of disturbance to kelp would be slightly greater than Alternative I for Sale 186. With regard to typical benthos, the total amount buried during pipeline construction can be estimated from the approximately 100-acre footprint for the Liberty pipeline trench. For all of the reasonably foreseeable developments, the pipeline footprints probably would be less than 400 acres total, and the cumulative effects of disturbance on typical benthos would be very small. An old exploration island exists for two of the reasonably foreseeable developments (Liberty and Sandpiper); however, islands might be constructed for three additional developments over the next decade or so (Flaxman, Stinson, and Hammerhead/Kuvlum). The total amount of benthos initially covered by these islands probably would be less than 200 acres. When Seal and the old Northstar islands were abandoned and allowed to erode outward, they doubled their footprints (Coastal Frontiers Corp, 2000); therefore, about 400 acres of benthos probably eventually would be covered. These effects on typical benthos would be moderated by benthic colonization on old exploration islands that were abandoned during the past decade (for example, BF-37, Tern, Mukluk, and the old Northstar).

The estimated cumulative number of offshore oil spills over the assumed 15- to 20-year production life of Sale 186 is shown in Table V-12. The estimated mean number of offshore spills greater than 1,000 barrels is 0.54 for all past, present, and reasonably foreseeable activities. Alternative 1 for Sale 186 would contribute an estimated 0.11 spills, bringing the total mean number to 0.65 spills. Even though the total mean number is less than one, we assumed one spill greater than 1,000 barrels for the sake of the cumulative analysis. The assumed spill number and size for the cumulative assessment is similar to the assumed spill number and size that was assessed in Section IV.C for Sale 186; therefore, the spill effects would be similar. As concluded in Section IV.C.2.a(3), such a spill would have lethal and sublethal effects on less than 1% of the planktonic and benthic organisms in the sale area and less than 5% of the epontic organisms in the sale area. The effect of oil that drifts to shore and contacts intertidal biota is discussed further in Section V.C.9.b. The moderation of the benthic effects means that some cumulative effects might counteract one another but probably would not be additive or synergistic.

Transportation Effects: Oil produced from Alternative I for Sale 186 is expected to contribute only a small fraction of cumulative oil spills from Trans-Alaska Pipeline System tankers (about 1%). However, future tanker spills of arctic oil, which may include oil from Alternative I for Sale 186, would be likely to adversely affect lower trophic-level organisms in Prince William Sound, if spills occurred there. If some of these spills were to occur close enough to shore, they also would be likely to adversely affect lower trophic-level organisms in the Gulf of Alaska along the tanker route. One of the future oil-tanker spills is assumed to be (for purposes of analysis) at least 250,000 barrels. Based on the assumptions for this EIS, the cumulative effects of tanker spills on lower trophic-level organisms are summarized here. Assuming that some of the spilled oil contacts the nearshore areas (Prince William Sound or the Gulf of Alaska) in a relatively nonweathered state, a 250,000-barrel oil spill is estimated to harm up to 10% of the coastal organisms within the affected area. Recovery is expected to take 1 or 2 days for phytoplankton and up to 1 week for zooplankton. The spill also is estimated to harm up to half of the affected intertidal and shallow subtidal marine plants and invertebrates. Recovery of these communities is expected to take 2-3 years in high-energy habitats and up to 7 years in lower energy habitats. Less than 5% of the subtidal benthic populations are expected to be affected.

Conclusion: One offshore oil spill greater than 1,000 barrels is assumed for the past, present, and reasonably foreseeable developments. About half of the reasonably foreseeable developments would be outside of the barrier islands, and the cumulative risk to river deltas and other sensitive portions of the coastline would not increase proportionally. Also, none of the developments other than possibly Liberty would be near the Boulder Patch and, therefore, the cumulative risk to it would be slightly greater with Alternative I for Sale 186. Benthos would be disturbed (buried) during pipeline and island construction for the reasonably foreseeable developments. The total disturbed area would probably be less than 800 acres, and the effect would be moderated by benthic colonization on old exploration islands that were abandoned during the past decade.

Contribution of Alternative I for Sale 186 to Cumulative Effects: We do not expect the cumulative effect of oil spills or disturbances from offshore developments (including any from Alternative I for Sale 186) to substantially affect organisms at the lower trophic level. For this reason, and because Alternative I for Sale 186 itself is estimated to contribute only about 4% of the estimated amount of oil spills to the cumulative case, Alternative I for Sale 186 is not expected to make a measurable contribution to the cumulative or synergistic effect on these organisms.

V.C.3. FISH

As discussed in detail in Section V.C, four categories of oil- and gas-related projects currently exist within the sale area. See Section V.B.1 for information about the projects in each category.

Each of these projects involves different types and amounts of oil and gas related activity that could affect fish populations. This applies equally to other future onshore oil and gas projects, such as those that may occur to the west of the Colville River (for example, the National Petroleum Reserve-Alaska). In general, the effects generated by these activities on fishes fall into two categories: those associated with disturbances, and those associated with exposure to oil spills. The following discussion briefly considers each of these.

V.C.3.a. Disturbances from Exploration, Development, and Production Activities

Fishes are sensitive to noise changes between 5-1,000 Hertz (Bell, 1990). Noise-producing activities from aircraft and vessels (summer) plus ice-road transportation (winter) would increase with many of the projects listed above. Those having activities in the nearshore area (for example, Kalubik, Sag River, Northstar, Niakuk, and Stinson) are likely to have the greatest effect on marine and anadromous fish populations. Onshore projects (for example, those associated with the Petroleum Reserve, Kuparuk, West Sag, Hemi Springs, and Yukon Gold) are likely to have the greatest effect on freshwater and anadromous fish populations. As mentioned in Section IV.C.1.a, noise effects on fishes could include local avoidance of seismic surveys, aircraft and vessel traffic, drilling and construction, and production operations. Also, some overwintering fishes may not be able to avoid noise and disturbances. However, noise associated with the projects mentioned above is not likely to have a measurable effect on fish populations, even if several are occurring at the same time. The wide distribution and low density of fishes, the short-term and mild nature of their response to noise associated with oil and gas activities, and the wide distribution and low density of likely oil and gas projects is the basis for this conclusion.

V.C.3.b. Effects of Discharges from Additional Drilling and Associated Oil and Gas Activities

The effect of the additional drilling and discharges associated with Alternative I for Sale 186 is likely to be local and temporary. These activities are not likely to contribute a measurable additive effect on fish populations. Fishes would be displaced from the areas where drilling equipment is installed, but this would affect only a very small area of the Beaufort Sea and would have no measurable cumulative effect on fish populations. The wide distribution and low density of fishes, the short-term and mild nature of their response to drilling and discharges associated with oil and gas activities, and the wide distribution and low density of likely oil and gas projects is the basis for this conclusion.

V.C.3.c. Effects from Pipeline Construction

Pipeline construction would kill small numbers of epibenthic invertebrates that fishes feed on. Trenching temporarily could alter the migration patterns of some migratory fishes, if the trenching occurred during migrations. However, epibenthic invertebrates quickly recolonize disturbed areas, and only minor changes in migration routes would be likely. Hence, measurable cumulative effects on fishes due to pipeline construction are not likely.

V.C.3.d. Effects from Cumulative Oil Spills

The cumulative effect of oil spills occurring and entering offshore waters on arctic fishes (including incidental anadromous species) would depend on the number of spills; the season of the year; and the hydrocarbon concentration, time of exposure, and stage of fish development involved for each spill encountered. However, mortality caused by a petroleum-related spill is seldom observed outside of a laboratory environment. Sublethal effects are far more likely, and these may include changes in growth, feeding, fecundity, and temporary displacement. In summer, the nearshore waters of the Beaufort Sea are used for migration and feeding by fishes. A small number of fish in the immediate area of an offshore summer spill could be killed or harmed; however, they would not be likely to have a measurable effect on fish populations.

V.C.3.d(1) Offshore Oil Spills

All past, present, and reasonably foreseeable oil spills for the cumulative analysis are estimated in Table V-12. For offshore spills, the estimated mean number of oil spills for all oil-related actions over the 15- to 20-year life of the sale (past, present, and reasonably foreseeable) is .54. Alternative I for Sale 186 is estimated to contribute .11 to this, bringing the total mean number of oil spills to less than one, or .65. The most likely number of offshore spills (greater than 1,000 barrels) that would be contributed by Alternative I for Sale 186 is zero.

As discussed in Section IV.C.1.b, Alternative I for Sale 186 assumed (for purposes of analysis) a 4,600-barrel pipeline spill or a 1,500-barrel platform spill. If either of these spills occurred and contacted the nearshore area, some marine and migratory fish may be harmed or killed. However, neither oil spill would be likely to have a measurable effect on marine and migratory fish populations, and recovery would be likely in 5-10 years.

V.C.3.d(2) Onshore and Trans-Alaska Pipeline System Pipeline Oil Spills

All past, present, and reasonably foreseeable oil spills for the cumulative analysis are estimated in Table V-12. For onshore spills, the estimated mean number of oil spills for all oil related actions over the 15- to 20-year life of the sale (past, present, and reasonably foreseeable) is 5.54. Alternative I for Sale 186 is estimated to contribute .05 to this, bringing the total mean number of oil spills to 5.59. The most likely number of offshore spills and Trans-Alaska Pipeline System pipeline spills (greater than 1,000 barrels) that would be contributed by Alternative I for Sale 186 is zero.

Onshore pipeline spills on the North Slope and along the Trans-Alaska Pipeline System in winter would not be likely to affect fishes, because the likelihood of their contacting fish habitat is very low during that time. Small spills are likely to occur, but they are not likely to be of sufficient size or frequency to measurably affect fish populations. If a summer onshore spill of sufficient size occurred in a small waterbody that contained fish and had a restricted water exchange, the fish and food resources in that waterbody would be likely to be harmed or killed. Recovery would be likely in 5-10 years.

However, due to the small amount of oil likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs) with restricted water exchange, an onshore oil spill associated with Alternative I for Sale 186 is not likely to have a measurable effect on fish populations. For these reasons, while small numbers of fish in the immediate area of an onshore oil spill may be killed or harmed, onshore oil spills would not be likely to have a measurable cumulative effect on fish populations.

V.C.3.d(3) Tanker-Spill Effects

We estimate the cumulative number of tanker spills over the 15- to 20-year life of the project at 10 (Table V-12): 7 with an average size of 4,000 barrels, 2 with an average size of 13,000 barrels, and 1 with an average size of 250,000 barrels. None of these are likely to be contributed by Alternative I for Sale 186. Each of these oil spills is assumed to occur at different locations and to contact different resources. This precludes the same fish population from being affected by any two of these spills, and concerns pertaining to the time needed for the recovery of the affected fish populations. In the unlikely event of a large offshore oil spill contacting the nearshore area, some marine and migratory fish might be harmed or killed, as discussed in Section IV.C. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 10 years.

Future oil-spill effects from tanker transportation of arctic oil (including oil from Beaufort Sea Sales 195 and 202) from the Trans-Alaska Pipeline System terminal at Valdez could affect some marine and anadromous fishes in the Gulf of Alaska. Section IV.C.1.a discusses the likely effects of a large oil spill on individual fishes and fish populations, such as those associated with the 1989 *Exxon Valdez* oil tanker spill.

IV.C.3.e. Effects from the Annual Subsistence and Commercial Harvests

The subsistence harvesting of fishes in the Beaufort Sea area is discussed in the subsistence section of this EIS (Section IV.C.11). Relatively large numbers (estimated at 50,000-200,000) of freshwater and migratory fishes are harvested each year for subsistence and commercial purposes on the North Slope. These activities have a substantial and measurable effect on the freshwater and migratory fish populations of the North Slope. That effect and its relationship to natural fluctuations (often extreme) in North Slope fish populations, is the primary reason for the establishment of annual State of Alaska, Department of Fish and Game fishing quotas. However, to our knowledge no studies have been conducted addressing the cumulative effect of subsistence and commercial fishing on the North Slope fish populations, or on the amount of time required for recovery. Hence, the cumulative effect of these activities on the fish populations of the North Slope is unknown.

Summary. In general, marine and migratory fish populations are not measurably affected by the type of disturbances generated by oil- and gas-related activities. The wide distribution of and low density of fishes, the short-term and mild nature (local avoidance) of their response to noise associated with oil and gas activities, and the wide distribution and low density of likely oil and gas projects is the basis for this conclusion. Some overwintering fishes may not be able to avoid noise and disturbances, and may be adversely affected. However, this is not likely to occur often and most fishes would be unaffected. Because the water used for construction is not likely to be withdrawn from waters supporting fish, the use of freshwater for ice-road and pad construction is not likely to have a measurable cumulative effect on fish populations. Hence, disturbances associated with Alternative I for Sale 186 are not likely to contribute measurably to the overall cumulative effect on fishes.

According to Table V-12, the most likely number of oil spills (greater than 1,000 barrels) that would be contributed by Alternative I for Sale 186 is zero. Nevertheless, in the unlikely event of a large oil spill, small numbers of fish in the immediate area may be killed or harmed if they were somehow trapped and unable to avoid it. However, marine and migratory fishes are widely distributed in the Beaufort Sea, most are not likely to become trapped, and most are not likely to be affected by an oil spill. Those that are in the vicinity of a large oil spill and are affected by it are likely to experience effects ranging from minor and short-term to no effect at all. For these reasons, oil spills associated with Alternative I for Sale 186 are not likely to have a measurable additive effect or synergistic effect on fish populations.

Conclusion: Some fish in the vicinity of a large oil spill may be adversely affected by it. Those that are affected are likely to experience effects ranging from minor and short-term to no effect at all.

Contribution of Alternative I for Sale 186 to Cumulative Effects. Disturbances and oil spills associated with Alternative I for Sale 186 are not likely to make a measurable contribution to the overall cumulative effect on fishes. No synergistic effects are expected.

V.C.4. Essential Fish Habitat

Past development and production has occurred on 28 fields and satellites, including seven offshore. Present development includes four discoveries that are expected to begin production within the next few years. If 16 reasonably foreseeable future discoveries are developed within the next 15-20 years and 9 are located offshore, Alternative I for Sale 186 is estimated to contribute 7% of past present and reasonably foreseeable development to 2023.

The low level of effects from seismic surveys, exploration and drilling activities, and drilling mud are unlikely to increase above the present level of effects, because there is an extremely low chance of the same geographical area to be contacted twice without sufficient recovery time between spills.

Because we have been unable to document impacts or conclusively show the lack of impacts to anadromous species, including salmon, when removing up to 15% of free water from large lakes, we have to assume there is a potential for effects to these fish. The effects of ice-road construction on freshwater salmon essential fish habitat could range from low (a population change in abundance or distribution in a localized area for a short time) to moderate (a population change in abundance or distribution but recovery would occur within one generation). Therefore, if a substantial proportion of all past, present, and reasonably foreseeable future projects cause low to moderate effects, cumulative effects could conceivably range from low to moderate and even to high (a population change in abundance or distribution requiring one or two generations to recover to its former status).

The substantial accumulation of effects on essential fish habitat, however, is most likely to occur from a large oil spill. Marine waters have the greatest likelihood of being oiled, up to a 59% chance of being oiled within 10 days if a large oil spill occurs and a 65% chance within a year. However, because of the low water temperatures, the marine habitat is unlikely to support any salmon, even with a maximum trend of temperature increases each decade. Therefore, no cumulative effect of oil spills on marine essential fish habitat is likely, because the effects likely would dissipate before salmon ever use the habitat.

Because local residents do see increasing numbers of salmon and an average of two salmon per year are caught during scientific studies in the Beaufort Sea (see Section IV.C.4), there is actual estuary and salmon habitat in use, although it is not very large. If the 8-10% probability of a large oil spill actually occurring as a result of Alternative I for Sale 186, the greatest likelihood of oil reaching the coastal freshwater essential fish habitat is 3-14%. Because Alternative I for Sale 186 is expected to contribute 17% of offshore large oil spills and the effects of large oil spills are additive, the cumulative effects of 2.8 oil spills are approximately 6 times that of Alternative I for Sale 186.

Summary and Conclusion: The low level of effects from seismic surveys, exploration and drilling activities, and drilling mud are unlikely to increase above the present level of effects. The substantial accumulation of effects on essential fish habitat are more likely to occur from oil spills effects on freshwater and estuarine water than on marine water essential fish habitat. However, because of the low water temperatures, the marine habitat is unlikely to support any salmon, even with a maximum trend of temperature increases each decade. Therefore, no cumulative effect of oil spills on marine essential fish habitat is likely, because the effects likely would dissipate before salmon ever use the habitat. Cumulative effects on essential estuarine and freshwater fish habitat also are considered minimal, because the habitat is marginal. Salmon 'populations' using this freshwater or estuarine habitat have an extremely short theoretical time to extinction, i.e., possibly as short as one generation. If oil spills were to occur in an area where salmon successfully spawned, they could further decrease the already marginal chances of another generation successfully reproducing.

Contribution of Alternative I for Sale 186 to Cumulative Effects. The contribution of Alternative I, Sale 186 to the cumulative effect level of seismic surveys, exploratory drilling, and drilling mud are unlikely to increase above the present low level of effects. If a large oil spill actually occurs as a result of Alternative I for Sale 186, the greatest likelihood of oil reaching the coastal freshwater essential fish habitat is 3-14%. No synergistic effects are expected.

V.C.5. Threatened and Endangered Species

V.C.5.a. Bowhead Whale

V.C.5.a(1) Cumulative Effects on Bowhead Whales

V.C.5.a.(1)(a) Projects That May Affect Bowhead Whales

There are several projects that might affect bowhead whales. Endicott and Northstar are past development projects currently producing oil. The Liberty Project is a reasonably foreseeable future development project that is located shoreward of the barrier islands and well shoreward of the bowhead whale's normal fall-migration route. An exploration plan for the McCovey Prospect has been approved northwest of Cross Island; if this results in submittal of a future development and production plan, coordination with Native groups will be necessary to maintain traditional hunting in the area. The Kuvlum and Hammerhead units, both reasonably foreseeable future development projects, are within the bowhead whale's normal fall-migration route. The Sandpiper and Flaxman Island units, also reasonably foreseeable future development projects, are not within the bowhead whale's normal fall-migration route. Endicott, Northstar, and Flaxman Island are all or mostly on State lands. These projects and their potential effects on whales are discussed later. Other Federal and State sales in the Beaufort Sea that are scheduled through 2007 could lead to more noise and disturbance from exploratory activities. Other types of projects mentioned above likely would not affect whales. These include the Trans-Alaska Pipeline System; constructing the Trans-Alaska Gas System, the Alaska Natural Gas Transportation System; converting natural gas to liquefied natural gas; or tankering crude oil from Valdez.

The potential for oil-industry activities outside of the Alaskan Beaufort Sea appears to be limited. Two Federal lease sales were conducted in the Chukchi Sea and exploration activities were conducted, but no producible wells were discovered. A Chukchi Sea/Hope Basin lease sale scheduled in the 1997-2002 OCS oil and gas leasing program was deferred. Two Chukchi Sea/Hope Basin lease sales are scheduled in the 2002-2007 OCS oil and gas leasing program. The Chukchi Sea will likely proceed through a "special interest" process, a new process for leasing Federal tracts. It is somewhat speculative whether industry interest in the area is sufficient that sales will be held in the future. Although there are no plans for future oil and gas exploration activities in the Bering Sea south of St. Lawrence Island, a "special interest" offering in Norton Sound in the northern Bering Sea was just completed on April 22, 2002. No nominations were received during the "special interest" offering. Although the entire Norton Sound area was open for nomination, the purpose of the "special interest" process is to identify and offer only small, focused areas where industry has a significant interest in exploration. In the Canadian Beaufort Sea, the main area of industry interest has been around the Mackenzie River Delta and offshore of the Tuktoyaktuk Peninsula. Oil was discovered in these areas, although industry showed little interest in the area during the 1990's. Interest in the area increased recently, and an open-water seismic-exploration program was conducted off the Mackenzie River Delta during late summer and autumn of 2001. This was the first major offshore seismic program in that area since the early 1990's. We are not aware of plans for any additional seismic surveys. Some drilling operations may be conducted over the next few years.

V.C.5.a(1)(b) Effects of These Projects on Bowhead Whales

Some effects on bowhead whales may occur because of activities from previous and proposed lease sales of State and Federal areas offshore. Generally, bowhead whales remain far enough offshore to be mainly in Federal waters, but they move into State waters in some areas, such as the Beaufort Sea southeast and north of Kaktovik and near Point Barrow. We detailed these potential effects in the Beaufort Sea Sale 170 final EIS (USDOI, MMS, 1998).

To date, activities conducted in State waters or on the OCS in the Beaufort Sea as a result of previous Federal lease sales since 1979 apparently have not had adverse effects on the bowhead whale population. Although numerous exploration wells have been drilled in the Beaufort Sea from a variety of platforms, including gravel islands, ice islands, bottom-founded drilling platforms, submersibles, and drillships and extensive seismic surveys have been conducted, no bowhead whale mortality has been reported. The bowhead whale population has continued to increase over that timeframe. However, Inupiat whalers have stated that noise from these activities at least temporarily displaces whales farther offshore, especially if the operations are conducted in the main migration corridor. Whales may avoid areas where seismic surveys or drilling operations are being conducted. Recent monitoring studies (Miller et al., 1997, 1999; Miller, Elliot, and Richardson, 1998) indicate that most whales migrating in the fall avoid an area with a radius about 20-30 kilometers around a seismic vessel operating in nearshore waters. These studies are discussed in detail below.

In general, development projects such as Endicott or Northstar, and reasonably foreseeable future development projects such as Liberty, are not likely to harm bowhead whales. Endicott is inside the barrier islands in relatively shallow water. Support traffic travels over the causeway. Although Northstar is not inside the barrier islands, it is well shoreward of the bowhead's fall-migration route. Operations for both Endicott and Northstar projects are conducted from gravel structures, which limit how far noise would travel. The Liberty Project is located inside of the barrier islands, well shoreward of the bowhead's fall-migration route (USDOI, MMS, Alaska OCS Region, 2002a). Operations for the Liberty Project, if developed, also likely would be conducted from gravel structures, limiting how far noise would travel. Studies discussed in Section IV.C.5 indicate that noise from oil and gas operations on gravel islands is substantially attenuated within 4 kilometers and not detectable at 9.3 kilometers.

Some bowhead whales could be disturbed if development proceeds at the Kuvlum and Hammerhead units or other reasonably foreseeable future development projects, such as the Sandpiper or Flaxman Island units. The Kuvlum and Hammerhead units are within the bowhead whale's normal fall-migration route. Development of these units likely would share infrastructure with the Badami group. Each unit likely would have its own production pads and wells and a pipeline connecting it to an existing or planned field associated with Badami. Installing production platforms and constructing pipelines could disturb some bowhead whales on their fall migration, if pipeline construction in deeper water took place during the latter part of the open-water season. If helicopters from Deadhorse pass low overhead, they could cause bowheads to dive. Whales would try to avoid close approach by vessels.

The Sandpiper and Flaxman Island units are not within the main bowhead whale fall migration route. Sandpiper is near Northstar, and the effects on bowheads from development at that location likely would be similar to those expected from Northstar. Flaxman Island is closer to the bowhead whale's main fall-migration route, but it is a barrier island. In general, noise from oil and gas activities on gravel islands does not travel more than a few kilometers. Development of the Sandpiper unit likely will share infrastructure with the Northstar group. The unit likely would have its own production pads and wells and a pipeline connecting it to Northstar. Development of the Flaxman Island unit likely would share infrastructure with the Badami group. The unit likely would have its own production pads and wells and a pipeline connecting it to a past or present development project associated with Badami.

In the Canadian Beaufort Sea, the main area of industry interest has been around the Mackenzie River Delta and offshore of the Tuktoyaktuk Peninsula. Bowhead whales summering in this area are thought to spend much of their time feeding. Industry interest in the area increased recently and an open-water seismic-exploration program was conducted off the Mackenzie River Delta during late summer and autumn of 2001. This was the first major offshore seismic program in that area since the early 1990's. We are not aware of plans for any additional seismic surveys.

V.C.5.a(1)(c) Effects of Noise, Oil Spills, and other Contaminants on Bowhead Whales

Overall, cumulative effects to bowhead whales could include behavioral responses to seismic surveys; aircraft and vessel traffic; exploratory drilling; construction activities, including dredging/trenching and pipelaying; and development drilling, production operations, and oil-spill-cleanup operations that take place at varying distances from the whales. In general, bowheads may try to avoid vessels or seismic surveys if closely approached, but they do not respond much to aircraft flying overhead at 1,000 feet or more. Bowheads also try to avoid close approaches by motorized hunting boats. Bowhead whales whose behavior appeared normal have been observed on several occasions within 10-20 kilometers of drillships in the eastern Beaufort Sea, and there have been a number of reports of sightings within 0.2-5 kilometers from drillships (Richardson et al., 1985; Richardson and Malme, 1993). On several occasions, whales were well within the zone where they should have been able to detect the noise. However, some bowheads are likely to change their migration speed and swimming direction to avoid getting close to them. Whales appear less concerned with stationary sources of relatively constant noise than with moving sources. Bowheads do not seem to travel more than a few kilometers in response to a single disturbance, and behavioral changes are temporary, lasting from minutes (for vessels and aircraft) up to 30-60 minutes (for seismic activity). Detailed discussions of how these various activities may affect bowheads can be found in the Final EIS's for Beaufort Sea Lease Sales 144 and 170, the Final EIS for the Liberty Development and Production Plan, and the Section 7 consultation for the Beaufort Sea Region (USDOI, MMS, 1996a, 1998; USDOI, MMS, Alaska OCS Region, 2002a; National Marine Fisheries Service, 2001). There has been some new information on the effects of seismic on bowhead whales from recent seismic studies. Information from studies conducted during the 1980's and new information from studies conducted during the 1990's are presented in the following.

Studies were conducted on the reactions of bowhead whales to marine seismic operations in the Canadian and Alaskan Beaufort Sea during the summer and early autumn in the early to mid 1980's. Detailed monitoring of the reactions of migrating bowheads to nearshore seismic operations was conducted from 1996-1998. The results of these two projects were different (LGL Ltd., 2001). Differences also were noted in the seismic operations conducted during the two timeframes. Seismic surveys in the 1980's were 2-dimensional surveys with wider spacing between gridlines, and they generally were conducted in deeper waters using larger arrays. Surveys from 1996-1998 were 3-dimensional surveys with gridlines much closer together, and the surveys were conducted in shallow waters much closer to shore using smaller arrays.

During the 1980's, the behavior of bowhead whales exposed to noise pulses from seismic surveys was observed during the summer in the Canadian Beaufort Sea and during the fall migration across the Alaskan Beaufort Sea (Reeves et al., 1984; Fraker et al., 1985; Richardson et al., 1986, as referenced in LGL Ltd., 2001). There also were a number of partially controlled experiments to observe the reactions of bowhead whales to single airguns and to full-scale arrays. These studies showed that most bowheads exhibited strong avoidance behavior and changes in surfacing, respiration, and dive cycles when an operating seismic vessel approached within a few kilometers. During the studies in the 1980's, bowheads exposed to pulses from vessels more than 7.5 kilometers away rarely showed observable avoidance of the vessel, but their surface, respiration, and dive cycles appeared to be altered in a manner similar to that observed in whales exposed at a closer distance (LGL Ltd., 2001). Ljungblad et al. (1985, 1988) conducted a series of four experimental tests of bowhead reactions to seismic surveys in the western Beaufort Sea during the early fall. Total avoidance, with all whales moving away from the source, occurred at 3, 3.5, and 7.2 kilometers from the three vessels using arrays of airguns, and at 1.25 kilometers from the vessel using a single airgun. Whales also demonstrated reduced surfacing and dive duration, fewer blows per surfacing, and longer intervals between successive blows. Observers noted that some whales were displaced by several kilometers, and that changes in behavior lasted for up to an hour (LGL Ltd., 2001). A more detailed discussion of the potential for noise disturbance to bowheads from seismic activities and a discussion about some of the limitations of the Ljungblad et al. (1985) study can be found in the Beaufort Sea Planning Area Oil and Gas Lease Sale 170 final EIS and the Section 7 consultation for the Beaufort Sea Region (USDOI, MMS, 1998; National Marine Fisheries Service, 2001, respectively). Various limitations to these studies also were pointed out by Dr. Tom Albert, North Slope Borough during the Arctic Seismic Synthesis and Mitigating Measures Workshop (USDOI, MMS, Alaska OCS Region, 1997).

Richardson et al. (1986) observed whales near another full-scale vessel with a 2,870-cubic-inch airgun array. Whales exposed to sounds from this array began to orient away from the vessel at 7.5 kilometers, but some continued to feed in the area until the vessel was within 3 kilometers. The whales were displaced approximately 2 kilometers, and behavioral changes were noted to persist for at least 2.4 hours.

It is likely that some migrating bowheads avoid seismic operations at distances exceeding those in the studies discussed above. One apparent longer distance response involved bowheads swimming away from a seismic vessel 24 kilometers away (LGL Ltd., 2001). Subtle changes in surfacing, respiration, and dive cycles, detected only by statistical analysis, were noted at longer distances, out to at least 73 kilometers (LGL Ltd., 2001).

New information on the effects of seismic noise on bowheads is now available from marine mammal monitoring programs conducted in 1996-1998 (Miller et al., 1997, 1999; Miller, Elliot, and Richardson, 1998). The LGL and Greeneridge 1996-1998 monitoring studies were analyzed to determine the general position of the bowhead migration corridor at times with and without seismic activity. The results revealed no clear effect of the 1996 and 1997 seismic programs on the position of the general migration corridor in the central Alaskan Beaufort Sea. In 1996, Miller et al. (1997) found nearly all the bowhead whales in relatively nearshore waters, mainly between the 15-meter- and 40-meter-depth contours, about 10-50 kilometers from shore. Overall, bowhead sightings were fairly broadly distributed between the 10-meter- and 50-meter-depth contours (Miller et al., 1999). However, the analyses were limited by the low number of sightings potentially influenced by seismic activities. In 1997, nearly all bowhead sightings were in relatively nearshore waters, between the 10-meter- and 40-meter-depth contours, unusually close to shore (Miller et al., 1999). Many aggregations of feeding whales were observed near or just shoreward of the 10-meter depth contour. In 1998, the bowhead migration corridor generally was farther offshore than in either 1996 or 1997, between the 10-meter- and 100-meter-depth contours and approximately 10-60 kilometers from shore (Miller et al., 1999). The distributions of sightings during periods with and without seismic exploration broadly overlapped. The 1996-1998 combined data indicated that sighting distributions tended to be farther offshore during times of seismic operations than with no seismic operations.

During 1996-1998 combined survey efforts, sighting distributions tended to be farther offshore on days with seismic airguns operating compared to days without seismic airguns operating. This was true for the study area as a whole, for the East region, and marginally so for the West region. The difference in the Central region was not statistically significant.

Aerial survey results indicated that bowheads tended to avoid the area around the operating source to a radius of about 20 kilometers. Results of the 1996-1998 studies show that bowheads rarely were seen within 20 kilometers of the operations area at times when airguns were operating, but there were some sightings within 20-30 kilometers of the nearest shotpoint (Miller et al., 1999). Sighting rates within a radius of 20 kilometers of seismic operations were significantly lower during seismic operations than when no seismic operations were occurring. Within 12-24 hours after seismic operations ended, the sighting rate within 20 kilometers was similar to the sighting rate beyond 20 kilometers. There was little or no evidence of differences in headings, general activities, and swimming speeds of bowheads with and without seismic operations. Miller et al. (1999) stated that the lack of any statistically significant difference in headings should be interpreted cautiously. Because it has been shown that most bowheads within 20 or even 30 kilometers of the operating airgun array showed avoidance or deflected offshore, westbound bowheads must have turned to the right at some point as they approached the seismic operation. Miller et al. (1999) noted that the distance at which deflection began cannot be determined precisely, but they stated that considering times with operations on offshore patches, deflection may have begun about 35 kilometers to the east. However, some bowheads approached within 19-21 kilometers of the airguns when they were operating on the offshore patches. It appears that in 1998, the offshore deflection might have persisted for at least 40-50 kilometers west of the area of seismic operations. In contrast, during 1996-1997 there were several sightings in areas 25-40 kilometers west of the most recent shotpoint, indicating the deflection in 1996-1997 may not have persisted as far to the west.

The observed 20- to 30-kilometer (12.5-18.8 mile) area of avoidance is a larger avoidance radius than was evident from scientific studies in the 1980's (approximately 7.5 kilometers). However, it is less than the 48 kilometers (30 miles) suggested by subsistence whalers, based on their experience with the types of seismic operations that occurred in the Beaufort Sea before 1996 (Richardson, 2000). Regarding the studies conducted in the 1980's, Richardson and Malme (1993) noted that strong avoidance may occur infrequently at distances of 20 kilometers or more (Koski and Johnson, 1987), although active avoidance usually does not begin unless the seismic ship is closer than 8 kilometers. Richardson and Malme (1993) noted that the apparent avoidance response observed by Koski and Johnson was the longest distance of a seismic vessel documented in the studies they reviewed. Regarding the distance suggested by subsistence whalers, whaling captains from Barrow, Nuiqsut, and Kaktovik, in written testimony at the Arctic Seismic Synthesis and Mitigating Measures Workshop on March 5-6, 1997 (USDOI, MMS, Alaska OCS Region, 1997), in Barrow, Alaska, stated:

> Factual experience of subsistence whalers testify that pods of migrating bowhead whales will begin to divert from their migratory path at distances of 35 miles from an active seismic operation and are displaced from their normal migratory path by as much as 30 miles.

During the 1996-1998 bowhead hunting seasons, seismic operations were moved to locations well west of Cross Island, the area where Nuiqsut-based whalers hunt for bowheads (Miller et al., 1999). This was done under the provisions of the Conflict Avoidance Agreements established between industry and the hunters in 1996-1998. No perceived interference between seismic operations and hunting was reported either in 1998 or in 1996-1997. As a result of mitigation measures implemented under the 1996-1998 Conflict Avoidance Agreements, the 1996-1998 seismic surveys did not adversely affect the accessibility of bowheads to subsistence whalers (Miller et al., 1999).

With respect to these studies conducted in the Beaufort Sea from 1996-1998, the peer review group at the Arctic Open-Water Noise Peer Review Workshop in Seattle from June 5-6, 2001, prepared a summary statement supporting the methods and results reported in Richardson et al. (1999) concerning avoidance of seismic sounds by bowhead whales:

> Monitoring studies of 3-D seismic exploration (8-16 airguns totaling 560-1,500 cubic inches) in the nearshore Beaufort Sea during 1996-1998 have demonstrated that nearly all bowhead whales will avoid an area within 20 km of an active seismic source, while deflection may begin at distances up to 35 km. Sound levels received by bowhead whales at 20 km ranged from 117-135 dB re 1μPa rms and 107-126 dB re 1μPa rms at 30 km. The received sound levels at 20-30 km are considerably lower levels than have previously been shown to elicit avoidance in bowhead or other baleen whales exposed to seismic pulses.

Behavioral studies suggested that some bowhead whales may get used to noise from distant ongoing drilling, dredging, or seismic operations, but they still will exhibit some localized avoidance (Richardson and Malme, 1993). Bowhead whales have behaved normally while on their summer feeding grounds within a few kilometers of operating drillships, well within the zone where drillship noise is clearly detectable (Richardson, Wursig, and Greene, 1990; Richardson, Wells, and Wursig, 1985; Richardson and Malme, 1993). Some bowhead whales tolerate considerable underwater noise from actual drillships and dredges. Biologists saw bowheads as close as 4 kilometers from a drillship, 10 kilometers from a conical drilling unit, and 0.8 kilometer from a suction dredge. Richardson, Wursig, and Greene also observed behavioral reactions of bowhead whales to underwater playbacks of recorded drillship and dredge noise. Some (but not all) bowheads oriented away when received noise levels and spectral characteristics were comparable to those several kilometers from actual drillships and dredges. During some playback tests call rates decreased; feeding ceased; and cycles of surfacing, respiration, and diving may have changed. The sensitivity of various whales differed. Roughly half responded when the received level of noise was about 115 dB re 1μPa on a broadband basis, or about 110 decibels in one 1/3-octave band at 0-30 decibels above ambient). These levels occurred about 3-11 kilometers from a drillship and dredge. The study concluded that some bowheads might habituate to prolonged noise exposure. Alternatively, only the less sensitive individual whales may be found within 5 kilometers of drillships and dredges. We do not have enough evidence to know whether or not industrial activity continuing for several years would preclude bowheads from using an area; and no documented evidence shows that noise from outer continental shelf operations would act as a barrier to migration.

Inupiat whalers observed and reported that noise from some drilling activities, especially drilling from drillships with icebreaker support in the main migration corridor, displaces whales farther offshore away from their traditional hunting areas. Inupiat whalers also have observed and reported that noise from seismic activities displaces whales farther offshore.

Overall, exposure to noise from oil and gas operations should not kill any bowhead whales, but some could experience temporary, nonlethal effects. There is no clear indication that disturbance from oil and gas exploration and development activities since the mid-1970's has had an additive or synergistic effect on the bowhead whale population. That population has been steadily increasing at the same time that oil and gas activities have been occurring in the Beaufort Sea and throughout the bowhead whale's range. Major changes in the bowhead's migration route through the Beaufort Sea are unlikely to result from this noise, although some individuals may be diverted farther offshore.

A more detailed discussion of the potential for noise disturbance to bowheads from industry activities, particularly drillship and seismic, can be found in the Beaufort Sea Planning Area Oil and Gas Lease Sale 170 final EIS and the Section 7 consultation for the Beaufort Sea Region (USDOI, MMS, 1998; National Marine Fisheries Service, 2001, respectively).

Bowhead whales could be affected by oil spills from oil and gas projects in the Beaufort Sea. Beaufort Sea Sale 186 represents about 7.66% of past and present oil and gas development projects in the Beaufort Sea area and about 3.80% of past, present, and reasonably foreseeable future oil and gas development projects in the Beaufort Sea area (Table V-7b). It is expected to contribute about 17% of the mean number of spills on the offshore area (Table V-13). The total estimated mean number of cumulative offshore spills is 0.65, and the estimated mean number of spills from the Beaufort Sea Sale 186 is 0.11. The most likely number of offshore spills for the Beaufort Sea Sale 186 is zero (Table V-13). It is expected to contribute about 4% of mean number of spills for the Trans-Alaska Pipeline System tanker spills (Table V-13). Because more oil spills are likely to occur under the cumulative case than for Beaufort Sea Sale 186 alone, whales are more likely to contact spilled oil, and oil-spill effects may be greater. However, oil has more of a chance of contacting the bowhead's habitat than the whales themselves.

The effects of oil on bowhead whales would be essentially as described in Section IV.C.5. Individuals exposed to spilled oil may inhale hydrocarbon vapors, experience some damage to skin or sensory organs, ingest spilled oil or oil-contaminated prey, feed less efficiently because of baleen fouling, and lose some prey killed by the spill. Prolonged exposure to freshly spilled oil could kill or injure a few whales.

Geraci (1990) reviewed a number of studies on the physiologic and toxic effects of oil on whales and concluded there was no evidence that oil contamination had been responsible for the death of a cetacean. Nevertheless, the effects of oil exposure to the bowhead whale population are uncertain, speculative, and controversial. The effects would depend on how many whales contacted oil, the duration of contact, and the age/degree of weathering of the spilled oil. The number of whales contacting spilled oil would depend on the size, timing, and duration of the spill; how many whales were near the spill; and the whales' ability or inclination to avoid contact. If oil got into leads or ice-free areas frequented by migrating bowheads, a large portion of the population could be exposed to spilled oil. Prolonged exposure to freshly spilled oil could kill some whales, but the number likely would be small. More information on the effects of noise and oil spills on bowhead whales can be found in Section IV.C.5.

Some information is available regarding how heavy metals and other contaminants may affect bowhead whales. Heavy metals and other contaminants, while not specifically associated with oil spills, are of concern to the health of bowhead whales and to humans who use bowhead whales for food. Information about cetacean metabolism also is inadequate. Bratton et al. (1993) measured organic arsenic in the liver tissue of one bowhead whale and found that about 98% of the total arsenic was arsenobetaine. Arsenic in marine biota generally is in an organic form, mostly arsenobetaine, that appears to be nontoxic and of no concern to humans using them as food. Based on the limited data available, researchers (Bratton et al., 1993) concluded that petroleum products appear not to harm bowheads or humans who eat them, but we need more research to be certain. In addition, we provided funds to the National Oceanic and Atmospheric Administration in 1987 to establish and conduct a program for collection and long-term storage of tissues from Alaska marine mammals for future contaminant analysis. This program, the Alaska Marine Mammal Tissue Archival Project, which has been managed by the National Marine Fisheries Service since 1992, contains tissue samples from bowhead whales and other marine mammals. Tissue samples were collected from whales landed at Barrow in 1992. Initial studies of bowhead tissues (Becker et al., 1995) indicate that bowhead whales have very low levels of mercury, PCB's, and chlorinated hydrocarbons, but they have fairly high concentrations of cadmium in their liver and kidneys. Cadmium is a naturally occurring heavy metal that commonly is present at high levels in marine mammal tissues, particularly in the liver and kidney. The study concluded that the high concentration of cadmium in the liver and kidney tissues of bowheads warrants further investigation. Becker (2000) noted that concentration levels of chlorinated hydrocarbons in bowhead whale blubber generally are an order of magnitude less than what has been reported for beluga whales in the Arctic. This probably reflects the difference in the trophic levels of these two species; the bowhead is a baleen whale that feeds on copepods and euphausiids, while the beluga whale is a toothed whale that feeds at a level higher in the food web. The concentration of total mercury in the liver also is much higher in beluga whales than in bowhead whales.

Bratton et al. (1997) looked at eight metals (arsenic, cadmium, copper, iron, mercury, lead, selenium, and zinc) in the kidneys, liver, muscle, blubber, and visceral fat from bowheads harvested from 1983-1990. These metals were chosen because they are the most common metals reported in the literature for cetaceans, they represent the most toxic metals to marine organisms, and they are the most likely metals to enter the Inupiat diet. They observed considerable variation in tissue metal concentration among the whales tested. Metal concentrations evaluated did not appear to increase over time between 1983 and 1990. Based on metal levels reported in the literature for other baleen whales, the metal levels observed in all tissues of the bowhead are similar to levels in other baleen whales. None of the metals studied were high enough in muscle, blubber, or visceral fat to pose a risk to human consumers. The study concluded the tissues from bowhead whales are, in general, nutritious and safe to eat. The bowhead whale has little metal contamination as compared to other arctic marine mammals, except for cadmium, which requires further investigation as to its role in human and bowhead whale health. The study recommended limiting the consumption of kidney from large bowhead whales pending further evaluation.

Conclusion: Exposure of bowhead whales to noise from oil and gas operations is not likely to kill any bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The levels of metals and other contaminants measured in bowhead whales appear to be relatively low.

V.C.5.a(1)(d) Effects of Other Activities on Bowhead Whales

Activities that are not oil and gas related also affect bowhead whales. Incidental take of bowhead whales apparently is rare. Between 1976 and 1992, only three ship-strike injuries were documented out of a total of 236 bowhead whales examined from the Alaskan subsistence harvest (George et al., 1994). The low number of observations of ship-strike injuries suggests that bowheads either do not often encounter vessels or they avoid interactions with vessels, or that interactions usually result in the animals' death. The bowhead whales' association with sea ice limits the amount of fisheries activity occurring in bowhead habitat. A young bowhead was reported to have died after being entrapped in fishing net in Japan (Shelden and Rugh, 1995) and another in northwest Greenland in a net used to capture beluga whales. Several cases of rope or net entanglement, at least 10 incidents from 1978-1999, have been reported from whales taken in the subsistence hunt (Angliss, DeMaster, and Lopez, 2001). The number of entanglements or scarring attributed to ropes may include more than 20 cases (Craig George, as cited in Angliss and Lodge, 2002 draft). There are no observer program records of bowhead whale mortality incidental to commercial fisheries in Alaska. New information on entanglements of bowhead whales indicates that bowheads do have interactions with crab-pot gear. There have been two confirmed occurrences of entanglement in crab-pot gear, one in 1993 and one in 1999 (Angliss and Lodge, 2002). Based on currently available data, the estimated annual mortality rate incidental to commercial fisheries is 0.2 (Angliss and Lodge, 2002).

Subsistence whaling authorized by the International Whaling Commission is another activity on the outer continental shelf that affects the bowhead whale. Bowheads are harvested by Alaska Natives in the northern Bering Sea and in the Chukchi Sea on their spring migration and in the Beaufort Sea on their fall migration. Canadian and Russian Natives also have requested to harvest bowhead whales. The Canadian Government granted permission in 1991 to kill one bowhead, and a bowhead was harvested in Mackenzie Bay in fall 1991. Additional permits were granted in 1993 and 1994, but no bowheads were harvested in either year. There is renewed interest by villages along the Russian Chukchi Sea coast to hunt bowhead whales. At the 1997 International Whaling Commission, the Commission approved a combined quota allowing an average of 56 bowheads to be landed each year to meet the needs of Eskimos in Alaska and Russia.

Since subsistence whaling was authorized by the International Whaling Commission in 1977, the number of whales harvested has ranged between 14-72 per year, depending in part on changes in management strategy and in part on higher estimates of bowhead whale abundance in recent years. The total estimated take annually by Alaska Natives in recent years, including struck and lost whales, was reported to be 41 (1990), 46 (1991), 46 (1992), 51 (1993), 46 (1994), 57 (1995), 44 (1996) (Hill and DeMaster, 1999), 66 (1997), 54 (1998), 47 (1999) (Angliss, DeMaster, and Lopez, 2001), 47 (2000), and 75 (2001) (Anliss and Lodge, 2002). Hunters from the western Canadian Arctic community of Aklavik killed one whale in 1991 and one in 1996. The average annual subsistence take (by Natives of Alaska and Canada) during the 5-year period from 1995 to 1999 is 54 bowhead whales (Angliss, DeMaster, and Lopez, 2001). The average annual subsistence take during the 5-year period from 1997-2001 is 58 bowhead whales (Angliss and Lodge, 2002).

Subsistence whaling quotas change every few years. A quota of 266 strikes or 204 bowhead whales landed was authorized by the International Whaling Commission for 1995-1997 to be divided among 10 Alaskan villages (Shelden and Rugh, 1995). There is a 5-year block quota of 280 bowhead whales landed, authorized by the International Whaling Commission for 1998-2002 (64 *FR* 28413). The number of bowheads struck in each year may not exceed 67, except that any unused portion of a strike quota from any year may be carried forward; however, no more than 15 strikes may be added to the strike quota for any one year. There were 15 unused strikes available after the 1997 harvest, and the combined strike quota for 1998 was 82 (67 + 15). There were 15 unused strikes available after the 1998 harvest, and the combined strike quota for 1999 was 82 (67 + 15). The Eskimos in Alaska and the Chukotka Natives in the Russian Far East shared the 82 combined strike quota for 1998 and 1999. In 1999, the Chukotka Natives in the Russian Far East were allowed no more than 7 strikes, and the Alaska Eskimos were allowed no more than 75 strikes. The quota for Alaska Eskimos is divided among 10 Alaskan villages in the Bering, Chukchi, and Beaufort seas. This compares with the previous quota of 266 strikes, or 204 bowhead whales landed, authorized by the International Whaling Commission for 1995-1998 to be divided among 10 Alaskan villages (Shelden and Rugh, 1995). This level of harvest was approved by the International Whaling Commission under the supposition that it still would allow for continued growth in the bowhead population. It is likely that the bowhead whale population will continue to be monitored and that the harvest quota will be set accordingly to maintain a healthy bowhead population level.

V.C.5.a(2) Transportation Effects on Bowhead Whales

Bowhead whales are a marine species that winter in the Bering Sea and migrate through the Chukchi Sea into the Beaufort Sea every spring. In the fall, they migrate back through the Chukchi Sea into the Bering Sea. Bowhead whales and their habitat are far removed from the tanker routes to the Far East and to southern California. Therefore, they would not be affected by overland transportation of oil through the Trans-Alaska Pipeline System or by marine transportation along the tanker routes.

Summary and Conclusions for Beaufort Sea, North Slope, and Transportation Activities on the Bowhead Whale. Bowhead whales might experience cumulative effects from OCS activities, such as oil spills or noise from drilling, vessel and aircraft traffic, construction, seismic surveys, or oil-spill-cleanup activities, and from non-OCS activities. Bowhead whales temporarily may move to avoid noise-producing activities and may experience temporary, nonlethal effects, if oil spills occur during activities associated with any past, present, or reasonably foreseeable future development projects in the arctic region.

We do not expect bowhead whales to die from noise produced while exploring, developing, and producing offshore oil and gas, but some whales could experience temporary, nonlethal effects. Some bowheads temporarily may move to avoid vessels and activities conducted for seismic surveys, drilling, and construction. Contact with spilled oil in the Beaufort Sea could cause some temporary, nonlethal effects to some bowhead whales, and a few could die from prolonged exposure to freshly spilled oil. There is no clear indication that disturbance from oil and gas exploration and development activities since the mid-1970's has had an additive or synergistic effect on the bowhead whale population. The bowhead whale population has been steadily increasing at the same time that oil and gas activities have been occurring in the Beaufort Sea and throughout the bowhead whale's range. Bowhead whales should not be affected by oil spills or activities associated with the transport of oil through the Trans-Alaska Pipeline System or by marine transportation along the tanker routes to market.

Activities that are not related to oil and gas also could have cumulative effects on bowhead whales. A small number of whales may be injured or killed as a result of entrapment in fishing nets or collisions with ships. Native whalers from Alaska harvest bowheads for subsistence and cultural purposes under a quota authorized by the International Whaling Commission. Native whalers from Russia also are authorized to harvest bowhead whales under a quota authorized by the International Whaling Commission.

Conclusion: Overall, exposure of bowhead whales to noise from oil and gas operations is not expected to kill any bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The incremental contribution of effects from Beaufort Sea Sale 186 to the overall effects under the cumulative case is not likely to cause an adverse effect on the bowhead whale population.

Contribution of Beaufort Sea Sale 186 to Cumulative Effects: Noise contribution to cumulative effects from Alternative I for Sale 186 likely would be limited to temporary avoidance behavior by a few bowhead whales in response to aircraft and vessel traffic, drilling activities and possibly some seismic surveys.

Alternative I for Sale 186 represents about 7.66% of past and present oil and gas development projects in the Beaufort Sea area and about 3.80% of past, present, and reasonably foreseeable future oil and gas development projects in the Beaufort Sea area (Table V-7b). It is expected to contribute about 17% of the mean number of spills on the offshore area (Table V-13). The total estimated mean number of cumulative offshore spills is 0.65, and the estimated mean number of spills from the Beaufort Sea Sale 186 is 0.11. The most likely number of offshore spills for Alternative I for Sale 186 is zero (Table V-13). It is expected to contribute about 4% of mean number of spills for the Trans-Alaska Pipeline System tanker spills (Table V-13). Because more oil spills are likely to occur under the cumulative case than for Alternative I for Sale 186 alone, whales are more likely to contact spilled oil, and oil-spill effects may be greater. Some individuals exposed to spilled oil may inhale hydrocarbon vapors, experience some damage to skin or sensory organs, ingest spilled oil or oil-contaminated prey, feed less efficiently because of baleen fouling, and lose some prey killed by the spill. Prolonged exposure to freshly spilled oil could kill or injure a few whales.

V.C.5.b. Spectacled and Steller's Eiders

V.C.5.b(1) Cumulative Effects on Spectacled and Steller's Eiders

V.C.5.b(1)(a) Projects and Activities That Could Contribute to Cumulative Effects

In addition to development of the prospects associated with Alternative I for Sale 186, other Federal and State projects and associated activities that could contribute to cumulative effects on migratory eiders seasonally occupying the Arctic Coastal Plain are outlined in Section V.C. Other projects and activities occurring on the Arctic Coastal Plain, along migration routes, or on the winter range also could contribute to cumulative effects. These include subsistence harvests, commercial fishing, environmental contamination including oil spills (large oil spill is an unlikely event), marine shipping, and recreational activities. These projects and activities could result in (1) additional oil or other toxic pollution effects (see the discussion in Section IV.C.5.b(1)), (2) additional disturbance during breeding and postbreeding periods, and (3) habitat degradation beyond what already has occurred in the Prudhoe Bay region.

V.C.5.b(1)(b) Disturbance

V.C.5.b(1)(b)1) Aircraft and Vessel Disturbance

Relatively large numbers of helicopter trips and substantial vessel traffic would be required to support offshore developments. Roadless development such as Alpine, Badami, and that projected for the National Petroleum Reserve-Alaska also may require substantial air support for development, although most construction would be done during winter. The number of helicopter roundtrips (Table IV.A-4) required to support exploration (155/year), construction (1-2 years, 300-600/month), development (28-56/month), and production (12-28/month) for Sales 186 and 195 have the potential for some overlap and, thus, higher totals would cause substantial increases in air traffic, amounting to perhaps 30-40 round trips per day.

Regardless of any attempts to mitigate effects by adjusting routes, continued activity at this level to support developing fields and future development is likely to result in some low-altitude flights over nesting, broodrearing, staging, or migrating spectacled eiders. Such disturbance is expected to result in short-term excess energy use by disturbed individuals and displacement of birds from the vicinity of routinely used air corridors. The latter would be similar to bird responses observed during low-level aerial bird-survey overflights where individuals dive, run across the water surface at various trajectories, or take flight, depending on species and circumstances. Such disturbance may flush females from nests resulting in lower productivity if eggs are lost to predators or exposure to low temperatures, or may cause displacement of females with broods from preferred foraging areas during broodrearing, or any individuals during preparation for migration.

If aircraft frequently overfly open water off river deltas in spring, some eiders may be displaced from this habitat. Because limited open water is available in spring, access to such areas is likely to be more restricted than in the postbreeding period. This could increase competition for the food available during this energetically stressful period following spring migration and could result in decreased survival or breeding success. In certain areas where such habitat is restricted (for example, only smaller stream or river deltas available), this could be an important effect during this period of relatively high energy requirement and limited resource availability. During the summer, nonbreeding individuals, failed breeders, and males may be feeding in nearshore or offshore areas. Helicopters flying over these areas 30-plus times per day could cause birds to move away from routinely used routes, increasing the stress of preparing for migration in some individuals and a decline in their fitness or survival.

Displacement from the vicinity of vessel transportation corridors may last through an entire open-water season depending on the number of concurrent projects and the stage of development that determines trip frequency. Although substantial numbers of vessel round trips (150-200/summer) for each development project are forecast during the construction period, supply vessels are likely to follow established routes, which would limit the actual area disturbed. The area would increase and, potentially, the numbers of individuals affected, if concurrent projects at different locations were developed. Vessel traffic occurs during the open-water season; therefore, although numbers of eiders displaced could be substantial (many tens of individuals during a season), alternate foraging and staging habitat would be available away from probable routes.

The presence of offshore or onshore facilities could cause eiders to avoid the immediate vicinity for variable periods up to the duration of such presence. However, adequate nesting habitat is not likely to be limiting factor in the Beaufort Sea area.

V.C.5.b(1)(b)2) Vehicle Disturbance

Substantial numbers of gravel truck passages per day plus other vehicle traffic along 364 miles of existing roads (Table V-3) were associated with the construction of causeways, pads for facilities, and roads in the expanding oil development around Prudhoe Bay. Frequent summer traffic in particular can disturb nesting eiders. Even lower, postconstruction traffic levels may continue to disturb eiders throughout the life of the field. Satellite expansion of the Prudhoe Bay development would require new access roads. Vehicle use of these roads may have additive though relatively small effects on the regional eider population (BPXA, 1998a), because relatively few birds would be affected. Also, at least some spectacled eiders apparently do not avoid nesting in the vicinity of roads or facilities (Troy Ecological Research Assocs., 1995a), and early season snowmelt in dust shadows of roads may attract nesting eiders. Little population effect is expected to result from these situations.

V.C.5.b(1)(b)3) Other Disturbance Factors

Human presence, construction and drilling activities, spill cleanup, and predators attracted to oil and gas development areas vary considerably in how much disturbance they cause. The presence of unconcealed humans, whether associated with oil and gas, hunting, or recreational activities, is disturbing to birds, especially during nesting and broodrearing periods. Common experience confirms that such presence generally causes birds to move from the immediate area of disturbance and may displace them for several hours or longer. Cumulative effects of such disturbance, with several activities occurring in the same period or one after the other through the summer season, could cause decreased production and survival of young or recruitment into the population. Attracted predators and hunting, of course, may cause direct mortality. Predators such as foxes attracted to nesting areas may cause losses up to total failure for the season. Most such disturbance associated with commercial activities could be controlled by mitigation. Although it is likely that behavioral effects resulting from disturbance associated with oil and gas development would be additive to naturally occurring disturbances, there is no evidence for synergism where the combination of effects from natural and/or development-related factors is greater than their additive effects.

V.C.5.b(1)(c) Habitat Alteration

Past development in the Prudhoe Bay region has resulted in habitat loss by the gravel burial of 7,126 acres, plus 1,601 acres of gravel mines, and 756 acres of reserve pits (Table V-3). Future development is expected to occur with a much smaller "footprint." For example, local roads, pads, and airstrips for the Alpine and Badami projects are estimated to cover less than 100 acres for each development (Table V-5). The cumulative effects of future projects' infrastructure on eider populations, although additive, presumably would be less severe because of the smaller areas involved. Effects from dust fallout, thermokarst, and hydrologic change (USDOI, MMS, 1998) would be restricted to much smaller areas and, thus, result in smaller habitat loss. The total area covered by roads/pads/airstrips for development of the Badami, Alpine, Northstar, and Liberty (if developed) prospects is 216 acres plus 170 acres of gravel mines. By comparison, these projects contain 12.5% as much estimated oil reserve as the Prudhoe Bay region but are estimated to cover only 5% as much area.

Habitat alteration associated with Sale 186 onshore construction is expected to contribute about 0.6% of that altered by Prudhoe Bay region projects (roads, pads, airstrips, gravel mines, pits). However, the pads would cover less than 1 acre of well-vegetated tundra wetland habitat preferred by birds for nesting, while Prudhoe region developments cover 7,126 acres of tundra. Considering just gravel structures covering tundra, that required for Alternative I for Sale 186 development would disturb 0.01% of the Prudhoe Bay region. Comparison of gravel mine areas alone indicates that Sale 186 development would disturb 2.1% of that area altered by development in the Prudhoe Bay region.

V.C.5.b(1)(d) Collision Effects

The low density of spectacled and Steller's eiders in the Beaufort suggests that few fatalities from collision with offshore structures are likely to occur. Collision involving a flock could result in significant effect.

V.C.5.b(2) Transportation Effects on Spectacled and Steller's Eiders

Oil produced by development of Alternative I for Sale 186 prospects is expected to contribute only a small fraction of unlikely future spills of arctic oil from Trans-Alaska Pipeline System tankers (0.41 spills or about 1% of 9.66 of past, present, and reasonably foreseeable estimated tanker spills, Table V-12). Although few of these spills are expected to reach areas of overwintering habitat that are critical to the survival of Steller's eiders (from the Aleutian Islands to Cook Inlet); if they do, the oil is expected to be less harmful as a result of weathering and dispersion in the water. However, this threatened species is not likely to recover from any substantial oil-spill mortality that might occur. For example, the recovery period for the harlequin duck, classified as not recovering from effects of the *Exxon Valdez* oil spill (*Exxon Valdez* Oil Spill Trustee Council, 2001), already has spanned 4 generations. Recovery from a large spill may require a lengthy period, and it is complicated by other factors before and after the spill that increase mortality and/or decrease production of offspring. Spectacled eiders do not occur in areas that could be contacted by Trans-Alaska Pipeline System tanker spills.

According to spill simulations by LaBelle, Marshall, and Lear (1996), in the unlikely event a large oil spill occurs, the probability of a tanker spill greater than or equal to 1,000 barrels occurring 200 miles offshore along a Far East route and contacting sensitive coastal bird habitats within 30 days during the summer season is less than 0.5%. In the unlikely event a large oil spill occurs, the probability of contact in eider winter habitat within 30 days would be less than 5% in the lower Cook Inlet area and less than 24% in the Kodiak Island area. Elsewhere, contact probabilities are less than 0.5%. In general, the effect of tanker spills on the Steller's eider is expected to be about the same as described above and in Section IV.C.5.b.

V.C.5.b(3) Effects of Large Oil Spills

Although the magnitude of oil-spill effects is uncertain, in the unlikely event a large oil spill occurs during the life of relevant oil and gas projects (0.54 spills [the most likely number of spills is 0] greater than 1,000 barrels estimated to occur within about 28 years, Table V-12), it could result in significant losses of spectacled eiders, if it occurred during the prebreeding or postbreeding seasons when eiders might be staging in marine waters. A large offshore spill during the summer season could contact spectacled eiders staging offshore, although the number at risk in specific areas is not well known (Fischer, 2002; Fischer, Tiplady, and Larned, 2002). A Fish and Wildlife Service spill model for the Liberty Project suggests that only two individuals would be contacted by a large oil spill (5,912 barrels) and one by a 1,580-barrel spill (Stehn and Platte, 2000).

In addition to direct contact losses, any declines of benthic prey populations in foraging areas contacted by oil from a spill that is unlikely at any time of year may result in secondary impacts to eiders, affecting productivity and/or survival. Likewise, effects of a spill on shoreline and coastal marsh habitat and water quality may adversely affect spectacled eider productivity and survival in subsequent years. Effects resulting from development of Alternative I for Sale 186 projects would be additive to natural mortality and potentially could contribute significantly to cumulative effects in the highly unlikely event that a large offshore oil spill were to occur during the open-water season or its oil released from melting ice during breakup. Although it is likely that mortality resulting from oil spills would be additive to naturally occurring mortality, there is no evidence for synergism where the combination of effects from natural and/or development-related factors is greater than their additive effect.

In the unlikely event a large onshore spill occurs during the summer season, it may cause the loss of small numbers of nesting individuals. Most small spills, whether originating from pipelines or spills of refined products, are expected to be contained on gravel pads and/or cleaned up before eiders are contacted. Even if an onshore 720- to 1,142-barrel spill occurred during the summer season and entered freshwater aquatic habitat, eider mortality is likely to be few individuals. By comparison, and equally uncertain, some mortality could result from the small spills that are projected (82 spills, most of which are less than 1 barrel; Table A.1-6b) for the 28-year production life of prospects assumed in this cumulative analysis.

Summary and Conclusions for Effects of Beaufort Sea, North Slope, and Transportation Activities on Spectacled and Steller's Eiders. The effects from normal activities associated with cumulative exploration and development of oil and gas prospects in the Beaufort Sea are expected to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds are exposed frequently to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is expected to be highest in the vicinity of primary support facilities. Overlap between cumulative project developments could increase disturbance effects. The spectacled eider population, currently declining at a nonsignificant rate, may be slow to recover from small losses or declines in fitness or productivity. No significant overall population effect is expected to result from small losses.

In the event a large oil spill occurs in the marine environment, spectacled eider mortality is expected to be less than 100 individuals; however, any substantial loss (e.g., 25+ individuals) would represent a significant effect. Mortality resulting from the cumulative effects of oil and gas projects would be additive to natural mortality and interfere with the recovery of the Arctic Coastal Plain population. Recovery from substantial mortality is not expected to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers. Although little Steller's eider mortality is expected from an oil spill, knowledge regarding their numbers and distribution in this region is insufficient to allow realistic calculation of risk or effects from cumulative adverse factors. Neither eider species is expected to experience synergistic effects from combinations of adverse factors.

Contribution of Alternative I for Sale 186 to Cumulative Effects: Contribution of Alternative I for Sale 186 to the cumulative case is likely to be about 4% of the local short-term disturbance and habitat alteration effects on eiders (based on the expectation that effects resulting from Beaufort Sea Sales 186, 195, and 202 exploration, development, and production activities would occur in the same proportion as is represented by the ratio of oil reserves estimated for this sale, 0.46 billion barrels, to cumulative oil reserves, 11.5 billion barrels [Table V-12]). It is estimated that the average number of cumulative offshore spills associated with the Beaufort Sea Multiple Sale is 0.11 (the most likely number is zero [Tables V-12, V-13]); this represents about 17 % (Table V-13) of cumulative offshore spills (0.65 [Table V-12], not including Trans-Alaska Pipeline System tanker spills).

Although development of an individual prospect represents a small proportion of cumulative oil-spill risk, it could contribute significantly to cumulative effects in the unlikely event a large oil spill occurs and contacts either eider species staging in offshore or nearshore areas. The number typically at risk of direct oil contact in the specific areas is unknown but may be relatively small. In addition, if benthic prey declines as a result of contact by oil from a spill at any time of year, secondary impacts to eiders may affect productivity and/or survival. Likewise, negative effects of a spill on coastal habitats and water quality may affect eiders adversely in subsequent years.

In the unlikely event a large oil spill occurs, mortality of spectacled eiders from a 720- to 1,142-barrel onshore spill estimated from Alternative I for Sale 186, for example, are expected to range from 0-1 bird (see Section III.C.2.a(2) in the Liberty final EIS [USDOI, MMS, Alaska OCS Region, 2002a] for details), although earlier in the nesting season a pair could be contacted and later, a female with brood. Greater though unknown mortality (estimated fewer than 20 individuals) could result from the numerous small spills (maximum of 82 ranging in size from 1 gallon to less than or equal to 500 barrels, for a total volume of 246 barrels from Alternative I for Sale 186 [Table IV.A-2]) that are projected for the estimated 28-year life of Alternative I for Sale 186 projects.

Disturbance of eiders by helicopter-support traffic for individual future offshore projects is expected to be about the same as that required for the Northstar Project, which included approximately 2,000 round trips for all construction activities completed during one year (U.S. Army Corps of Engineers, 1999: Table 4-13). This difference would decrease to about one-tenth of the total for such projects during the production phase. Habitat alteration onshore associated with locating and constructing individual offshore oil and gas projects is expected to be about 0.6-3.5% of the total altered by Prudhoe Bay region projects (roads, pads, airstrips, gravel mines [Tables V-3, V-5, and V-6b]). A comparison of gravel-mine areas and preferred tundra wetland nesting habitat likely to be disturbed by development projects with that disturbed at Prudhoe Bay shows that these could disturb 2.1% and 0.01%, respectively, of the area altered by Prudhoe Bay development. Also, although development projects are expected to contribute substantially to cumulative noise and habitat disturbance effects, this contribution will decrease considerably after construction is completed.

Tanker spills of arctic oil, an unlikely event, which would include only 0.41 spill potentially attributable to of 10.07 total spills (about 4% [Table V-12]), are unlikely to reach the most densely populated Steller's eider wintering areas along the Alaska Peninsula and Aleutian Islands.

Overall cumulative effects of Alternative I for Sale 186 would be additive to effects from all projects. Only in the case of a large offshore oil spill would these projects be expected to increase cumulative adverse effects to potentially significant population-level consequences.

V.C.6. Marine and Coastal Birds

V.C.6.a. Cumulative Effects on Marine and Coastal Birds

In addition to development of the prospects associated with Alternative I for Sale 186, other Federal and State projects and associated activities that could contribute to cumulative effects on birds seasonally occupying or resident on the Arctic Coastal Plain are outlined in Section V.C.5.b. Other projects and activities occurring on the Arctic Coastal Plain, along migration routes, or on winter ranges also could contribute to cumulative effects. These include subsistence and sport harvests, commercial fishing, commercial development, environmental contamination, marine shipping, and recreational activities. These projects and activities could result in (1) additional oil or other toxic pollution effects (see discussions in Sections IV.C.6); (2) additional disturbance during breeding and postbreeding periods; and (3) habitat degradation beyond what already has occurred in the Prudhoe Bay region.

V.C.6.b. Effects of Disturbance

Potentially disturbing factors associated with oil and gas development include aircraft, vessel, and vehicle traffic; human presence; construction of facilities and roads/pads; drilling operations; spill cleanup; and attracted predators.

V.C.6.b(1) Aircraft and Vessel Disturbance

Relatively large numbers of helicopter trips and substantial vessel traffic would be required to support offshore developments. Roadless developments such as Alpine, Badami, and any that occur in the National Petroleum Reserve-Alaska, also may require substantial air support for development, although most construction would be done during winter. Numbers of helicopter round trips (Table IV.A-4) required to support exploration (155/year), construction (1-2 years, 300-600/month), development (28-56/month), and production (12-28/month), Sales 186 and 195, with potential for some overlap and thus higher totals, could cause substantial increases in air traffic, amounting to perhaps 30-40 round trips per day. Regardless of any attempts to mitigate effects by adjusting routes, continued activity at this level to support developing fields and future development is likely to result in some low-altitude flights over nesting, broodrearing, molting, staging, or migrating birds. Such disturbance is expected to cause excessive short-term energy use by disturbed individuals and displacement of birds from the vicinity of routinely used air corridors. The latter would be similar to bird responses observed during low-level aerial bird-survey overflights where individuals dive, run across the water surface, or take flight, depending on species and circumstances. Such disturbance may flush females from nests resulting in lower productivity if eggs are lost to predators or exposure to low temperatures, or may cause displacement of females with broods from preferred foraging areas during broodrearing, or any individuals during preparation for migration. Long-term displacement (1 year or more) from the vicinity of heavily used corridors and offshore or onshore facilities may result in fewer young produced and somewhat lower survival of adults and young.

If aircraft frequently overfly open water off river deltas in spring, loons, king and common eiders, long-tailed ducks, and other species are likely to be displaced from this essential habitat. Because limited open water is available in spring, access to such areas is likely to be more restricted than in the postbreeding period. This could increase competition for the food available during this energetically stressful period following spring migration and could result in decreased survival or breeding success. In certain areas where such habitat is restricted (for example, only smaller stream or river deltas available), this could be an important effect during this period of relatively high-energy requirement and limited resource availability. During the summer, nonbreeding individuals, failed breeders, molting individuals, and males may be feeding in nearshore or offshore areas. Helicopters flying over these areas 30+ round trips per day could cause birds to move away from routinely used routes, increasing the stress of preparing for migration in some individuals and a decline in their probability of survival.

Displacement from the vicinity of vessel transportation corridors may last through an entire open-water season, depending on the number of concurrent projects and the stage of development, which determines trip frequency. Although substantial numbers of vessel round trips (30-60/month) for a project (Table IV.A-4) are forecast during construction period, supply vessels are likely to follow established routes, which would limit the actual area disturbed. The area would increase, and potentially the numbers of individuals affected, if concurrent projects at different locations were developed. Vessel traffic occurs during the open-water season and, although numbers of birds displaced could be substantial (many tens of hundreds or thousands of individuals during a season), alternate foraging and staging habitat would be available away from probable routes.

The presence of offshore or onshore facilities could cause loons, eiders, and other waterbirds to avoid the immediate vicinity for variable periods up to the duration of such presence. This potentially could result in lowered productivity although adequate nesting habitat is not likely to be limited in the Beaufort Sea area.

V.C.6.b(2) Vehicle Disturbance

Substantial numbers of gravel-truck passages per day plus other vehicle traffic along about 364 miles of existing roads (Table V-3) were associated with the construction of causeways, pads for facilities, and roads in the expanding oil development around Prudhoe Bay. Frequent summer traffic in particular can disturb molting waterfowl such as snow geese when they attempt to cross roads. Even postconstruction traffic levels (low volume) may continue to disturb some species throughout the life of the field. During development of the Lisburne field, geese and swans appeared tolerant of vehicle traffic on roads during most seasons; however, during broodrearing, they moved away from roads (Murphy and Anderson, 1993). Early season snowmelt in dust shadows of roads may attract nesting birds. The Lisburne development activities had no apparent effect on overall bird habitat use in the area. However, some species of shorebirds, such as the semipalmated sandpiper and the dunlin, were reduced in density (up to 40%) within about 100 meters of roads during breeding compared to postbreeding periods and undisturbed areas (Troy, 1988; Troy Ecological Research Assocs., 1993). Satellite expansion of the Prudhoe Bay development could require new access roads. Vehicle use of these roads is expected to have additive though relatively small effects on bird populations (BPXA, 1998a).

V.C.6b(3) Other Disturbance Factors

Human presence, construction and drilling activities, spill cleanup, and attracted predators associated with oil and gas development vary considerably in the severity of disturbance they cause. The presence of unconcealed humans, whether associated with oil and gas, hunting, or recreational activities, is disturbing to birds especially during nesting, broodrearing, and molting periods. Common experience confirms that such presence generally causes birds to move from the immediate area of disturbance and may displace them for several hours or longer. Cumulative effects of such disturbance, with several activities occurring in the same period or one after another through the summer season, could cause decreased productivity if eggs or young are exposed to predators or low temperatures, or decreased survival of young if left unprotected.

Predators and hunters cause direct mortality. Predators such as foxes attracted to island or colonial species' nesting areas may cause losses of varying severity including up to total destruction of the season's productivity (Quinlan and Lehnhausen, 1982). Foxes may have increased in certain areas because of reduced trapping efforts by local people. Most such disturbance associated with commercial activities could be controlled by mitigation. Although it is likely that behavioral effects resulting from disturbance associated with oil and gas development would be additive to naturally occurring disturbances, there currently is no evidence for synergism where the combination of effects from natural and/or development-related factors is greater than their additive effects.

Low-flying waterbirds, especially sea ducks and loons, may collide with offshore islands/structures under conditions of poor visibility (darkness, fog). Because present offshore production islands/structures cumulatively represent relatively small obstructions in the Beaufort Sea, and birds encountering them when visibility is good are expected to see and avoid them, bird mortality from collisions with an island or other structure is expected to be low. However, although it is not possible to determine whether recent (late September/early October 2001) bird fatalities (18 sea ducks) at the currently operational Northstar Island occurred during daylight or evening hours under good visibility or foggy conditions (but darkness also would obscure the facility), the largest, single-day total occurred during a foggy period (fatality data supplied by Taylor, 2001). Increasing numbers of structures associated with greater offshore production in the foreseeable future potentially could result in substantial mortality for several waterbird species. Collision involving flocks of common eiders, for example, could result in a significant effect. There is little information on which to base a projected mortality estimate.

V.C.6.c Effects of Habitat Alteration

Development in the Prudhoe Bay-Kuparuk area (not including Alpine, Badami) has resulted in habitat loss by gravel burial of 6,944 acres, plus 1,512 acres of gravel mines and 756 acres of reserve pits (Table V-3). Future development is expected to occur with a much smaller disturbed area (footprint). For example local roads, pads, and airstrips for the Alpine and Badami projects are estimated to cover less than 100 acres for each development (Table V-5). Presumably, the effect of facilities for future projects on bird populations, though additive, would be substantially less severe because of the smaller areas involved. Such effects as from dust fallout, thermokarst, and hydrologic change (USDOI, MMS, 1998) would be restricted to much smaller areas and, thus, result in smaller habitat loss. For example, the total area covered by roads/pads/airstrips for the Badami, Alpine, Northstar, and Liberty (if developed) prospect areas is about 216 acres plus 170 acres of gravel mines. These projects are estimated to contain 12.5% as much estimated oil reserve as the Prudhoe Bay region but would cover only 5% as much area.

Habitat alteration associated with Sale 186 onshore construction is expected to contribute about 0.6% of that altered by Prudhoe Bay region projects (roads, pads, airstrips, gravel mines, and reserve pits; Table V-3). However, the pads would cover less than 1 acre of well-vegetated tundra wetland habitat potentially used by birds for nesting while Prudhoe region developments cover 7,126 acres of tundra. Considering just gravel structures covering tundra, that required for Alternative I for Sale 186 development would disturb about 0.01% of that disturbed in the Prudhoe region. Comparison of gravel mine areas alone indicates that Sale 186 development would disturb 2.1% of that altered by Prudhoe region development. Withdrawal of freshwater from lakes during winter for construction of ice roads and pads is expected to have almost no effect on tundra-nesting bird populations. Water used for this purpose is replaced rapidly by snowmelt runoff in spring; therefore, it is not likely that waterbodies depleted somewhat in winter would present decreased foraging opportunities for birds. Also, species of concern due to small and/or declining populations are present at low density on the coastal plain so it is unlikely that more than a very few individuals would by chance attempt to nest at lakes used as winter water sources. In addition, most species potentially affected are not considered habitat limited because they have rather general nest site requirements, so acceptable nesting habitat is widely available if areas used for water withdrawal lack some necessary characteristics.

V.C.6.c(1) Effects of Natural Events

On August 10, 2000, a violent windstorm occurred in the Beaufort Sea producing extreme wave action that eroded coastlines and restructured barrier island habitats. The storm was followed by several days of subnormal temperatures and 1.5 inches of snow (Divoky and Mendenhall, 2000). Many islands were heavily eroded, with some sloping shores converted to cliffs, and low-lying spits and islands were inundated. The immediate effect may have been the loss of common eider broods; at one of the two principal island study sites for the MMS-sponsored Beaufort Waterfowl Project, only one brood was observed following the storm. However, perhaps most importantly, much of the accumulated driftwood typically used by common eiders for nesting habitat on barrier islands was swept away; investigators at the study island estimated that three quarters of the driftwood disappeared. The ultimate effect of this aspect is difficult to gauge, because it is not known how quickly new driftwood will accumulate on the islands. It also is not possible to estimate the extent of and long-term effect of brood loss associated with this event. However, the declining status of this population plus the potential for greatly reduced nesting habitat in the immediate future suggests that recovery from any short-term losses associated with oil and gas development could be hindered by lowered productivity.

V.C.6.c(2) Effects of Large Oil Spills

Although the magnitude of oil spill effects is uncertain, in the unlikely event a large offshore oil spill occurs during the life of relevant oil and gas projects, the 0.65 spill (the most likely number of spills is zero) of greater than or equal to 1,000 barrels estimated to occur within about 28 years (Table V-12) may result in losses exceeding 10,000 individuals if it is released during the summer/fall season when marine and coastal birds are present. This primarily would involve large flocks of postbreeding waterfowl and shorebirds staging offshore, in lagoons, or along beaches before migration. In addition to direct contact losses, any declines of benthic prey populations in foraging areas contacted by oil from a spill at any time of year may result in secondary impacts to birds affecting productivity and/or survival. Likewise, negative effects of a spill on shoreline and coastal marsh habitat and water quality may affect several species of shorebirds and waterfowl adversely in subsequent years.

Although highly unlikely, development of these prospects potentially could result in the release of a large oil spill into the offshore marine environment and, thus, contribute significantly to cumulative effects for some species such as long-tailed duck and king and common eider. Using average estimated bird density calculated from Fish and Wildlife Service survey data, and average severity of spill-trajectory paths and thus exposure of birds to oil, a Fish and Wildlife Service model estimates, for example, that at average bird densities and severity of oil-spill movement an average of 1,443 long-tailed ducks, 232 king eiders, 147 scoters, 159 common eiders, 217 glaucous gulls, and 23 Pacific loons could be exposed to a large spill (5,912 barrels) within 30 days in July (see details in Section IV.C.6, and Stehn and Platte, 2000). It is likely that mortality resulting from oil spills would be additive to naturally occurring mortality; however, there currently is no evidence for synergism where the combination of effects from natural and/or development-related factors is greater than their additive effect.

In addition to direct mortality, any declines in oiled bottom-dwelling prey organisms could result in secondary impacts such as decreased survival and/or productivity of sea duck species that forage on the bottom. A large onshore spill during the summer season may cause losses of up to hundreds of individual molting and broodrearing waterfowl if it enters a heavily used lake or coastal marsh habitat, plus smaller numbers of nesting waterfowl, shorebirds, and passerines. Small spills, whether originating from field pipelines or spills of refined products, are expected to be contained on gravel pads and/or cleaned up before substantial losses occur. However, some mortality could result from projected small spills (82 spills, most of which are less than 1 barrel, Table A.1-6b) for the 28-year production life of prospects assumed in this cumulative analysis.

Spills from the Trans-Alaska Pipeline System pipeline are not expected to cause substantial losses of those species occurring in the Beaufort Sea region. Tanker spills of North Slope crude oil in the Gulf of Alaska could cause substantial losses of migrating shorebirds and waterfowl that use Beaufort Sea habitats during the breeding season if major stopover areas such as the Copper River Delta and Prince William Sound were contacted. In the latter area in addition to bays to the west and lower Cook Inlet, overwintering loons, sea ducks, and gulls could take major hits if contacted by an oil spill.

V.C.6.c(3) Transportation Effects

V.C.6.c(3)(a) Effects of Disturbance

Disturbance effects primarily would result from helicopter traffic during inspection of the Trans-Alaska Pipeline System. The corridor from which individuals of at least some species likely would be displaced is estimated to be within 1 kilometer (0.62 miles) of the Trans-Alaska Pipeline System. Although such flights occur frequently, they are intermittent, thus some species may tolerate this level of disturbance and nest, rear their broods, or forage within the pipeline corridor.

In addition, tanker traffic transporting North Slope oil through Prince William Sound and the Gulf of Alaska is likely to result in some intermittent disturbance of marine birds along and/or displacement from the tanker route. In terms of displacement of birds from foraging areas along the route this is likely to represent a minor effect since there are alternate foraging sites available throughout these areas with similar prey available. Also, forage fishes that constitute the principal prey of many marine bird species are highly mobile and not likely to remain for long periods only in the tanker route corridor. Further discussion of aircraft and vessel disturbance effects is included in Section IV.C.6.a(1)(a)1.

V.C.6.c(3)(b) Effects of a Pipeline Spill

In the unlikely event of a large oil spill from the Trans-Alaska Pipeline system, some habitat in the immediate vicinity of the pipeline that is contacted by oil would become unsuitable for nesting, broodrearing, or foraging by birds. Oil entering freshwater aquatic habitats could spread more widely, including into river deltas and nearshore marine habitats, and result in death of birds contacted and/or a larger area unsuitable for the above activities. Loons, waterfowl, and shorebirds are likely to be the groups most adversely affected.

V.C.6.c(3)(c) Effects of a Tanker Spill

Oil produced by development of Alternative I for Sale 186 is expected to contribute only a small fraction of future spills of arctic oil, considered to be unlikely events, from Trans-Alaska Pipeline System tankers (0.41 spills or about 1% of 9.66 total estimated tanker spills [Table V-12]). However, future tanker spills of arctic oil, which may include oil from Alternative I for Sale 186, could cause serious effects on marine and coastal birds in Prince William Sound and the Gulf of Alaska. In these instances, the contribution of oil from Alternative I for Sale 186 to overall effects is expected to be proportional to its percentage in the particular shipment.

The principal example for estimating potential effects in Prince William Sound and the northern Gulf of Alaska are those resulting from the *Exxon Valdez* oil spill, an unusually large spill (Table V-14). Following the *Exxon Valdez* spill, more than 30,000 dead oiled birds were collected, most of them outside Prince William Sound (Piatt et al., 1990). The actual toll probably was 3-10 times this number. Species that have recovered or are recovering include the bald eagle, black oystercatcher, marbled murrelet, and common murre *(Exxon Valdez* Oil Spill Trustee Council, 2001). Those that are not recovering or recovery is unknown include the common loon, cormorants, harlequin duck, pigeon guillemot, and Kittlitz's murrelet. The recovery period for these species already has spanned up to four generations; recovery from an event of this magnitude obviously requires a lengthy period and is complicated by other factors before and after the spill that increase mortality and/or decrease production of offspring. Potential effects of a large spill between April and September within 50 miles of shore in the Gulf of Alaska are discussed in Section IX.B.3 of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a).

A more realistic projection of the risk from tanker spills is indicated by the average estimated size of tanker spills (Table V-15) that were calculated from tanker spill records (Table V-14). Most spills (9 of 10) are expected to average 13,000 barrels or less (Table V-15). Of these, four likely would occur in ports with readily available containment and cleanup equipment. When the effects have been studied, at-sea spills of this size have not been found to cause serious effects on bird populations. Also, they are not expected to reach large areas of habitat that are critical to the survival of bird populations until the oil is rendered much less harmful by weathering and dispersion in the water. This suggests that for spills of this size, mortality would be relatively low and recovery periods could be relatively short, except for species whose populations are declining and/or have a low reproductive rate (for example, sea ducks). Recovery periods would be lengthened if more than one spill affected the same populations within a short interval, which is unlikely to happen.

In the unlikely event a large spill of oil produced by cumulative arctic oil development occurs along the transportation route in the Gulf of Alaska, marine and coastal bird populations could be affected. According to spill simulations by LaBelle and Marshall (1995), a large tanker spill assumed to occur 100-200 miles offshore would not be expected to contact sensitive coastal bird habitats for more than 30 days (model spills 80-100 miles offshore contacted shore in 30 days), at which point, the oil would have weathered and dispersed. In addition, bird densities generally are quite low in the pelagic habitat. Shearwaters, kittiwakes, and various species of auks probably are most vulnerable. If a tanker spill occurred, the probability of bird contact in summer or winter habitat within 30 days would be less than 0.5%. The effect of such a spill on overwintering waterfowl in the Gulf of Alaska is likely to be substantial.

In-port spills are likely to be contained and recovered or cleaned up relatively quickly. Vulnerable species during winter and spring/fall migration would include loons, waterfowl, shorebirds, and some auks; in summer, herons, rails, and various seabirds would be the main groups affected.

Most projects and activities not associated with petroleum development affect birds at latitudes south of the Beaufort Sea and outside the summer breeding season. Several of these factors, individually or in combination, probably affect bird populations as much or more than potential effects of petroleum development and may have contributed importantly to recent declines in these populations.

Summary and Conclusions for Effects of Beaufort Sea, North Slope, and Transportation Activities on Marine and Coastal Birds. The effects from normal activities associated with cumulative exploration and development of oil and gas prospects in the Beaufort Sea are expected to include the loss of small numbers of several waterfowl and loon species. This is most likely to occur as a result of collisions with offshore or onshore structures, which are expected to increase in number in association with reasonably foreseeable future development, although they still would be considered very infrequent obstacles.

Declines in fitness, survival, or production of young may occur where birds are exposed frequently to various disturbance factors, particularly helicopter support traffic. Human presence that disturbs nesting or broodrearing birds, or attracts predators, may result in predation of unprotected eggs or young. Because of a smaller disturbed area, the effect of future projects' infrastructure on bird populations, although additive to natural effects, is expected to be less severe than previous development in the Prudhoe Bay region. The frequency of such disturbance is expected to be highest in the vicinity of primary support facilities at Deadhorse. Overlap between cumulative project developments could increase disturbance effects. Several waterbird populations, currently declining at non-significant or significant rates, may be slow to recover from small losses or declines in fitness or productivity. No significant overall population effect is expected to result from small losses. However, for species such as the common eider that are experiencing a population decline, recovery from any short-term losses associated with oil and gas development could be hindered by lowered productivity resulting from natural occurrences. For example, greatly reduced potential nesting habitat resulting from the major storm in August 2000 could substantially reduce productivity in the region.

In the event a large oil spill occurs in the marine environment, mortality of tens of loons, hundreds of king and common eiders, and thousands of long-tailed ducks (potentially could exceed 10,000 for the latter) is possible; any substantial loss of long-tailed ducks or common eiders would represent a significant effect. Mortality resulting from the cumulative effects of oil and gas projects would be additive to natural mortality and interfere with the recovery of these species' Arctic Coastal Plain populations. Recovery from substantial mortality is not expected to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers. Onshore spills, also considered unlikely to occur, are expected to be contained and cleaned up; however, a spill entering a lake could cause substantial losses of molting and broodrearing waterfowl plus smaller losses of nesting waterfowl, shorebirds, and passerines. Any tanker spill in the Gulf of Alaska could cause substantial losses of migrating shorebirds and waterfowl that use Beaufort Sea habitats during the breeding season, or of overwintering loons, sea ducks, and gulls.

Overall cumulative effects of oil-industry activities on marine and coastal birds potentially could be substantial in the case of loon species and the king eider, and significant in the case of long-tailed duck and king and common eiders, primarily as a result of mortality in the unlikely event a large oil spill occurs. Although the chance of oil-spill occurrence is relatively small (8-10%), the potential is highest for contact with bird concentrations in the vicinity of primary support facilities in the central Beaufort, where most projects assumed in the cumulative case likely will occur. Also, as a result of the apparent decline in populations of some species (for example, several sea duck species), and the challenge of recovering spilled oil, particularly in broken-ice conditions, there is uncertainty as to the ultimate effect of any spills on bird populations. Disturbance may cause some small loss of productivity and lowered fitness or survival of birds occupying areas with high levels of industry-activity, but these effects are not expected to be significant. Effects resulting from oil and gas development activities likely would be additive to naturally occurring effects. No bird species are expected to experience synergistic effects from combinations of adverse factors.

Contribution of Alternative I for Sale 186 to Cumulative Effects: Contribution of Alternative I for Sale 186 to the cumulative effects is likely to be about 4% of the local, short-term disturbance and habitat alteration effects on marine and coastal birds (based on the expectation that effects resulting from Beaufort Sea exploration, development, and production activities for Sales 186, 195, and 202 would occur in the same proportion as is represented by the ratio of oil reserves estimated for this sale (0.46 billion barrels) to cumulative oil reserves (11.5 billion barrels) (Table V-12). It is estimated that the average number of cumulative offshore spills associated with the Beaufort Sea sales is 0.11 (the most likely number is zero [Tables V-12, V-13]); this represents about 17% (Table V-13) of cumulative offshore spills (0.65 [Table V-12], not including tanker spills).

Alternative I for Sale 186 could contribute substantially to losses of waterfowl and shorebirds occupying lagoons in the area from an offshore spill. The number typically at risk of direct oil contact is unknown for most species. In addition, if benthic prey declines as a result of contact by oil from a spill at any time of year, secondary impacts to eiders may affect productivity and/or survival. Likewise, effects of a spill on coastal habitats and water quality may affect eiders adversely in subsequent years. Mortality associated with an onshore spill could be up to a few hundred individuals. Bird mortality from the numerous small spills that are projected for the 28-year life of the oil and gas projects in this analysis is not expected to be substantial, although if lakes supporting concentrations of molting or broodrearing waterfowl are contacted, mortality would be higher.

Disturbance of birds by supply helicopter traffic for Alternative I for Sale 186 is expected to be greater than for individual onshore projects due to potential overflight of waterfowl and shorebird, nesting (barrier islands) molting and staging habitat. Habitat alteration caused by Alternative I for Sale 186 onshore construction is small. Overall effects of Alternative I for Sale 186 would be additive to effects observed or anticipated for the other projects in this cumulative analysis. In the case of oil spills, it could increase adverse effects and cause significant regional population effects in species such as the long-tailed duck and king and common eider that concentrate in local lagoons and could cause substantial effects in other regional populations of waterbirds.

V.C.7. Seals, Walruses, Beluga Whales, Polar Bears, Sea Otters, and Other Marine Mammals

V.C.7.a. Effects of Noise and Disturbance on Pinnipeds and Beluga, and Gray Whales

In the Beaufort Sea, noise and disturbance from on-ice seismic surveys during any one year would affect breeding ringed seals in that area for no more than 1 year, because only a small fraction (less than 1%) of the population is likely to be exposed to and potentially be disturbed by the operations. Subsequent surveys in other areas during other years have disturbed different seals and would be expected to in the future. A few pups could be lost, because mothers may abandon maternity lairs or because seismic vehicles may destroy snow lairs along the shot line. Past seismic exploration on the sea ice over several years might have killed some pups and displaced some seals locally very near seismic lines (within 150 meters) during operations for that ice season (Burns et al., 1983; Link, Olson, and Williams, 1999). However, these additive effects probably were not significant to the seal population above changes in distribution associated with changes in sea ice.

Noise and disturbance effects on seals, walruses, and beluga and gray whales in the Beaufort Sea from an estimated total of more than 450 helicopter round trips per month and at least 200 vessel round trips per month should last only a few minutes to less than an hour for any one disturbance event. Disturbance reactions of seals, walruses, and beluga and gray whales would be brief; they would return to normal behavior patterns and distribution shortly after the boat, seismic vessel, or aircraft has left the area. Effects are not expected to be additive or synergistic, because disturbance reactions most likely would involve different animals and occur in different areas. Seals and walruses also may get used to aircraft and vessels, if they saw them often and routinely.

Ringed and bearded seals, walruses, and beluga and gray whales have been exposed to oil-exploration activities in the Beaufort Sea, including seismic surveying, drilling, air and vessel traffic, dredging, and gravel dumping (Map 2). These activities in the Beaufort Sea, barge traffic to the North Slope, and some icebreaker activity to support oil exploration might increase in the future. These activities could affect how seals are distributed near the activity for 1 season or less than 1 year during high levels of activity. However, some seals will get used to marine and air traffic, industrial noise, and human presence. Displacement from cumulative industrial activities is not likely to affect the overall abundance, productivity, or distribution of ringed and bearded seals, walruses, and beluga whales in Alaska's Beaufort Sea.

Cumulative noise sources that may affect beluga and gray whales are from seismic activities and drilling, and other noise associated with exploration, development, and production operations; vessel and aircraft traffic; construction; and oil-spill cleanup. Underwater industrial noise, including drilling noise measured from artificial gravel islands, has not been audible in the water more than a few kilometers away. Because the beluga whale's migration corridor is far offshore of the barrier islands, seismic exploration, drilling, development, and production noise from most development in the nearshore area for Alternative I for Sale 186 is not likely to reach many migrating beluga or gray whales. Noise also is unlikely to affect the few whales that may be in lagoon entrances or inside the barrier islands due to the rapid attenuation of industrial sounds in a shallow-water environment. Because island and pipeline construction would occur during the winter and be well inside the barrier islands, it is not likely to affect beluga or gray whales.

V.C.7.b. Effects of Noise and Disturbance on Polar Bears

Individual air- and vessel-traffic disturbances assumed for this analysis likely would disturb a few polar bears for a few minutes to less than an hour. Seismic operations, ice-road traffic, and other activities could disturb some coastal denning sites in Alaska. A few females may have abandoned maternity dens because of nearby noise and humans, and some cubs might have been harmed. However, the number of bears disturbed in any given year is likely to be very low (probably no more than 1-3 animals). Bears disturbed in one year are not expected to be disturbed the next year, because they would not den at the same location due to changes in snow cover. Current information of the distribution of den locations near oil facilities does not show that bears were permanently displaced from denning habitat. There is no clear indication that disturbance from oil exploration and development has had an additive or synergistic effect on the polar bear population. "Two hunters from Nuiqsut reported that polar bear activity has decreased in recent decades around Prudhoe Bay and west, to the Colville River," while " some hunters stated that the number of polar bears varies from year to year but has remained stable overall" (Kalxdorff, 1997).

The Marine Mammal Protection Act requirements should prevent excessive disturbance to polar bears. Letters of Authorization for incidental take of polar bears requested by industry and issued by the Fish and Wildlife Service recommend a 1-mile buffer around occupied polar bear dens. Compliance with the Letter of Authorization is expected to avoid any significant disturbance of polar bears in the Beaufort Sea.

A very small number of polar bears have been and could be killed in encounters with humans near industrial sites and settlements associated with cumulative oil development. In the Northwest Territories in Canada, conflicts with humans near industrial sites from 1976-1986 accounted for 15% (33 out of 265) of the polar bears killed (Stenhouse, Lee, and Poole, 1988). Some of these losses were unavoidable, and the polar bear population recovered through recruitment within 1 year. Four bears were unavoidably killed after being attracted to offshore platforms in the Canadian Beaufort Sea during 5 years of intensive oil exploration (Stirling, 1988). Fewer losses of polar bears in arctic Alaska are expected, because the Marine Mammal Protection Act requires that the oil industry avoid killing any bears. Polar bear loss in Alaska is not likely to exceed more than one animal per year, and it probably would be less. Only three lethal takes of polar bears were related to industrial activities on the North Slope over the past 20 years (Gorbics, Garlich-Miller, and Schliebe, 1998). These losses have not significantly increased the mortality rate of the polar bear population over that from subsistence harvest and natural causes. The loss rate in Canada over a 5-year period was higher than that in Alaska but was not significant to the population, which increased at 2.4% per year. The Marine Mammal Protection Act has kept losses low in Alaska. The act did not cover bears during the extensive oil explorations in Canada.

V.C.7.c. Effects of Habitat Alteration

More than 40 exploration-drilling units (gravel islands, drill ships, and other platforms) have been installed or constructed in the Beaufort Sea as a result of past Federal and State oil and gas leases. Several million cubic yards of gravel and dredge-fill material have altered at least a few square kilometers of benthic habitat in the Beaufort Sea. Alterations from island construction, trench dredging, and pipeline burial are expected to affect some benthic organisms and some fish species within 1 kilometer for less than 1 year or season. These activities also may temporarily affect the availability of some local food sources up to 1-3 kilometers (0.62-1.9 miles) distance during island construction. These activities are not expected to affect food availability over the long term for the following reasons:

- Common prey species for seals, such as arctic cod, have a very broad distribution and would not suffer from the fractional loss of benthic habitat associated with platforms and pipelines.
- Ringed and bearded seals and walruses can forage over large areas of the Beaufort Sea; they do not rely exclusively on the abundance of local prey.
- Gravel islands used for oil production may provide habitat for some prey species. They are not likely to affect the availability of seals and walruses as prey for polar bears in the Beaufort Sea.

Drilling units for exploration and platforms for future production (including gravel islands) in the Beaufort Sea are likely to have only local effects on ice movements and fast-ice formation around the structures. These local changes in ice movements and ice formation are not likely to change the seal distribution. Noise, movements, and human presence associated with installing platforms and other construction activities could displace some seals, walruses, beluga whales, and polar bears within 1 mile of the activity for 1 season or year. Exploration platforms have not had any apparent lasting effect on seal, walrus, beluga whale, gray whale, and polar bear distribution and abundance in the Beaufort Sea. The number of production platforms in the Beaufort Sea over the next 20 years is uncertain. An optimistic estimate would be about eight platforms, which include six platforms from Sales 186, 195, and 202; Liberty; and Northstar. That number is not expected to affect ice habitats of seals and polar bears in the Beaufort Sea. Natural variation in ice conditions and resulting changes in the distribution of seals, walruses, beluga and gray whales, and polar bears are likely to reverse or overwhelm any local reduction (or increase) in their distribution because of cumulative exploration and production.

V.C.7.d. Effects of Hunting and Harvesting on Pinnipeds, Polar Bears, and Beluga and Gray Whale Populations

International subsistence hunting of seals and polar bears would have no more than a very short-term effect on the abundance of these species (USDOI, MMS, 1998).

V.C.7.e. Effects of Large Oil Spills on Pinnipeds, Polar Bears, and Beluga and Gray Whales

Cumulative risks from oil spills assumed for purposes of analysis to seal, walrus, beluga whale, gray whale, and polar bear habitats in the Beaufort Sea would be higher than risks from Alternative I for Sale 186 alone (0.11 mean number of spills). That compares to the 0.65 mean number of spills for the cumulative analysis (Table V-12); the most likely number of spills is zero. A spill that might occur in the Beaufort Sea during the summer or that occurred during the winter and persisted after meltout would pose the highest risk to the marine mammals' flaw-zone habitats, which are offshore from about Cape Halkett east to offshore of Prudhoe Bay (Table A.2-19, ERA 32). During spring, ringed and bearded seals and polar bears could contact the oil spill in this habitat. During the summer (open-water) season, resident ringed and bearded seals, polar bears, and migrant seals, walruses, and beluga and gray whales in the western Beaufort Sea could contact a spill that might occur to the east during winter, contact the flaw-zone habitat, and then melt out. The most noticeable cumulative effects of a potential oil spill would be from direct oiling of ringed, spotted, or bearded seals; walruses; and polar bears. These species could suffer the following estimated mortalities should a spill occur:

- Perhaps 100-200 ringed seals out of an estimated population of about 40,000.
- Perhaps 10-100 bearded seals out of a population of several thousand.
- Perhaps 6 up to 10 polar bears out of a population of 1,800 assuming a bear density of 1 bear per 25 square kilometers) see Section IV.C.7.
- Perhaps a small number of beluga and gray whales and maybe a few walruses would be exposed to the spill and may be affected. Few if any walruses or beluga and gray whales are expected to be killed by the assumed oil spill. We assume environmental degradation resulting from the oil spill is below the level that would alter reproduction and survival of the polar bear population.

In addition to direct contact with oil, ingesting oil or loss of thermal insulation could cause the death of very young seal pups, walrus calves, and highly stressed adults. Seals, walruses, polar bears, and beluga and gray whales are likely to replace their losses within 1 year, and additive and synergistic effects are not expected.

V.C.7.f. Transportation Effects on Sea Otters, Harbor Seals, and Other Marine Mammals

Although Alternative I for Sale 186 likely would not contribute any tanker spills to the cumulative analysis (mean number of spills 0.41 in Table V-12), potential future oil-spill effects from tanker transportation of arctic oil (including oil from Alternative I for Sale 186) from the Trans-Alaska Pipeline System terminal at Valdez could have cumulative effects on marine mammals, especially sea otters, in Prince William Sound and the Gulf of Alaska. There also could be local effects on harbor seals, as resulted from the 1989 *Exxon Valdez* oil spill. It is likely that local assemblages of sea otters in heavily contaminated coastal areas of Prince William Sound would take 5-10 years or longer to recover from the spill.

Future transportation of North Slope oil through Prince William Sound could have a long-term (5 years or longer) effect on sea otters and harbor seals. The contribution of Beaufort Sea Sales 186, 195, and 202 to tanker spills is estimated to be zero spills (Table V-12). We estimate the number of cumulative tanker spills to be 10 (Table V-15); 7 with an average size of 4,000 barrels, 2 with an average size of 13,000 barrels, and 1 with an average size of 250,000 barrels (Table V-15). These spills are expected to have similar effects on sea otters and harbor seals as described but cause fewer losses of otters and seals. Recovery of populations is expected within 1 or 2 years after the spills, assuming the same populations and habitats are not affected. If two or more of these spills affect the same populations and habitats within 1 or 2 years of the previous spill, recovery would take longer (perhaps 10 years or more).

If tanker spills associated with oil development in arctic Alaska, including Alternative I for Sale 186, occurred south of the Gulf of Alaska, other nonendangered marine mammals and their habitats could be affected along the transportation routes or at marine ports. The effects of tanker spills on these marine mammals and their habitats are expected to be about the same as described above and in Section IX.B for seals, sea otters, and cetaceans in the Gulf of Alaska of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a).

V.C.7.g. Summary and Conclusions for Beaufort Sea, North Slope, and Transportation Activities on Seals and Polar Bears

Beaufort Sea Sales 186, 195, and 202 and other ongoing or planned projects (Map 2) may affect ringed and bearded seals, walruses, beluga and gray whales, and polar bears by causing noise and disturbance, altering habitat, and accidentally spilling oil.

V.C.7.g(1) Effects of Noise and Disturbance and Habitat Alteration

Only three “lethal takes” of polar bears were related to industrial activities on the North Slope over the past 20 years (Gorbics, Garlich-Miller, and Schliebe, 1998). These small detectable losses of polar bears have had no effect on the population. More than 40 exploration-drilling units (gravel islands, drill ships, and other platforms) have been installed or constructed in the Beaufort Sea as a result of past Federal and State oil and gas leases. These activities may have displaced a few bears during island construction but have had no detectable effect on the polar bear population. The Fish and Wildlife Service concluded that existing onshore development, proposed exploration activities, and the Northstar development would have negligible effects on polar bears (65 *FR* 16828).

Development would alter a small amount of the habitat at the one production island for Alternative I for Sale 186 versus an estimated 40 past or existing exploration and production platforms in the Beaufort Sea. These platforms have not had any apparent lasting additive or synergistic effect on seal, walrus, beluga whale, gray whale, and polar bear distribution and abundance in the Beaufort Sea. The number of production platforms in the Beaufort Sea over the next 20 years is uncertain, but an optimistic estimate would be about eight, which includes six from Sales 186, 195, and 202; Liberty; and Northstar. That number is expected to have little or no effect on the ice habitats of seals and polar bears in the Beaufort Sea.

Alternative I for Sale 186 is expected to contribute about 2-4% of the local short-term noise and disturbance effects on seals and polar bears (based on 10-20 flights per day/450 helicopter roundtrips/day during busy construction periods on the North Slope). Activities from Alternative I for Sale 186 should only briefly and locally disturb or displace a few seals, walruses, beluga and gray whales, and polar bears. A few polar bears could be temporarily attracted to the production island, with no significant effects on the population's distribution and abundance.

V.C.7.g(2) Effects of Oil Spills

Over their lifetime, fields from Alternative I for Sale 186 would contribute a mean (0.11) number of spills to potential offshore oil spills and potential effects on seals and polar bears. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is 1 (Table V-12). The contribution of spilled oil from Alternative I for Sale 186 is estimated at 0.11 spills, with the most likely number of spills being zero (Table V-12). The estimated 6-10 or fewer polar bears lost to a large (greater than or equal to 1,000-barrel) spill assumed under the cumulative analysis represents a severe event. The more likely loss of polar bears from Alternative I for Sale 186 development would be fewer than six bears, assuming a bear density of one bear per 25 square kilometers (Amstrup, Durner, and McDonald, 2000). In the likely cumulative case, pinnipeds, polar bear, and beluga and gray whale populations in the Beaufort Sea Planning Area are expected to recover within 1 year, assuming one large spill (greater than or equal to 1,000 barrels) occurs. Alternative I for Sale 186 is expected to contribute 0.41 spills and about an equal fraction of the potential oil-spill effects on other marine mammals along the tanker route to the U.S. West Coast. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have long-term (more than perhaps 5-10 years) effects on sea otters and other marine mammals.

Conclusion. The overall effects (mainly from one oil spill assumed for this analysis) is the potential losses of perhaps up to 10 polar bears and a few hundred seals, and walruses, and small numbers (probably less than 10) of beluga and gray whales. In the likely cumulative case, pinnipeds, polar bear, and beluga and gray whale populations are expected to recover within 1 year, assuming only one large spill (greater than or equal to 1,000 barrels) occurs. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have long-term (more than one generation or perhaps 5-10 years) effect on sea otters and perhaps harbor seals and other marine mammals. Cumulative noise and disturbance in the Beaufort Sea Planning Area is expected to briefly and locally disturb or displace a few seals, walruses, beluga and gray whales, and polar bears. A few polar bears could be temporarily attracted to the production island, with no significant effects on the population's distribution and abundance.

Contribution from Alternative I for Sale 186 to Cumulative Effects. The contribution of Alternative I for Sale 186 is expected to be about 2-4% of the local short-term disturbance and habitat effects on pinnipeds, polar bears, and beluga and gray whales (based on 0.46-billion barrel/11.5-billion barrel oil reserves in Table V-12). Alternative 1 for Sale 186 likely would contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).

V.C.8. Terrestrial Mammals

V.C.8.a. Overall Effects on Terrestrial Mammals

Cumulative oil and gas activities on the Arctic Slope of Alaska has had some local effects on the Central Arctic caribou herd's calving distribution and use of habitats within 4 kilometers (2.48 miles) of oil field roads and other facilities. A shift in calving activities away from the oil fields may mean the caribou have lost some calving habitat (Nellemann and Cameron, 1998). Aircraft and ice-road traffic (the latter during winter only) from Alternative I for Sale 186 and other recent projects could disturb some caribou, muskoxen, and other terrestrial mammals for a few minutes to an hour, but they would not affect population distribution or abundance. Caribou would not be disturbed by ice-road traffic during calving, because ice roads melt in the spring and are no longer used when caribou are calving.

Activities such as gravel mining and the construction of roads and gravel pads have reduced local use of nearby habitat because of additive levels of vehicle traffic during operations. Caribou cows with calves tend to avoid roads with vehicle traffic. These effects are long lasting but local (within 4 kilometers of roads with traffic) and would displace some caribou from part of the calving range. If this displacement/avoidance were to include more calving habitat and affect the distribution of more calving caribou, the herd's productivity could be affected. However, we do not now see such an effect, because development in the Prudhoe Bay area has not clearly affected the abundance of the Central Arctic Herd (Cronin, Whitlaw, and Ballard 2000; Ballard, Cronin, and Whitlaw, 2000). This herd had declined from 23,000 in 1992 to about 18,000 animals in 1994, and reduced weights of cow-caribou that calve on the oil fields suggest that their productivity may be affected by oil development (Cameron, 1994; Needleman and Cameron, 1996, 1998). However, this decline may reflect natural changes in forage habitat and in caribou abundance. Recorded differences in calf numbers between cows calving west (on the main oil fields) versus east (of the main oil fields) of the Sagavanirktok River only occurred during years of low overall calf production; however, during years of high calf production, there are no differences (Whitten, 1998, pers. commun.). This finding indicates that factors other than or in addition to oil development are affecting caribou productivity (Whitten, 1998, pers commun.). The most recent estimate for the Central Arctic Herd caribou is more than 27,000 animals (Lawhead and Prichard, 2001).

Constructing more than 400 miles of roads to support oil development has increased human access to the Arctic caribou herds, muskoxen, grizzly bears, and arctic foxes. However, hunting regulations should keep hunters from overharvesting any of the caribou herds and other terrestrial mammal populations on the North Slope. Ongoing oil-development projects such as Badami and Alpine, and future projects such as Alternative I for Sale 186, would have smaller "footprints" (fewer and smaller gravel pads, fewer infield roads, and no roads connecting to Prudhoe Bay). Limiting construction at developing oil fields (Badami and Alpine) to winter months and not building roads that connect to Prudhoe Bay have minimized or avoid disturbance and displacement of caribou from calving areas.

This technology likely would reduce additive effects of development on terrestrial mammal habitats. These measures would greatly reduce the amount of habitat affected by oil-development and reduce disturbance of caribou and muskoxen from vehicles, especially during the calving season. Future oil-development projects that do not include interconnecting roads should not significantly disturb or displace calving caribou or muskoxen. They also would not greatly change caribou and muskoxen movements across the Arctic Slope.

V.C.8.b. Effects of Oil Spills

For this cumulative analysis, we assume one offshore oil spill greater than 1,000 barrels would occur from Alternative I for Sale 186. The mean number of spills greater than 1,000 barrels is 0.65, and the most likely number of spills is zero (Table V-12). If the spill occurred during the open-water season or during the winter and melted out of the ice in the spring, this oil could affect coastal habitats from about Harrison Bay east to about Flaxman Island. Thus, some caribou of the Central Arctic and Teshekpuk Lake herds (the latter herd could be affected by the spill that might occur west of Alternative I, Sale 186) could be directly contacted and harmed by the spill along the beaches and in shallow waters while they are escaping from insects. However, even in a severe situation, only a few to fewer than 100 caribou are likely to contact the spilled oil and die from inhaling and absorbing toxic hydrocarbons. Either of the caribou herds would replace these losses within 1 year.

The most likely number of onshore crude oil spills is 5 (assumed size 500-1,142 barrels), which likely would occur near pipelines, including the Trans-Alaska Pipeline System, for the cumulative analysis ((Table V-12). These minor spills would have a very small additive effect on terrestrial mammal habitats near pipelines, roads, and other facilities (see Section V.C.7 - Cumulative Effects on Vegetation and Wetlands). Some of these spills would contaminate 1 acre or less of tundra vegetation near the pipeline, road, or gravel pads. Alternative I for Sale 186 would contribute about 0.41 Trans-Alaska Pipeline System tanker spills (Table V-12). Caribou and muskoxen probably would not ingest oiled vegetation, because they are selective grazers and are particular about the plants they consume (Kuropat and Bryant, 1980). Also, control and cleanup operations (ground vehicles, air traffic, and humans) at the spill site would frighten caribou and other terrestrial mammals away from the spill and prevent contact with the oil. Thus, onshore spills from cumulative oil development are not likely to affect caribou, muskoxen, or other terrestrial mammal populations.

V.C.8.c. Effects of Disturbance on Caribou Movements and Calving

The main sources of disturbance for caribou are traffic from surface-vehicles, human presence, and aircraft near cows with newborn calves. Further oil exploration, particularly helicopter traffic, briefly would disturb some caribou when the traffic passes overhead. This activity has not and would not affect caribou populations. However, during development, concern exists about disturbance from traffic on roads next to pipelines and traffic on roads that cross calving habitats. Caribou hesitate crossing under an elevated pipeline next to a road when vehicles are moving on the road. Their success in crossing depends on motivation. When mosquitoes and oestrid flies pester them, caribou are highly motivated to seek relief. They cross under pipelines more often during the insect season in the Prudhoe Bay-Kuparuk area (Curatolo, 1984), but increased disturbances from vehicle traffic can keep crossing-success rates down. However, caribou do successfully cross pipeline-road complexes and many highways in Alaska and Canada with no apparent effect on the herd's distribution or abundance. Although caribou can get used to roads and traffic, cows and calves avoid areas of human activity before and during the calving season (Smith, Cameron, and Reed, 1994).

Several hundred vehicles per day travel along more than 400 miles of roads in the Prudhoe Bay area. This traffic has displaced caribou for a few minutes up to several days within about 1-2 kilometers of the road system. Road traffic temporarily delays some animals from crossing under pipelines but has not affected the herd's overall distribution or abundance. However, where roads cross calving areas, any vehicle traffic could disturb cows during calving, displacing many of them up to 4 kilometers away from the road (Dau and Cameron, 1986a,b; Cameron et al., 1992; Nellemann and Cameron, 1996). This local displacement continues to persist every year during the calving season. Calving also has shifted to the west and southwest of the Kuparuk oil field (Lawhead et al., 1997; Nellemann and Cameron, 1998). However, during the postcalving season when caribou are harassed by insects (oestrid flies), Central Arctic Herd caribou are attracted to gravel pads, pipelines, and other oil-field facilities to avoid or reduce their exposure to insect harassment (Noel et al.,1998; Curatolo and Murphy, 1986). The caribou's use of gravel pads and roads for insect relief may compensate for the loss of foraging habitat at the pad sites and may compensate somewhat for the disturbance they experience when road traffic is present (a countervailing effect).

At present, oil development on the North Slope has produced 754 miles of pipelines, over 400 miles of roads, and 7,805 acres of habitat covered by gravel pads, mines, reserve pits, and other facilities (Tables V-3 and V-5). All this activity has caused some additive displacement of Central Arctic Herd caribou from part of the calving range with no apparent effect on the herd's abundance or overall productivity. There is no evidence that synergistic effects have occurred.

In theory, reducing calving use of habitats within 4 kilometers of roads on the North Slope eventually could limit the growth of arctic caribou herds within their present ranges. It may even keep the herds from reaching the population size they could achieve on these ranges without development. However, existing cumulative oil development has not been shown to affect caribou abundance or population growth. Recent information suggests the Central Arctic Herd caribou may be calving better east of the oil fields, which could mean that disturbance and local displacement of some cow caribou may affect their productivity (Cameron, 1994; Nellemann and Cameron, 1996, 1998). If future construction activity, especially road traffic, avoided calving concentration areas and construction activities and road traffic was restricted just before, during, and just after calving, caribou would experience less disturbance and displacement from calving areas.

V.C.8.d. Effects of Oil Development Projects without Connecting Roads

Offshore Beaufort Sea developments, Badami, Alpine, and other recent projects would not have roads constructed that connect with Prudhoe Bay (Map 2). This measure would save the oil companies millions of dollars and would avoid disturbing caribou along the pipeline corridors during the calving season. The Badami and Alpine projects would have short gravel roads between airstrips, docks, camps, and production pads (see Table V-6a). The Alpine Project, however, is not located in a caribou calving area. Badami is near calving areas near Bullen Point and southward between the Shaviovik and Staines rivers. Vehicles moving along ice roads between the airstrips and production pads or between the airstrip and the dock could disturb some caribou moving during the winter. This local disturbance would not greatly change caribou movements or displace calving caribou. As more vehicles move along the Endicott Road during Alternative I for Sale 186 and Badami development, they temporary could disturb more caribou, but they are not likely to affect caribou movements and distribution in the Sagavanirktok River area.

V.C.8.e. Effects of Construction and Supply Helicopter Traffic

The 10-20 flights per day during 2-3 years of development from Alternative I for Sale 186 could briefly disturb some caribou, muskoxen, and grizzly bears. Cumulatively, these animal populations see more than 450 helicopter round trips/day during busy construction periods on the North Slope. Alternative I for Sale 186 would increase air traffic by 2-4% overall (10-20 flights/450 flights per day). Disturbance events are not likely to be cumulative, because they would be rather infrequent and involve different animals and different areas.

V.C.8.f. Effects of Construction and Supply Ice-Road Traffic

Construction traffic and about 100 supply trips per year for Alternative I for Sale 186 briefly could disturb some caribou, muskoxen, and grizzly bears during December through early May. This traffic would be highest during the 2 years of development and would continue at a lower level to support project operations during the 15-20 years of production. These animals have experienced ice-road traffic from other projects over the past 20 years without any apparent effect on their abundance or distribution. Ice roads for future and ongoing projects, such as development from Alternative I for Sale 186 and Northstar, also likely would not affect terrestrial mammal abundance or distribution.

V.C.8.g. Effects of Ice Roads, Gravel Mining, and Constructing Onshore Pipelines and Gravel Pads

For Alternative I for Sale 186, these activities would alter perhaps 50 acres of terrestrial mammal habitats. Existing development has altered more than 7,800 acres.

A gravel road would not be constructed along the onshore pipelines connecting production facilities from Alternative I for Sale 186 to other common-carrier pipelines. Disturbance of caribou would be limited to helicopter traffic during the summer and winter and ice-road traffic during the winter. Central Arctic Herd caribou see thousands of motor vehicles each month on more than 400 miles of roads in the Prudhoe Bay area during and after calving. This traffic has caused a decrease in calving near roads and temporarily changed the caribou's movements. Assuming future activities do not include roads connecting the Prudhoe Bay-Dalton Highway road system, this development is not expected to cause further displacement of Central Arctic Herd caribou from calving habitat nor affect caribou movements.

V.C.8.h. Effects of Interactions with Humans

The onshore activity for Alternative I for Sale 186 (12-50 miles of onshore pipeline but no camp onshore) is not likely to result in the loss of any bears. However, some grizzly bears have been killed or removed from the oil fields because of confrontations with people or because the bears were damaging buildings or equipment. Arctic foxes actually have increased around the Prudhoe Bay area, because they have more food (garbage) and shelter (in culverts and under buildings). Future development activities could result in the loss of some additional grizzly bears, but the numbers are likely to be small and would not affect the population.

V.C.8.i. Effects of Altering Habitat

Oil development on the North Slope covers more than 7,800 acres (Tables V-3, V-4, and V-6b) and includes more than 400 miles of gravel roads that cross much of the Central Arctic Herd caribou's calving range. This extensive development actually has destroyed only about 3% of the tundra grazing habitat because of roads, pads, gravel quarries, pipelines, pump stations, and other facilities. Construction in ongoing and future oil developments (such as Northstar, Alpine, and Alternative I for Sale 186 projects) would alter much smaller areas of the available grazing habitat.

Roads for development on the North Slope eventually may be open to the public, which would increase access to the caribou herds, muskoxen, grizzly bears, and other terrestrial mammals, possibly leading to more hunting and disturbance. Although people cannot hunt caribou with firearms within 5 miles of the Dalton Highway, they can hunt with bows and arrows. Noise and disturbance from this harvest is not expected to significantly affect caribou movements across the Dalton Highway or other roads on the North Slope. Caribou have continued to cross roads and highways, even under heavy hunting pressure and the associated noise and disturbances (Valkenburg and Davis, 1986). However, if the public, through future development activities, were allowed access to the caribou calving areas during the calving season, such disturbance could have effects on the caribou population.

V.C.8.j. Transportation Effects on River Otters and Brown and Black Bears

Alternative I for Sale 186 likely would not contribute any tanker spills to the cumulative analysis (the mean number of spills is 0.41 [Table V-12]). However, potential future oil-spill effects from tanker transportation of arctic oil (including from Alternative I for Sale 186) from the Trans-Alaska Pipeline System terminal at Valdez could have local cumulative effects on river otters and brown and black bears and other terrestrial mammals in Prince William Sound, the Gulf of Alaska, or along the tanker route to the West Coast. The potential loss of river otters (perhaps 50-100 individuals) and contamination of intertidal habitats from a 250,000-barrel oil spill likely would take more than 1 year to recover (probably 3 years or longer). The potential loss of brown and black bears (perhaps 10 individuals) likely would take 1 year for the populations to recover. We estimate the number of cumulative tanker spills to be 10 (Table V-15); 7 with an average size of 4,000 barrels, 2 with an average size of 13,000 barrels, and 1 with an average size of 250,000 barrels. These spills likely would have similar effects on river otters and bears as described, but fewer losses of river otters and bears. Recover of populations is likely within 1 or 2 years after each spill, assuming the same populations and habitats are not affected by multiple spills. If two or more of these spills affect the same populations and habitats within 1 or 2 years of the previous spill, recovery will take longer.

If tanks spills associated with cumulative oil development in arctic Alaska, including from Alternative I for Sale 186, occurred south of the Gulf of Alaska, other terrestrial mammals and their habitats could be affected along the transportation routes or at marine ports. The effects of tanker spills on these terrestrial mammals and their habitats are expected to be about the same as described for the effects on tanker spills in the Gulf of Alaska.

Conclusion. Terrestrial mammals that would be affected include caribou, muskoxen, grizzly bears, and arctic foxes. Oil development in the Prudhoe Bay area could continue to displace some caribou during the calving season within about 4 kilometers (2.48 miles) of some roads with vehicle traffic that crosses calving habitat. The general shift of caribou calving away from the extensive oil fields may persist. Cows and calves of the Central Arctic Herd caribou may, over time, reduce calving and the use of summer habitats near roads with high levels of traffic. If they do, these activities potentially could affect the caribou's productivity and abundance over the long term. However, this potential effect may not be measurable, because the caribou's productivity greatly varies under natural conditions. Some oil-development projects, such as Badami and Alpine, do not include roads constructed to connect to Prudhoe Bay and the Dalton Highway. They are not likely to disturb or displace calving caribou or change caribou movements across the Arctic Slope. Cumulative oil development is likely to have only local effects on the distribution and abundance of caribou, muskoxen, arctic foxes, and grizzly bears on the North Slope of Alaska but not affect overall distribution and abundance. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have short-term (1-3 years) effects on other terrestrial mammals.

Contribution of Beaufort Sea Sale 186 to Cumulative Effects: The contribution from Alternative I for Sale 186 to the cumulative case is expected to be about 4% of the local short-term disturbance and habitat effects on of caribou, muskoxen, grizzly bears, and arctic foxes and zero reduced use of habitat for calving (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). It could attract few if any foxes to facilities and construction sites, with no effects on distribution and abundance. Alternative I for Sale 186 is estimated to contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).

V.C.9. Vegetation and Wetlands

V.C.9.a. Cumulative Effects on Vegetation and Wetlands

Cumulative development has directly covered more than 7,800 acres through the construction of 402 miles of roads, 95 gravel pads, 10 airports and airstrips, and 17 gravel mines. The mines alone cover more than 1,846 acres (TablesV-3, V-5, and V-6b) Development in the Prudhoe Bay and Kuparuk areas has directly affected about 9,666 acres by extracting and filling with gravel and indirectly affected many adjacent acres of vegetation (Walker et al., 1986, 1987). However, the total acreage is a small part of the Arctic Coastal Plain, and these effects probably are not significant to the overall productivity of tundra plants in this area. No synergistic effects are expected.

Present-ongoing oil-development projects, such as Alpine, Badami, and Northstar, and Beaufort Sea Sales 186, 195, and 202, would include much smaller acreage than existing and past projects on the North Slope (see Tables V-3 and V-5). Advances in drilling technology have allowed industry to drill more wells from fewer exploration and production pads than were required by past exploration and existing oil production in the Prudhoe Bay complex. This technology is expected to reduce additive effects of development on wetlands. Development plans that do not include interconnecting roads to the Trans-Alaska Pipeline System and the Dalton Highway also would greatly reduce the amount of affected vegetation and wetlands on the Arctic Slope.

V.C.9.b. Risks of Offshore Oil Spills from Production Contacting Vegetation and Wetlands

Estimated oil production from Alternative I for Sale 186 (0.46 billion barrels) represents about 4% of the total oil production (11.50 billion barrels) onshore and offshore from Alaska's Arctic Slope (Table V-12). Oil developed from Alternative I for Sale 186 would contribute about 7% of future offshore oil. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12). The estimated contribution of spilled oil offshore from Alternative I for Sale 186 is 0.11 spills, with the most likely number of spills being zero (Table V-12). Oil spills from Alternative I for Sale 186 would contribute 0.41 mean number of spill from the total estimated from the Trans-Alaska Pipeline-Tanker System. The chances of an oil spill occurring and contacting vegetation are highest (greater than 15% up to 21%) with wetlands in coastal habitats from Dease Inlet, Cape Simpson east to Atigaru Point-Kogru River (Land Segments 26, 28-33, and 47), and Kaktovik area (Land Segment 74) that have the highest conditional risks of spill contact, assuming spills occur during the summer season and contact the coastline within 30 days (Table A.2-27 from either LA1-LA18 or P1-P13). Additively, there is a 9-73% conditional chance oil will spill and contact the shoreline somewhere in the planning area within 30 days (Table A.2-21 contacts to Land). We assume that one large offshore oil spill greater than or equal to 1,000 barrels would occur during development over the life of these potential fields. Complete recovery of oiled coastal wetlands could take several decades to fully recover from this spill and associated cleanup activities.

V.C.9.c. Cumulative Effects of Onshore Spills on Vegetation and Wetlands

The most likely number of onshore crude spills is 5 (assumed size of 500-1,142 barrels), which likely would occur near pipelines, including the Trans-Alaska Pipeline System, for the cumulative analysis (Table V-12). The additive effect of those spills would cause very minor ecological harm; vegetation should recover within a few years but may take more than 20 years. Most onshore spills occur on gravel pads, and their effects do not reach the vegetation. About 20-35% of past spills of crude oil reached areas beyond pads. The corresponding proportion for refined oil probably is much less, but we assume that .27% of all onshore spills would occur at or reach beyond gravel pads. These percentages translate to 388-591 spills totaling 1,502-2,628 barrels of oil. Because winter spans most of the year, about 60% of the time spills occur when workers can clean up oil on the snow cover before it reaches the vegetation. Thus, we estimate that 11% of all onshore spills would affect vegetation (37-65 spills). Most spills would cover less than 500 square feet, or 0.01 acre, but may cover up to 4.8 acres if the spill is a windblown mist. We assume 98% of the spills would cover 0.01 acre, and 2% would cover 4.8 acres. Over the lifetime of developed oil fields, spilled oil most likely would cover about 6.5 acres (65 spills x 0.1 acre). Overall, past spills on Alaska's North Slope and along the Trans-Alaska Pipeline System have caused minor ecological damage, and ecosystems have shown a good potential for recovery (Jorgenson, 1997).

V.C.9.d. Effects of Construction of Onshore Pipelines, Gravel Pads, Roads, and Gravel Mining

Cumulative oil fields on the North Slope include more than 750 miles of pipelines, 95 gravel pads, about 400 miles of roads, and 17 gravel mines (Tables V-3, V-5, and V-6b).

V.C.9.d(1) The Effect of Constructing Onshore Pipelines

The pipeline for Alternative I for Sale 186 would remove a few acre of vegetation at the Point Thomson or Smith Bay landfall and along the 12- or 50-mile long pipeline to existing facilities. Vegetation would be removed at excavations for vertical support members (about 90-100 pilings/mile) along the elevated pipeline connecting to existing facilities. The gravel pads would be a small area (less than 1 acre) of overlapping impacts on tundra vegetation from both Alternative I for Sale 186 and the existing pipelines.

For this analysis, we assume vertical support beams would support pipelines. The beams would be 12 inches in diameter and would be placed 55-70 feet apart. Each support beam would disturb about 20 inches of vegetation around it in addition to the vegetation it directly displaces (Jorgenson, 1997, as cited in U.S. Army Corps of Engineers, 1998). The disturbance zone could come from locally deposited excess trench material and possible thermokarsting; it could change the composition of plant species. Each vertical support beam would disturb about 4 square feet of vegetation, 6% of which would be destroyed or replaced. This would result in 0.03 acre being disturbed per pipeline mile, or 0.36-1.5 acre from Alternative I for Sale 186. This would represent a very small fraction of the acreage affected by the existing 550 miles of pipeline in the Prudhoe Bay area (Tables V-3 and V-5).

Pipelines also could harm vegetation indirectly through snow drifting or shading from the pipeline. Information about snow drifting around pipelines with no parallel road is inconsistent (Jorgenson, 1997, as cited in U.S. Army Corps of Engineers, 1998), but residents of Nuiqsut say it happens. Any vegetation under a pipeline would receive slightly less direct sunlight during the growing season, potentially leading to a slightly shallower active layer in the soil and slightly reduced photosynthesis by the plants.

V.C.9.d(2) Cumulative Effects of Gravel Pads

Gravel fill for the Prudhoe Bay area (pads, mines, reserve pits, airstrips, and pipeline ramps) covers more than 7,800 acres (Tables V-3, V-5, and V-6b). This cover has directly destroyed some tundra vegetation. Within a few feet of a pad, the dust and gravel may smother the original vegetation. Weedy species and thermokarsting replace it, with the latter leading to high-centered polygons with deep moats (Jorgenson, 1997, as cited in U.S. Army Corps of Engineers, 1998).

The type of material used for gravel fill also can affect vegetation, because it sometimes has a salty source. If the material is salty, water draining from or leaching through the pad can pick up the salt and kill plants near the pad. More halophytic (salt-loving) plant species eventually colonize these areas, changing one plant community to another.

Rehabilitation of gravel pads on the Kuparuk oil field has resulted in the robust growth of grasses-sedges within 2 years, but recovery of shrubs has been slow (Cater, Rossow, and Jorgenson, 1999). Natural recovery of abandoned gravel pads has been slow (30-year period), but grasses-sedges have colonized old pads with plant cover similar to undisturbed adjacent tundra (Bishop et al., 1999).

From 1968-1983, flooding from construction caused the greatest indirect effect on vegetation in the Prudhoe Bay oil field (Walker et al., 1986, 1987). Flooding resulted when roads and pads intercepted the natural flow of water and caused ponding. Thus, the Beaufort Sea project area, through Corps of Engineers permits, would need to have natural drainage patterns identified before construction, and they would have to be maintained during and after construction. Even if such conditions were not required, or were not completely successful, flooding would affect no more land than that affected by dust and snow, as previously described. The change in vegetation from flooding could result in more aquatic grasses and sedges versus dwarf shrubs.

Alternative I for Sale 186 would require two valve stations. These stations and a helicopter pad would require less than 1 acre of gravel fill. We assume the perimeter of this gravel fill would encompass about 11 acres of potential dust effect and changes in moisture, a small fraction of the tundra affected by existing projects.

Gravel pads for future development activities are expected to have similar local effects on vegetation and wetlands.

V.C.9.d(3) Cumulative Effect of Gravel Roads and Onshore Ice Roads

There are more than 400 miles of gravel roads in the Prudhoe Bay development area (Tables V-3, V-5, and V-6b). Construction of these roads has caused the removal or burial of more than 4,000 acres of tundra-wetland-vegetation and has flooded an additional 4,000 acres of adjacent tundra because of changes in water flow due to the roads. However, development for Alternative I for Sale 186, Badami, Alpine, and most other proposed projects would not require the construction of interconnecting access roads next to elevated onshore pipelines tying into the Trans-Alaska Pipeline System and the Dalton Highway. The

Badami and Alpine projects would contribute only a few miles of additional roads, and Alternative I for Sale 186 would not contribute any effects in this area.

Ice roads would melt and become green later in the spring than the adjacent tundra, resulting in "green trails" along their routes. Ice roads tend to compress and flatten (but not kill) the vegetation under them, and we expect this vegetation to recover within a few years. Several hundred to more than a thousand miles of ice roads have been built over the tundra to support oil and gas exploration on Alaska's Arctic Slope. Alternative I for Sale 186 and future development would include perhaps a few hundred to several hundred miles of ice roads, but most of them would be offshore over landfast ice. The ice roads for Alternative I for Sale 186 would run between Endicott and Foggy Island Bay at the production island site and to the Kadleroshilik River mine site. These ice roads would not affect vegetation or wetlands along the coast, except for short-term, local effects where the roads cross the land. The use of freshwater from ponds and lakes for ice-road and pad construction are expected to have a negligible effect on vegetation-wetlands. We assume currently implemented stipulations on ice roads and pads would be followed for the exploration and development from Alternative I for Sale 186 and for future oil-exploration and -development projects. Onshore ice roads between gravel-mine sites, freshwater supplies, and other support areas temporarily would alter nearby vegetation. Ice and gravel roads for future development activities are expected to have similar local effects on vegetation and wetlands.

V.C.9.d(4) Cumulative Effects of Gravel Mining

The 17 mines around Prudhoe Bay area have removed more than 1,800 acres of tundra vegetation (Tables V-3 and V-5). Gravel mines for the Badami Project has altered another 89 acres, and gravel mines for Alternative I for Sale 186 development could alter additional acres. Future development is expected to alter the same amount or less acreage of tundra vegetation for gravel mines and have local effects on North Slope wetlands.

V.C.9.e. Effects of Future Oil Development Projects

If companies develop the Sourdough and Yukon Gold oil prospects west of the Canning-Staines rivers and the Point Thomson and Flaxman prospects along the Beaufort Sea's coast east of Badami (Table V-6a), these projects may tie into the Badami pipeline (Maps 1 and 2). Companies would add more gravel pads, pipelines, mine sites, and other facilities that would cause some further loss of vegetation and wetlands between the Sagavanirktok and Canning rivers. Developing the Alpine, Fiord, Colville, and Kalubik prospects in the Colville Delta, and possibly other oil prospects in the Prudhoe Bay area (Maps 1 and 2) would affect vegetation and wetlands that are west of the Sagavanirktok River to the Colville Delta.

Future exploration and development of oil and gas on the National Petroleum Reserve-Alaska would alter or destroy some vegetation and wetland on that part of the Arctic Slope. However, such losses likely would be small compared to the overall amount of vegetation and wetlands on the Arctic Slope. Future projects would use fewer and much smaller gravel pads and roads (smaller footprint) than existing oil fields in the Prudhoe Bay-Kuparuk River complex.

Conclusion. Oil-field development on Alaska's North Slope centers on the Arctic Coastal Plain, which covers about 13 million acres. Existing gravel-mine reserve pits, pads, and other facilities cover more than 7,800 acres (Tables V-3 and V-5). About 50 miles of shoreline, including vegetation and wetland habitats, potentially would be affected by cumulative development within the Alternative I for Sale 186 area. (See Section III.B.8 for a description of the distribution of vegetation and wetland in the project area.) All projects in Maps 1 and 2 either have or would destroy vegetation through construction of onshore gravel pads, gravel mines, and roads; burial of pipelines; or installation of vertical support members for elevated pipelines. Sources of past and potential impacts include directly digging up and burying vegetation; changes in snow drifting and water drainage; accumulation of dust, salt, and chemicals along roads and near gravel pads; and damage from oil spills and other accidental chemical spills. In terms of acres of land affected, construction causes more than 99% of the effects, with spills having a very minor role. Rehabilitation of gravel pads can result in the growth of grasses-sedges within 2 years after abandonment of the pads. Natural growth of plant cover on abandoned gravel pads would be very slow.

Construction of existing facilities, past exploration pads, and vehicle tracts across the tundra landscape has affected a small percentage of the total tundra-wetland habitats on the Arctic Coastal Plain. However, local additive effects of gravel pads, roads, mines, and other facilities on tundra wetlands are expected to persist decades long after the oil fields are abandoned.

We assume one large offshore oil spill greater than or equal to 1,000 barrels would occur during development over the life of these potential fields. Complete recovery of oiled coastal wetlands could take several decades to fully recover from this spill and associated cleanup activities.

Contribution of Alternative I for Sale 186 to Cumulative Effects: Alternative I for Sale 186 would contribute about 4% of the cumulative disturbance effects on over 7,800 acres of tundra and wetlands now affected by oil development (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). Alternative I for Sale 186 is estimated to contribute about 18% mean number of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12). We expect no synergistic effects.

V.C.10. Economy

V.C.10.a. Background of Cumulative Effects on State and Borough Economies

Without the activities considered in the cumulative-effects analysis described in Section V.B, the onshore and offshore oil industry in and near Prudhoe Bay probably would decline. That is, exploration, development and production and its associated direct employment could decline. Accordingly, associated indirect employment in Southcentral Alaska, Fairbanks, and the North Slope Borough and revenues to the Federal, State, and North Slope Borough governments could decline. Fluctuations in oil prices and other factors generated fluctuations throughout the Alaska economy from 1975-1995 (McDowell Group, Inc., 1999). The Alaska economy currently is not nearly as dependent on the oil sector as it was in the mid-1980’s, when the major crash in the Alaska economy occurred. Activities described in Section V.B generate employment, create economic opportunity, and add benefit to the cash economy of Alaska.

The oil and gas industry with interests in and near Prudhoe Bay and the Trans-Alaska Pipeline System have a strong interest in using the pipeline system many years into the future. The pipeline system represents a tremendous capital investment. Extending the useful life of the pipeline allows society to receive returns from its investment further into the future than would be the case if oil development on the North Slope ceased. In November 2002 an EIS was written and the TAPS Right-of-Way was renewed for another 20 years by both State and Federal agencies.

The oil and gas industry has reduced the costs of drilling wells and bringing new fields into production. This has made it more economic to develop fields that require more pipeline, both onshore and offshore, to connect to the existing pipeline system. Examples of this are the onshore pipelines that in recent years extended eastward and westward from Prudhoe Bay to the Badami and Alpine prospects, respectively. These onshore pipelines, and other possible future extensions proximate to the Beaufort Sea coast, make it more economic to develop offshore prospects. This can be done by extending pipelines northward to the offshore, including the OCS. The North Star development is an example of an extension of pipeline northward from previously existing pipeline infrastructure to the offshore. Future development prospects, which potentially may fit this geographic and economic pattern, are described in Section V.B.

In the following, we assess cumulative effects on the economy in terms of (1) current conditions, described in Section III.C.1; (2) economic effects from Alternative I for Sale 186 described in Section IV.C.10; and (3) activities considered in cumulative-effects analysis described in Section V.C.

V.C.10.b. Cumulative Effects on State and Local Revenues

The National Petroleum Reserve-Alaska alone would generate considerable revenues in the future. According to the final EIS for the Northeast National Petroleum Reserve-Alaska Integrated Activity Plan (USDOI, BLM, and MMS, 1998), oil from the Reserve at $18 a barrel could generate additive annual revenues of:

- $28 million State and North Slope Borough share of royalty receipts
- $3 million property tax to the State
- $48 million severance tax to the State
- $28 million Federal share of royalty receipts

For purposes of analysis, we presume that the $28 million royalty receipts will be divided so that the State receives $13 million and the Borough $15 million.

Not counting the National Petroleum Reserve-Alaska, other components of the cumulative case could generate the following additive annual revenues:

- $15 million State share of royalty receipts
- $7 million State income tax
- $4 million State spill and conservation tax
- $41 million Federal share of royalty receipts
- $56 million Federal income tax

In total, the cumulative case would generate the following additive annual revenues:

- $15 million to the North Slope Borough
- $90 million to the State
- $125 to the Federal Government

V.C.10.c. Cumulative Effects on Employment and Personal Income

The cumulative gains in direct employment would include additive jobs in petroleum exploration, development, and production, plus oil spill cleanup. The direct employment would generate indirect and induced employment and associated personal income for all the workers. This cumulative case is projected to generate additive employment and personal income increases as follows:

- 160 jobs annual average for North Slope Borough residents during development, declining to 40 during production. These include direct oil industry employment, indirect and induced employment.
- $10 million in total average annual personal income for workers residing in the North Slope Borough during development, declining to $2.8 million during production.
- 5,800 jobs annual average during development, declining to 3,300 during production. These jobs are for workers on the North Slope who reside in Southcentral Alaska and Fairbanks. These include direct oil industry employment and indirect and induced employment.
- $367 million in total average annual personal income for workers residing in Southcentral Alaska and Fairbanks during development, declining to $211 million during production.
- 5,800 jobs annual average during development, declining to 3,300 during production. These jobs are for workers who reside in the rest of the U.S. These include indirect and induced employment generated by expenditure for goods and services used on the North Slope and spending by direct employees.
- $367 million in total average annual personal income for workers residing in the rest of the U.S. during development, declining to $211 million during production. This income is for indirect and induced workers generated by expenditure for goods and services used on the North Slope and spending by direct employees.
- 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea.

This information is derived from Section IV.C.10 of this EIS and Section V.C.11 of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a).

V.C.10.d. Cumulative Effects on Transportation

In the unlikely event of a spill of 250,000 barrels of oil in the cumulative case in the Beaufort Sea, activities associated with cleaning it up would employ about the same number of workers as associated with the *Exxon Valdez* spill: 10,000 cleanup workers worked for 6 months in the first year, declining to zero by the fourth year following the spill, along with price inflation above 25% during the first 6 months of the cleanup operation. These workers also are additive workers. See Section IX.B.3.k of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a) for details. The same economic effects could occur whether the spill was in the Gulf of Alaska or farther south along the Canadian or U.S. West Coast bordering on the Pacific Ocean. These are additive workers.

V.C.10.e. Cumulative Effects of Subsistence Disruptions on the North Slope Borough's Economy

The cumulative effect of disruptions to the harvest of subsistence resources could affect the economic well-being of North Slope Borough residents mainly by the loss of some part of those resources. See Section V.C.11 for effects on subsistence-harvest patterns.

Conclusions. The cumulative case would generate additive annual revenues and additive employment and personal income increases as follows. In total, the cumulative case would generate the following additive annual revenues:

- $15 million to the North Slope Borough
- $90 million to the State
- $125 to the Federal Government

This cumulative case is projected to generate additive employment and personal income increases as follows:

- 160 jobs annual average for North Slope Borough residents during development, declining to 40 during production. These include direct oil industry employment, indirect and induced employment.
- $10 million in total average annual personal income for workers residing in the North Slope Borough during development, declining to $2.8 million during production.
- 5,800 jobs annual average during development, declining to 3,300 during production. These jobs are for workers on the North Slope who reside in Southcentral Alaska and Fairbanks. These include direct oil industry employment and indirect and induced employment.
- $367 million in total average annual personal income for workers residing in Southcentral Alaska and Fairbanks during development, declining to $211 million during production.
- 5,800 jobs annual average during development, declining to 3,300 during production. These jobs are for workers who reside in the rest of the U.S. These include indirect and induced employment generated by expenditure for goods and services used on the North Slope and spending by direct employees.
- $367 million in total average annual personal income for workers residing in residing in the rest of the U.S. during development, declining to $211 million during production. This income is for indirect and induced workers generated by expenditure for goods and services used on the North Slope and spending by direct employees.
- 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea.

Contribution of Alternative I for Sale 186 to Cumulative Effects: Additive contributions of Sale 186 to the cumulative effect would be as follows:

- $1 million revenue average annually to the North Slope Borough annually for 22 years of production
- $27 million revenue average annually to the State for 22 years of production
- $57 million revenue average annually to the Federal Government for 22 years of production

- 40 jobs annual average for North Slope Borough residents during development declining to 9 during production. These include direct oil industry employment, indirect and induced employment
- $3.4 million in total average annual personal income for workers residing in the North Slope Borough development and declining to $0.7 million during production.
- 600 jobs annual average during development, declining to 390 during production. These jobs are for workers on the North Slope who reside in Southcentral Alaska and Fairbanks. These include direct oil-industry employment and indirect and induced employment.
- $38 million in total average annual personal income for production workers, declining to $25 million during production for these workers.
- 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea
- 10,000 jobs for 6 months for cleanup of an unlikely tanker spill in the Gulf of Alaska
- For a more complete analysis, see Section IV.C.10. Disruptions to harvesting of subsistence resources could affect the economic well-being of North Slope Borough residents mainly through the direct loss of some part of these resources. See Section V.C.11 for effects on subsistence-harvest patterns.

We anticipate no synergistic effects.

V.C.11. Subsistence Harvest Patterns

V.C.11.a. Cumulative Effects on Subsistence Harvest Patterns

Cumulative effects on subsistence-harvest patterns include effects from Alternative I for Sale 186 exploration and development and other past, present, and reasonably foreseeable projects on the North Slope (see Table V-7c). Alternative I for Sale 186 exploration and development itself could affect subsistence resources because of potential oil spills; noise and traffic disturbance; or disturbance from construction activities associated with ice roads, pipelines, and landfalls. Noise and traffic disturbance might come from building, installing, and operating production facilities and from supply efforts. See Section IV.C.11 Effects on Subsistence-Harvest Patterns for a more detailed discussion of effects on subsistence resources and harvest patterns.

To understand effects on subsistence-harvest patterns, we must recognize three major characteristics of North Slope communities: (1) they rely heavily on bowhead whales, caribou, and fish in the annual average harvest; (2) subsistence-hunting ranges overlap for many species harvested by Native communities; and (3) subsistence hunting and fishing are central cultural values in the Inupiat way of life. Chronic cumulative biological effects to subsistence resources would affect their harvests. Potential effects from oil spills and noise disturbance could affect (a) seal hunting during the winter; (b) whale, seal, bird, and caribou hunting in spring; and (c) whale, seal, bird, and caribou hunting during the open-water season.

Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources, could change if oil development reduces the availability of resources or alters their distribution patterns. Cumulative effects to bowhead whales is a serious concern. If increased noise affected whales and caused them to deflect from their normal migration route, they could be displaced from traditional hunting areas, and the traditional bowhead whale harvest could be adversely affected. Ideally, ongoing seismic operations are seasonally timed and monitored to minimize conflicts with the migration and the subsistence hunt. Drilling for Northstar development is being monitored to prevent conflicts with whales and whalers. Most projected reasonably foreseeable development projects are expected to be close to shore and away from traditional bowhead whale migration and harvest areas. In addition, although seismic and drilling noise from Alternative I for Sale 186 deepwater activities are projected and deflection of whales further offshore is possible, winter drilling and timing and siting concerns can normally be accommodated in a Conflict Avoidance Agreement between industry and whaling captains. Noise effects can be eliminated or substantially reduced by the coordination and location of seismic activities and offshore facility access and helicopter paths to minimize operations in the vicinity of migrating whales. Existing and proposed mitigation and eventual permit conditions for Alternative I for Sale 186 development and other future projects would examine the timing and monitoring of potential noise sources to prevent conflicts to whales and subsistence whalers.

If the unlikely event that a large oil spill occurred and affected any part of the bowhead whale's migration route, it could taint this culturally important resource. Any actual or perceived disruption of the bowhead-whale harvest from oil spills and any actual or perceived tainting anywhere during the bowhead's inmigration, summer feeding, and fall migration could disrupt the bowhead hunt for an entire season, even though whales still would be available. Tainting concerns also would apply to polar bears, seals, fish, and birds. Biological effects to subsistence resources may not affect species' distributions or populations, but disturbance could force hunters to make more frequent and longer trips to harvest enough resources in a given season. For beluga whales, more flexible hunting patterns may reduce the effects of noise and disturbance. Hunters can take belugas in ice leads and open water at different times for a 6-month period, and belugas are not the whale species preferred in potentially affected communities. In the unlikely event that a large oil spill occurred, it could cause potential short-term but significant adverse effects to long-tailed duck and king and common eider populations. Subsistence-bird resources could experience short-term, local disturbance, but such disturbance could cause waterfowl to avoid productive subsistence-hunting sites. For the spring subsistence-waterfowl harvest, cumulative loss of habitat from development activities and population losses from oil spills significantly could disrupt harvests. An onshore pipeline spill that contacted rivers and streams could kill many fish and affect these fish populations. A potential loss of polar bears from oil-spill effects could reduce their availability locally to subsistence users, although polar bears are most often hunted opportunistically by North Slope subsistence hunters while in pursuit of more-preferred subsistence resources.

Limited monitoring data prevent effective assessment of cumulative subsistence-resource damage; resource displacement; changes in hunter access to resources; increased competition; contamination levels in subsistence resources; harvest reductions; or increased effort, risk, and cost to hunters. We cannot project effects properly without monitoring harvest patterns and the effectiveness of mitigating measures, and any effective monitoring regime must include serious attention to traditional Inupiat knowledge of subsistence resources and practices. Development already has caused increased regulation of subsistence hunting, reduced access to hunting and fishing areas, altered habitat, and intensified competition from nonsubsistence hunters for fish and wildlife (Haynes and Pedersen, 1989; Pedersen et al., 2000). These trends show why it is vital to monitor subsistence resources and harvests.

Because oil development and the refounding of Nuiqsut essentially were simultaneous, passage of the Alaska Native Claims Settlement Act precipitated a resurgence of the community and its subsistence culture and, at the same time, allowed the Trans-Alaska Pipeline to be built—it is difficult to disaggregate the cumulative effects of oil development in the region from these relatively recent processes of extreme local social change. Proper assessment of cumulative effects on the North Slope is critical, but separating the effects of an oil-development project from those of general social change can be difficult.

V.C.11.a(1) Native Views Concerning Cumulative Effects on Subsistence Harvest Patterns

V.C.11.a(1)(a) Nuiqsut's Views on Cumulative Effects

Cumulative effects from oil development have been, and continue to be, paramount concerns for North Slope residents. Sam Taalak, Nuiqsut's Mayor in 1982, saw the onslaught of cumulative activity 18 years ago: "We presently live at Nuiqsut and for the moment we're hemmed in from all sides by major oil explorations, even from the coast front" (Taalak, 1983, as cited in USDOI, MMS, 1983a). Leonard Lampe, another former Mayor of Nuiqsut, noted that the village has begun to consider the long-term effect of oil development on their subsistence lifestyle and Inupiat culture: "It's time to look at things seriously and ask if it's worth it. That's what the town is asking itself" (Lavrakas, 1996).

Thomas Napageak, Nuiqsut Native Village President and Chairman of the Alaska Eskimo Whaling Commission, recently clarified some of these concerns. In a January 10, 1997, meeting with MMS in Anchorage over a possible Nuiqsut Deferral for Sale 170, Mr. Napageak explained that the people of Nuiqsut have begun to focus on cumulative effects because they are concerned that when the Northstar

Project proceeds, it will be out there and affecting the community and its ability to harvest subsistence resources for 15-20 years. Such development directly affects Nuiqsut. Mr. Napageak wanted Sale 170 stipulations to deal with cumulative effects from the sale, and from other projects, and clear language about cumulative effects in the EIS. He wanted to see protective language developed for leases in the Sale 170 area that would extend to, and bind lessees with, leases from past sales (Casey, 1997, pers. commun.).

At a scoping meeting in Nuiqsut for the Northeast National Petroleum Reserve-Alaska Integrated Activity Plan EIS, Mr. Napageak noted again the importance of assessing cumulative effects on subsistence resources and harvests, especially the cumulative and indirect effects of existing and potential oil development on Nuiqsut. He remarked, “Federal leasing cannot be examined in isolation as though none of this other development and potential development were going on” (USDOI, Bureau of Land Management, 1997a). At a Bureau of Land Management symposium on the National Petroleum Reserve-Alaska held later the same month, he reaffirmed this concern: “Accumulated impact effects that would hinder the community and the socioeconomics of the community, how it will be affected by Alpine and presumably by NPR-A, these...really need to be considered” (Napageak, as cited in USDOI, Bureau of Land Management, 1997b). At an information update meeting in November 1999 for the Liberty Development Project, Elders Ruth Nukapigak and Marjorie Ahnupkana reaffirmed local concern for ongoing effects from oil development, saying that Eskimo traditions of long ago were going away with the oil companies coming in (Ahnupkana, as cited in USDOI, MMS, Alaska OCS Region, 1999).

V.C.11.a(1)(b) Kaktovik’s Views on Cumulative Effects

Kaktovik resident Michael Jeffrey, testifying for the first MMS lease sale of offshore oil and gas, saw a social impact from government actions. He said there was a cumulative effect on the villagers from having to participate in hearings and meetings. People knew the issues were important, so they had to take time off from working and hunting to attend. Jeffrey believed assessment documents are too technical. To help villagers with them, he suggested extending deadlines in communities that do not speak English so there would be enough time for agencies to translate documents (Jeffrey, 1979, as cited in USDOI, Bureau of Land Management, 1979b).

V.C.11.a(1)(c) Barrow’s Views on Cumulative Effects

The North Slope Borough sent written scoping comments and recommendations on the Bureau of Land Management’s Northeast National Petroleum Reserve-Alaska Integrated Activity Plan in April 1997. Their comments articulated concerns about potential effects to subsistence hunting and “about the cumulative impacts of all industrial and human activities on the North Slope and its residents. Consideration of these impacts must take into account industrial activities occurring offshore and at existing oil fields to the east; scientific research efforts; sport hunting and recreational uses of lands; and the enforcement of regulations governing the harvest of fish and wildlife resources by local residents. To date, no agency has addressed the concerns of Borough residents over how cumulative impacts might affect life on the North Slope” (North Slope Borough, 1997). Barrow Mayor Ben Nageak, spoke at public hearings for the National Petroleum Reserve-Alaska Integrated Activity Plan EIS in Barrow in January 1997. He said one of the key issues in developing the Reserve was to identify “a mechanism for recognizing and mitigating the potential cumulative impacts of multiple industrial operations” (Nageak, as cited in USDOI, Bureau of Land Management, 1997b). At a Liberty Development Project information update meeting in November 1999, Ron Brower, head of the Inupiat Heritage Center in Barrow, asked about future leasing and development plans and noted that MMS seemed to be doing projects piece by piece when instead it should be studying cumulative impacts. He believed new data and new development projections were needed and wanted to see a “new blueprint [for development] from aerial flights to underwater impacts” (Brower, as cited in USDOI, MMS, 1998). At the same meeting, Maggie Ahmaogak, Executive Director of the Alaska Eskimo Whaling Commission, asked that MMS take into account cumulative risks.

V.C.11.a(1)(d) Chukchi Sea Communities’ Views on Cumulative Effects

Native bowhead and beluga whale hunters in communities in the Chukchi Sea region maintain that they, too, will be affected if important marine mammals are harmed. Just as in the Beaufort Sea communities of Barrow, Nuiqsut, and Kaktovik, the potential tainting of bowhead and beluga whales and seals, in any portion of their respective ranges and habitats, could taint these culturally important resources. Even if these species were available for the spring and fall seasons, traditional cultural concerns of tainting could make them less desirable and alter or stop subsistence harvests.

The following is a summary of effects of oil spills, disturbance, and habitat loss on subsistence resources.

V.C.11.a(2) Effects of Large Oil Spills and Disturbance on Subsistence Resources

V.C.11.a(2)(a) Bowhead Whales

Overall, exposure of bowhead whales to noise from oil and gas operations should not kill any bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The incremental contribution of effects from Alternative I for Sale 186 to the overall effects under the cumulative case is not likely to cause an adverse effect on the bowhead whale population (Section IV.C.11.b(1)(b)1)).

V.C.11.a(2)(b) Seals and Polar Bears

The overall effects (mainly from one oil spill assumed for this analysis) is the potential losses of perhaps up to 30 polar bears, a few hundred to a few thousand seals and walruses, and probably fewer than 10 beluga and gray whales. In the likely cumulative case, seal, polar bear, and beluga and gray whale populations are expected to recover within 1 year, assuming only one large spill (greater than or equal to 1,000 barrels) occurs. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have long-term (more than one generation or perhaps 5-10 years) effects on sea otters and perhaps harbor seals and other marine mammals. Cumulative noise and disturbance from Alternative I for Sale 186 is expected to briefly and locally disturb or displace a few seals, walrus, beluga whales, and polar bears. A few polar bears could be temporarily attracted to the production island with no significant effects on the population's distribution and abundance (Section IV.C.11.b(1) (b)2))

V.C.11.a(2)(c) Birds

Although the potential effects of spills are very uncertain, a large offshore oil spill could result in losses exceeding 10,000 individuals, primarily to waterfowl and shorebirds staging offshore in lagoons or along beaches, if the spill occurred during the breeding season. Overall cumulative effects of oil-industry activities on marine and coastal birds potentially could be substantial, primarily as a result of mortality from oil spills. Disturbance may cause loss of productivity and lowered survival of birds occupying areas with high levels of industry activity (Section IV.C.11.b(1)(b)5))

V.C.11.a(2)(d) Caribou and Other Terrestrial Mammals

Terrestrial mammals that would be affected include caribou, muskoxen, grizzly bears, and arctic foxes. Oil development in the Prudhoe Bay area could continue to displace some caribou during the calving season within about 2.5 miles of some roads with vehicle traffic that crosses calving habitat. The general shift of caribou calving away from the large oil fields may persist. Cows and calves of the Central Arctic Herd may, over time, reduce calving and the use of summer habitats near roads with high levels of traffic. If they do, these activities potentially could affect the caribou's productivity and abundance over the long term. However, this potential effect may not be measurable, because the caribou's productivity greatly varies under natural conditions. Some oil-development projects, such as Badami and Alpine, do not include roads constructed to Prudhoe Bay and the Dalton Highway. They are not likely to disturb or displace calving caribou or change caribou movements across the Arctic Slope. Cumulative oil development is likely to have only local effects on the distribution and abundance of caribou, muskoxen, grizzly bears, and arctic foxes on the North Slope of Alaska and not affect overall distribution and abundance. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have short-term (1-3 years) effects on other terrestrial mammals (Section IV.C.11.b(1)(b)3))

V.C.11.a(2)(e) Fishes

In general, marine and migratory fish populations are not measurably affected by the type of disturbances generated by oil- and gas-related activities. The wide distribution and low density of fish, the short-term and mild nature of their response to noise associated with oil and gas activities, and the wide distribution and low density of expected oil and gas projects is the basis for this conclusion. Some overwintering fish may not be able to avoid noise and disturbances and may be adversely affected. However, this is not likely to occur often, and most fish would be unaffected. Because water used for construction is not expected to be withdrawn from waters supporting fish, the use of freshwater for ice-road and pad construction is not expected to have a measurable cumulative effect on fish populations. Hence, disturbances associated with Alternative I for Sale 186 are not expected to contribute measurably to the overall cumulative effect on fishes.

According to Table V-12, the most likely number of oil spills (greater than 1,000 barrels) that would be contributed by Alternative I for Sale 186 is zero. Nevertheless, if a large oil spill occurred, small numbers of fish in the immediate area might be killed or harmed, if they were somehow trapped and unable to avoid it. However, marine and migratory fishes are widely distributed in the Beaufort Sea, most are not likely to become trapped, and most are not likely to be affected by an oil spill. Those that are in the vicinity of a large oil spill and are affected by it are likely to experience effects ranging from minor and short-term to no effect at all. For these reasons, oil spills associated with Alternative I for Sale 186 are not likely to have a measurable additive effect on fish populations (Section V.C.6).

V.C.11.a(3) Cumulative Effects on Habitat

Development has directly covered about 7,000 acres through the construction of 350 miles of roads, 89 pads, 4 airstrips, and 14 gravel mines (Table V-3). The mines cover more than 1,500 acres. Development in the Prudhoe Bay and Kuparuk areas has directly affected about 9,500 acres because of gravel excavation and filling, and indirectly affects many adjacent acres of vegetation. The total affected acreage is a small part of the Arctic Coastal Plain, and cumulative effects probably are not significant to the overall productivity of tundra plants in this area. It is important to remember that ongoing oil-development projects, such as Alpine, Badami, and Northstar, require a much smaller acreage footprint than existing and past projects on the North Slope.

Alterations from offshore production platform-island construction, trench-dredging, and pipeline burial are expected to affect some benthic organisms and some fish species within 1 kilometer for less than 1 year or season. These activities also temporarily may affect the availability of some local food sources for these species up to 1-3 kilometers (0.62-1.9 miles) distance during island construction, but these activities are not expected to affect food availability for seals over the long term. The effect of onshore-facilities siting—dust fallout, thermokarst, and hydrologic change—for future projects on bird populations, though additive, would be significantly less severe, because they would be restricted to much smaller areas and result in smaller habitat loss. Pads, gravel quarries, pipelines, pump stations, and gravel roads that cross much of the Central Arctic Herd’s calving range actually have destroyed only about 3-4% of the tundra grazing habitat for caribou.

If roads on the North Slope are opened to the public, there would be an increase in access to caribou herds, muskoxen, grizzly bears, and other terrestrial mammals, potentially leading to more hunting and disturbance. Increased access increases competition for resources—a potential negative impact on subsistence hunters. Furthermore, more roads usually means reduced access (or increased effort) for subsistence hunters. New roads are obstacles to traveling to traditional hunting areas because of security protocols imposed on access roads to and in development areas. Roads and pipelines force hunters to travel farther to hunt or force them to hunt in nontraditional areas.

V.C.11.b Transportation Effects on Subsistence Harvest Patterns

V.C.11.b(1) Small Onshore Spills from the Trans-Alaska Pipeline System

Considering the small additive effects of onshore oil spills from the Trans-Alaska Pipeline System on individual subsistence resources, measurable cumulative effects on subsistence harvests are not expected.

Small onshore spills, whether originating from field pipelines or from the Trans-Alaska Pipeline System would have a very small additive effect on terrestrial mammal habitats near pipelines, roads, and other facilities. Small spills are expected to be cleaned up before substantial losses occur and cleanup at the spill site would frighten caribou and other terrestrial mammals away from the spill and prevent contact with the oil. Small spills are not expected to significantly affect bird species occurring in the Beaufort Sea region. In winter, onshore pipeline spills on the North Slope and along the Trans-Alaska Pipeline System would not be expected to affect fish, because their likelihood of contacting fish habitat is very low. In summer, fish and food resources in a small waterbody with restricted water exchange likely would be harmed or killed from a small spill of sufficient size. Recovery would be expected in 5-7 years. Small numbers of fish in the immediate area of an onshore oil spill may be killed or harmed, but small oil spills would not be expected to have measurable cumulative effects on fish populations. The additive effect of small onshore spills would cause minor ecological harm to wetlands and vegetation that should recover within a few years but could take more than 20 years. Most onshore spills occur on gravel pads, and their effects do not reach surrounding vegetation. About 20-35% of past crude oil spills has reached areas beyond pads. Because winter spans most of the year, about 60% of the time spills occur when workers can clean up oil on the snow cover before it reaches the vegetation.

V.C.11.b(2) Large Tanker Spill in the Gulf of Alaska

Alternative I for Sale 186 is not expected to contribute any tanker spills to the cumulative analysis—the mean number of spills is 0.41 (see Table V-12). However, potential future oil-spill effects from tanker transportation of arctic oil, including oil from Alternative I for Sale 186, from the Trans-Alaska Pipeline System terminal in Valdez could produce local cumulative effects. Using experience from the *Exxon Valdez* spill as a gauge, a 250,000-barrel oil spill substantially could reduce or alter subsistence harvests for the residents of Cordova and Yakutat. In Cordova, especially for intertidal resources and some fish species, effects could be experienced for at least 4 years. Lesser effects of shorter duration could be expected for Yakutat. The instantaneous nature of the event would not permit opportunistic "stocking up" of available resources.

V.C.11.b(3) Potential Effects of Transporting Arctic Oil from the Trans-Alaska Pipeline System

Oil produced from Alternative I for Sale 186 is expected to contribute about 7%; the most likely number of spills is zero spills from Trans-Alaska Pipeline System tankers. In Alaskan waters, the probable oil-tanker route lies seaward of the 200-mile Economic Exclusion Zone boundary except in the northcentral Gulf of Alaska, where the transportation route leaves Prince William Sound. Oil spilled along most of this route would tend to move parallel to the Alaska Peninsula and the Aleutian Islands, rather than towards the coast, where vulnerable resource populations could be contacted. Oil spilled from a tanker after exiting Prince William Sound could contact the Kodiak and Alaska Peninsula areas.

A large oil spill, future tanker spills of arctic oil, which may include Alternative I for Sale 186 oil, could cause serious and long-term cumulative effects on some subsistence resources in Prince William Sound and the Gulf of Alaska, especially marine and coastal birds, sea otters, and harbor seals, with lesser effects on river otters and brown and black bears. An economic loss for 2 years following the spill to the commercial-fishing industry in this area would range from 37-64% per year and also would represent a serious loss to the subsistence fishery. (See Sections V.C.1 on threatened and endangered species; V.C.2 on seals and polar bears; V.C.3 on marine and coastal birds; V.C.4 on terrestrial mammals; and V.C.6 on fishes.)

A realistic projection of the occurrence of a tanker spill calculated from tanker spill records indicates most spills (7 of 10) are expected to average 6,000 barrels or less. We estimate 11 spills with an average size of 6,000 barrels, 1 of which occurs in port and 10 at sea. We assume two spills with an average size of 13,000 barrels, both which occur at sea, and one spill at sea in the Gulf of Alaska at 200,000 barrels (see Table V-15). One of these spills would occur in ports where contingencies for cleanup and containment are in place, contributing to relatively quick containment and cleanup of these in-port spills. Spills of this size at sea have not been found to cause serious effects on bird, fish, and sea mammal populations when the effects have been studied. Additionally, at-sea spills of these average sizes are not expected to reach large areas of habitat critical to these species' survival until after the oil has been rendered less harmful by weathering and dispersion in the water. Recovery periods would be lengthened, if more than one spill affected the same population within a short interval—an unlikely situation. Therefore, effects on species along the tanker-transportation route south of the Gulf of Alaska to West Coast and California ports are expected to be about the same or less than those described here, keeping in mind that there are few and limited subsistence harvests of any species along this corridor outside of Alaska. The potential for an oil spill to affect subsistence fisheries, particularly salmon, in the Pacific Northwest (see Section V.C.1, Threatened and Endangered Species) and the small subsistence gray whale hunt of the Makah tribe on the Washington coast along the tankering corridor, appears to be limited.

LaBelle and Marshall (1995) calculated simulated oil-spill trajectories for tanker routes off the U.S. West Coast. Oil-spill trajectories were mapped as "risk contours" (or oil-spill travel time at sea), showing the chance of contact to environmental resource areas, assuming an oil spill occurred (conditional probabilities). Off the California coast, an oil spill at 100 nautical miles offshore would have a 5% chance of contacting the shoreline within 30 days, while an oil spill at 80 nautical miles offshore would have a 10% chance of contacting the shoreline within 30 days. The contour lines are farther offshore off Washington and Oregon.

Summary and Conclusion for Beaufort Sea, North Slope, and Transportation Activities on Subsistence-Harvest Patterns: Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources could change, if oil development reduces the availability of resources or alters their distribution patterns. The most serious concern to North Slope Inupiat is that potential increases in noise from cumulative oil development could disrupt the normal migration of bowhead whales, forcing subsistence whalers into longer hunts farther from shore. This issue has been voiced many times over many years. Recently, Eugene Brower, President of the Barrow Whaling Captains' Association, articulated the issue in a statement he made at the January 6, 2000, meeting of the MMS Regional Offshore Advisory Committee:

> I have the responsibility of talking on behalf of my whaling captains in Barrow. There's 44 captains with 550 plus crew members that have great concern for the lease sales…the area of concern that we're talking about is the whole migration route of the bowhead whale. What goes on in the eastern portion of the Canadian Border all the way through Barrow impacts three villages. [For] their livelihood, we have a great concern…The concern is always the same…but what impacts Kaktovik impacts Barrow and Nuiqsut in the middle. Anything that goes [on] in the east impacts us all the way to Barrow. And I, for one, would never want to see a permanent structure out in the open sea because of the experience we had from…one little platform off Cooper Island, five miles offshore. It was stationary, just idling. Just the noise being emitted from that structure was enough to divert the bowhead whales further out. There was nothing in between the structure and the mainland, 9 miles of water in between them but nothing went through. It was always on the outside. So if you're going to be putting permanent facilities out in the water on the Beaufort Sea, it's going to be making a lot of noise with the gravel pad, whatever structure you put out there. It's going to impact our livelihood (USDOI, MMS, 2000).

In the unlikely event that a large oil spill occurred and affected any part of the bowhead whale's migration route, it could taint this culturally important resource. Any actual or perceived disruption of the bowhead-whale harvest from oil spills and any actual or perceived tainting anywhere during the bowhead's migration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season, even though whales still would be available. In fact, even if whales were available for the spring and fall seasons, traditional cultural concerns of tainting could make bowheads less desirable and alter or stop the subsistence harvest in Barrow, Nuiqsut and Kaktovik for up to two seasons. Concerns over the safety of subsistence foods could persist for many years past any actual harvest disruption. This would be a significant adverse effect. In terms of other species, this same concern also would extend to polar bears and seals. Native harvests of bowhead and beluga whales by subsistence hunters in the Chukchi Sea region also would be affected by tainting concerns. From Alternative I for Sale 186 exploration and development alone, in the unlikely event that a large oil spill occurred, other subsistence resources, as well, could be periodically affected in the communities of Barrow, Nuiqsut, and Kaktovik.

Additionally, in the unlikely event that a large oil spill occurred, potential short-term but significant adverse effects to long-tailed ducks and king and common eider populations; a large onshore pipeline spill that contacted the Sagavanirktok River or East Sagavanirktok Creek could kill many fishes and affect these fish populations. A potential loss of polar bears from oil-spill effects could reduce their availability locally to subsistence users although they are seldom hunted by subsistence hunters except opportunistically while in pursuit of more preferred subsistence resources. More roads on the North Slope increase non-Native access to, competition for, and disturbance of resources—a potential negative impact on subsistence hunters. More roads usually mean reduced access or increased effort for subsistence hunters, because new roads bring new access and security restrictions imposed by the oil industry. This forces hunters to travel farther to hunt or forces them to hunt in nontraditional areas.

Ongoing tanker transportation of oil from Valdez to the West Coast could cause serious and long-term cumulative effects on some subsistence resources in Prince William Sound and the Gulf of Alaska, especially on marine and coastal birds, sea otters, and harbor seals, with lesser effects on river otters and brown and black bears. Economic losses could be expected for 2 years to the commercial-fishing industry, and a serious loss to the subsistence fishery also would be expected. Effects on species along the tanker-transportation route south of the Gulf of Alaska to West Coast and California ports are expected to be about the same or less than those described above because there are few and limited subsistence harvests of any species along this corridor outside of Alaska. The threat of an oil spill to subsistence fisheries, particularly salmon, in the Pacific Northwest and the small subsistence gray whale hunt of the Makah tribe on the Washington Coast along the tankering corridor appears to be limited.

Conclusion: Cumulative effects on subsistence-harvest patterns include effects from Alternative I for Sale 186 exploration and development and other past, present, and reasonably foreseeable projects on the North Slope with one or more important subsistence resources becoming unavailable or undesirable for use for 1-2 years, a significant adverse effect Sources that could affect subsistence resources include potential oil spills, noise and traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. The communities of Barrow, Nuiqsut, and Kaktovik would potentially be most affected, with Nuiqsut potential being the most affected community because it is within an expanding area of oil exploration and development both onshore (Alpine and the Northeast National Petroleum Reserve-Alaska) and offshore (Northstar and McCovey). In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive significant effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Because the likelihood of a large oil spill is unlikely, attaining a level of significant effect also is unlikely. The placement of a drilling structure or production island near the bowhead whale migration corridor that operated over the life of a field (15-20 years) would represent a far more significant effect because of potential long-term noise disturbance to migrating whales. We expect that mitigation would be developed to prevent any long-term disruption to migrating whales from industrial noise. No synergistic effects are expected.

Contribution of the Alternative I for Sale 186 to Cumulative Effects: Alternative I for Sale 186, represents a small proportion 7% of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. While the most likely number of oil spills greater than or equal to 500 barrels from all past, present, and future activities onshore is estimated to be 5, the most likely number of offshore spills is estimated to be zero. The Alternative I for Sale 186 is estimated to contribute about 18% of the estimated mean number of cumulative offshore spills, with a most likely number of spills of 0 (Table V-12).

In the unlikely event of a spill from Alternative I for Sale 186, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads, threatening a critical underpinning of Inupiat culture. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated.

V.C.12. Sociocultural Systems

V.C.12.a. Details of Cumulative Effects on Sociocultural Systems

Cumulative effects on sociocultural systems include effects of Alternative I for Sale 186 exploration development and other past, present, and reasonably foreseeable projects on the North Slope (Tables V-3, V-5, and V-6a). Cumulative effects on sociocultural systems would come from changes to subsistence-harvest patterns, social organization and values, and other issues, such as stress on social systems (see Impact Assessment Inc., 1990a,b,c; 1998; Human Relations Area Files, Inc., 1995; State of Alaska, Dept. of Fish and Game, 1995b).

V.C.12.a(1) Social Organization

In this cumulative analysis, effects on social systems could result from industrial activities, changes in population and employment, and changes in subsistence-harvest patterns. These effects would be similar to those described in Section IV.C under Effects Common to All Alternatives, but the level of effects would increase because collectively, activities would be more intense. More air traffic and non-Natives in the North Slope region could increase the interaction and, perhaps, conflicts with Native residents. In the past, non-Native workers have stayed in enclaves, which kept interactions down. However, recent activity in the Alpine field has brought non-Natives directly into the Native village of Nuiqsut, and this has added stresses in the community. Already, these workers have made demands on the village for more electrical power and health care. This potential remains for the communities of Barrow and Kaktovik.

Increases in population growth and employment could cause long-term disruptions to (1) the kinship networks that organize the Inupiat communities' subsistence production and consumption, (2) extended families, and (3) informally derived systems of respect and authority (mainly respect of elders and other leaders in the community). Offsetting such effects are strong efforts by the North Slope Borough, the Alaska Eskimo Whaling Commission, regional and tribal governments, local governments, and village corporations to institutionally foster and protect Inupiat cultural traditions. Cumulative effects on subsistence-harvest patterns (which also would be long term) would affect Inupiat social organization through disruptions to kinship ties, sharing networks, task groups, crew structures, and other social bonds. Effects on sharing networks and subsistence-task groups could break down family ties and the communities' well-being, creating tensions and anxieties that could lead to high levels of social discord. The North Slope Borough, the Alaska Eskimo Whaling Commission, and local whalers have set precedents for negotiating agreements with the oil industry to protect subsistence-whaling practices. Such cooperation is expected to continue. Negotiated agreements exist for development effects onshore at the Alpine Unit north of Nuiqsut. The Bureau of Land Management has convened a Subsistence Advisory Panel for the Northeast National Petroleum Reserve-Alaska Integrated Activity Plan/EIS planning. It consists of Bureau of Land Management officials and tribal members from local communities. This group is tasked with investigating conflicts between subsistence activities and oil exploration and development, verifying the levels of conflict, and proposing resolutions to the lessee and the Bureau of Land Management. It is too soon to know how effective this panel will be in resolving such conflicts.

V.C.12.a(2) Cultural Values

Cumulative effects on cultural values also could result from industrial activities, changes in population and employment, and changes in subsistence-harvest patterns. These effects would be similar to those described in Section IV.C under Effects Common to All Alternatives for Alternative I for Sale 186 exploration and development, but at higher levels. Cumulative effects on social organization could include decreasing importance of the family, cooperation, sharing, and subsistence as a livelihood, and increasing individualism, wage labor, and entrepreneurship. Long-term effects on subsistence-harvest patterns also would be expected. Chronic disruption could affect subsistence task groups and displace sharing networks, but it would not displace subsistence as a cultural value. Sociocultural cumulative effects of changing norms and values would be expected to affect all five social institutions (family, polity, economics, religion, and education), but the North Slope Borough's institutional infrastructure, the Alaska Eskimo

Whaling Commission, community whaling organizations, regional and tribal governments, and regional and village corporations work diligently to develop programs to protect these cultural values (Impact Assessment Inc., 1990a,b,c, 1998; Human Relations Area Files, Inc., 1995; State of Alaska, Dept. of Fish and Game, 1995b).

V.C.12.a(3) Other Issues

Stress created by the fear of an oil spill also is a distinct predevelopment impact-producing agent within the human environment. Stress from this general fear can be broken down to the particular fears of:

- being inundated during cleanup with outsiders who could disrupt local cultural continuity;
- the damage that spills would do to the present and future natural environment;
- drawn out oil-spill litigation;
- contamination of subsistence foods;
- the lack of local resources to mobilize for advocacy and activism with regional, State, and Federal Agencies;
- the lack of personal and professional time to interact with regional, State, and Federal agencies;
- retracing the steps (and the frustrations involved) taken to oppose offshore development;
- responding repeatedly to questions and information requests posed by researchers and regional, State, and Federal outreach staff; and
- needing to employ and work with lawyers to draft litigation to attempt to stop proposed development.

A State of Alaska Department of Fish and Game social-effects survey administered by the Division of Subsistence Management in 1994 in Nuiqsut included questions on effects from outer continental shelf development. Sixty-percent of the respondents did not believe a small oil spill could be contained or cleaned up, and 80% did not believe a large oil spill could be contained or cleaned up. The overall study on 21 Alaskan communities concluded that impacts persist from the *Exxon Valdez* oil spill on subsistence use and the social and cultural system that subsistence activities support (Fall and Utermohle, 1995; Impact Assessment, Inc., 1998; Field et al., 1999).

For this cumulative analysis, we may see increases in social problems, such as rising rates of alcoholism and drug abuse, domestic violence, wife and child abuse, rape, homicide, and suicide. The North Slope Borough already is experiencing problems in the social health and well-being of its communities, and additional development (including offshore oil development) on the North Slope would disrupt them further. Historically, more income in these communities has connected somewhat to the abuse of alcohol and increased violence. Sources show increases in dysfunctional behavior during the peak of the commercial-whaling era and then again during the height of the fur trade. Drinking and violence seem to ebb when increases decline. Recent evidence of the effects of employment during and just after World War II loosely supports these views. Although this evidence is not clear, it can still be assumed that onshore oil development has resulted in large cash flows that have lead to significant social changes. These social changes on the North Slope are likely to have influenced the extremely high rate of suicide among the Inupiat (90.8 per 100,000 for the Inupiat versus 35 per 100,000 among the Yup'ik [Travis, 1989]).

The relationship of oil and gas development to aberrant behavior and social pathologies might be seen more clearly in terms of social change and associations rather than in direct causality. Oil and gas development has affected all communities in Alaska and, for this reason, finding control communities is difficult; yet these impacts to communities are important to understand, and more cumulative-effects studies need to be conducted. In a general sense, the cumulation of effect occurs as modernization occurs. As change happens, these alterations spread through the social fabric. Such change can be both negative and positive and can be measured to an extent with objective indicators of the opportunity structure or the stratification system such as education, income, occupation, social networks, and social mobility (created through income, education, etc.) (Cluck, 2000, pers. commun.).

Within this change, produced by the trends of modernization, the "rational choice" of individuals being affected by this change must be considered. Individuals make decisions, sometimes negative, sometimes positive, and stress or fear of change can reinforce a situation of internal conflict that can lead to negative social pathological effects. At the same time, positive impacts may come from higher incomes (that can purchase better equipment for subsistence), better health care, and improved educational facilities. Yet what may be seen on the surface as having positive impacts may, at the same time, produce negative effects by producing apathy to or disinterest in older cultural norms known as anomie. An example of this is an increased used of the Internet versus a reduction in listening to elders. Certain negative effects from social change are inescapable. As technology and opportunity develop, younger individuals readily accept these changes. This is seen easily in less developed countries where rapid change is evident or in the desertion of rural America by young people (Cluck, 2000, pers. commun.).

Both positive and negative impacts from oil and gas development exist in the North Slope Borough. Whether they are the more positive ones of increased funding for infrastructure or education or more negative ones associated with a lack of interest by younger people in traditional ways, both have added to social change. Oil and gas development has been one catalyst for such cumulative change on the North Slope; it needs further study, but it is not the single causal agent (Cluck, 2000, pers. commun.).

In the cumulative case, long-term effects could displace social systems; however, the North Slope Borough is vigilantly protecting the rights and culture of the Inupiat. Health and social services programs have tried to respond to alcohol and drug problems with treatment programs and shelters for wives and families of abusive spouses, in addition to providing greater emphasis on recreational programs and services. These programs, however, sometimes do not have enough money, and North Slope Borough city governments cannot help as much now that they get less money from the State. Partnering together, tribal, city, and the Borough governments may be able to provide programs, services, and benefits to residents. All communities in the North Slope Borough have banned the sale of alcohol for many years, but the possession of alcohol is not banned in Barrow, and many communities are continually under pressure to bring the issue up for a local referendum (North Slope Borough, 1998).

V.C.12.a(4) Effects of Oil-Spill Cleanup on Social Systems

In the unlikely event that a large oil spill occurred, cleanup activities for the one estimated offshore spill greater than or equal to 1,000 barrels occurring over the life of the field and elsewhere could generate many cleanup and response jobs. Based on the *Exxon Valdez* spill, Native residents employed in cleanup work could stop participating in subsistence activities, have a lot of money to spend, and tend not to continue working in other lower paying community jobs. In the event of a much larger spill event, these dramatic changes could cause tremendous social upheaval (Human Relations Area Files, Inc., 1995; State of Alaska, Dept. of Fish and Game, 1995b; Impact Assessment, Inc., 1990c, 1998). Many North Slope village men have been trained in cleanup procedures and have said they want to be part of any cleanup response (Lampe, 1999). The North Slope Borough would play a large part in structuring any spill response and cleanup (*North Slope Subarea Contingency Plan*, Environmental Protection Agency, U.S. Coast Guard, and State of Alaska, Dept. of Environmental Conservation, 1999).

V.C.12.b. Transportation Effects on Sociocultural Systems

V.C.12.b(1) Large Tanker Spill in the Gulf of Alaska

Sociocultural systems in the community of Cordova could undergo severe individual, social, and institutional stress and disruption from a 250,000-barrel spill (Section IV.I), which would last at least 4 years. Lesser effects of shorter duration could be expected for Yakutat. Individuals and the community of Cordova that depend on income from commercial fisheries could experience stress and anxiety from debt burden, income shortfalls, litigation, and fear for the future, should the fisheries they participate in or depend on in other capacities be shortened or terminated because of the accidental spill. Considerable stress and anxiety also would be expected over the loss of subsistence resources, contamination of habitat, fear of the health effects of eating contaminated wild foods, and the need to depend on the knowledge of others about environmental contamination (Fall, 1992; McMullen, 1993). Individuals and the community of Cordova would be increasingly stressed during the time needed to modify subsistence-harvest patterns by selectively changing harvest areas, if such areas were even available. Associated culturally significant activities, such as the organization of subsistence activities among kinship and friendship groups and the relationships among those that customarily process and share subsistence harvests, also would be modified or would decline.

A 250,000-barrel-spill also would be expected to affect individuals and social systems in ways similar to the experience from the *Exxon Valdez* spill. As shown by that spill, some individuals found a new arena for pre-existing personal and political conflict, especially over the dispensation of money and contracts. In the smaller communities, cleanup work produced a redistribution of resources, creating new schisms in the community (Richards, No date). Many members of small communities were on the road to sobriety before the spill; after the spill, some people began drinking again, producing the re-emergence of numerous alcohol-related problems, such as child abuse, domestic violence, and accidents (Richards, No date). Institutional effects included additional burdens being placed on local government, disruption of existing community plans and programs, strain on local officials, difficulties dealing with the spiller, community conflict, disruptions of customary habits and patterns of behavior, emotional effects and stress-related disorders, confronting environmental degradation and death, and the violation of community values (Endter-Wada, 1992). Postspill stress resulted from this seeming loss of control over individual and institutional environments as well as from secondary episodes such as litigation, which produced secrecy over information, uncertainty over outcomes, and community segmentation (Smythe, 1990; Picou and Gill, 1993). Attempts to mitigate effects met with a higher priority placed on concerns over litigation and a reluctance to intervene with people for fear it might benefit adversaries in legal battles (Richards, No date; Human Relations Area Files, Inc., 1995; State of Alaska, Dept. of Fish and Game, 1995b; Impact Assessment, Inc., 1990c, 1998).

V.C.12.b(2) Potential Effects of Transporting Arctic Oil from the Trans-Alaska Pipeline System

Oil produced from Alternative I for Sale 186 is expected to contribute about 7%; the most likely number of spills is zero spills from Trans-Alaska Pipeline System tankers. In Alaskan waters, the probable oil-tanker route lies seaward of the 200-mile Economic Exclusion Zone boundary except in the northcentral Gulf of Alaska, where the transportation route leaves Prince William Sound. Oil spilled along most of this route would tend to move parallel to the Alaska Peninsula and the Aleutian Islands, rather than towards the coast, where vulnerable resource populations could be contacted. Oil spilled from a tanker after exiting Prince William Sound could contact the Kodiak and Alaska Peninsula areas.

Based on the assumptions discussed in Section IV.I for a large oil spill, future tanker spills of arctic oil, which may include Alternative I for Sale 186 oil, could cause serious and long-term cumulative effects on some subsistence resources in Prince William Sound and the Gulf of Alaska, an economic loss for 2 years following the spill to the commercial-fishing industry that would range from 37-64% per year that would also represent a serious loss to the subsistence fishery (see Section V.C.11- Subsistence-Harvest Patterns).

A realistic projection of the occurrence of a tanker spill calculated from tanker spill records indicates most spills (7 of 10) are expected to average 6,000 barrels or less. We estimate 11 spills with an average size of 6,000 barrels, 1 of which occurs in port and 10 at sea. We assume 2 spills with an average size of 13,000 barrels, both which occur at sea, and 1 spill at sea in the Gulf of Alaska at 200,000 barrels (see Table V-15). One of these spills would occur in ports where cleanup and containment contingencies are in place, contributing to relatively quick containment and cleanup of these in-port spills. For this reason, effects on sociocultural systems along the tanker-transportation route south of the Gulf of Alaska to West Coast and California ports are expected to be reduced from those described above and in Section V.C.11.b(3) primarily because Native subsistence cultures south of Alaska have historically been marginalized by the dominant culture, and there are few Native communities that continue to practice a subsistence way of life. Other potential sociocultural effects not related to Native subsistence cultures are described in the following text.

V.C.12.b(3) Potential Effects on Recreation and Tourism Along the Transportation Route

A 200,000-barrel oil spill would preclude recreation and tourism activities in the coastal areas of the Wrangell-Saint Elias National Park and Preserve, the northern portion of the Tongass National Forest, and portions of Prince William Sound until spill-cleanup operations and natural processes restored the sites. Major economic losses could be expected for the tourist industry in the affected areas following a spill, with small charter boat, lodge, and sportfishing operations in the Yakutat and Cordova being the hardest hit. Tourist levels would be expected to rebound to prespill levels 1 year after the spill.

In the unlikely event of a large spill, effects on recreation and tourism along the tanker transportation route south of the Gulf of Alaska to West Coast and California ports could affect the same tourist industries and resources identified above. In coastal areas to the south, marine sanctuaries, shoreside beaches, parks, campgrounds, and recreation areas are more numerous and see more overall visitation. For this reason, economic losses to tourism could be greater. Public perceptions about the desirability of an area could change drastically after a spill event, and visitation could take longer to rebound. A recent agreement between The United Nations' International Maritime Organization and the U.S. Department of Commerce has set the shipping lanes for tankers 25-30 miles offshore of the Monterey Bay, Gulf of the Farallones, and Channel Islands National Marine Sanctuaries, affording these areas greater protection from vessel collisions, groundings, and spills. (CNN.com, 2000).

For tanker routes off the West Coast, simulated oil-spill trajectories were calculated by LaBelle and Marshall in 1995. Oil-spill trajectories were mapped as "risk contours" showing the chance of contact to environmental resource areas over time (3-, 10-, and 30-day travel times at sea) assuming an oil spill occurred (conditional probabilities). An oil spill at 100 nautical miles off the California coast would have a 5% chance of contacting the shoreline within 30 days, while an oil spill at 80 nautical miles offshore would have a 10% chance of contacting the shoreline within 30 days. For Washington and Oregon, the contour lines are farther offshore, and it is important to remember that tankers carrying oil from Alaska are from 100-200 miles offshore except when entering a port.

Summary and Conclusion for Beaufort Sea, North Slope, and Transportation Activities on Sociocultural Systems: In this cumulative analysis, effects on social institutions (family, polity, economics, education, and religion) could result from industrial activities, changes in population and employment, and changes in subsistence-harvest patterns. These effects would be similar to those described in Section IV.C under Effects Common to All Alternatives, but the level of effects would increase because collectively, activities would be more intense. More air traffic and non-Natives in the North Slope region could increase interaction and, perhaps, conflicts with Native residents. In the past, non-Native workers have stayed in enclaves, which kept interactions down. However, recent activity in the Alpine field has brought non-Natives directly into the Native village of Nuiqsut, and this has added stresses in the community. Already, these workers have made demands on the village for more electrical power and health care. This potential remains for the communities of Barrow and Kaktovik.

Increases in population growth and employment could cause long-term disruptions to (1) the kinship networks that organize the Inupiat communities' subsistence production and consumption, (2) extended families, and (3) informally derived systems of respect and authority (mainly respect of elders and other leaders in the community). Cumulative effects on social organization could include decreasing importance of the family, cooperation, sharing, and subsistence as a livelihood, and increasing individualism, wage labor, and entrepreneurship. Long-term effects on subsistence-harvest patterns also could be expected. Chronic disruption could affect subsistence-task groups and displace sharing networks, but it would not tend to displace subsistence as a cultural value.

At the same time, revenues from North Slope Borough taxation on oil development produce positive cumulative impacts that include increased funding for infrastructure, higher incomes (that can be used to purchase better equipment for subsistence), better health care, and improved educational facilities. We may see increases in social problems, such as rising rates of alcoholism and drug abuse, domestic violence, wife and child abuse, rape, homicide, and suicide. The North Slope Borough already is experiencing problems in the social health and well-being of its communities, and additional development, including offshore oil development on the North Slope, would further disrupt them. Health and social-services' programs have tried to respond to alcohol and drug problems with treatment programs and shelters for wives and families of abusive spouses, in addition to providing greater emphasis on recreational programs and services. These programs, however, sometimes do not have enough money, and North Slope Borough city governments cannot help as much now that they get less money from the State. Based on experiences after the *Exxon Valdez* spill, Native residents employed in cleanup work could stop participating in subsistence activities, have a lot of money to spend, and tend not to continue working in other lower paying community jobs. Because Nuiqsut is relatively close to oil development activities on the North Slope, cumulative effects chronically could disrupt sociocultural systems in the community—a significant effect; however, overall effects from these sources are not expected to displace ongoing sociocultural systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. This potential exists for the communities of Barrow and Kaktovik as Beaufort Sea areawide leasing, exploration, and development proceed on- and offshore. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive (but not synergistic) effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

Future transportation of North Slope oil through Prince William Sound could produce cumulative effects on sociocultural systems from the effects of a large spill assumed, for purposes of analysis, to be 200,000 barrels. As a result, the communities of Yakutat and Cordova likely would undergo severe individual, social, and institutional stress and disruption that would last for at least 4 years. Sociocultural effects south of the Gulf of Alaska to U.S. West Coast and California ports are expected to be reduced from those described above, primarily because Native subsistence cultures south of Alaska historically have been marginalized by the dominant culture, and there are few Native communities that continue to practice a subsistence way of life. Effects to recreation and tourism would be major economic losses for the tourist industry, with small charter boat, lodge, and sportfishing operations in the Yakutat area being the hardest hit. Tourist levels would be expected to rebound to prespill levels 1 year after the spill. Recreation and tourism effects south of the Gulf of Alaska to West Coast and California ports would affect the same tourist industries and resources; however, in coastal areas to the south, marine sanctuaries, shoreside beaches, parks, campgrounds, and recreation areas are more numerous and see more overall visitation. For this reason, economic losses from tourism losses could be greater.

Contribution of Alternative I for Sale 186 to Cumulative Effects: The contribution from Alternative I for Sale 186 to cumulative effects on the sociocultural systems of the communities of Barrow, Nuiqsut and Kaktovik could come from disturbance from oil-spill-cleanup activities; small changes in population and employment; and disruption of subsistence-harvest patterns from oil spills and oil-spill cleanup. Disturbance effects could periodically disrupt, but not displace, ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. Community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term if there are concerns over the tainting of bowhead whales from an oil spill.

Environmental Justice: For a discussion of Environmental Justice cumulative effects, see Section V.C.16.

V.C.13. Archaeological Resources

V.C.13.a. Cumulative Effects on Archaeological Resources

The greatest cumulative effect on archaeological resources in the Beaufort Sea Sale 186, 195, and 202 area is from natural processes such as ice gouging, bottom scour, and thermokarst erosion. Because the destructive effects of natural processes are cumulative, they have affected and will continue to affect archaeological resources in this area.

Accidental oil spills would affect onshore archaeological sites the most, but past cleanups have shown us that spilled oil had little direct effect on archaeological resources (Bittner, 1993). Following the *Exxon Valdez* spill, the greatest effects came from vandalism, because more people knew about the locations of the resources and were present at the sites. Various mitigating measures used to protect archaeological sites while cleaning up oil spills are avoidance (preferred), site consultation and inspection, onsite monitoring, site mapping, scientific collection of artifacts, and programs to make people aware of cultural resources (Haggarty et al., 1991).

Although archaeological resources are not renewable, they are not affected directly or cumulatively by oil spills, the build up of toxic substances, noise, or air pollution. Effects are minimized due to modern technologies and practices that reduce the impact to the environment and therefore to archaeological resources (no thawing of permafrost, restricted personnel access, wintertime operations, small-footprint drilling and transportation technologies). Furthermore, mitigating measures, such as offshore high-resolution seismic surveys with archaeological analysis in zones of potential resources, and onshore archaeological surveys where offshore pipelines make landfall, will avoid damage or destruction of potential archaeological resources.

V.C.13.b. Transportation Effects on Archaeological Resources

The expected effect on onshore archaeological resources from potential future oil-spills from tanker or pipeline transportation of arctic oil is uncertain; however, data from the *Exxon Valdez* oil spill indicate that less than 3% of the resources within a spill area would be significantly affected (Dekin, 1993).

A potential tanker or pipeline spill would affect archaeological resources by creating surface-disturbing activities resulting from emergency shoreline and contaminated ground treatment. Following the *Exxon Valdez* oil spill, Exxon developed and funded a Cultural Resource Program to ensure that potential effects on archaeological sites were minimized during shoreline treatment (Betts et al., 1991). This program involved a team of archaeologists who performed reconnaissance surveys of the affected beach segments, reviewed proposed oil-spill treatment, and monitored treatment. As a result of the coastline surveys, hundreds of archaeological sites were discovered, recorded, and verified. This resulted in the most comprehensive archaeological record of Alaska coastline ever documented.

Although a number of sites in the *Exxon Valdez* spill area were vandalized during the 1989 cleanup season, the large number of Exxon and Government agency archaeologists visible in the field may have lessened the amount of site vandalism that may have occurred (Mobley et al., 1990).

The Dekin (1993) study found that small amounts of petroleum hydrocarbons may occur in most archaeological sites within the study area. This suggests a low-level petroleum contamination that previously had not been suspected. Because the researchers found no evidence of extensive soil contamination from a single definable source (the oil spilled from the *Exxon Valdez*), they "now add the continuing contamination of soils from small and large petroleum spills in areas where present and past land use coincide" (Dekin, 1993). Vandalism was found to have a significant effect on archaeological site integrity but could not be tied directly to the oil spill (Dekin, 1993).

Summary and Conclusions for Beaufort Sea, North Slope, and Transportation Activities on Archaeological Resources. In addition to Alternative I for Sale 186, other activities associated with this cumulative analysis that may affect archaeological resources in the Beaufort Sea include lease sales and activity in the National Petroleum Reserve-Alaska and State lands, State oil and gas fields, oil and gas transportation, noncrude carriers, and any Federal activities. Cumulatively, these proposed projects likely would disturb the seafloor more often, but remote-sensing surveys made before approval of any Federal or State lease actions should keep these effects low. Federal laws would preclude effects to most archaeological resources from these planned activities.

Contribution of Alternative I for Sale 186 to Cumulative Effects: The contribution of Alternative I for Sale 186 to the cumulative case is expected to be minimal for archaeological resources, because any surface-disturbing activities that could damage archaeological sites would be mitigated by current State and Federal procedures, which require identification and mitigation of archaeological resources in the proposed project areas.

Overall effects of the Alternative I for Sale 186 would be additive to effects anticipated for other future projects and, in the case of oil spills, is uncertain. However, data from the *Exxon Valdez* oil spill indicate that less than 3% of the resources within a spill area would be significantly affected.

V.C.14. Land Use Plans and Coastal Zone Management

V.C.14.a. Land Use Plans

The development projects that constitute the basis of the assessments in this section are described in Section IV. Many of the projects included in the cumulative case could occur on Federal lands, including the OCS, as well as lands covered by the North Slope Borough Land Management Regulations. Because the Land Management Regulations' areawide policies are the same as those developed by the North Slope Borough for the NSB CMP, the areawide policies of the Land Management Regulations are incorporated into the section on coastal management.

V.C.14.b. Coastal Zone Management

Cumulative effects may lead to changes in the level of effects. However, ACMP statewide standards and NSB CMP policies that are relevant to the analysis in Section IV Land Use Plans and Coastal Management Programs remain relevant for the cumulative. The following paragraphs focus only on the differences in the analysis in Section IV. Although the level of effects may increase for the cumulative, the hypothetical activities described in the scenarios are not expected to conflict with the statewide standards and NSB CMP policies. Activities that occur within the North Slope Borough boundary, including the offshore coastal zone area, will require permitting and approval from the North Slope Borough prior to those activities proceeding. Activities will not be approved by the Borough until it is certain they do not conflict with the CMP policies.

V.C.14.b(1) Energy Facilities (6 AAC 80.078), Transportation and Utilities (6 AAC 80.080), and Habitats (6 AAC 80.130)

The effects of pipelines, roads, and facilities installation and construction are magnified in the cumulative case. However, the analyses indicate that the potential additive effects will not significantly alter or interfere with the habitats, species, and activities that these standards address. Cumulative effects are not anticipated to increase the potential for conflict with these Statewide standards. Siting of energy facilities, transportation, and utilities within the boundaries of the North Slope Borough and the offshore coastal zone would require North Slope Borough permitting and approval. The NSB CMP policies would be addressed through this approval process and permitting would be dependent upon adherence to these policies.

V.C.14.b(2) Subsistence (6 AAC 80.120)

Access to subsistence-hunting areas and subsistence resources and the use of subsistence resources could change, if development reduces the availability of resources or alters their distribution patterns. Sources that could affect subsistence resources and access include noise and traffic disturbance, disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, supply efforts, and the unlikely event of a large oil spill and associated cleanup efforts. Of these, the unlikely event of a large spill is the only source that could significantly interfere with access to subsistence resources. If a large spill occurred and contaminated essential harvesting areas, effects could occur when impacts from contamination, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

The other affects agents are not expected to have any more than local, short-term effects or can be effectively addressed through mitigation such as the stipulations on Conflict Avoidance and Industry Site-Specific Whale-Monitoring Program. Noise effects from seismic activities can be eliminated or substantially reduced by the coordination and location of seismic activities. Offshore facility access and helicopter routes can be planned to minimize operations in the vicinity of migrating whales. Existing mitigation and eventual permit conditions for future projects would examine the timing and monitoring of potential noise sources to prevent conflicts with subsistence whalers. Therefore, activities addressed for cumulative effects are not likely to result in conflict with this Statewide standard or with the NSB CMP policies addressed in Section IV. Activities occurring within the boundaries of the North Slope Borough will require Borough permitting and approval.

Summary: Access to subsistence-hunting and subsistence resources offers the greatest opportunity for conflict with the Statewide standards and the NSB CMP policies related to these concerns. Increases in noise and disturbance from cumulative oil development could have localized short-term effects on some subsistence resources and access to those resources. The resource of most concern is bowhead whales. The concern relates to the potential for noise to disrupt the normal migration of bowhead whales, forcing subsistence whalers into longer hunts farther from shore. In the unlikely event of a large oil spill occurring in the migration route, the bowhead whale could be tainted and the harvest disrupted, although bowhead whales still would be available. However, tainting concerns would remain.

Noise and disruption can be effectively addressed through mitigation, coordination and through future permitting processes, including Federal, State, and local processes as applicable. A large oil spill is an accidental event. Federal regulations require and implement strict oil-spill prevention standards and a large oil spill is considered unlikely.

Conclusion: The potential for conflicts arising from the cumulative case is the same as those discussed in Section. IV.C - Effects Common to All Alternatives. Conflicts with Statewide standards of the ACMP and the policies of the NSB CMP are not inherent in the hypothetical scenarios presented in the cumulative case.

Contribution of Alternative I for Sale 186 to the Cumulative Potential for Conflict: Alternative I for Sale 186 represents a small proportion (7%) of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. No conflicts are anticipated for activities associated with Alternative I for Sale 186, and its contribution to the cumulative case does not alter the conclusion for the cumulative case. This conclusion is based partly on the small contribution of Alternative 1for Sale 186, but predominantly on the conclusion that exploration and development and production can proceed consistent with the enforceable policies of the ACMP and the NSB CMP. The MMS regulatory oversight and lease stipulations address many of the concerns applicable to the enforceable standards. In addition, the consistency review of these activities will address the applicable policies at the time that specific plans are submitted.

V.C.15. Air Quality

V.C.15.a. Details of Cumulative Effects on Air Quality

Despite considerable oil and gas related activity since 1969, the overall air quality on the North Slope of Alaska remains relatively pristine. See Section III.A.6 for a discussion of the existing environment.

Table V-2 shows that Prudhoe Bay and Kuparuk are the big oil producers. However, their production will continue to decline over the coming years. Air monitoring at a number of sites in the Kuparuk and Prudhoe Bay fields showed that concentrations of nitrogen dioxide, sulfur dioxide, and PM_{10} are well within the national ambient air-quality standards. BPXA's air quality modeling for the Liberty Project indicated that emissions from the Prudhoe Bay and Kuparuk fields have very little effect on ambient concentrations elsewhere. Their air quality modeling for their project also indicated that maximum concentrations would occur within about 100-200 meters from the facility boundary and would be considerably lower at 1 kilometer from the facility. We consider that their results are representative of what we could expect from any development resulting from Alternative I for Sale 186. Thus, there would be very little cumulative interaction between developments under this and other oil-producing facilities.

Potential impacts from future lease sales on the OCS and on land are difficult to evaluate. However, we can expect that any development would be scattered over a rather large area. Modeling performed for the Sale 144 final EIS (USDOI, MMS, 1996a) showed that impacts from widely scattered emissions sources on the OCS are small and well within regulatory standards. The Final 5-Year Program EIS for 2002-2007 (USDOI, MMS, 2002a) discusses the cumulative effects of the program in all areas. The relevant major finding was that no major degradation of onshore air quality is predicted. Emissions associated with routine program activities could cause small increases in onshore concentrations of some air pollutants. Emissions should not cause any exceedance of national or State air quality standards. In the unlikely event of a large oil spill, the accidental oil spill could cause rapid and perhaps dramatic increases in volatile organic carbon concentrations near the spill, but the duration of these should be too short (generally a few days) to cause major impacts.

A more comprehensive discussion occurs in the Impacts on Air Quality sections of that document (USDOI, MMS, 2002a:Sections 4.3.2.2 and 4.3.3.2); we incorporate that discussion here by reference. Section 4.3.2.2 (pertaining to the Gulf of Mexico) includes also a general discussion of ambient air quality standards, the effects of pollutants, and the type and relative amounts of pollutants generated by offshore operations. Section 4.3.3.2 (specific to Alaska) discusses the most commonly emitted air pollutants associated with Alaska OCS oil and gas activities, including operations affected by ice cover, the construction of ice islands and gravel islands, and the concentration of activities into short timeframes. The conclusions drawn there are that the impacts from the 5-year program on the pollutant levels, the ozone levels, and visibility all would be minor or negligible. Section V.C.13 of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a) discusses the cumulative effects on air quality of all North Slope oil and gas activity since 1969. It concludes that the cumulative effects of all projects affecting that area in the past and occurring now have caused generally little deterioration in air quality, which remains better than required by national standards. The Northstar and Liberty projects and all other reasonably foreseeable North Slope projects would not change this situation. Also, Sections IV.C.15.b(2)(a) and IV.C.15.b(2)(b) of this EIS conclude that from small oil spills there would be a small, very localized increase in concentration of hydrocarbons. Concentrations of criteria pollutants would remain well within Federal air quality standards. The overall effects on air quality would be very low.

Total emissions from development for all three of the Beaufort Sea sales considered in this EIS (Sales 186, 195, and 202) would be from the installation of a maximum of 8 platforms and 115 miles of pipeline, and the drilling of a maximum of 206 production wells and 100 injection wells. In the peak years, a probable maximum of 28 wells per year would be drilled from four rigs. Peak-year production emissions would result from operations producing about 100 million barrels of oil and from transportation of that oil. The total production is estimated to be 1,380 million barrels over 39 years, which averages to about 35 million barrels per year, or 97,000 barrels per day. (See Appendix F - Exploration and Development Scenarios and Table F-2 for more details of the expected infrastructure.)

We could expect very little cumulative interaction between emissions from developments resulting from Alternative I for Sale 186 and any other existing, planned, or potential oil or gas development projects. For the area as a whole, we could expect the quality of the air to increase in those areas where oil production currently is the greatest and to decline in other areas where future development is expected to take place. It is possible that new development would be relatively scattered and, therefore, regional impacts would be small, except for higher, localized concentrations in the immediate vicinity of production facilities.

We also expect that no synergistic effects will affect air quality.

Arctic Haze: Arctic haze is a phenomenon resulting from elevated concentrations of fine particulate matter that are found over the Arctic, primarily in winter and spring. Scientists believe that most of these pollutants are attributed to combustion sources in Europe and Asia. It is not known to what extent local sources in Alaska contribute to arctic haze in the area of the Beaufort Sea. However, the arctic haze phenomenon was first observed in the 1950's, long before oil development started on the North Slope. Also, emissions in the general area are expected to decrease due to a downward trend in oil production and, thus, any possible contribution to arctic haze would be reduced. Projected emissions from development resulting from the proposed Beaufort Sea multiple-sale proposal are small compared to the emissions from the Prudhoe Bay and Kuparuk oil field production. For example, actual emissions reported for the Prudhoe Bay oil fields for the year 1994-1995 listed 56,000 tons of nitrogen oxide, 1,471 tons of sulfur dioxide, and 6,200 tons of PM_{10} (U.S. Army Corps of Engineers, 1999:Table 5.4-7). Projected emissions from Alternative I for Sale 186 would be only a small percentage of those figures. Therefore, any contribution from Alternative I for Sale 186 to arctic haze would be minor.

Global Climate Change: The global climate change analysis performed for the Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007 (USDOI, MMS, 2002a:Section 4.1.2 and Tables 4-7a and 4-7b) estimated that the emission rate of greenhouse gases (carbon dioxide, methane, and nitrous oxide) from cumulative OCS activities for Alaska would be from 381,000-723,000 metric tons of carbon equivalent per year for carbon dioxide and from 1,100-2,100 metric tons of carbon equivalent per year for methane. Emissions of nitrous oxide were not calculated due to a lack of information about emission factors. However, these emissions are expected to be much smaller than for the other greenhouse gases. The total estimated greenhouse gas emissions from Beaufort Sea Sales 186, 195, and 202, including emissions from tanker transport to U.S. West Coast ports, were from 177-311 million metric tons of carbon equivalent. This is about 0.01-0.02% of current nationwide greenhouse gas emissions. The Northstar EIS estimated that the greenhouse gas emissions from current North Slope oil production (including shipping, refining, end-product transportation, and consumption) is about 1% of the global fossil-fuel greenhouse gas emissions (U.S. Army Corps of Engineers, 1999). (Emissions from the actual combustion of oil produced are much greater than that from just the production activities.) For Alternative I for Sale 186, the peak oil production rate is 43.6 million barrels per year, or about 120,000 barrels per day. This is about 8% of current North Slope oil production, or 0.08% of global fossil fuel greenhouse gas emissions.

The cumulative analysis for Alternative I for Sale 186 considers three ranges of onshore and offshore future production activity. The low range includes reserves in currently producing fields and resources and discoveries in the planning or development stage. The midrange consists of the low-range figure plus any reasonably foreseeable future production. The high range adds in potential speculative future production. If we use the midrange estimate, which is 11 billion barrels of oil, and assume that this entire amount is produced over a 20-year period, we get an average production rate of about 1.4 million barrels of oil per day. This is very close to the 1996 North Slope oil-production rate. While it is difficult to precisely estimate greenhouse gas emissions from future oil and gas production activities in Northern Alaska, one may assume that the greenhouse gas emissions would be proportional to the oil-production rate at the same ratio as presently exists. Based on that assumption, the regional greenhouse gas emissions associated with future cumulative production would be about the same as the 1996 North Slope emission levels. This is about 30% higher than current levels (since the 1999 North Slope production rate was about 1.1 million barrels of oil per day). Greenhouse gas emissions associated with production activities can be reduced by using more fuel-efficient power generators and minimizing flaring. Based on the Northstar analysis cited above, the cumulative future oil production in northern Alaska would produce a relatively small (about 1%) contribution to global greenhouse gas emissions. The Alternative I (Sale 186) production of 460 million barrels over 24 years averages to about 19 million barrels per year, or 52,000 barrels per day. This is about 3.5% of current North Slope production and greenhouse gas emissions. The contributions of Beaufort Sea Sales 186, 195, and 202 would represent about 6.7% of current North Slope production and greenhouse gas emissions. Nationwide and global greenhouse gas emissions can be reduced by energy conservation, improving energy efficiency, and developing alternative energy sources. Regardless of any downward pressure on the growth of oil consumption in the future as a result of measures to reduce greenhouse gas emissions, the need for continued development of domestic new oil and gas resources still will exist. If Alaska energy sources were not to be developed in the future, resources would have to be produced in other areas of the globe. The impacts on greenhouse gas emissions would be very similar, regardless of the location of the energy source.

V.C.15.b. Transportation Effects on Air Quality

The transportation of crude oil to market by tankers would result in air emissions from the tankers' engines during loading operations, transit, and unloading. These emissions would consist primarily of nitrogen oxides, sulfur dioxide, and particulate matter. Emissions of volatile organic compounds also would occur during tanker loading and unloading operations. Emissions of nitrogen oxides and volatile organic compounds would be of concern in ports located within ozone nonattainment areas because of their potential to contribute to tropospheric ozone levels. In these areas, local regulations commonly require the use of vapor-balance systems to substantially reduce volatile organic compound emissions. For any particular port, the emissions would be intermittent, and nitrogen dioxide, sulfur dioxide, and particulate matter concentrations would be within ambient air quality standards. Impacts from emissions during transit would be very small, because emissions would be dispersed over a large area.

A major oil spill would result in a localized increase in ambient volatile organic compounds concentrations due to evaporation from the spill. Details on the effects of an oil spill and impacts associated with in situ burning are provided in Section IX.B.3.m of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002a) and in Section IV.A.6(b) of this EIS. Overall air quality impacts from transportation would be low.

Summary and Conclusions for Beaufort Sea, North Slope, and Transportation Activities on Air Quality. The cumulative effects of all projects affecting the North Slope of Alaska in the past and occurring now have caused generally little deterioration in air quality, which remains better than required by national standards. All reasonably foreseeable North Slope projects (see Table V-1a) would not change this situation. We also expect that no synergistic effects will affect air quality.

Contribution of Alternative I for Sale 186 to Cumulative Effects: Considering that predicted discoveries and development from Alternative I for Sale 186 would represent only a few percent of the existing North Slope activity, air emissions from Alternative I, Sale 186 would have no significant cumulative effects on air quality. See Section IV.C.15 for a discussion of these emissions.

V.C.16. Environmental Justice

Alaska Inupiat Natives, a recognized minority, are the predominant residents of the North Slope Borough, the area potentially most affected by Alternative I for Sale 186 exploration and development. Effects on Inupiat Natives could occur because of their reliance on subsistence foods, and cumulative effects may affect subsistence resources and harvest practices. Potential effects from noise, disturbance, and oil spills on subsistence resources and practices and sociocultural patterns would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik, within the North Slope Borough. For a detailed discussion of Environmental Justice effects, see Section IV.C.16 and the cumulative-effects analyses for subsistence-harvest patterns and sociocultural systems in Sections V.C.11 and V.C.12.

Additional Aspects of Environmental Justice Cumulative Impacts. The MMS acknowledges sociocultural cumulative impacts on the North Slope and that Inupiat culture has undergone significant change (see Sec. IV.C.12, Effects on Sociocultural Systems). The influx of money and a changing landscape due to wage employment has added many benefits and raised the standard of living, but these influences also have given rise to an array of social pathologies that include increased alcoholism. However, cumulative effects are difficult to separate and, by far, most cumulative effects result from onshore development, as the oil patch spreads outward from Prudhoe Bay/Deadhorse.

One point that was made numerous times at a Research Design Workshop for the Bowhead Whale Subsistence Hunt and OCS Oil and Gas Activities convened by MMS in April 2001 in Anchorage, was that any realistic analysis of cumulative effects on the North Slope needs to consider both onshore and offshore effects. To date, the most obvious cumulative effects have occurred and continue to occur onshore, although no adequate monitoring or comprehensive baseline data gathering has ever been undertaken onshore by responsible Federal and State agencies and industry. Most of the stress factors mentioned by local stakeholders normally can be associated with onshore impacts. Until a serious onshore-monitoring program is developed, causal linkages to impacts from onshore or offshore sources will be problematic.

Mitigating Initiatives Related to Environmental Justice Cumulative Impacts. For a discussion of standard and proposed mitigation measures and other ongoing mitigating initiatives that relate to environmental justice concerns, see Section IV.C.16.

Additionally, if development occurred, MMS would encourage development of a standing interagency-intergovernmental working group that would include local and regional North Slope governments, State and Federal land management agencies, and industry to consult, coordinate, design, and monitor solutions to subsistence and sociocultural cumulative impacts on- and offshore. Such a body would better serve the concerns of subsistence hunters and lead to more balanced decisions on approaches to long-term monitoring and the proper assessment of oil-activity cumulative impacts on subsistence resources and harvests and Inupiat culture. After its 1998 lease sale in the Petroleum Reserve, the Bureau of Land Management established a National Petroleum Reserve-Alaska Subsistence Advisory Panel and an

Interagency Research and Monitoring Team that includes the Bureau of Land Management, the Fish and Wildlife Service, other Federal agencies, the State of Alaska, the North Slope Borough, and local North Slope groups who meet to address local subsistence concerns. A similar offshore panel could be established if development occurs.

In its November 2001 meeting, the OCS Policy Committee discussed the possibility of the Department of the Interior determining a way to provide funds to tribal and local governments for training and travel needs to facilitate their participation in Department of the Interior planning and decisionmaking processes. Without funding, these executive orders are perceived by the Native community simply as new "unfunded mandates." Funding of this nature would ameliorate some of the stress caused in small Native villages from the burden of participation in the agency public process.

More specifically, and based on Native stakeholder concern, the MMS has addressed cumulative impacts by redesigning its approach to oil-spill risk to make its methodology better suited to the Arctic region. Also, based on stakeholder concern, the MMS has redesigned its EIS analysis of cumulative effects. These changes are reflected in the Liberty EIS and in this EIS. Another initiative pursued by the MMS to improve its analysis of cumulative impacts has been through a cooperative agreement with the Alaska Department of Fish and Game, Subsistence Division, whereby MMS provides funding for the collection and maintenance of the State-maintained Community Profile Database, which is the only long-term archive of subsistence data in the State.

Ongoing and proposed MMS studies that address environmental justice concerns will provide valuable data for the assessment of cumulative impacts of oil and gas activities. Monitoring efforts for the Northstar and Liberty projects, such as the 14-year aerial Monitoring of the Distribution of Arctic Whales Project, will provide long-term information on areawide and cumulative effects of oil and gas activities on the fall migration of the bowhead whale and help in the development of mitigation measures to protect this pivotal Inupiat subsistence resource. A top-priority 5-year, $3.7 million ANIMIDA study was established in response to Inupiat requests to gather long-term monitoring data that will provide a basis for evaluating potential effects from upcoming development and production activities in the Beaufort Sea. A portion of this study will assess the historic and ongoing subsistence use of the area surrounding Cross Island by working with local whale hunters. The intent of the *Exxon Valdez Oil Spill, Cleanup, and Litigation: A Community-Based Collection of Social-Impacts Information and Analysis, 1989-2001* study is to produce an analytical tool from the synthesis of the *Exxon Valdez* literature that would assist MMS analysts in preparing National Environmental Policy Act documents, the design of mitigating measures, facilitate the review of oil-spill-contingency plans, and pave the way for a dialogue with coastal communities regarding the MMS offshore program. The *Quantitative Description of Potential Effects of OCS Activities on Bowhead Whale Hunting Subsistence Activities in the Beaufort Sea* study was developed in response to concerns raised by the Alaska Eskimo Whaling Commission and the North Slope Borough. This study will involve a systematic analysis of residents' observations and perceptions about how their lives, and especially subsistence whale hunting activities, have been and might in the future be affected by oil-industry activities and other forces of modernity. A study titled *Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow: Past and Present Comparison* is ongoing and will map geographic patterns of subsistence use near important North Slope communities. The MMS will use this comparative time-series information to assess cumulative sociocultural effects in the Beaufort Sea region. The ongoing Alaska Marine Mammal Tissue Archival Project field sampling and long-term storage of frozen tissues archive has provided a wealth of information on contaminants. A proposed study called "the Alaska Marine Mammal Health and Contaminants Database" will make this tissue-archival information available to management agencies and subsistence villages that, by necessity, need to make timely decisions about the safety of the environment and subsistence foods. Finally, an ongoing study titled *North Slope Borough Economy, 1965 to Present* will provide a comparative basis for assessing potential economic effects of upcoming offshore oil and gas activity to better assess potential cumulative effects of offshore oil and gas development. Another aspect of this study will be to consider and estimate economic effects from decreasing oil- and gas-development revenues at Prudhoe Bay and assess community impacts.

In April 2001, the MMS held The Bowhead Whale Subsistence Hunt and Outer Continental Shelf Oil and Gas Activities Research Design Workshop in Anchorage. This workshop was requested by the National Marine Fisheries Service and the Alaska Eskimo Whaling Commission to better focus scientific research on the cumulative effects of OCS activity on bowhead whales and their migration, in addition to the sociocultural dimensions of the subsistence whale hunt. Recommendations from the workshop identified: (1) the need for extensive funding to effectively study the complex relationship between OCS and onshore socioeconomic effects; (2) the need for effective monitoring to document and analyze industry and whaling activities and the many factors of change in local communities; (3) that defining and disaggregating (on- and offshore) cumulative social effects will be a difficult process; and (4) that defining the relative causal effect of any given factor, such as OCS oil and gas activity, on social problems is problematic. Participants agreed that available resources would better be applied to researching means of prevention, intervention, and treatment of social problems in North Slope Native communities.

The MMS, in conjunction with the North Slope Borough Wildlife Management Department, helped sponsor an Information Transfer Meeting in Anchorage in January 1999 and the Beaufort Sea Information Update Meeting in Barrow in March 2000 to present updates on research and studies being conducted in the Beaufort Sea. The March 1999 meeting included presentations by Barrow, Nuiqsut, and Kaktovik whaling captains. Future meetings on the North Slope are expected.

While these efforts in themselves would not resolve the larger problems of ongoing cultural challenge to Inupiat traditions from increasing development in the region and from the powerful influences of modernity, such as cable television, the Internet, and an increasing dependence on a wage-based economy, they provide processes for information sharing and opportunities for mutual decisionmaking and remediation of cumulative social and subsistence impacts.

Conclusion: Potential effects would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik, within the North Slope Borough; however, effects are not expected from routine activities and operations. If a large spill assumed in the cumulative case occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives, because oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health. Any potential effects to subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated.

Contribution of Alternative I for Sale 186 to Cumulative Effects: Only in the event of a large spill, which is a low likelihood event, would disproportionate high adverse effects be expected on Alaska Natives from Alternative I for Sale 186.

SECTION VI

CONSULTATION
AND
COORDINATION

CONTENTS OF SECTION VI

VI. CONSULTATION AND COORDINATION

VI.A. Development of the Proposals

As scheduled in the current OCS 5-Year Oil and Gas Leasing Program (2002–2007), the Secretary has decided to have three sales in the Alaska Region's Beaufort Sea Planning Area. Sale 186 is scheduled in 2003, Sale 195 in 2005, and Sale 202 in 2007. In keeping with the Secretary's decision, the MMS has modified its prelease planning and decision process and has prepared a single EIS for all three Beaufort Sea sales (proposed actions). Official coordination with other government agencies, industry, and the public regarding these proposed actions began on September 19, 2001, with a Call for Information and Nominations (Call) and Notice of Intent (NOI) to Prepare an Environmental Impact Statement. This Call/NOI requested expressions of industry interest in blocks within the Call area and requested comments on environmental issues related to possible oil and gas leasing in the area. As a result of the Call/NOI, nine written comments and/or nominations were received. Three companies commented and nominated blocks, and six written responses were received from the following: the State of Alaska, Office of the Governor, Division of Governmental Coordination; the North Slope Borough, Office of the Mayor; North Slope Borough Planning Department Director; the Alaska Eskimo Whaling Commission, Director; City of Wainwright, Mayor; combined letter from the Sierra Club, Arctic Connections, The Wilderness Society, and Greenpeace; Phillips Alaska Exploration; Shell Oil; and British Petroleum (Alaska) Inc.

Following evaluation of the area nominations and environmental information received in the EIS process described, together with other relevant information, the MMS submitted a recommendation for area selection to the Secretary of the Interior. On January 10, 2002, the Department of the Interior announced the area selected for further environmental study (see Section I.A for more details).

VI.B Development of the EIS

During preparation of this Beaufort Sea Planning Area multiple-sale EIS, Federal, State, and local agencies; industry; and the public were consulted to obtain descriptive information, identify significant effects and issues, and identify effective mitigating measures and reasonable alternatives to the proposed action. The comments received during the scoping process for this EIS also noted that issues raised and mitigating measures and alternatives suggested for past Beaufort Sea Planning Area lease sales were relevant to the multiple sales. All of the information received has been considered in preparing the draft EIS. In addition, scoping meetings on the draft EIS, were held in Barrow, Nuiqsut, Kaktovik, and Anchorage, Alaska, with local agencies and the public to more clearly and specifically identify issues and alternatives to be studied in the draft EIS. Scoping information can be found in Section I.C and the Scoping Report in Appendix E. The North Slope Borough local communities, in addition to departmental agencies with interest and expertise in the OCS, were consulted during the development of the potential mitigating measures for these proposed actions.

In addition, Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), states that the U.S. Government will continue "to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, trust resources, and Indian tribal treaty and other rights." To meet that direction, MMS has met with the local tribal governments of Barrow, Nuiqsut, and Kaktovik; in addition to the Inupiat Community of the Arctic Slope (the recognized regional tribal government), and an important nongovernmental Native organization, the Alaska Eskimo Whaling Commission. These tribal governments and the Alaska Eskimo Whaling Commission were contacted by letter and given the opportunity to participate in scoping meetings and the development of this EIS.

VI.C Contacts for Review of the EIS

The following are the major Federal, State, and local government agencies; academic institutions; members of the oil and gas industry; special interest groups; other organizations; and private citizens who were contacted during the preparation of this EIS, or past Beaufort Sea EIS's, and were sent copies of the draft EIS for review.

Federal – Executive Branch – Departments

Department of Commerce

- National Marine Fisheries Service
  - Bowhead Whale Project
  - Regional Administrator, Juneau
  - Alaska Regional Office, Anchorage
- National Oceanic and Atmospheric Administration
  - Policy and Strategic Planning

Department of Defense

- U.S. Army Corps of Engineers
  - Regulatory Branch, Alaska District
- Deputy Under Secretary of Defense for Installations and Environment

Department of Energy

- Technical Information Center

Department of Transportation

- Office of Pipeline Safety
- U.S. Coast Guard

Department of the Interior

- Bureau of Indian Affairs
  - Environmental Services
  - West Central Alaska Field Office
- Bureau of Land Management
  - State Director
  - Northern Field Office, Fairbanks
- U.S. Fish and Wildlife Service
  - Federal Activities Branch
  - Regional Office
  - Anchorage Ecological Services
  - Fairbanks Ecological Services
  - Migratory Bird Management
  - Subsistence and Fisheries
- U.S. Geological Survey
  - Alaska Science Center
  - Environmental Affairs Program
- National Park Service
  - Regional Director
  - Division of Environmental Quality
  - Subsistence Division
- Office of Environmental Policy and Compliance
- Special Assistant to the Secretary for Alaska

Federal – Legislative Branch

U.S. Senate

- Alaska delegates

U.S. House of Representatives

- Alaska delegates

Federal – Administrative Agencies and Other Agencies

Arctic Research Commission

Marine Mammal Commission

Environmental Protection Agency

- Office of Federal Activities
- Region 10, NPDES Permit Unit
- Alaska Operations Office, Anchorage

State of Alaska

Alaska Oil and Gas Conservation Commission

Department of Community and Regional Affairs

Department of Environmental Conservation
- Anchorage District Office
- Northern Alaska District Office

Department of Fish and Game
- Region II, H&R
- Subsistence Division
- Habitat Division

Department of Natural Resources
- Citizen's Advisory Commission on Federal Areas
- Division of Geological and Geophysical Surveys
- Division of Oil and Gas
- Division of Water, Fairbanks

Dept. of Transportation and Public Facilities
- State Pipeline Coordinator, Joint Pipeline Office

Office of the Governor
- Governor
- Division of Governmental Coordination
- Office of Budget and Management

Local Governments - Native Organizations

Alaska Eskimo Walrus Commission, Barrow
Alaska Eskimo Walrus Commission, Nome
Alaska Eskimo Whaling Commission
Alaska Federation of Natives
Alaska Inter-Tribal Council
Alaska Native Science Commission
Arctic Development Council, Barrow
Arctic Slope Native Association
Arctic Slope Regional Corporation
Atqasuk Inupiat Corporation, Atqasuk
Barrow Whaling Captains Association
Bering Straits CRSA, Unalakleet
City of Anaktuvuk Pass, Mayor
City of Barrow, Mayor
City of Kaktovik, Mayor
City of Kotzebue, Planning Dept.
City of Nome, City Manager
City of Nuiqsut, Mayor
City of Point Hope, Mayor
City of Wainwright, Mayor
Cully Corporation, Point Lay
Inupiat Community of the Arctic Slope (ICAS)
Kaktovik Inupiat Corporation
Kaktovik Whaling Captains Association
Nagsragmuit Tribal Council, Anaktuvuk Pass
Kuukpik Village Corporation, Nuiqsut
NANA Regional Corporation Inc., Kotzebue
Native Village of Barrow
- Wildlife Director
- Tribal Council President

Native Village of Kaktovik
Native Village of Nuiqsut
Native Village of Point Hope
Native Village of Point Lay
Native Village of Wainwright
North Slope Borough
- Department of Wildlife Management
- Mayor's Office
- Planning Department
- Public Information Office
- Village Coordinator, Anaktuvuk Pass
- Village Coordinator, Atqasuk
- Village Coordinator, Kaktovik
- Village Coordinator, Nuiqsut
- Village Coordinator, Point Hope
- Village Coordinator, Wainwright

Nunamiut Corporation, Anaktuvuk Pass
Olgoonik Corporation, Wainwright
Tigara Corporation, Point Hope
Ukpeagvik Inupiat Corporation

Libraries

Alaska Pacific University
  Academic Support Center Library
Alaska Resources Library and Information Service (ARLIS)
Alaska State Library
  Government Publications, Juneau
American Petroleum Institute Library, D.C.
Canadian Circumpolar Library, Edmonton AB
Canadian Joint Secretariat Librarian, Inuvikon NT
Department of Indian and Northern Affairs, Canada Yellowknife, NT
Environmental Protection Agency, Region 10
  Librarian, Seattle
Fairbanks North Star Borough
  Noel Wien Library
George Francis Memorial Library
Ilisaavik Library, Shishmaref
Juneau Public Library
Kaveolook School Library, Kaktovik
Kegoyah Kozpa Public Library, Nome
National Oceanic and Atmospheric Administration
Information Services Division, Seattle, WA
North Slope Borough School District
  Library/Media Center, Barrow
Northern Alaska Environmental Center Library
Tikigaq Library, Point Hope
Trapper School Community Library, Nuiqsut
Tuzzy Consortium Library, Barrow
University of Alaska, Anchorage
  Elmer E. Rasmuson Library
  Government Documents
University of Alaska, Fairbanks
  Geophysical Institute
  Government Documents
  Institute of Arctic Biology
University of Alaska, Southeast (Juneau)
U.S. Army Corps of Engineers Library, Anchorage
U.S. Fish and Wildlife Service Library, Anchorage
Valdez Consortium Library
Z.J. Loussac Library, Anchorage

Canada

Department of Fisheries and Oceans
  Institute of Ocean Sciences, Sidney, BC
Canadian Wildlife Service
  National Wildlife Research Division, Hull, PQ
Department of Indian and Northern Affairs
  Natural Resources and Economic Development, Ottawa

Special Interest Groups

Alaska Conservation Foundation
Alaska Native Knowledge Network, Fairbanks
Alaska Natural Heritage Program
Alaska Public Interest Research Group
Arctic Connections
Arctic Marine Resource Commission
Arctic Sounder, Kotzebue
Barrow Cable TV
Bering Air, Inc., Nome
Center for Biological Diversity
Defenders of Wildlife
EarthJustice, Juneau
Exxon Valdez Oil Spill Trustee Council
Greenpeace
Ilisagvik College, Barrow
Indigenous Peoples Council for Marine Mammals
KBRW News, Barrow
Living Resources, Inc. Fairbanks
Marine Advisory Program
National Audubon Society
National Parks and Conservation Association
National Resources Defense Council
National Wildlife Federation
Northwest and Alaska Fisheries Center
Ocean Conservancy
Rural CAP
Subsistence/Natural Resources Dept.
Sierra Club
Trustees for Alaska
University of Alaska, AEIDC, ENRI
Wilderness Society
Wildlife Federation of Alaska

Petroleum Industry

AEC Oil and Gas (USA) Inc.
Alaska Clean Seas
Alaska Support Industry Alliance
Amerada Hess Corporation
American Petroleum Institute
Amoco Production Co.
Anadarko Petroleum Corporation
Armstrong Oil and Gas Inc.
Atofina Petrochemicals, Inc.
BP Exploration (Alaska) Inc.
  Records Mgmt.
  Lands Mgr.
Chevron U.S.A. Inc.
Conoco, Inc.
Encana Oil and Gas, Inc.
Exxon Mobil Oil Corporation
Exxon Mobile Production Company
Forest Oil Corporation
Marathon Oil Company
Murphy Exploration (Alaska), Inc.
Pennzoil
Petro-Canada (Alaska) Inc.
Phillips Alaska, Inc.
  Environmental Protection Dept.
Phillips Petroleum Company
Shell Frontier Oil & Gas, Inc.
Texaco Inc.
Union Oil Company of California
Western Geophysical Company

Associations, Companies, and Other Groups

Alaska Journal of Commerce
Alaska Marine Conservation Council
Alaska Newspapers, Inc.
Alaska Oil and Gas Association
Alaska Public Radio Network, Anchorage
Anchorage Daily News
Continental Shelf Associates
Fairbanks Daily News-Miner
Guess and Rudd P.C.
I.H.S. Energy
LGL, Environmental Research
Lynx, Inc.
Oil and Gas Journal
Prince William Sound RCAC
Regional Director, MMS, GOM OCS Region
Regional Director, MMS, Pacific OCS Region
Steven R. Braund and Associates
URS Corporation
Waddell Marine Biotech

Individuals

Patsy Aamodt, Barrow
Fred Ahmaogak, Wainwright
George N. Ahmaogak, Barrow
Maggie Ahmaogak, Barrow
Morjorie Ahnupkana, Nuiqsut
Rosemary Ahtuangaruak, Nuiqsut
Freddie Aishanna, Kaktovik
Bendell Akootchook, Kaktovik
Isaac Akootchook, Kaktovik
Joseph K. Akpik, Barrow
Jim T. Allen, Nuiqsut
Lou I. Angisan, Kaktovik
Walt Audi, Kaktovik
Earl H. Beistline, Fairbanks
Barry Bodfish, Wainwright
Arnold Brower, Jr., Barrow
Charlotte Brower, Barrow
Eugene Brower, Barrow
Maggie Hopson, Nuiqsut
Harry Hugo, Anaktuvuk Pass
Herbert Ipalook, Nuiqsut
Edward Itta, Barrow
Kathy Itta, Barrow
Shirley Kagak, Atqasuk
Fred Kanayurak, Barrow
Lydin Kisoadik, Nuiqsut
Jake Koonuk, Point Hope
Maggie Koraldy, Nuiqsut
Sarah Kunaknony, Nuiqsut
Bernie Kyld, Nuiqsut
Doreen Lampe, Barrow
Leonard Lampe, Nuiqsut
Martha Larepe, Nuiqsut
William Leavitt, Barrow
Jessica S. Levre, Alexandria, VA
Marie Lisborne, Point Lay
Enoch Oktollik, Wainwright
James Paktotak, Barrow
Emily Paniger, Nuiqsut
Peter Panik, Wainwright
Delbert Rexford, Barrow
Fenton Rexford, Kaktovik
Ladorne Rexford, Nuiqsut
Rosabelle Rexford, Barrow
Jack Schaefer, Point Hope
Willie Sielak, Jr., Nuiqsut
Aunuptana Simiktug, Nuiqsut
Abe Simmonds, Nuiqsut
Nolan Soloman, Kaktovik
Lon Sonsalla, Kaktovik
Jim Stimpfle, Nome
Debbie Suvlu, Barrow
Edward Syrjala, Centerville, MA
George Tagarook, Kaktovik

Individuals

Gordon Brower, Barrow
Ronald Brower, Sr., Barrow
Albert Driggs, Wainwright
Della Driggs, Barrow
Robert Edwardson, Barrow
Flores Elfoeelouk, Nuiqsut
Emma Eudiliak, Nuiqsut
John C. George, Barrow
Paul Gronholdt, Sand Point
Walter R. Grove, Nashville, TN
Jana Harcharek, Barrow
Edward Hopson, Barrow
John Hopson, Jr., Wainwright
Martha Hopson, Barrow
Tom Lohman, Anchorage
Dr. Don Ljungblad, Elk Mountain, WY
Frank Long, Nuiqsut
Gordan Matumack, Nuiqsut
Warren Matumeak, Barrow
Thomas Napageak, Nuiqsut
Billy Nashoalook, Sr., Wainwright
Polly Neejeranner, Nuiqsut
Silas Negovanna, Barrow
Ruth Nukapigak, Nuiqsut
Isaac Nukapigak, Nuiqsut
Eli Nukapigak, Nuiqsut
Joe Nulupih, Nuiqsut
Don Nulusee, Nuiqsut
Harry Tazruk, Wainwright
Kenneth Togarook, Wainwright
Alice Tpalook, Nuiqsut
Merylin Traynor, Kaktovik
Patsy Tukle, Nuiqsut
Frederick S. Tuklesik, Barrow
Rex Tuzroyluke, Point Hope
Joseph Upickson, Barrow
David Whitney, Washington, D.C.
Vera Williams, Barrow
Wasku Williams, Barrow
Emilly Wilson, Nuiqsut
Joeb Woodson, Nuiqsut
Sheri Yatlin, Fairbanks

VI.D Contributing Authors and Supporting Staff Members

Elinore M. Anker, Technical Publications Writer-Editor
Christy Bohl, Oil Spill Contingency Plan Coordinator
Michael Burwell, Socioeconomic Specialist
Doug Choromanski, Geologist
Jim Craig, Geologist
Raymond R. Emerson, Environmental Special Assistant
Donald J. Hansen, Wildlife Biologist
Matt Heller, GIS Programmer/Analyst
Ken Holland, Fisheries Biologist
Tim Holder, Socioeconomic Specialist
Joel Hubbard, Wildlife Biologist
Fred King, Chief Environmental Assessment Section, Project Manager
Steven Levi, Publication Specialist
Paul L. Lowry, Physical Scientist and Multiple-Sale Project Coordinator
Ida Menge, Cartographer
Tom Murrell, Petroleum Engineer
Thomas Newbury, Biological Oceanographer
Richard Newman, Physical Oceanographer
Kristopher Nuttall, EAS Secretary
Mazelle O. Parker, EIS Specialist
Beverly Sires, Minerals Leasing Specialist
Caryn Smith, Oceanographer
Janet Stan, Minerals Leasing Specialist
Paul Stang, Regional Supervisor, Leasing and Environment
Dennis Thurston, Geophysicist
John Tremont, Geographer
George Valiulis, Headquarters EIS Project Officer
Kate Wedemeyer, Fisheries Biologist
Frank Wendling, Wildlife Biologist

Alaska Outer Continental Shelf

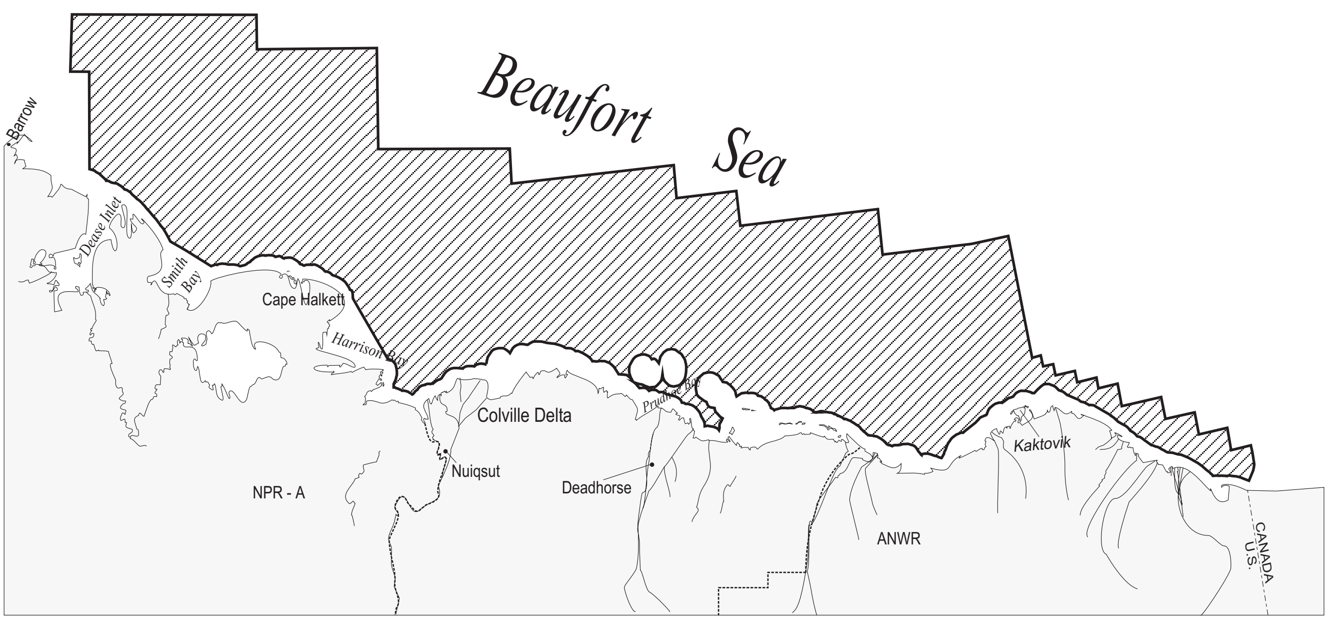
OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area

Oil and Gas Lease Sales
186, 195, and 202

Final Environmental
Impact Statement

Volume II
(Section VII, Bibliography, Index)



U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

BEAUFORT SEA PLANNING AREA OIL AND GAS LEASE SALES 186, 195, AND 202
Final Environmental Impact Statement
OCS EIS/EA, MMS 2003-001, in 4 volumes:
Volume I, Executive Summary, Sections I through VI
Volume II, Section VII, Bibliography, Index
Volume III, Tables, Figures, and Maps for Volumes I and II
Volume IV, Appendices

The summary is also available as a separate document:
Executive Summary, **MMS 2003-002.**

The complete EIS is available on CD-ROM (**MMS 2003-001 CD**) and on the Internet (**http://www.mms.gov/alaska/cproject/Beafort Sea/**).

This Environmental Impact Statement (EIS) is not intended, nor should it be used, as a local planning document by potentially affected communities. The exploration, development and production, and transportation scenarios described in this EIS represent best-estimate assumptions that serve as a basis for identifying characteristic activities and any resulting environmental effects. Several years will elapse before enough is known about potential local details of development to permit estimates suitable for local planning. These assumptions do not represent a Minerals Management Service recommendation, preference, or endorsement of any facility, site, or development plan. Local control of events may be exercised through planning, zoning, land ownership, and applicable State and local laws and regulations.

With reference to the extent of the Federal Government's jurisdiction of the offshore regions, the United States has not yet resolved some of its offshore boundaries with neighboring jurisdictions. For the purposes of the EIS, certain assumptions were made about the extent of areas believed subject to United States' jurisdiction. The offshore-boundary lines shown in the figures and graphics of this EIS are for purposes of illustration only; they do not necessarily reflect the position or views of the United States with respect to the location of international boundaries, convention lines, or the offshore boundaries between the United States and coastal states concerned. The United States expressly reserves its rights, and those of its nationals, in all areas in which the offshore-boundary dispute has not been resolved; and these illustrative lines are used without prejudice to such rights.

Alaska Outer Continental Shelf

OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area
Oil and Gas Lease Sales
186, 195, and 202

Final Environmental
Impact Statement

Volume II
(Section VII, Bibliography, Index)

Author
Minerals Management Service
Alaska OCS Region

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

February 2003

SECTION VII

REVIEW AND ANALYSIS OF COMMENTS RECEIVED

Contents for Section VII

VII. Review and Analysis of Comments Received

VII.A. Summary of Comments Received on the Draft Beaufort Sea Multiple-Sale EIS

We received 4,911 written comments on the draft EIS during the public comment period from June 19, 2002, to September 20, 2002. A notice requesting comments appeared in the *Federal Register* (see Appendix H for a copy of that notice) on Wednesday, June 19, 2002. We received letters or e-mails from every State; some e-mails came from outside of the United States and from a wide spectrum of the population. Approximately 4,871 comments arrived via e-mail, and 40 individual letters were written. We held four public hearings in July/August 2002 in Nuiqsut, Kaktovik, Anchorage, and Barrow, at which 28 persons testified. We also held four government-to-government meetings with Native communities.

Most respondents voiced a preference for Alternative II – No Lease Sale. These commenters also suggested that the national energy policy should shift away from fossil fuels and instead emphasize conservation and alternative energy sources. Many respondents felt that further leasing in the Beaufort Sea would endanger the unique Arctic ecosystem, the Native subsistence culture and lifestyle, and would lead to the opening of the Arctic National Wildlife Refuge. Many commenters expressed the fear of an oil spill, and their perception that the oil industry could not clean up oil, especially in broken-ice conditions. They also wanted a separate EIS for each lease sale and not use one EIS as an umbrella NEPA document for three lease sales.

Many of the 4,911 written comments were identical statements prompted by e-mail campaigns on environmental organization web sites. The Ocean Conservancy wrote a lengthy letter representing twelve environmental organizations. We assigned tracking numbers to the comment letters in roughly the order in which they were received. All comment letters and hearing transcripts were reviewed by a team of MMS specialists, who identified comments that required a response. Comments require a response if they "are substantive and relate to inadequacies or inaccuracies in the analysis or methodologies used; identify new impacts or recommend reasonable alternatives or mitigation measures; or involve substantive disagreements on interpretations of significance." We have responded in Section VII.C and have revised the final EIS to address many of the concerns and incorporate additional information provided in the public's comments.

We received numerous comments that did not suggest changes to the EIS but offered an opinion, a point of view, and/or a recommendation that decisionmaker(s) adopt specific alternative(s), specific mitigating measures, or take specific actions. These comments are included as part of the public record and they available to the decisionmakers during the deliberation process for the three proposed sales evaluated in this EIS.

VII.B. Introduction and Process

VII.B.1. Distribution of the EIS

After the draft EIS was completed and published, the MMS made copies available for the public, organizations, and governmental agencies to review. A Notice was published in the *Federal Register* (see Appendix H) notifying the public of the availability of the draft EIS and giving them a contact to notify if they wanted a review copy. Copies were distributed to public libraries around the State; these locations were indicated in the *Federal Register* notice. Lists of parties interested in the Beaufort Sea lease areas are maintained by the MMS, and copies of the draft EIS were mailed to this listing. The MMS made available a CD-ROM of the draft EIS and, in some cases, mailed this out instead of a paper copy, saving postage costs. This initial distribution was approximately 350 copies. A copy of the draft EIS was placed on the MMS's web page.

The MMS also had the Executive Summary translated into Inupiaq, and reproduced 350 copies for distribution across the North Slope. Before the Public Hearings were held, copies were mailed to the Alaska Eskimo Whaling Commission; the Inupiat Community of the Arctic Slope (ICAS); and the Native Villages of Barrow, Kaktovik, and Nuiqsut. Copies were available and distributed at the Public Hearings and the government-to-government meetings; on request, copies were mailed to all ICAS Board Members. Copies were provided to the University of Alaska Fairbanks, Elmer E. Rasmuson Library; Ilisagvik College; Alaska State Library Juneau; and to the Alaska Resources Library and Information Service (ARLIS). A copy of the Inupiaq language Executive Summary also was posted on MMS's web page.

The final EIS has been distributed to the same interested partied that received copies of the draft EIS and to those who requested copies of the final EIS. The MMS will make available a CD-ROM copy of the final EIS which, in some cases, will be mailed out with a paper copy of the executive summary. A copy of the final EIS will be placed on the MMS web page.

VII.B.2. Response Approach to Comments

During the comment period, various governmental agencies, organizations, and individuals provided letters, e-mail messages, or oral testimonies. Tracking numbers were assigned to all comments received. Specific comments are identified in numerical order, and responses to comments are placed at the end of each letter, e-mail message, or oral-testimony transcript. We have not reproduced all the e-mail messages received; however, a representative summary of substantive comments are included.

All of the comment letters, e-mail messages, government-to-government notes, and hearing transcripts were reviewed by a team of MMS specialists and considered in preparing responses. Comments required a response if they were substantive and suggested modifications to alternatives, including the proposed action; recommended new alternatives or mitigating measures; disagreed with analysis or methodologies; or related to the accuracy and/or completeness of the data or information. As noted previously, we received numerous comments that did not suggest changes to the EIS but offered an opinion, a point of view, and/or a recommendation that decisionmaker(s) adopt specific alternative(s), specific mitigating measures, or take specific actions. These comments are included as part of the public record, and they available to the decisionmakers during the deliberation process for the three proposed sales evaluated in this EIS.

VII.B.3. Public Hearings Held

Public Hearings for this EIS were announced in the *Federal Register* notice. Newspaper advertisements about the Public Hearings were placed in the *Arctic Sounder* on July 11 and 18. Public service announcements were faxed to

KBRW and Barrow Cable. A notice was placed on the Barrow Cable bulletin board. Posters were sent to the villages about the various Public Hearings. When the Barrow Public Hearing had to be rescheduled because of weather problems, an advertisement announcing this was placed in the *Arctic Sounder* and public service announcements regarding the change were on KBRW and the Barrow Cable's Community Bulletin Board. Current data about Public Hearings also was posted on MMS's web page. Transcripts of the Public Hearings follow the letters in Section VII.E.

Public Hearings on the draft EIS were held as follows:

Nuiqsut, Alaska	Kisik Community Center, 7-9 p.m.	Wednesday, July 24, 2002
Kaktovik, Alaska	Qargi Community Center, 7-9 p.m.	Friday, July 26, 2002
Anchorage, Alaska	MMS 3rd floor Conf. Rm., 5-7 p.m.	Tuesday July 30, 2002
Barrow, Alaska	Inupiat Heritage Center, 7-9 p.m.	Thursday, August 1, 2002

VII.B.4. Government-to-Government Meetings

In accordance with Executive Order 13175, Government-to-Government Relationships with Native American Tribal Governments, the MMS held government-to-government meetings with the Native villages of Barrow, Nuiqsut, and Kaktovik, and the Inupiat Community of the Arctic Slope. These exchanges covered items of mutual concern, although they were concerned primarily with taking comments on the draft EIS.

Meetings were held as follows:

Native Village of Nuiqsut	Wednesday, July 24, 2002
Native Village of Kaktovik	Friday, July 26, 2002
Native Village of Barrow	Thursday, August 1, 2002
Inupiat Community of the Arctic Slope	Thursday, August 1, 2002

Government-to-government meeting attendees and meeting summaries prepared by MMS attendees are found in Sections I.D.1 through I.D.3.

VII.B.5. E-mail Comments Received in Response to DEIS

The MMS received approximately 4,871 e-mail messages. Several e-mails were in favor of proceeding with the proposed lease sales, but 99.9% were supportive of Alternative II No Lease Sale. Most of the e-mail messages were identical to or based on one of two different form messages posted on an environmental group's internet web site. All of the e-mail messages sent in response to the environmental group's internet web site were reviewed. E-mail messages were selected to be representative of each of the two message groups and, if appropriate, we prepared responses to the individual comments of these messages. About two-thirds of the e-mail messages were identical or similar to e-mail message (a) and about one-third of the e-mail messages were identical or similar to e-mail message (b). Approximately 50 respondents sent in both format letters. Some of the e-mail messages contained additional information that differed from the standard text in messages (a) and (b). Those with additional information were reviewed further to determine if any of the additional comments required written responses, beyond what we had responded to in other comments received. None were identified.

E-mail messages were logged in and assigned an identifying number. These e-mail messages are listed in Appendix H. Representative e-mails are found in Section VII.F.

Table VII.B.1 summarizes e-mails received and lists them according to where the respondent resides. Surprisingly, out of the approximately 4,871 e-mails received, only 81 (about 2%) originated in Alaska, where the proposed action is located. Of that number, only 4 originated from the North Slope.

VII.C. Comments and Responses

Tracking numbers were assigned to the 40 comment letters in the order in which they were received. A summary listing of letters by date received can be found in Appendix H. These letters are reproduced in Section VII.D, and the responses follow the letter.

Following is a list of letters to the MMS that included comments for which we prepared responses based on certain criteria noted previously. Many of the comments were similar. We responded to similar comments in full and then referred the commenter to the earlier response to avoid much repetition in our responses. In some cases, we provided additional information. Following this, we provide the public hearing transcripts and response comments. Following the Pubic Hearings, we list e-mail messages. All of the e-mail messages are not listed, however, but the list covers all of the comments we received by e-mail. If warranted, responses are provided. Meeting notes taken by MMS staff from the various government-to-government meetings we attended are found in Section I. D.

VII.C.1. Letters

The comment letters have been assigned a number and are presented in numerical order (see the table that follows), which respond to bracketed portions of the cited letters. The MMS responses follow each letter. Comment letters were received from:

Letter	Ltr. No.	Letter	Ltr. No.
Federal Agencies			
Department of Commerce National Oceanic and Atmospheric Administration, National Marine Fisheries Service	L-0023	Department of the Interior Fish and Wildlife Service	L-0037
Environmental Protection Agency, Region 10	L-0038		
State of Alaska			
Office of the Governor, Division of Governmental Coordination	L-0024	Alaska State Legislative, Representative Reggie Joule	L-0009
North Slope Borough			
Office of the Mayor	L-0001 L-0035		
Alaska Native Organizations and Tribes			
Alaska Eskimo Whaling Commission (AEWC)	L-0002 L-0034	Inupiat Community of the Arctic Slope (ICAS)	L-0006
Conservation Groups and Environmental Organizations			
Northern Alaska Environmental Center	L-0003	The Ocean Conservancy (representing 12 environmental organizations)	L-0004 L-0021 L-0029
Greenpeace	L-0022	Environmental Defense	L-0026
Sierra Club	L-0032		
Industry			
Alaska Oil and Gas Association	L-0020 L-0033		

Letter	Ltr. No.	Letter	Ltr. No.
Individual Commenters			
Carol Ampel	L-0039	Elizabeth MacGowan	L-0028
K.A. Beckwith	L-0015	Pam A. Miller	L-0025
Terry Cummings	L-0013	George L. Pettit	L-0031
Robert Franz	L-0040	William L. Risser	L-0008
Kimberly Donovan / Bruce Hazen	L-0011	Kathleen Roberts	L-0010
Amy and Chris Gulick	L-0019	Manika Schultz, et. al.	L-0017
Jim Havlena	L-0016	Nancy and Sebastian Sommer	L-0027
K.A. Havlena	L-0014	John Strasenburgh	L-0012
Alexandra Howells	L-0030	John Van Syoc, Sr	L-0036
Jenny Jacobs	L-0018	Pam and Wallace Taylor	L-0007
Ben Kostival	L-0005		

Note: Ltr. No. = Letter Number

VII.C.2. Public Hearings

The transcripts of the four Public Hearings as announced in the *Federal Register* notice are included and follow the letters. Each public hearing document has been assigned an abbreviation (for example PH-Kaktovik) with comments bracketed and assigned a number (for example .018) for response. Public Hearing attendees are listed in Appendix H. The MMS responses to each comment follow each public hearing transcript in Section VII.E.

VII.C.3. Government-to-Government Meetings

Government-to-government meetings were held at three locations on the North Slope. Meeting attendees and meeting summaries can be found listed in Section I.D.

VII.C.4. E-mails

More than 99% of the e-mails received were a result of responding to a form letter copied from an environmental group web page. Comments basically were the same and only expressed opposition to the lease sale; however, senders occasionally put in an opinion of their own either as an introduction or in closing, none of which challenged the text of the draft EIS. E-mails are numbered (for example E-1004) from when they first appeared on the MMS website. Representative examples of such e-mails are included in Section VII.F so that readers and decisionmakers can get the essence of those e-mails. For a listing of logged e-mail messages see Appendix H.

VII.D. Comment Letters and MMS Responses to Comments

In this section we have reproduced each of the comment letters we received. As explained earlier, we have numbered each comment that we identified for a response. The responses for each comment letter are provided immediately following the letter.

L-0001

RECEIVED
JUL 24 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Testimony
George N. Ahmaogak, Sr.
Mayor, North Slope Borough

Public Hearing on the
Draft Environmental Impact Statement
Beaufort Sea OCS Planning Area
Oil and Gas Lease Sales 186, 195, and 202
U.S. DOI, Minerals Management Service
July 22, 2002
Barrow, Alaska

I'd like to welcome the federal Minerals Management Service officials who have traveled to Barrow this evening. They have come to hear testimony from our North Slope residents on their agency's Draft Environmental Impact Statement for three proposed Beaufort Sea Outer Continental Shelf oil and gas lease sales. They will be traveling to Nuiqsut for a hearing on Wednesday evening, and to Kaktovik for a hearing on Friday evening. MMS wants to hold one lease sale in 2003, one in 2005, and one in 2007. Each of the sales would offer all unleased blocks in the same planning area. Seven federal lease sales have been held in the Beaufort Sea since 1979. This is the first time MMS has published a single EIS covering more than one Beaufort Sea sale. We appreciate the chance to once again tell you what's on our minds, though if you've been paying attention for the last 25 years, you should have a pretty good idea of what you're going to hear tonight. You have heard from us many times before, and from our people in the affected villages. My comments tonight will be somewhat general, and preliminary to more detailed written comments we will submit by the close of the comment period on September 20th. Our review of the Draft EIS is continuing, and we will consult with our villages, the AEWC, tribes, and others before finalizing our comments.

I'll be honest and say that I'm not optimistic about our chances of convincing you to do the right thing from or perspective concerning oil and gas leasing in our Beaufort Sea. I've been Mayor too long, and testified at too many of these hearings over the years to expect that. You should not be leasing here, or in the neighboring Chukchi Sea. While in many ways this Draft EIS seems better organized and more clearly written than similar documents we have reviewed in the past, it also seems in other alarming ways a step backward. MMS appears ready to roll back some of the hard-fought incremental positive steps we've taken during the planning of the seven previous sales. I'll touch on those points later. My comments tonight will be in two general areas: First, I'll again highlight some general process and policy concerns we have commented on before. Second, I will address the failure of the Draft EIS to adequately respond to several points we raised during the scoping phase of this review. I'll hold off pointing out most specific concerns with the language and conclusions of the document until we finish our analysis and provide you with written comments.

PROCESS AND POLICY CONCERNS

Leasing of Arctic Waters

Our concerns have been the same ever since the federal and state governments first considered offshore oil and gas leasing in the Beaufort and Chukchi Seas. We don't like it. We think it's a bad idea for all kinds of reasons. Offshore leasing leads to offshore exploration. Offshore exploration with minimal environmental impacts is perhaps possible in many cases with seasonal and other restrictions, but it leads to offshore development and production. Even if there are no oil spills, production causes year-round impacts. Industrial noise in the marine environment has altered the distribution of bowhead whales and other subsistence resources in the past. The subsistence harvest of bowheads has defined our Inupiat culture forever. Our communities have known hardship in the recent past when industrial operations have put the whales out of the safe reach of our hunters. Protection of the opportunity for the Inupiat people to safely engage in the subsistence hunt of bowhead whales and other marine species should have the highest priority when governments are deciding on the best use of the Beaufort and Chukchi Seas. .001

We are frustrated that most OCS planning areas offshore of the lower-48 states remain withdrawn from consideration for leasing by Executive Order or under a congressional moratorium. We do not think that these areas should be leased, but question why they are off-limits while the Beaufort Sea is not. MMS has explained that several factors contribute to decisions about offering areas for leasing. The Final EIS for the 2002-2007 OCS Oil and Gas Leasing Program was published in April. It says that these factors include not only environmental concerns, but also oil and gas potential, industry interest, and the views of the Governors of coastal states. (Page 5-12) Other factors that we consider critical were not mentioned. Shouldn't it matter that the prevailing conditions of an area limit the ability to mitigate the potential risks of oil and gas operations? And shouldn't a primary factor be the views of the local residents who live adjacent to the planning area and who will feel 100% of the impacts of leasing? MMS continues to aggressively lease in remote, highly sensitive, challenging, and vulnerable arctic waters over the loud and continuous objections of the local Native Inupiat population. We are the population which bears all of the risks, and receives very little of the benefit. At the same time all other OCS planning areas except certain areas within the Gulf of Mexico are withdrawn or deferred from leasing. This raises significant questions of fundamental fairness and environmental justice. .002

These questions have not been adequately addressed in the Draft EIS or the 5-Year Program Final EIS. All OCS planning areas should be considered in an analysis of the equitable sharing of the benefits and environmental risks of leasing, development, and production. It is unfair that states adjacent to waters under a moratorium from leasing still receive federal 8(g) payments from OCS revenues, while the Borough and other local governments receive no direct payments but suffer the greatest impact from ongoing leasing and industrial activity. Not weighing the potential environmental and cultural .003

risks against the potential benefits of nationwide leasing choices is clear environmental **in**justice. .003

And the unfairness keeps getting worse. Adding insult to our ongoing injury was the President's announcement at the end of May that the federal government would spend \$235-million to buy back oil and gas rights in the Everglades and in federal waters in the eastern Gulf of Mexico off the Florida coast. Of the total, \$120-million would be paid to a family company for the Everglades rights and \$115-million would go to three oil companies to buy out offshore leases. Though not fully explored, the offshore unit is believed to contain at least 700 billion cubic feet of economically producible natural gas. The President announced the deal with his brother, the Florida Governor, at his side. It's no surprise that the popular moves to prevent oil and gas drilling are sure to help Governor Bush's standing with environmentalists as he seeks reelection this year. They also just happen to boost support for the President in the state, which decided his 2000 election. Speaking at the announcement, Interior Secretary Norton said: "When it comes to energy development on federal lands, each case must be evaluated individually **in cooperation with the people who live in the area**. In this case, the amount of oil was relatively small compared to the nation's overall energy needs, the impact of development could be significant, and the government and people of Florida supported this action." .004

All I can say is, where's the justice in spending federal money to buy back Gulf of Mexico leases containing 700 billion cubic feet of producible gas, and continuing to offer oil leases in the Beaufort Sea? We're the people who live in this area, and for more than 25 years we have told you that you shouldn't be leasing here.

EIS Process For Beaufort Sea Sales

We are frustrated with MMS over the way you deal with public input in your reviews. We are always told that our concerns will be fully addressed during some later review. We review the 5-Year Leasing Program, and are told that addressing our concerns is premature at the program level. We review individual lease sales under the 5-Year Program, and are told things will get worked out during a specific project review because a lease stipulation requires consultation. The Borough commented several times before publication of the Final EIS for the 2002-2007 OCS Oil and Gas Leasing Program in April. At each step in the process it seemed that MMS ignored the comments we submitted at the preceding stage. These Beaufort Sea sales will fall under the 2002-2007 Leasing Program, but their review was started long before the Leasing Program was finalized. In our comments on both the Leasing Program and on this Beaufort Sea leasing proposal, the North Slope Borough has strongly objected to the new multiple-sale review process. We believe that there should be a full public process associated with each of the three proposed sales. The public process and consultation with the Borough, the AEWC, and the affected communities, interested organizations, and general public has improved with each of the past Beaufort Sea sales. Improvement in the process has been slow over the years, but has led to stronger mitigation measures and appropriate area deferrals, and has stimulated necessary scientific study. .005

We continue to believe that any marginal benefits in efficiency and reduction in burnout among MMS authors realized by consolidating three sales in a single EIS is outweighed by the reduction in public engagement and MMS interaction with the directly affected North Slope community. An EIS should be developed and a Coastal Management Program Consistency Analysis should be conducted for each sale. Both processes are valuable. MMS officials should not find it burdensome to visit the three most directly impacted communities of Barrow, Nuiqsut, and Kaktovik for scoping meetings and for public hearings for three lease sales in five years. And it should be the highest MMS officials in Alaska who should make those visits along with their staff to hear the concerns of the community. .006

The Draft EIS does not adequately answer our concerns over this new process. It only says that multiple-sale EIS's have been used for other areas. It mentions the Gulf of Mexico and the NPRA. There are differences between those areas and the Beaufort Sea. The Gulf of Mexico was highly industrialized long before MMS used a multiple-sale EIS process for the region under the last two 5-year oil and gas leasing programs. The 2002-2007 Final EIS notes that "the Western and Central Gulf of Mexico Planning Areas...are two of the most active offshore oil and gas areas in the world." (Page 3-42) Production has occurred there for many years, and the issues raised during the public planning process are fairly well understood. The Beaufort Sea is a frontier area for the oil industry. The first production island was just constructed, and oil only began flowing at the end of October last year. Many issues remain unresolved, and new pipeline, spill response, and other technologies must be developed to cope with arctic conditions. Many information gaps exist, and traditional knowledge and western science do not always agree. The relationship of Inupiat subsistence users to our marine environment and our cultural, nutritional, and spiritual dependence on its resources is very different from the commercial and recreational relationship which the many Gulf of Mexico users share with that environment, no matter how deep their ties. .007

In the same way, onshore activities in the NPRA are following long-established patterns developed and refined over three decades at Prudhoe Bay. Still, because it was essentially a newly leased area that had not been offered for many years, 79 mitigating measures were attached to the Northeast NPRA sale in 1999. You now want to cover three Beaufort Sea sales in a single EIS, with only 5 assumed standard stipulations and 16 purely advisory clauses when there continue to be many unknowns about the Beaufort Sea and broad disagreements over potential impacts to many resources and uses. The reasons and justifications given for using a multiple-sale EIS for the Beaufort Sea just aren't good enough. .008

INADEQUATE RESPONSE TO PREVIOUS COMMENTS

Area Deferrals

The North Slope Borough believes that areas around Barrow, Kaktovik, and Cross Island sufficient to protect vulnerable resources and the subsistence harvests of bowhead whales .009

and other species should be deferred from leasing. The deferral Alternatives developed for the Draft EIS don't get the job done. They are inadequate, and you have to some extent misused data we provided to define them. At a meeting with MMS Alaska Region Director John Goll in my Barrow office in November, I agreed to work with the Borough's Department of Wildlife Management and the AEWC to release to MMS bowhead whale subsistence harvest locations for the three Beaufort Sea whaling communities. It was made very clear to MMS in subsequent written and e-mail correspondence with members of my staff, and acknowledged by Director Goll, that it would be absolutely inappropriate to use the harvest locations alone to define either subsistence whaling zones or appropriate deferral areas intended to protect subsistence whaling opportunities. That, however, is exactly what MMS has done in this Draft EIS. .009

The data were primarily provided as one tool to assist MMS in determining the appropriate extent of an offshore area around the Nuiqsut subsistence whaling base of Cross Island which should be considered for exclusion or heightened protection in future Beaufort Sea OCS oil and gas lease sales. Data were also provided to help in refining previously identified deferral areas offshore of Barrow and Kaktovik. I thought we had made it clear to MMS prior to release of the information that harvest data alone do not provide a true picture of the entire zone utilized by and essential to subsistence hunters in the successful harvest of bowhead whales during the animals' fall westward migration. Harvest locations are simply points on a map. Additional areas critical to the successful subsistence harvest of bowhead whales include staging areas for crews, supplies, and harvested product, areas of pursuit, routes used for the transportation of crews, supplies, and harvested whales and whale product, and areas used for the processing of harvested whales. Harvest data alone also do not define the area east, or "upstream" of the full area utilized by subsistence crews from Barrow, Nuiqsut, and Kaktovik within which industrial disturbance would adversely impact subsistence efforts. This distinction is important. To provide a reasonable chance of a successful bowhead whale subsistence harvest, protection must be provided to a combination of two areas. First, there is clearly the area utilized directly by subsistence whalers for all related purposes. Let's call this the subsistence use area. Next, there's the area east of the subsistence use area we can call the area of influence. That's the area within which migrating whales could be affected significantly enough by industrial activities so that they are deflected beyond the subsistence use area or are made more difficult to harvest within the subsistence use area. These qualifications must accompany any publication and use of the harvest location data, and any conclusions drawn from the data. .010

Let's start with the Barrow area. Everyone should accept by now that the spring lead system concentrates wildlife resources and is too valuable and vulnerable to offer for lease and potential development. The area is also a critical year-round subsistence use area, which extends farther offshore and to the east than the spring lead system alone. It reaches at least to Cape Halkett. Your own Stipulation 5 describes the timing and area utilized by Barrow hunters for subsistence whaling in the fall. It recognizes that occasional use may extend to Cape Halkett. As we have repeatedly stated, this area should never be leased, and the Borough will oppose the siting of any permanent industrial facilities in the vicinity of the spring lead system, and within the Barrow .011

subsistence use area and area of influence east of that. The permitting of any permanent facility or non-winter exploratory operations in this area would be inconsistent with the Borough's Land Management Regulations (LMRs) and North Slope Borough Coastal Management Program (NSBCMP). .011

The eastern Beaufort Sea is a similar case. It is a feeding area for bowhead whales migrating westward in the fall, and a use area for subsistence hunters from the community of Kaktovik. Kaktovik hunters take whales as they move westward through the waters offshore of their community. In the past, fall exploratory drilling operations occurring to the east of that harvest zone have deflected whales beyond the reach of subsistence hunters. The community suffered great hardship, stress, anxiety, and depression when no whales were taken for two consecutive seasons. That experience would be evidence to support our opposition to any drilling operation within Kaktovik's subsistence use area or upstream area of influence proposed during the fall whaling season. Such a proposal would be inconsistent with those provisions of our LMRs and the NSBCMP that explicitly prohibit development, which prevents subsistence user access to a subsistence resource. You have included two Eastern Beaufort Sea deferrals as Alternatives V and VI in the Draft EIS. You did not include as an alternative a deferral of all waters offshore of ANWR. We believe you should have, and that such an alternative would be preferable to Alternative IV, Alternative V, or any combination of the two. Sale 170 did not offer the waters offshore of ANWR. In doing that, MMS noted the lack of information on cumulative impacts on the Refuge, insufficient information on emergency response plans, and the inability to make direct landfall with a subsea production pipeline. Those problems still exist, and the deferral of all waters offshore of ANWR is appropriate. .012

Nuiqsut's subsistence whaling base of Cross Island presents a somewhat different case. A deferral area should be established for the protection of subsistence uses alone. The lease stipulation included in Beaufort Sea Sale 170 prohibits the placement of permanent facilities within a 10-mile zone around Cross Island unless the lessee can demonstrate that such facilities placed within the zone will not have a significant impact on the subsistence harvest of bowhead whales. The 10-mile distance was chosen somewhat arbitrarily after the community of Nuiqsut had requested a zone 50 miles in radius. You've played with that stipulation by breaking it into two parts in the Draft EIS. You've also included a Nuiqsut Subsistence Deferral Area as Alternative IV. We acknowledge that a zone of 50 miles in all directions from Cross Island is perhaps too large. We also believe, however, that there should be acceptance by all parties that 10 miles north and east of Cross Island does not accurately define the full extent of the area within which impacts on fall migrating bowhead whales can disrupt the Nuiqsut subsistence hunt. Again, your Stipulation 5 recognizes that Nuiqsut whalers use an area extending east to Flaxman Island. .013

The Borough was pleased by the adoption of the current lease stipulation. We believe MMS should now be willing to consider the available harvest data as a starting point in defining the actual extent of a zone around Cross Island requiring heightened protection. A new zone which includes the full subsistence use area plus the upstream area of .014

influence should be defined in consultation with the AEWC, Nuiqsut, and the National Marine Fisheries Service, and refined as noise monitoring studies, including those associated with British Petroleum's Northstar Development Project, produce more accurate information on noise impacts to migrating whales. .014

Potential Effects

The analysis of the potential effects of leasing, exploration, and development in the EIS is driven largely by the development scenarios used. What makes no sense is the way MMS deals with the effects of the various deferral Alternatives within those scenarios. MMS reaches a conclusion concerning the Barrow and two Eastern Beaufort deferrals that really defies logic. The Draft EIS first finds that because these are far from existing infrastructure, they are less likely to be leased and developed. We agree. MMS then goes on to say that because these areas are less likely to be leased and developed, the consequences to resources and subsistence harvest patterns with or without the deferrals would be essentially the same. That's where we part company. The implication of that analysis is that if there would likely be no reduction in effects but would be a reduction in resource potential, why defer the areas? That reasoning avoids the most critical question of what effects there could be if the deferrals are not adopted and leasing and development occurs in those areas. At the heart of our desire to see these areas deferred is the belief that if activities occur in these areas, impacts will be greatest compared with other blocks within the Beaufort Sea planning area. A reduced likelihood of activities occurring in the far eastern or western portions of the planning area does not mean that the effects would be insignificant if exploration and development do take place there. .015

A general flaw in the development scenarios applied in the Draft EIS is that they do not consider the specific potential effects if one of the projects predicted is located in a particularly sensitive area. The very reason deferral areas are being discussed is that all areas within the Beaufort Sea planning area are not the same. Some contain resources, which are more concentrated or sensitive. In many cases, these areas are also critical for subsistence. MMS should do impact analyses of alternatives using scenarios, which place one, or more developments squarely within proposed deferral areas. Then you will get at the issues most important to the affected North Slope Inupiat community. .016

Cumulative Impacts

The Draft EIS significantly understates the current and potential levels of cumulative impacts of oil and gas activities on North Slope resources and community residents. These proposed Beaufort Sea sales and the offshore and onshore operations that would follow will not occur in isolation. More onshore exploration took place on the North Slope this past winter than at any time in decades. Development in the near term is likely from Pt. Thomson at the border of ANWR in the east, to the National Petroleum Reserve-Alaska (NPRA) in the west. Companies are looking south to the foothills of the Brooks Range. The Bureau of Land Management has held a second northeast NPRA lease sale, and expects to offer a northwest area twice that size next year. MMS and other state and federal leasing agencies are moving ahead with their plans without a good handle on the .017

cumulative impacts of all of this on the environment, wildlife resources, and residents of the North Slope. Serious cumulative impacts have already occurred, and are certain to increase. MMS should acknowledge and describe that. .017

The issue of cumulative impacts of oil and gas activities on the North Slope is being studied by a Committee of the National Research Council. Its report due out this year. MMS should acknowledge the importance of the Committee's work, and agree to put forth appropriate effort and funds to see that any recommendations offered in its report are acted upon. This EIS should be modified as appropriate to reflect the Committee's findings. .018

The Borough and the people of the North Slope are the only ones now dealing with and paying for these impacts. We believe that through past Beaufort Sea lease sales, and continuing today, MMS has failed to meaningfully follow the intent of the OCS Lands Act with respect to the study of all effects of OCS leasing, exploration, and development on the social, economic, and cultural systems of the North Slope. We provide substance abuse treatment, counseling, public assistance, crisis lines and shelters, and other social service programs. We provide the search and rescue services, which must respond when hunters put themselves at risk in the pursuit of scarce or less accessible game deflected from normal migration paths. We provide the police force, which must respond to all of the kinds of unfortunate situations, which arise when people and entire communities are subjected to long-term and persistent stress. We provide the biologists, planners, and other specialists who review and offer recommendations on the staggering volume of lease sale, exploration plan, and development project documents which are produced and distributed each year. We must absorb the ever-increasing expense of travel to Fairbanks, Anchorage, Juneau, Seattle, and Washington, D.C., where the agencies conduct most of their work and make most of their decisions. Travel to our own remote villages has greatly increased as areas under oil and gas leasing continue to expand. We again ask that the EIS provide a detailed description of ongoing costs borne by the Borough and other local entities as a direct or indirect result of OCS leasing, exploration, and development. That analysis should include the budgetary effects on the Borough, community, and tribal governments of attempting to fully participate in OCS review and planning processes. That information should be a necessary component of your impact assessment, and would serve as a means of identifying an appropriate level of impact assistance, which should accompany any continued OCS leasing. .019

CONCLUSION

In conclusion, I'll add that even at this early point in our review of the DEIS, we have noticed many of the same problems we have seen in previous MMS documents. Analysis seems biased in favor of leasing. Impacts, and especially cumulative impacts, are understated. The potential impacts of vessel and aircraft traffic are all but dismissed. Figures given for "trips" should really be doubled to reflect that they are actually round trips and involve two passes between shore and drilling structures. The issue of increased skittishness of bowhead whales following exposure to industrial noise is not adequately addressed. The difficulties and delays due to weather, distance, and other factors in .020

responding to oil spills in the more remote reaches of the planning area are not adequately discussed. The significance, value, and vulnerability of the traditional subsistence culture is not given appropriate weight in balancing its protection against the risks of leasing. After all these years of listening to us, MMS just doesn't seem to fully understand how hard it is to be successful at subsistence in this environment; how many things you have to do right, how many things out of your control have to go right, and how little it takes to cost you your harvest or your safety. Once again, it seems that traditional knowledge is included in the document, but does not contribute to your analysis or conclusions. .020

I thank you for coming tonight, and encourage you to listen closely to what you hear in Barrow and when you travel to the villages. We will provide more detailed written comments at a later date. You are going to have your lease sale I think. But I also think you should defer the areas most important to the people who will be most impacted, honestly talk about the impacts which have occurred and will occur, and use strong mitigating measures to protect resources in the areas you do lease.

MMS Response to Comment Letter L-0001

L-0001.001

The MMS has listened to and reacted to the North Slope Borough's scoping concerns in drafting the Beaufort Sea Multiple Sale draft EIS. The MMS has incorporated mitigating measures as part of every alternative, except the No Lease Sale Alternative. These standard mitigating measures have been developed during previous OCS lease sales, and they are effective in reducing effects to subsistence whaling. The MMS will continue to work with the Inupiat people in a cooperative approach to address concerns related to offshore oil and gas activities that potentially could affect the bowhead whale subsistence harvest. Two of the stipulations included as part of the current and past proposals address these concerns (1) The stipulation on Industry Site-Specific Bowhead Whale-Monitoring Program provides site-specific information about the migration of bowhead whales. (2) The stipulation on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities helps reduce potential conflicts between subsistence hunters and whalers from oil and gas activities. It helps reduce noise and disturbance conflicts during specific periods of time important to the subsistence whale hunt, such as the annual spring and fall whale hunts. The consultations required by this stipulation ensure that lessees, including contractors, consult and coordinate events including both the siting and the timing with subsistence activities. This stipulation applies to exploration and development and production activities.

L-0001.002

The U.S. energy plan is a national program that takes into consideration competing energy sources, domestic and foreign and renewable and nonrenewable, together with economic and political interests. The Department has participated in discussions about areas considered for moratoria or exclusion by Executive Order, but the decisions are made by the Congress or the President. The Department continues to support leasing in areas where environmental and other citizen concerns can be addressed through mitigation.

L-0001.003

The Congress and former Presidents chose to remove some of the areas of the OCS from leasing consideration through imposition of moratoria. If an area is within moratoria and does not have existing leases, no 8(g) funds would exist for the adjoining State.

See also Responses L-0001.001 and L-0001.002.

L-0001.004

See Responses L-0001.001, L-0001.002, and L-0001.003.

L-0001.005

The MMS has attempted to assure appropriate public processes at each level of the OCS program: 5-year program, leasing and exploration, and development. Public input to lease sales offered under a 5-year leasing program are addressed and documented in draft and final EIS's, either at the overall 5-year program stage, the individual lease-sale phase, the exploration drilling stage, and /or at the development and production phase. All stages are subject to NEPA documentation and review, including public involvement. Although the final results may not be to the liking of individual commenters, all viewpoints are considered within the decision process. The evaluation of similar projects in a single NEPA document is not only allowable under current regulations, but it is encouraged by NEPA. Our experience from preparing seven lease-sale EIS's in the Beaufort Sea demonstrates that the issues and concerns identified and analyzed in these EIS's remain similar. The approach has been used in other OCS areas and has proven to be successful. Full public involvement will be invited and encouraged for each of the sales. This involvement includes continuing to request information and concerns from the public and interested groups concurrent with the Call for Information and Nominations. The MMS also has committed to distributing an Environmental Assessment and, if needed, a Supplemental EIS for public review. Separate consistency determinations will be made for Sales 195 and 202. In regard to responses to comments on the 2002-2007 OCS Oil and Gas Leasing Program, please see section 5.4.3 of the final EIS for the 2002-2007 program.

This process, which has been used over the years to develop mitigating measures that are effective in reducing impacts, has proven to be viable. Those mitigating measures are now considered standard, and they are evaluated as part of the proposal and all deferral alternatives. The continuing dialogue between the North Slope Borough, the Inupiat community, and the MMS on study needs and results also has improved the quality of scientific research on the North Slope and, we believe, the quality of our NEPA analysis.

L-0001.006

The MMS is not backing away from meeting with local communities and individuals about the OCS leasing program; we are willing to continue meeting with local and tribal governments on issues of mutual concern. We continue to believe that producing one EIS instead of three saves everyone concerned much time and effort writing or reading predominately the same information three times. The process we described in response to the previous comment indicated that any new information that is developed or comes to light after the final EIS is published will be considered in the environmental assessment processes or supplemental EIS's for the second and third sales. A coastal-management Federal-consistency analysis also will be conducted for each sale.

See also Response L-0001.005.

L-0001.007

Although various OCS lease-sale areas have differences in local perception, environmental concerns, and maturity of OCS fields, each will be viewed on its own merits when making decisions regarding leasing options. Overriding considerations are the OCS national energy leasing program guidelines and the OCS regulations under which MMS operates. The oil and gas industry has been operating in the North Slope OCS environment since the mid-1970's, and the MMS has been taking local testimony during this same time. As issues surface, we will continue to address them through the NEPA and public comment process.

We understand that the Arctic is substantively different from the Gulf of Mexico. However, since the late 1970's the Beaufort Sea has been the site of numerous environmental studies and environmental analyses related to oil and gas development. There is sufficient scientific evaluation of oil and gas development to justify a multiple-sale EIS approach. The Secretary of the Interior will have sufficient information on which to make a decision for each Beaufort Sea lease sale.

L-0001.008

Leasing areas onshore Alaska have different regulatory agencies, operating regulations, and leasing histories than OCS areas, and one cannot equate the two. The OCS areas are under the OCS Lands Act Amendments and administered by the MMS; onshore areas are either under Federal land use managers (Fish and Wildlife Service for the Arctic National Wildlife Refuge and the Bureau of Land Management for the National Petroleum Reserve in Alaska) or the State (for the remaining North Slope lands). Each jurisdiction has their own rules based on tradition, use, and regulatory authority. The multiple-sale approach is allowable under Federal regulations.

In addition to the sale-specific stipulations, lessees also would have to follow MMS's extensive regulations found in CFR Part 30.

L-0001.009

See Response L-0035.001.

The MMS acknowledges that the North Slope Borough, in cooperation with the Alaska Eskimo Whaling Commission, provided MMS with additional recommendations for deferring areas that were much larger than areas in deferral Alternatives III, IV, and V. However, as noted in Section I.C.2.b, the three larger deferral alternatives suggested by the North Slope Borough would remove about half the opportunity for discovering and developing an economic oil field. A large portion of the area being deferred is offshore Prudhoe Bay, where most of the existing oil and gas infrastructure exists. The deferrals as suggested by the North Slope Borough would remove much of the area in the Nearshore and Midrange zones (see Map 4), where MMS projects most of the leasing and activities for Sales 186 and 195 would occur, and would eliminate a large portion of the economically recoverable resources. These deferrals essentially would become the same as the No Action Alternative, which is evaluated as Alternative II (Section IV.B). As noted in Section I.C.2.b, the suggested scoping comments for the deferral alternatives and, for the most part, the comments on the draft EIS from the North Slope Borough and the Alaska Eskimo Whaling Commission, do not acknowledge the positive effects and protection offered by the standard stipulations and mitigating measures that are assumed to be part of the Proposal. These stipulations, especially Stipulations 4

(Industry Site-Specific Bowhead Monitoring Program) and 5 (Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities), have proven to be effective in reducing and eliminating adverse effects on subsistence whaling. Proposed exploration and seismic activities have been modified or limited in scope to reduce conflicts with whaling and potential deflection of the bowhead whale migration.

The MMS acknowledges that the North Slope Borough and the Alaska Eskimo Whaling Commission have consistently recommended the "no sale" alternatives and they have consistently stated their preference for no offshore oil and gas activity. As stated in Section I.C.2.b, the MMS analysis indicates that the levels of effects offered by the standard stipulations and ITL clauses, in combination with Alternatives III, IV, and V, provide essentially the same level of protection offered by the much larger deferrals suggested by the North Slope Borough.

The current alternatives, with the standard stipulations and ITL clauses, offer an effective range of alternatives that also meet the goals and objectives of the OCS Lands Act and the recent national energy plan to offer Federal offshore oil and gas resources for lease and possible exploration and development in an environmentally safe manner.

L-0001.010

See Responses L-0001.009 and L-0035.001.

L-0001.011

See Responses L-0001.009 and L-0035.001.

The MMS does not anticipate any exploration activities, including seismic surveys, in the spring lead system area during the bowhead whale spring migration near Barrow as a result of OCS Lease Sale 186. This area is far removed from existing infrastructure, and industry interest in the area is likely to be limited. Available technology and cost of operations likely would preclude operating in the spring lead system during the ice-covered period, which would include the spring migration period. Furthermore, if the area is leased as a result of any of the proposed sales, the MMS will conduct environmental analysis of all proposed exploration plans and, if successful, any proposed development plans. These analyses will evaluate specific site information, proposed equipment specification, and facility designs pertaining to the proposed activities, including timing and duration of the activities. If necessary, additional requirements can be developed and required to mitigate any adverse effects. Finally, should industry acquire leases in the area and technology is developed that allows operations to take place during the spring migration, the National Marine Fisheries Service's May 25, 2001, Biological Opinion for the Beaufort Sea requires the MMS to reinitiate Section 7 consultation under the Endangered Species Act before such operations could be approved and proceeded with.

See response L-0001.009 for additional information on the protection to subsistence whaling offered by the standard stipulations.

L-0001.012

See Responses L-0001.009 and L-0035.001.

A recent study, *Bowhead Whale Feeding in the Eastern Beaufort Sea: Update of Scientific and Traditional Knowledge* (Richardson and Thomson, 2002) indicates that more than 10% of the bowhead whales that pass through the eastern Alaskan Beaufort Sea during late summer and autumn feed there. However, based on comparisons of carbon isotope ratios in bowhead muscle and baleen, bowhead whales consume a relatively small portion of their food in the eastern and central Beaufort Sea. The study concluded in an average year the population of bowhead whales derives an estimated 2.4% of annual energetics in the eastern Alaskan Beaufort Sea. This study is discussed in Section III.B.4.a(1). We would be interested in more information on the observed deflection and its timing related to prior exploration of the area. However, we believe that the mitigation envisioned for Sale 186 and subsequent sales would help ensure that subsistence users would have access to the bowhead whales passing through the area, and that any deflection could be prevented or kept to a minimum. While at the time of Sale 170 we did indicate that additional analysis of cumulative effects was to be done, that analysis has been completed and appears in this EIS in Section V. Also, response plans have subsequently been enhanced.

Although there is no single deferral that includes all waters east of Kaktovik, the Secretary can choose both Alternatives V and VI as protection for feeding and migrating bowhead whales "upstream" of the Kaktovik subsistence-use area in addition to comparable protection offered by the stipulations and ITL clauses.

As to a total deferral of all offshore areas off the Arctic National Wildlife Refuge, deferring these blocks would reduce the opportunity of discovering and developing an economic oil field by 23%. Alternatives V and VI defer about 60% of the Refuge's coastline and reduce the opportunity of discovering and developing and economic oil field by only 6%. The whale-strike information provided by the Alaska Eskimo Whaling Commission and the North Slope Borough indicates that most whaling activities in the Kaktovik area occur to the north and east of Kaktovik.

L-0001.013

See Responses L-0001.009 and L-0035-001.

The EIS still evaluates the effects of stipulations (Stipulations 6a and 6b) prohibiting permanent facilities within 10 miles of Cross Island. As noted by the North Slope Borough, Stipulation 6a applies seaward of Cross Island, and Stipulation 6b applies landward of Cross Island. The Secretary can select both stipulations. However, data provided by the North Slope Borough and the Alaska Eskimo Whaling Commission indicate little or no whaling occurs inside or landward of the barrier islands. Furthermore, noise studies indicate that sounds that would divert the whale migration travel less than 10 kilometers (about 6 miles). Any OCS facilities inside the barrier islands would be more than 10 kilometers from the whale migration route, which occurs seaward of the barrier islands.

The current Cross Island deferral includes tracts that are beyond the 10-mile radius of Stipulation 6a. The environmental analysis in Section IV.C provides an assessment of the effects and benefits of deferring additional tracts east and north of the 10-mile radius used in the stipulation. The EIS also evaluates the effects of the standard stipulations that are part of all of the deferral alternatives. These stipulations have proven to be effective in reducing potential effects.

Regarding production noise from permanent industrial facilities around Cross Island, companies will be required to demonstrate to the National Marine Fisheries Service that any such proposed facilities will be in compliance with the Marine Mammal Protection Act and Endangered Species Act as they seek to obtain incidental harassment authorizations and avoid conflicts with subsistence activities. This analysis will occur with the submission of any exploration or development plans, and additional mitigation can be designed and required, if necessary.

The 94 whole or partial blocks depicted as a candidate for deferral on the map developed by the Nuiqsut Whaling Captains would reduce, by an estimated 19%, the opportunity of discovering and developing an economic oil field. This compares to an estimated reduction of about 2% for the Nuiqsut Subsistence Whaling Deferral.

L-0001.014

The MMS is always open to discussing oil- and gas-related issues with the Alaska Eskimo Whaling Commission, Nuiqsut subsistence users, NOAA fisheries, and industry to better define, refine, and develop the effects of noise on bowhead whales using data from ongoing noise-monitoring studies at Northstar. The development of appropriate noise mitigation and protection of the bowhead whale migration is important to the MMS and the Inupiat communities.

See response L-0001.013.

L-0001.015

In developing a hypothetical resource-development scenario and sale-alternative configurations for a proposed offshore Federal lease sale, the MMS attempts to take a reasoned approach to the formulation of a framework for potential oil and gas activity. In general, at the lease-sale stage, we estimate that the level of effects that likely would occur are, to a large degree, a function of development that we estimate, in turn, as a function of the resource estimates for a particular area. The environmental analysis is conducted around this framework. Hypothetical assessments for each specific area within the program area substantially would increase the size of the already large EIS without producing significant additional information given the uncertainty inherent in estimating the amount and location of future exploration and development. The current process is appropriate and satisfies NEPA requirements in that the Secretary of the Interior is provided sufficient information with which to make a decision on whether or not to proceed with the lease sale. During this process, we also relay to the Secretary the views of the North Slope Borough, the Alaska Eskimo Whaling Commission, the North Slope villages, and those of others commenters. Nevertheless, actual development of leased tracts, if any occurs, may differ from what is forecast. If exploration and development occurs after leasing, we perform additional NEPA analysis using site-specific information, including the concerns and issues from nearby communities and villages. Extensive developmental EIS's were prepared for the Northstar and the now-deferred Liberty projects. Specific local issues will be discussed within such NEPA analysis for the Secretary's consideration, if development is proposed for any tracts leased as the result of the three sales analyzed in this EIS.

L-0001.016

See Responses L-0001.015, L-0001.001, l-0001.005 and L-0035.001.

Response L-0001.015 provides a partial answer to this comment. In addition, in a lease-sale EIS, the MMS generally avoids placing a hypothetical development in a very specific location, because the document needs to assess the whole program area. Subsequent NEPA analysis would be done for specific development proposals in specific geographic areas. Furthermore, a development project could affect a broader area than the area immediately surrounding the proposed site. Because we do not know which leases will be bought or if, when, or where development will occur, a broader assessment at the sale stage is warranted. The standard stipulations, if adopted, would provide substantial protection to potentially affected resources wherever they are located.

L-0001.017

The MMS disagrees with this comment. We believe the EIS does a thorough job in assessing cumulative effects. We have included the mentioned oil and gas activities in addition to others that may occur in our cumulative analysis. We agree that last winter and the previous two winter seasons have seen an increase in exploration activity on the North Slope with the present interest in the National Petroleum Reserve in Alaska. However, that level of activity may or may not be significantly different in subsequent years, depending on whether or not major companies opt to develop their present North Slope discoveries and explore areas other than the North Slope (Smitts, pers. commun.). We estimate past, present, and reasonably foreseeable cumulative effects in the cumulative section of this EIS. Through our analysis, we have not found other continuing or additive effects relevant to the framework for this cumulative analysis. We expect that any estimated effects on species would recover usually in two to three generations. If the commenter knows of serious cumulative effects that we have not accounted for in our analysis, we would appreciate receiving the appropriate references or statements of traditional knowledge.

L-0001.018

The MMS understands the importance of the National Research Council study and will include it in future analysis of cumulative effects.

We have cooperated with the Environmental Protection Agency and the National Research Council on this important study and are looking forward to its completion. Any results will be included in our assessment, as appropriate, if they are available in time to meet our prepublication schedule. If not, they will be addressed in subsequent NEPA analysis. The Congressional appropriations language for this study indicated that no projects should be delayed waiting for its results.

L-0001.019

See Responses L-0034.027, PH-Kaktovik.043, and Section I.C.1.e(1) for additional information.

We understand that the North Slope Borough and the Inupiat communities of the North Slope provide substantial services to the residents of their communities. We also acknowledge the staff hours and travel are involved in responding to proposals for oil and gas leasing, exploration, and development. Agencies are not required by CEQ NEPA Regulations to evaluate the costs and impacts of voluntary participation in the NEPA process. MMS does not and can not require the North Slope Borough or individuals to participate in the NEPA process, nor can we control the level of participation, which can range from a few hours to review summary documents to many hours to review each and every page of the EIS. We clearly understand the Borough's strong desire to receive impact assistance or a portion of OCS receipts.

L-0001.020

We appreciate the North Slope Borough's comments. We agree on some points, but disagree on others. We do not believe the EIS favors leasing; rather, it indicates the potential effects of possible exploration and development that may result should tracts be offered and companies successfully bid on those leases. To date, after years of leasing and many EIS's, little exploration has been conducted and the only production is from a few OCS wells that were drilled from the Northstar Island in State waters. In sum, few effects of OCS oil and gas have been felt. We have written the EIS to portray a realistic assessment, not an overstatement or understatement, of what effects may occur in the future should these sales be conducted. We believe this applies not only to the analysis of impacts in Section

IV but also to Section V on cumulative impacts, which has been totally restructured and substantially expanded from previous lease sale EIS's.

While we discuss the effects of vessel and aircraft on whales, we do not believe this to be a significant effect, especially in light of the tight controls over when and how they may operate in the Arctic, especially in periods of broken ice and open water. The MMS is aware that the number of trips indicated is inherently round trips. We will ensure that the text is clear on that.

We continue to fund several assessments of bowhead whales to expand our database regarding the species and effects thereon. While we have seen some effects on whales from seismic noises, we have not measured any long-term skittishness as a result of exposure to seismic noise.

The MMS is well aware that delays due to weather, distance, and other factors affect companies' ability to respond in the unlikely event of a large oil spill. The Oil Spill Contingency Plan for any development project would need to address those issues.

We believe that potential effects of the traditional subsistence culture are substantially treated in the EIS. We do, however, request that the North Slope Borough provide any other specific information or references we may have missed, so we can address this issues as effectively as possible in future NEPA documents.

We agree that the MMS does not have as full an understanding of the difficulties faced by subsistence hunters and gatherers as the Inupiat themselves, but we have attempted to address this issue in the EIS in some detail and appreciate the Inupiat community's efforts to further educate us on these matters.

We have tried to expand the traditional knowledge content of recent EIS's, including this one. We also have done our best to communicate traditional knowledge information to decisionmakers in the top management of the Department of the Interior, including the Secretary.

L-0002

RECEIVED
JUL 24 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

July 22, 2002

Mr. John Goll, Regional Director
U.S. Department of the Interior
MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
949 East 36th Avenue, Suite 300
Anchorage, Alaska 99508-4363

Dear Mr. Goll:

Submitted herewith are the comments of the Alaska Eskimo Whaling Commission on the Minerals Management Service's Draft Environmental Impact Statement for its OCS Oil and Gas Lease Sale 186, 195, and 202 in the Beaufort Sea Planning Area.

Thank you for the opportunity to comment.

Yours truly,

Maggie Ahmaogak

Maggie Ahmaogak
Executive Director

Cc: Arnold Brower, Jr., President of ICAS
Lloyd Leavitt, Executive Director, NVB
Mayor George N. Ahmaogak, Sr., North Slope Borough
Eugene Brower, President of Barrow Whaling Captains' Association
AEWC Commissioners

Fax: (907) 852-2303 • Toll Free: 1-800-478-2392

ALASKA ESKIMO WHALING COMMISSION

PRELIMINARY COMMENTS
On
U.S. MINERALS MANAGEMENT SERVICE
DRAFT ENVIRONMENTAL IMPACT STATEMENT
For
BEAUFORT SEA PLANNING AREA
SALES 186, 195 and 202
OIL AND GAS LEASE SALE

July 22, 2002

INTRODUCTION

The Alaska Eskimo Whaling Commission (AEWC) appreciates the opportunity to submit these preliminary comments, and reserves the right to submit additional comments on the DEIS for Oil and Gas Lease Sales 186, 195 and 202 by the U.S. Minerals Management Service by the deadline date in September of 2002. (20)

The AEWC hereby endorses and incorporates by reference the comments submitted on this matter by the North Slope Borough

SUMMARY

The Draft Environmental Impact Statement (DEIS) prepared by the U.S. Minerals Management Service (MMS) for its proposed Oil and Gas Lease Sales 186, 195, and 202 in the Beaufort Sea .001 Planning Area still fall short of the standards of review and analysis set under the National Environmental Policy Act (NEPA). Important research results and other information from ongoing programs that could be used are still disregarded throughout the document. .002 The AEWC applauds the MMS in its statements that it provided information from the consultation of the North Slope residents and the AEWC into this DEIS document. Unfortunately, one of the most important components of the DEIS, the cumulative effects/impacts analysis, contains only conclusive statements and entirely neglects any discussion of the past, present and reasonably .003 foreseeable future activities whose impacts might interact with those of the proposed sale/action, in federal activities.

Furthermore, this DEIS continues MMS' tradition of ignoring the dictates of federal law and Executive Order by continuing to refuse impact mitigation funding to our community. The DEIS responds to our request for impact assistance by refusing to acknowledge the possibility of pushing the Administration to include mitigation impact assistance in the President's Budget, or asking the Administration to put a request for impact assistance for North Slope communities in an energy .004 bill. This is a fundamental flaw. We have heard agency officials claim that they would like to help us, but complain that MMS has no authority to fund impact assistance. We do not agree with the agency's legal opinion and we wonder whether MMS really wants to help us since we see no sign that you have ever asked for clearer legal authority to do what you say you want to do.

AEWC believes that MMS most certainly has the authority to budget for impact assistance. The one year allocation of funds to coastal states is evidence that Congress recognizes that coastal impacts from offshore oil development are a real problem. If MMS believes it does not have authority or funding, MMS needs to ask for it. This is part of MMS' responsibility to balance the orderly development of the OCS with protection of the human and marine environment. .004

Finally, AEWC believes that MMS has not performed or provided accurate and substantial analysis of the mitigation stipulations for this particular DEIS. A list of mitigation measures without analysis does not qualify as a "reasoned discussion" or a "hard look" as NEPA requires. .005

REQUESTS FROM PREVIOUS EIS TO THE 5-YEAR LEASING PROGRAM

On January 24, 2002, the AEWC submitted its comments on the DEIS for the OCS Oil and Gas Leasing Program: 2002-2007. In those comments, the AEWC noted a number of items that need to be addressed by the MMS before Lease Sales 186, 195 and 202 can be held. In particular, the AEWC requested that MMS acknowledge recent research results on the adverse industrial impacts of OCS development. MMS' failure to fully address these findings, especially given the participation of MMS representatives in hearings and meetings addressing these matters, is extremely disappointing. .006

Again, the AEWC insists that MMS fully revise the sections of the DEIS in which it purports to address the **"effects of accidental oil spills"** and the **"cumulative effects of past, present, and future activities on the people and environment of Alaska's North Slope"**, as well as its conclusions within the Executive Summary on pages EXSUM 2, 3, 4, and 5. MMS has not performed or provided an accurate and substantial analysis of the mitigation stipulations for this particular DEIS. A list of mitigation measures without analysis does not qualify as a "reasoned discussion" or a "hard look" as NEPA requires. .007

For instance, the DEIS contains a stipulation prohibiting permanent facilities within a 10-mile zone around Cross Island unless the lessee can demonstrate that their placement in the zone will not have a significant impact on the subsistence harvest of whales. The DEIS claims that AEWC agreed to this, but we never did and do not now. The ten-mile figure is someone else's arbitrary and inaccurate invention. The document is dishonest in claiming our support. Our judgment now is the same as it has been. The exclusion zone should be expanded to include an area based on the real Nuiqsut traditional bowhead harvest area (which lies more to the north and east) and production noise effects on bowhead whales. The new zone should be defined in consultation with the AEWC and Nuiqsut and refined as noise monitoring studies produce more accurate information on impacts on whales. .008

In addition, we object to MMS' absurd characterization of an 8-10% chance of a major oil spill as "highly unlikely." Compared to what? What odds would you consider acceptable if your culture and your community were at stake? A risk of **8%-10% is particularly unacceptable to AEWC, and especially without an offer of impact assistance.** We believe that the approach taken to risk evaluation and assignment in the DEIS violates the principles of Environmental Justice embodied in current executive order and other law. .009

Furthermore, given the vital importance of the analysis of oil spill and cumulative impacts to our community as a basis for understanding the impacts to our community from OCS industrial activity in the Arctic OCS, including the proposed lease sales, **the AEWC insists that MMS revise the sections indicated above and make the revised DEIS available for review by the AEWC, the NSB and ICAS, and the consulting agencies including the National Marine Fisheries Service, the EPA and the Marine Mammal Commission.** .010

In addition to the above, in its comments on the DEIS for the OCS Oil and Gas Leasing Program: 2002-2007, the AEWC also requested that the MMS prepare a revised discussion on Sociocultural Impacts and Enviromental Justice, including a balanced account of the "Socioeconomic Environment" for the North Slope, with a reasoned discussion of mitigation measures. The MMS has yet to provide this revised discussion. .011

In 1994, the National Research Council published a review of MMS' Environmental Studies Program in Alaska. The AEWC has pointed MMS to the conclusions and recommendations of this review on numerous occasions in recent years. These conclusions and recommendations remain relevant as MMS has yet to incorporate or otherwise address them. Notably, the NRC Committee conducting the 1994 review pointed out that, just as it does in the current DEIS, MMS in the past has devoted considerable attention to the "amount and kind of subsistence activities, the importance of these subsistence activities for the maintenance of traditional cultures, and at least the potential for these activities to be disrupted in the case of catastrophic dame to the physical environment" without providing measures to protect against this potential disruptions. .012

In the first paragraph of Section 4.3.3.15. "Environmental Justice" within the 5-Year Leasing Program, it is noted that Executive Order 12898 calls for the development of mitigation measures to address "all identified effects." Agencies also are directed, in the Executive Order, to integrate those mitigation measures into the level of NEPA review required, in this case, into the Environmental Impact Statement (EIS). .013

The AEWC hereby makes the statement that the MMS has failed to provide a clear analysis and reasoned discussion of all of the effects likely to result from the Lease Sales 186, 195 and 202. .014

Therefore MMS has placed itself in a position where it cannot adequately identify mitigation measures necessary to address the "Environmental Justice" concerns raised by the proposed lease sales.

For these and other reasons, the present DEIS is in violation of the Outer Continental Shelf Lands Act and the regulations promulgated under the National Environmental Policy Act, which requires that the Secretary of the Interior provide "information needed for assessment and management of environmental impacts on human, marine, and coastal environments of the Outer Continental Shelf and the coastal areas which may be affected by oil and gas development." Furthermore, as noted before, the Council on Environmental Quality requires that MMS ensure the "professional integrity, including scientific integrity" of the analyses in the Draft EIS. .015

THE AEWC BELIEVES THAT PREPARATION OF A SINGLE EIS FOR THREE INCREMENTAL LEASE SALES IS INAPPROPRIATE

The AEWC recognizes MMS' desire to expedite permitting of energy projects, but the agency's proposed "tiering" is not appropriate in Alaska's OCS for several reasons:

MMS approach inevitably will short-circuit the chance for thorough environmental review of the three lease sales. Indeed, we believe that your proposed approach is not "tiering" but is in fact impermissible "segmentation" because the projects will be carried out in changing circumstances and may have different impacts. .016

In a stable, low risk environment, MMS' approach might have merit, but not here. Weather, ice, and other environmental conditions in the Beaufort Sea are shifting, both year-to-year and over the long term with climate change. Three days ago the Washington Post ran a story about glacial melting and the rapidity of change in the ice of the Arctic. Now more than ever is the time to fulfill NEPA's mandate to take a hard look at the impacts of these projects. A hard look means one EIS per lease sale. We cannot afford to do less. Every year we learn more about and change our understanding of the Beaufort Sea environment, the habitat needs of the whales, and the scale and pace of change in those things resulting from shifts in the global climate. Moreover, on almost a daily basis the Nation's policies and attitude toward energy production and consumption are themselves changing. NEPA requires an informed evaluation and weighing of facts, legal requirements, and social concerns to strike a "productive harmony between man and the environment." The projects must be evaluated pursuant to the most up-to-date information and perspectives.

MMS CANNOT CONTINUE TO IGNORE THE FISCAL CRISIS ITS ONGOING ACTIONS ARE CREATING FOR THE NORTH SLOPE COMMUNITIES.

When Congress passed the OCS Lands Act, it recognized, in its declaration of policy, "the national interest in the effective management of the marine, coastal, and human environments." (43 USC 1332 (4)). In order to accomplish this goal, Congress recognized that affected states and local governments are likely to "require assistance" in dealing with adverse impacts from OCS development. .017

Congress then went on to give the Secretary of the Interior a very broad grant of authority to administer the leasing of the OCS for the development of non-renewable resources, directing the Secretary to "prescribe such rules and regulations as may be necessary to carry out" the provisions of the OCSLA. (43 USC 1334 (a). Congress further authorized the Secretary to:

> At any time prescribe and amend such rules and regulations as he determines to be necessary and proper in order to provide for the protection of correlative rights.

The AEWC was formed in 1977 for the purpose of representing the 10 bowhead whale subsistence hunting villages on issues related to the quota system imposed on our communities by the International Whaling Commission and for managing the bowhead whale subsistence hunt in compliance with that Quota system. The Federal Government provides the AEWC, a small grant through the U.S Department of Commerce for these purposes. However, because of the aggressive leasing program administered by the MMS in the Beaufort Sea, and soon the Chukchi Sea, the AEWC has been forced to take on representation of our bowhead subsistence community in dealing with OCS Oil and Gas operators to try to protect our bowhead subsistence hunt from adverse impacts of OCS oil and gas activities. .017

Furthermore, the amount of work on OCS-related matters in recent years has grown to the point that it dominates the AEWC's staff time, again with no funding through the agency responsible for these impacts. Despite repeated requests, both formal and informal from the AEWC and residents of the NSB, MMS has yet to act to fulfill this statutory obligation.

As is the tradition of our community, we have taken whatever steps we can to protect ourselves. One of the most important mitigation measures in place at this time to protect our bowhead hunting is the annual "Open Water Season Conflict Avoidance Agreement". This agreement is the result of the extensive negotiations between the AEWC and oil and gas operators over more than 15 years, with no support from the U.S. Department of the Interior or the MMS. In recent years, the AEWC, along with the NSB and the Inupiat Community of the Arctic Slope (ICAS) has undertaken negotiations with oil and gas operators to try to address adverse impacts of North Slope oil and gas development, especially the OCS activities, on our traditional subsistence culture and on the physical and psychological well-being of our people. This is work that falls squarely within the Secretary's responsibility to protect "correlative rights" in the natural resources of the Outer Continental Shelf. Not withstanding this statutory responsibility and despite repeated requests, MMS continues to refuse to provide meaningful assistance to the AEWC, either through its regulatory or its funding authority.

In fact, in AEWC's September 21, 2001 comments on MMS's Draft Proposed Oil and Gas Leasing Program for 2002-2007, the AEWC specifically requested that MMS **include mitigation funding in its agency budget to cover local mitigation costs under the new five-year OCS leasing plan.** MMS has informed AEWC that the agency cannot do this. Furthermore, MMS representatives have indicated that the agency considers itself to be "unable" to provide this kind of support.

However, the Secretary has statutory responsibility for protecting our people's interests in our Beaufort Sea subsistence resources and for mitigating impacts to our community as a result of the OCS Leasing Program. Furthermore, the Secretary has been instructed by Congress to provide whatever measures "may be necessary" to protect our interests and mitigate impacts to our community. Therefore, MMS is placing the Secretary of the Interior in direct violation of the OCS Lands Act by refusing to provide support for our community and to work with us to address and mitigate the adverse impacts of Beaufort Sea OCS oil and gas leasing and permitting.

CONCLUSION

The Alaska Eskimo Whaling Commission, representing the bowhead whale subsistence whaling captains from ten villages of Kaktovik, Nuiqsut, Barrow, Wainwright, Pt. Hope, Kivalina, Wales, Little Diomede, Savoonga and Gambell, opposes OCS Lease Sales 186, 195 and 202 within the .018

Beaufort Sea Planning Area due to the current and potential adverse impacts to our bowhead resource and our subsistence hunting. The AEWC continues to advise the MMS to heed the advise of the National OCS Policy Committee with respect to the need to address the fiscal issues raised and faced by our community. .018

Furthermore, the AEWC insists that the MMS to prepare a revised DEIS or a Supplemental EIS to address the issues raised in these comments and in the comments submitted by the North Slope Borough. .019

Finally, let me share a general observation. MMS has an extensive environmental, social, and economic studies program. MMS interviews our people. We see our traditional knowledge repeated in this and other MMS environmental studies. .020

But even with all that dialogue and all that purported understanding, MMS decisions invariably run counter to our interests. We are gratified to see a cumulative effects analysis that pays attention to the long term harmful effects of OCS development on our sociocultural systems, but we ask for meaningful mitigation—not more words and studies—to address it.

We have shown that we need coastal impact assistance. But MMS has not requested OCS mitigation funding in its agency budget, though the agency assures us that it has studied our way of life and needs. .021

MMS combines three lease sales in one EIS, allowing an expedited and inevitably less accurate review of the impacts of these OCS lease sales on our hunt. It does not comfort us to know that there are thousands of pages of data on our culture when MMS sets up a process calculated to expedite damage to our interests. .022

The message you have delivered is that MMS, while claiming to know us by heart, chooses to refrain from making decisions that protect our way of life.

Thank you for this opportunity to express the views of the AEWC. I'd be happy to answer any questions you may have.

MMS Response to Comment Letter L-0002

L-0002.001

We disagree with this comment. The EIS was prepared in accordance with all applicable NEPA and Council on Environmental Quality requirements.

L-0002.002

The commenter uses the general statement that “Important research results and other information from ongoing programs that could be used are still disregarded throughout the document.” Without more specific information, it is hard for MMS to understand what the commenter is referring to. If we knew what was missing from the commenter’s perspective, we would be glad to supplement our analysis with additional information. The MMS staff tries its best to update text and analysis with current information, if it is known and available.

When available, MMS uses information gathered from conversations with local residents. The MMS’s outreach program tries to be attuned to what the local community is saying and, in turn, tries to reflect this information in our EIS’s.

L-0002.003

The conclusion reached in the cumulative analysis for each resource usually is only one paragraph long. We include a summary and an analysis of the contribution of the proposed lease sales to past, present, and reasonably foreseeable future actions. The summary and conclusions are preceded by an extensive analysis of that resource. For example, the bowhead whale analysis is more than 6 pages long, and the marine and coastal birds analysis is 5 pages long. We include summaries and incorporation by reference of previous analysis where appropriate.

We do not neglect any discussion of past, present, and reasonably foreseeable future activities. The rather long introductory statements to the cumulative section of the EIS (Sections V.A and V.B spell out in detail exactly which activities are included in the analysis which is presented in the subsequent section [V.C]).

L-0002.004

See Responses L-0034.026, L-0034.027, and PH-Kaktovik.043.

L-0002.005

The MMS analysts, when considering the effects of proposed lease sales, do take into account the effect of mitigating measures. In Sections IV.C.1 through IV.C.16, each analyst provides an evaluation of the effectiveness of mitigation for their respective resources. A summary of that analysis is provided in Section II. H.1.a, and follows the text of the stipulation.

For example, our EIS evaluation found that Stipulation No. 1 lowers the potential adverse effects to lower trophic-level organisms, primarily unknown kelp communities or other unique biological communities, that may be identified during oil and gas exploration or development activities and provided additional protection. It also would provide protection to fish (including the migration of fish) from potential disturbance associated with oil and gas exploration, development, and production.

Stipulation No. 2 provides protection to fish (including the migration of fish), pinnipeds, polar bears, bowhead whales, gray whales, and beluga whales from potential disturbances associated with oil and gas exploration, development, and production by increasing the awareness of workers to their surrounding environment. It increases the sensitivity to and understanding by workers of the values, customs, and lifestyles of Native communities and reduces the potential conflicts with subsistence resources and hunting activities.

Similar types of summaries are provided for Stipulations No. 3 through 8 (see Sections II.H.1.c through II.H.2.d), and the full analysis is provided in Sections IV.C.1 through IV.C.16 by resource category.

Section II.H.3 notes that the effectiveness of the ITL clauses evaluated in the EIS vary. The primary purpose or focus of all of these ITL clauses is to provide the lessee with information about the requirements or mitigation required by other Federal and State agencies. The ITL clauses themselves provide no mitigation. However, the regulations and mitigation required by the other agencies are effective and do lower potential adverse impacts from proposed oil and gas activities. To the extent that the ITL clauses enlighten lessees and their contractors to these mitigating measures, the ITL clauses also may be considered effective.

L-0002.006

See Response L-0001.005.

Reader requests MMS acknowledge of recent studies showing adverse industrial impacts of OCS development, but fails to cite or reference any studies. MMS is unaware of any recent or new studies that attribute significant adverse effects to OCS development. In fact, the only OCS related development that is occurring on the OCS in the Alaska Region are a few Federal wells drilled into the federal leases at Northstar. MMS is unaware of any studies showing significant effects related to those wells or the Northstar project. We do discuss industrial effects in the EIS, for example, we discuss the effects from <u>unmitigated</u> seismic surveys on bowhead whales conducted before the current stipulations were used.

L-0002.007

The effects of accidental spills are thoroughly addressed for each individual resource in Section IV, which has been updated with the most current information MMS has available. The cumulative effects section was totally restructured and updated for the Liberty EIS that was issued in final in early 2002.

Effectiveness of mitigating measures has been addressed for each resource in Section IV. These mitigating measures also have been presented in Section II along with a summary of their effectiveness. See also our answer to L-0002.005.

Stipulations have been updated and one stipulation has been broken into two parts, which are now Stipulations 6 and 6b - Permanent Facility Siting in the Vicinity Seaward of Cross Island. Also, two new stipulations have been added: Stipulation 7 - Pre-Booming Requirements for Fuel Transfers and Stipulation No. 8 - Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider. These also are discussed in the Executive Summary because they are new.

Effectiveness of mitigating measures as they have been analyzed for the proposed action in Section IV also apply to the cumulative effects analysis.

L-0002.008

The EIS evaluates two stipulations for prohibiting permanent facilities within a 10-mile zone around Cross Island unless the lessee can demonstrate that their placement will not have a significant impact on the subsistence harvest of whales. The stipulation language is essentially the same as the stipulation adopted for Sale 170, but it has been divided into two options, one inside the barrier islands and one outside the barrier islands. The language of this stipulation was developed during the Sale 170 decision process with the State, and that process included information and coordination with the North Slope Borough and Alaska Eskimo Whaling Commission, through the State. The Alaska Eskimo Whaling Commission has consistently recommended the "no sale alternatives" and the enlargement of deferral options to provide potential development.

The stipulation requires the lessee to coordinate with the North Slope Borough and the Alaska Eskimo Whaling Commission if they are proposing permanent facilities within the 10-mile zone.

The effects of a larger area to the north and east is evaluated in this EIS as a deferral alternative; the benefits to the bowhead whale of not allowing oil and gas development in that area are evaluated as Alternative IV (see Section IV.C.11.c). Alternative IV was developed by the MMS using whale-strike information provided by Alaska Eskimo Whaling Commission. The MMS found that the effects of deferring this area from oil and gas leasing and development would be essentially the same as Alternative I. Based on our analysis, enlarging the area either by deferral or stipulation could lessen the potential for discovery of oil and, in turn, the potential impacts, but would not eliminate the potential adverse effects that could occur in the unlikely event of an oil spill. The available studies and information about bowhead whales diverting their course has been considered and incorporated into this EIS and into the development of the 10-mile zone in Stipulations 6a and 6b.

As new information is developed, such as the whale monitoring and noise information being collected at the Northstar facility, the MMS will review and incorporate that information into our environmental assessment and future decision processes.

L-0002.009

We understand the Alaska Eskimo Whaling Commission's views regarding the probabilities of spill occurrence. In Section IV.A.4 we state: "The MMS uses the term 'low' to characterize the relative chance of a large spill occurring, and it is based on our familiarity with oil-spill rates and sizes. We recognize that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. For some stakeholders, a10% chance of a large spill over the life of the field may be 'high'." Regardless of the probability, we do assess the effects of oil spills on various environmental resources. Environmental justice analysis requires the MMS to evaluate events that will occur and that might result in high adverse effects. Oil spills are unlikely events, and the most likely event is "no oil spill will happen"; therefore, they are not included in our conclusions for effects that will occur.

The environmental justice analysis provided in this EIS meets the Council on Environmental Quality and Department of the Interior guidance for Environmental Justice evaluation.

The MMS acknowledges the need for impact assistance to mitigate some of the real and perceived impacts of oil development on the North Slope. The North Slope Borough also may receive funds from the State under the Coastal Impact Assistance Program. The funds that may accrue to the Borough under this Program also are relatively small. Environmental Justice is analyzed in the Section IV.C.16. Additional information pertaining to impact assistance as been added to Section I.C.1.e(1).

L-0002.010

Except for revisions we made to the text of the EIS after receiving the Alaska Eskimo Whaling Commission's and other comments on the draft EIS, we believe this EIS is more than adequate, given the limited information we have about where and what leasing, exploration, and development is likely to occur, let alone about what effects may result from such activity. The EIS meets the requirements of NEPA, and a revised draft EIS is not warranted.

L-0002.011

The draft EIS for the 2002-2007 OCS Oil and Gas Leasing Program is a national, programmatic document that does not approach analysis at the level of detail that a discussion of mitigation would require. The document is meant to be an overview of the entire national program. A "reasoned discussion" of mitigation would come at the lease-sale EIS stage. We believe that the draft and this final multiple-sale EIS for the Beaufort Sea has provided such a discussion. As mentioned in responses to earlier comments in this letter, the mitigating measures are built into the analysis, and effects are assessed as though they were in place.

New stipulations also are being considered. For instance, concerns about potential effects to Inupiat bowhead subsistence activities are addressed to some degree by proposed Stipulation No.7 - Pre-Booming Requirements for Fuel Transfers. This stipulation would moderate possible effects on this activity. Even though the stipulation would not prevent a fuel spill, pre-booming would help with spill recovery and would serve to moderate potential effects.

L-0002.012

Measures to protect against potential disruption of subsistence in the case of catastrophic events and damage are included in that the MMS has regulations that lessees must follow to minimize the likelihood of any such catastrophic events. The potential effects on subsistence and subsistence resources from catastrophic events are analyzed in the EIS (See Section IV.I), and the suite of standard mitigating measures are identified and evaluated in the document. Other mitigating measures have been developed and are considered for inclusion as lease-sale conditions. Note that steps in the postsale processes include additional opportunities to develop and fine tune mitigating measures that can be adopted as conditions of exploration and development through operating orders, if site specific conditions and circumstances so warrant. These all are aimed at allowing exploration and development to proceed in an environmentally sound manner to meet the goals of the OCS Lands Act.

L-0002.013

See Response L-0002.011.

L-0002.014

The MMS believes that we have given a clear, full, and reasonable analysis of effects as they relate to Environmental Justice. We estimate that no disproportionate high adverse effects would occur to the Inupiat population from routine leasing, exploration, and development. We estimate such effects could occur in the event of a large oil spill, but we calculate that such a spill is unlikely. However, in the unlikely event of a large spill, we believe that proposed mitigation and spill-cleanup response would mitigate some but not all potential effects. No activity can proceed on the North Slope with zero risk. We have done our best to reduce that risk consistent with the OCS Lands Act; Executive Order 12898; and other laws, regulations, executive orders and policies.

L-0002.015

Since the late 1970's, the MMS has engaged in oil and gas leasing activities in the Beaufort Sea. The MMS and the Department of the Interior have funded a long series of multimillion-dollar efforts aimed a studying the oceanography, biology, and people of the Beaufort Sea and its coast. This peer-reviewed scientific research and other pertinent research efforts have formed the backbone of the analysis performed in our EIS's. Over the last 20 years, we have provided each Secretary of the Interior with the information requisite to make a reasonable decision regarding leasing Federal tracts in the Beaufort Sea, and we believe we have done so with professional and scientific integrity.

L-0002.016

The Alaska Eskimo Whaling Commission believes that covering/tiering three lease sales under one umbrella EIS is inappropriate and shortchanges the NEPA process by not taking into consideration long-range changes that may occur over the time covered under this EIS. As pointed out in the process section/introduction of this Beaufort Sea multiple-sale EIS, further NEPA analysis will be performed after both the first and second lease sales are held. This will highlight any new information and analyze any new facts not covered in the initial multiple-sale draft EIS. For each of the two sales, Sales 195 and 202, an Environmental Assessment will be written that will include a public review process. If the Environmental Assessment finds that further NEPA documentation is warranted, a supplemental EIS will be written to cover the missing analysis. The MMS believes that with the several lease-sale EIS documents written for the Beaufort Sea area, we have addressed issues raised over the years by North Slope residents. We do not repeat the same litany each time but reference previous MMS documents. We believe our plan for the combination of the multiple-sale EIS and subsequent Environmental Assessments is an effective, sound way to provide the most up-to-date information and perspectives and is consistent with NEPA.

L-0002.017

See Responses L-0034.026, L-0034.027, PH-Kaktovik.043, and Section I.C.1.e(1).

Within the limits of the relationship between the Legislative and Executive branches of Government, the MMS has done its best over the last 20 years to support the concept of revenue sharing or impact assistance, which could directly fund the North Slope Borough. However, the authorization of funds must come from Congress.

L-0002.018

See Section I.C.1.e(1) for additional information.

In 1994, the National Research Council suggested that MMS set up a trust fund for subsistence and sociocultural effects mitigation. The OCS Lands Act legislation does not authorize this, and Congress would have to authorize such funds. In 2001, Congress provided coastal states with a one-time award of impact-assistance funds. Alaska received an appropriation of $12.2 million, of which $1,939,680 went to the North Slope Borough.

The OCS is considered a national resource, and revenue received from leasing and development activities currently is deposited in the Federal Treasury. In its reports, the OCS Policy Committee has expressed the view that "while the benefits of the OCS program are national, a disproportionate share of the infrastructure, environmental and social costs are local." In its Coastal Impact Assistance report, the Committee recommended a program to share 27% of revenue from the OCS with coastal States. Inclusion of all coastal States as eligible recipients recognizes that they form a unified coalition of entities with similar interests relating to their coastline. Both the House and the Senate have introduced impact assistance legislation, but no ongoing funding for impact assistance has been legislated to date.

L-0002.019

Thank you for the observations. We are particularly pleased that the Alaska Eskimo Whaling Commission appreciates the efforts that MMS has made to restructure the cumulative analysis we use in our EIS's for the Beaufort Sea to, among other things, pay greater attention to the long-term effects of OCS development on the Inupiat community's sociocultural systems. The MMS will continue to work with the Commission, the North Slope

Borough, the Inupiat Community of the Arctic Slope, and the villages to consider any additional, meaningful mitigation that we find would be appropriate to add to the substantial mitigation that is part of our standard package.

See Responses L-0002.011 and L-0002.018.

Northern Alaska Environmental Center
830 COLLEGE ROAD, FAIRBANKS, ALASKA 99701
PHONE: (907) 452-5021 FAX: (907) 452-3100
http://www.northern.org • northern@northern.org

L-0003

RECEIVED
JUL 31 2002
LEASING & ENVIRONMENT
MINERALS MANAGEMENT S

Testimony of Deb Moore, Arctic Coordinator
Northern Alaska Environmental Center July 30, 2002

Good evening and thank you for this opportunity to comment on the draft Environmental Impact Statement for the three Beaufort Sea lease sales. My name is Deb Moore and I am the Arctic Coordinator for the Northern Alaska Environmental Center. The Northern Center is the nation's most northerly, broad-spectrum environmental advocacy organization, based in Fairbanks. Our mission is to conserve Alaska's stunning natural resources, by advocating management and stewardship policies that promote sustainable, responsible practices.

The Northern Center opposes leasing in the Beaufort Sea – particularly off the shore of the Arctic National Wildlife Refuge or Teshekpuk Lake in the National Petroleum Reserve of Alaska (NPR-A). Our reasons for this opposition are many: the potential impacts from oil spill risks are too great to risk in these sensitive wilderness and wildlife areas; previous Beaufort Sea Sales have deferred or deleted the areas off the Arctic Refuge and Teshekpuk Lake from leasing due to this high risk - thereby setting a precedent that we believe should be continued; and the US should be focusing on ways to *decrease* our dependence on oil, not encouraging that dependence by developing in frontier areas. .001

The Beaufort Sea is home to polar bear, walrus, seals, migratory birds – including the Pacific black brant, threatened spectacled and Steller's eiders and the endangered bowhead whale. Oil spills in this harsh ice-dominated environment, would have a severe impact on many of these species – particularly on the bowhead whales during migration east of Barrow and offshore the Arctic National Wildlife Refuge and on black brant during molting along the coast in the Teshekpuk Lake area of the NPRA. .002 Considering the industry's proven lack of ability to clean up oil spills in the Beaufort Sea during most of the year as well as the maximum of 10 – 15% of spilled oil that is ever "cleaned up" even in much less severe climates, the risks to these species and sensitive areas are too great to allow new lease sales to go forward. .003

The Minerals Management Service (MMS) has developed a recent history of not leasing and/or deferring the sale of lease tracks off the coast of the Arctic National Wildlife Refuge and the Teshekpuk Lake area of the NPR-A. It is our understanding that these deferrals have occurred due to the sensitive nature of the areas, the high environmental risks associated with development of these areas, and overwhelming public opposition to these leases. For these same reasons, we request that these areas not only be deferred but ***permanently deleted*** from the current and futures sales. .004

While the Northern Center agrees that the United States should decrease its reliance on oil imports, we believe that domestic offshore drilling not the correct way to accomplish this. The US has only 3% of global oil reserves while accounting for 25% of the world's oil consumption. Therefore, the US will never drill its way to energy security and independence, even if every last .005

printed on recycled paper

drop of oil is drilled from federal waters off the coast of Alaska. In fact, the expansion of development into frontier areas such as the Beaufort Sea *encourages* this dependence. Instead, to decrease our reliance on *all* oil, not just imported oil, the United States should halt offshore leasing and focus its efforts on improving energy conservation and energy efficiency and shifting toward the use of more alternative, renewable energies. .005

Finally, we would like to make two comments about public process. The Northern Center is disappointed that the Minerals Management Service chose not to hold a hearing in the Fairbanks area. As the second largest community in Alaska, it is very likely that numerous individuals would have been interested in attending and commenting at such a hearing. However, by excluding Fairbanks, you have excluded these people – many of whom cannot take the time to travel to Anchorage or find another person to speak for them as I have. We encourage you to not overlook Fairbanks in the future. .006

In addition, we are concerned with MMS' efforts to lump three lease sales into one Environmental Impact Statement Process covering approximately 10 million acres. As these three sales are expected to be held sequentially, not simultaneously, so should there be *three full public EIS processes held sequentially*. In this way, each EIS will reflect the most current knowledge, experience and technology at the time - not reflect outdated information, as may be the case when using this current EIS process for a lease sale not set to begin for 5 years. In addition, by holding separate EIS's sequentially, the public will be a more active and informed part of the process – focusing their attention of each sale individually and basing their comments on the immediate situation for each sale. .007

Once again, thank you for the opportunity to comment.

MMS Response to Comment Letter L-0003

L-0003.001

The MMS recognizes the sensitivity of the Arctic National Wildlife Refuge and addresses this issue in the EIS under Alternative VI - Eastern Deferral and under Alternative V - Kaktovik Subsistence Whaling Deferral. The Teshekpuk Lake area is inland from the Beaufort Sea coast and is not at risk from potential oil spills that might occur offshore. This EIS evaluates the environmental risks of leasing offshore the North Slope of Alaska, including offshore of the Arctic National Wildlife Refuge and offshore of the National Petroleum Reserve-Alaska. The Secretary of the Interior determined that these areas should be considered for potential leasing as part of the OCS Oil and Gas Leasing Program: 2002 to 2007. This decision process follows the EIS process and will consider the information provided in the EIS and from the public and other Federal, State, tribal, and local governments in the decision to include or exclude the areas for each sale (186, 195, and 202) covered in this EIS.

The MMS has determined that it is inappropriate to make lease-sale and project-level environmental assessments to consider programmatic issues such as alternative fuels, conservation, etc., as suggested by the commenter. These issues are properly evaluated in the National Energy Policy and the 5-year OCS program.

L-0003.002

The MMS recognizes the potential threats that oil spills pose to endangered bowhead whales, polar bears, walruses, seals, and many species of migratory birds, including brant and threatened spectacled and Steller's eiders and their habitats. See Section IV.C - Analysis of Effects by Resource and Alternative: IV C.5 - Endangered and Threatened Species, including bowhead whale and threatened eiders; IV.C.6 - Marine and Coastal birds, including brant; and IV.C.7 - Marine Mammals, including polar bears, walruses, and seals for a detailed analysis of potential effects of oil and gas development on these species. Routine activities associated with such developments are not likely to result in significant adverse effects on birds or marine mammals.

Overall, the chance of one or more spills occurring and entering the offshore waters is low (8-10%); and the chance of one or more spills occurring and contacting resource areas important to these species is lower, on the order of 2% or less.

L-0003.003

The field tests conducted during 2000, did not demonstrate a failure of industry to contain and clean up oil. The tests were key in establishing reasonable maximum operational limits for one set of tactics. The efficiency of the tactics demonstrated was more limited than initially proposed, but they would have been effective in removing oil in a broken-ice environment. In a response situation, these tactics would be only one of the methods used to remove oil from the environment. In a real-world response situation, responders would be able to use any of the various tactics and response equipment they maintain in their response toolbox to include in situ burning. Additional field tests were conducted during July 2002 to demonstrate response tactics developed to improve response capabilities in broken ice following the 2000 demonstrations. The new tactics were highly effective and expand industry's window of operation and provide better access in broken-ice conditions, should an oil spill occur. Also, the broken-ice season is a short period of time, not the majority of the year. Solid-ice conditions are present nearly 9 months out of the year, and industry has an extensive inventory of equipment and tactics that can be used effectively on the ice surface to remove oil.

L-0003.004

At the discretion of the Secretary of the Interior, any number of, or all, of the blocks composing this sale may be deleted. The Secretary has the option to evaluate the proposed sale blocks based on new information or any circumstances that may have changed over time. The commenter's concerns are a matter of record.

L-0003.005

While the commenter has a point in that the United States may never be completely free from the need for oil produced from foreign sources; the United States can reduce its dependence on foreign imports with domestic production, which would strengthen the economy. These same actions would improve our balance of payments and strengthen the U.S dollar. They also reduce our reliance on foreign governments for meeting our energy needs. This is consistent the with the energy policy that was recently issued. As new technologies are developed, the need for hydrocarbons for generating energy may decrease. Changing technology, recycling, and conservation, when combined with a good national energy-development program, can lead to a greater level of energy security.

L-0003.006

The MMS did consider holding public hearings for this draft EIS in the Fairbanks area; however, based on the last public turnout in that city, we did not feel that local participation was warranted. Most of the agencies that commented did so under their agency letterhead, which did not show a Fairbanks address. We will evaluate holding future public hearings in Fairbanks for next cycle of lease-sale NEPA reviews.

L-0003.007

As explained in the process/introduction sections of this EIS, the MMS has followed NEPA guidelines and MMS regulations and precedence in combining similarly focused EIS's into one document. The EIS also explains that after each succeeding lease sale, further NEPA documentation will be evaluated, and the public will have a chance to review and comment on the resulting analysis. The MMS feels that this gives the public adequate information and access to make comments on these documents.

Advocates for Wild, Healthy Oceans

Alaska Regional Office
425 G Street
Suite 400
Anchorage, AK 99501

907.258.9922 Telephone
907.258.9933 Facsimile
www.oceanconservancy.org

Formerly the Center for
Marine Conservation

L-0004

The Ocean
Conservancy

July 26, 2002

RE: Outer Continental Shelf Oil & Gas Leasing Program: Beaufort Sea Planning Area Draft Environmental Impact Statement

Dear MMS,

Thank you for the opportunity to comment on the Outer Continental Shelf (OCS) Oil and Gas Leasing Program for the Beaufort Sea Planning Area Draft Environmental Impact Statement (DEIS).

Alaska's Beaufort Sea OCS waters host endangered species, productive marine life and vibrant coastal communities. The proposed lease sales threaten these sensitive marine, coastal, and social environments including the Arctic National Wildlife Refuge and areas near Teshekpuk Lake. .001

This proposed leasing program is a "major federal action" requiring the preparation of an EIS, as mandated by the National Environmental Policy Act (NEPA), 42 U.S.C. Sec. 4321-4370d. NEPA's purpose is to promote efforts "which will prevent or eliminate damage to the environment," 42 U.S.C. Sec. 4321, to inform the public of environmental consequences, 40 C.F.R. Sec. 1500.1(b), and to "help public officials…take actions that protect, restore, and enhance the environment." 40 C.F.R. Sec. 1500.1(c). To be sufficient under the law, an EIS must assess the direct, indirect and cumulative impacts of the project and its alternatives. 40 C.F.R. Sec. 1508.7, 1508.8, 1508.9(b), 1508.25(c)(1)-(3). .002

The Beaufort Sea DEIS fails to satisfy the above-listed requirements of NEPA. The proposed oil and gas lease sales endanger the fragile marine environment off the coast of northern Alaska. Productive marine ecosystems, marine mammals, sea birds, and coastal communities are all at risk from potential blowouts and pipeline oil spills. Additionally, .003

The Ocean Conservancy strives to be the world's foremost advocate for the oceans. Through science-based advocacy, research, and public education, we inform, inspire and empower people to speak and act for the oceans.

marine life is threatened by toxic sediments and cuttings disposed at sea during exploratory drilling, noise pollution generated by vessel traffic, drilling, platform work and seismic testing, and the laying of miles of pipelines in or on the seafloor. Even small amounts of oil can negatively affect marine life. Oil pollution increases susceptibility to diseases in fishes, inhibits phytoplankton productivity, and interferes with reproduction, development, growth, and behavior of many species. .003

The inclusion of all of the Beaufort Lease Sale area *prominently* ignores the inability to respond to an oil spill in ice conditions. Fierce climatic conditions, high winds and seas, sea ice, and cold temperatures challenge offshore technologies and spill cleanup far beyond present capabilities. Recent oil-spill drills by both oil companies and contractors have confirmed their inability to effectively respond to a spill in broken ice and open water conditions that prevail for most of the year in the Beaufort Sea. The Exxon Valdez oil spill of 1989 taught Alaskans and the world harsh lessons about the ability to clean up a significant oil spill. Scientific studies of the Exxon Valdez oil spill show long-lasting and significant damage to fish, wildlife, and subsistence. .004

Apart from large spills, smaller persistent spills can have a dramatic impact to the marine environment. For example, based on current sub-sea buried pipeline technology, persistent leaks of up to100 barrels a day could go unnoticed, particularly if under ice where sheening wouldn't be noticed (U.S. Army Corps of Engineers, 1999. Final EIS, Beaufort Sea Oil and Gas Development/ Northstar Project, page 8-37). .005

The DEIS asserts that this offshore drilling is necessary to satisfy US energy demands and to reduce reliance on oil imports. However, MMS fails to mention that the US has only three percent of global oil reserves. Therefore, the US will never drill its way to energy security and independence, even if every last drop of oil is drilled from federal waters off the coast of Alaska. .006

Oil development off the coast of the Arctic National Wildlife Refuge poses risks to the Porcupine caribou herd, bowhead whales, fish, polar bears, and migratory birds using the refuge coastline, lagoons, and barrier islands. Offshore exploration and development would cause pollution, aircraft and vessel noise and related industrial activity, and oil spills degrading the Refuge, even if there were no construction of infrastructure within its boundaries. In the future, there would be intense pressure to construct sprawling onshore airports, pipelines, roads, docks, and other support facilities in the Refuge. In light of these threats to our national treasure, MMS should do more than what is indicated by the Eastern Deferral which only provides a thin margin of protection and assumes oil could be cleaned up before it travels a mere 20 miles to the Arctic Refuge from the Beaufort Planning Area. .007

Internationally significant brant molting areas are located along the Beaufort Sea coast in the Teshekpuk Lake area of the National Petroleum Reserve-Alaska. This area is sensitive to aircraft and other disturbances caused by industrial activities and infrastructure, as well as oil spills. We strongly support the exclusion of tracts in the spring bowhead lead zone around Barrow, but because of the above-listed concerns, we .008 .009

also urge the MMS to pursue a "no sale" alternative for the entire Beaufort Sea planning area. .009

In conclusion, Alaska's Beaufort Sea is too productive and sensitive to threaten with OCS oil and gas development. Alaska is the only state in the nation where large portions of coastal residents depend on marine resources for subsistence. The fierce climatic conditions, high winds and seas, sea ice, and cold temperatures challenge offshore technologies far beyond their capabilities at present. These conditions make ecosystems more vulnerable and less resilient to disturbance and perturbations. Because of the inhospitable climate, challenging spill response and extreme productivity/sensitivity of the marine ecosystems off Alaska, this is the *last* place in the world that OCS exploration and development should be allowed. If moratoria are in place along the remainder of the U.S. coastline (except the Gulf of Mexico) then logic would dictate that at very least Alaska should be similarly exempted from leasing. Alaska shoulders more risk than any other state in the U.S., and the Beaufort sale areas constitute some of the riskiest acreage proposed for leasing. This is both unacceptable and dangerous to Alaska's unique environment. Please don't place our environment at such a risk and add this lease sale area to the moratoria as is appropriate. .010

Thank you for this opportunity to comment. These comments supplement prior letters and testimony we submitted on the 5-Year Program (Natural Resources Defense Council et al. February 1, 2001 and September 20, 2001; and The Ocean Conservancy et al. ,January 25, 2002), on three Beaufort Sea Sales (Sierra Club et al. November 5, 2001), and during the 5-Year Program DEIS public hearing (Anchorage, Alaska (12/3/01).

Sincerely,

Jeremiah Millen and Martin Robards
The Ocean Conservancy
coho@acsalaska.net

MMS Response to Comment Letter L-0004

L-0004.001

See Response L-0003.001.

L-0004.002

The MMS followed NEPA and MMS regulatory requirements in preparing this "major federal action" EIS. All appropriate subject matter has been addressed within this EIS. See the Table of Contents for specific topic listings.

L-0004.003

Topics listed in this comment letter have been addressed in this EIS, and satisfy the requirement of NEPA disclosure, discussion, and analysis. Effects of the proposed action have been discussed either in the physical, biological, and/or social-cultural sections of this EIS. See the Table of Contents for specific topic listings.

L-0004.004

See response L-0003.003.

L-0004.005

The EIS acknowledges and evaluates the effects of small oil spills (less than 1,000 barrels) in the analysis of routine activities for each of the sources (See Section IV.B).

The Department of the Army permit authorizing work associated with the Northstar Project required the permittee to design, construct, install during pipeline-trenching activities, and operate and maintain a prototype oil-spill leak-detection system external to the carrier pipeline to detect an oil spill below the 100-barrel-per day threshold-detection limit in the EIS. Since the Northstar EIS was distributed, BPXA installed the LEOS leak-detection and -location system, which is manufactured by Siemens. During construction, a semipermeable tube, which allows hydrocarbons at the molecular level to enter the tube, was buried next to pipeline. This system is operational and, every 24 hours, it samples vapors collected from outside the entire length of the buried subsea oil pipeline. These vapors are then analyzed for the presence of hydrogen. This system is sensitive to quantities of oil less than a barrel and detects them in less than 24 hours. This technology has been available for more than 20 years and has been used successfully in Europe.

L-0004.006

See response L-0003.005.

L-0004.007

The EIS evaluates the effects of offshore oil and gas leasing to all of the biological resources (caribou, bowhead whales, fish, polar bears, and migratory birds) noted by the Ocean Conservancy letter. The potential effects of OCS leasing to these and marine and terrestrial resources were fully evaluated, and those risks are identified in Section IV.C. That analysis did not determine that any effects to the resources they listed would exceed the NEPA level of significance (see Section IV.A and Table II.A-4).

See Response L-0001.012 for a reply to your comment regarding an Arctic National Wildlife Refuge deferral.

L-0004.008

The MMS believes that most brant-molting areas, particularly those that host significant numbers of individuals in the Teshekpuk Lake area, are sufficiently removed from marine waters that substantial contact by an offshore oil spill is unlikely. Also, marine waters adjacent to most nesting colonies and molting areas lie in the Midrange or Far zones where relatively little development is likely to occur and, thus, the probability of a spill is low. For the same reason, transportation activity and associated potential for disturbance in these areas is likely to be very low. In addition, ITL No. 4 on Bird and Marine Mammal Protection (see Section II.H.3) advises lessees that aircraft flying in the vicinity of wildlife concentration areas (maps and figures are available showing locations) should maintain at least a 1-mile horizontal distance and at least a 1,500-foot altitude from known or observed wildlife concentration areas. The ITL No. 5 on River Deltas advises lessees that shore-base facilities may be prohibited on certain river deltas, including the Colville River Delta, where some brant nest and molt.

L-0004.009

Leasing and exploration activities are not expected to occur in the spring lead system near Barrow as a result of this lease sale, particularly during the bowhead whale spring migration. In their May 25, 2001, Beaufort Sea Biological Opinion, the National Marine Fisheries Service stated that an additional and separate consultation under Section 7(a)(2) of the Endangered Species Act would be necessary if leases are issued in that area and technology is developed that allows for exploration activities during this period. This will ensure that bowhead whales are protected without excluding the area from leasing.

L-0004.010

The MMS recognizes that the Beaufort Sea is a productive and sensitive area and has a very unique environment. However, oil and gas exploration and production have been successfully and safely conducted in other areas of the world where the environments are equally productive and sensitive and unique in their own right. The Gulf of Mexico Region is an extremely productive ecosystem and also is very sensitive to changes introduced by the oil and gas industry. The area is home to endangered and threatened species and supports a huge fishing industry. However, these situations have been addressed through a comprehensive regulatory process and through site- and situation-specific mitigation. The United States has the most rigorous regulatory regime for protection of the environment from potential impacts related to offshore oil and gas activities than any other country. One of the most serious threats to the offshore is the potential for oil spills from tankers importing oil from foreign countries. Domestic exploration and production is needed to lessen this very real threat.

The MMS is confident that this area can be explored and developed safely while protecting the marine resources and the subsistence lifestyle of the local inhabitants.

B. Kostival
385 Main St., Apt. 313
Rockland ME 04841
207-596-0193 bckost@yahoo.com

L-0005

RECEIVED
AUG 7 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 E 36th Ave., Rm. 308
Anchorage, AK 99508-4363

August 2, 2002

Dear Director Goll,

I am writing to oppose the 5-year plan for offshore leases on the Outer Continental Shelf Region approved last year by the Minerals Management Service. I am extremely concerned the plan will not adequately protect the Beaufort Sea and North Slope environments.

Offshore lease sales jeopardize the integrity of the wilderness, wildlife and coastal habitats of the Arctic Refuge and Teshekpuk Lake as well as the marine ecosystem itself. Offshore exploration and development would cause pollution, aircraft and vessel noise and related industrial activity, and potential spills. .001 Failure of four field tests showed industry's inability to contain and clean up an oil spill in Arctic waters during most of the year. .002 Oil spills pose great threats to endangered bowhead whale migration and feeding areas, polar bear habitat, migratory bird, fish and other sensitive environments. .003

In the future, there would be intense pressure to construct sprawling onshore airports, pipelines, roads, docks, and other support facilities within the Arctic Refuge. The last Beaufort Sea lease sale 170 set a precedent of not leasing off the coast of the Arctic National Wildlife Refuge. At that time, the Interior Department cited among many reasons, the lack of information on cumulative impacts on the refuge, emergency response plans, and sub-sea pipelines. That lack of information still exists. .004

The Beaufort Sea is home to polar bear, walrus, seals, migratory birds – including the Pacific black brant, threatened spectacled and Steller's eiders and the endangered bowhead whale. Oil spills in this harsh ice-dominated environment, would have a severe impact on many of these species – particularly on the bowhead whales during migration east of Barrow and offshore the Arctic National Wildlife Refuge and on black brant during molting along the coast in the Teshekpuk Lake area of the NPRA. .005

Industry has not yet developed failsafe means of cleaning up oil spills in the Beaufort Sea during most of the year (especially during break up). Moreover, a maximum of 10 – 15% of spilled oil is ever "cleaned up", even in much less severe climates. Combined, these facts suggest that the risks to the above species and sensitive areas are too great to allow new lease sales to go forward. .006

The Minerals Management Service (MMS) has developed a recent history of not leasing and/or deferring the sale of lease tracks off the coast of the Arctic National Wildlife .007

Refuge and the Teshekpuk Lake area of the NPR-A. These deferrals have occurred due to the sensitive nature of the areas, the high environmental risks associated with development of these areas, and overwhelming public opposition to these leases. .007

Amazingly, only a single environmental impact statement was drawn up for the three proposed lease sales in the Beaufort Sea – one report for an area covering nearly 10 million acres! These areas should not only be deferred but PERMANENTLY deleted from the current and futures sales. .008

Domestic offshore drilling is not the correct way to decrease our reliance on oil imports. The US has only 3% of global oil reserves while accounting for 25% of the world's oil consumption. The US will never drill its way to energy security and independence, even if every last drop of oil is drilled from federal waters off the coast of Alaska. In fact, the expansion of development into frontier areas such as the Beaufort Sea encourages this dependence. .009

Instead, to decrease our reliance on all oil, not just imported oil, the United States should halt offshore leasing and focus its efforts on improving energy conservation and energy efficiency and shifting toward the use of more alternative, renewable energies.

The three lease sales are expected to be held sequentially, not simultaneously, so should there be three full public EIS processes held sequentially. In this way, each EIS will reflect the most current knowledge, experience and technology at the time - not reflect outdated information, as may be the case when using this current EIS process for a lease sale not set to begin for 5 years. .010

In addition, by holding separate EIS's sequentially, the public will be a more active and informed part of the process - focusing their attention of each sale individually and basing their comments on the immediate situation for each sale.

Sincerely,

Ben Kostival

MMS Response to Comment Letter L-0005

L-0005.001

See Response L-0003.001.

L-0005.002

See Response L-0003.003.

L-0005.003

The EIS recognizes the potential threats that oil spills pose to bowhead whale migration and feeding areas; polar bear habitat; and migratory bird, fish, and other sensitive environments. See Section IV.C - Analysis of Effects by Alternatives on the following resources: IV.C.3 - Fishes; IV.C.4 - Essential Fish Habitat; IV.C.5 - Endangered and Threatened Species, including bowhead whales; IV.C.6 - Marine and Coastal Birds; IV.C.7 - Marine Mammals, including polar bears; and IV.C.9 - Vegetation and Wetlands.

L-0005.004

See Response L-0003.004.

The EIS assesses the effects of large oil spills (Section IV.C) and very large oil spills (Section IV.I); however, it does not assess the effects of a massive tanker spill such as the *Exxon Valdez*. Additional information on the effects of the *Exxon Valdez* oil spill has been added to Section IV.C.2 on Lower Trophic-level Organisms. The additional information notes the decade-long persistence of *Exxon Valdez* oil in Prince William Sound shoreline sediments.

L-0005.005

The EIS recognizes the potential threats that oil spills pose to endangered bowhead whales, polar bears, walruses, seals, and many species of migratory birds, including brant and the threatened spectacled and Steller's eiders and their habitats. See Section IV.C - Analysis of Effects by Resource and Alternative: IV.C.5 - Endangered and Threatened Species, including bowhead whale and threatened eiders; IV.C.6 - Marine and Coastal birds, including brant; and IV.C.7 - Marine Mammals, including polar bear, walrus. and seals for a detailed analysis of potential effects of oil and gas development on these species. Routine activities associated with such developments are not likely to result in significant adverse effects on birds or marine mammals.

Overall, the chance of one or more spills occurring and entering the offshore waters is 8-10%, and the chance of one or more spills occurring and contacting resource areas important to these species is lower, on the order of 2% or less.

L-0005.006

See Response L-0003.003.

Overall, the chance of one or more spills occurring and entering the offshore waters is 8-10%, and the chance of one or more spills occurring and contacting resource areas important to these species is lower, on the order of 2% or less. We recognize that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. For some stakeholders, such as the commenter, a 10% chance of a large spill over the life of the field may be considered high.

L-0005.007

The area offshore of the Arctic National Wildlife Refuge has been deferred from some of the past OCS oil and gas lease sales in response to concerns related to the bowhead whale and the potential for this area to be an important feeding area during their fall migration. The area offshore the Refuge has been offered and leased in four of the seven previous Beaufort Sea OCS lease sales, and exploratory activity has taken place with no significant impacts to the area of the bowhead whale's fall migration. LGL Ltd. environmental research associates recently completed a study entitled *Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information*. The study indicates that the population of bowhead whales derives an estimated 2.4% of its annual energetic requirements in the eastern Alaskan Beaufort Sea in an average year. In 1 of 5 years of study, the population may have derived 7.5% or more of its annual energetic requirements from the area. Use of the study area varies widely in time and space, depending on the availability of zooplankton and other factors. Information from this study has been included in the EIS in Section III.B.4.a. In addition, further information will be gleaned from continuing monitoring programs.

The MMS is offering this area in the current proposal to include mitigating measures that effectively address remaining concerns. The stipulation on Industry Site-Specific Bowhead Whale-Monitoring Program provides site-specific information about the migration of bowhead whales. The stipulation on Subsistence Whaling and Other Subsistence-Harvesting Activities helps reduce potential conflicts between subsistence hunters and whalers from oil and gas activities. It helps reduce noise and disturbance conflicts during specific periods of time important to the subsistence-whale hunt, such as the annual spring and fall whale hunts. The consultations required by this stipulation ensure that lessees, including contractors, consult and coordinate events including both the siting and the timing with subsistence activities. This stipulation applies to exploration and development and production activities.

The area offshore of the Teshekpuk Lake area has been offered and leased in five previous OCS lease sales, and exploratory activity has taken place with no significant impacts to the area. The most recent sale, Sale 170 in 1998, did not include this area, because the sale was configured as a small sale focused only on the central portion of the Beaufort Sea.

L-0005.008

As explained in both the process and introduction sections of this EIS, the MMS followed NEPA guidelines and agency regulations in covering these three lease sales in one EIS. With each successive lease sale, full NEPA review and public comment periods will be held. If an Environmental Assessment (NEPA documentation) finds that further analysis is needed beyond the initial EIS, a supplemental EIS will be written to cover the missing analysis.

L-0005.009

See Response L-0001.002.

L-0006

IÑUPIAT COMMUNITY of the ARCTIC SLOPE

an IRA Regional Tribal Government

[illegible] Box [illegible] • Barrow, Alaska [illegible]
Ph: [illegible] 888 788 4227 Fax: [illegible]

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

RECEIVED
AUG 2 1 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

James Q. Patkotak
Natural Resources Department
Inupiat Community of the Arctic Slope
P.O. Box 934
Barrow, Alaska 99723

To whom it may concern,

First of all, my names is James Patkotak, I work for the Regional Tribal Government, Inupiat Community of the Arctic Slope and our job is to advocate and assist all membership with their concerns especially the health & welfare for this generation, and more generations of the Inupiat to come.

With that in mind, I will comment on the Beaufort Sea Multiple Sale Environmental Impact Statement reinforcing the concerns brought out by individuals at public hearings in which the Inupiaq Nation is starting to realize that MMS and other organizations are ignoring our plea's to not invade our subsistence hunting grounds, especially the sea.

In talking with leaders around Barrow & our surrounding North Slope Villages, that MMS has certainly heard many times of these concerns and comments since these lease sales began and here are some of the main concerns that I will speak on behalf of our membership in which I am proud to be a member of and work for.

Mitigative measures; this concern is, we feel that the oil industry can live with slowing down or take mitigative measures on exploration and developmental activities on the sea and that the coastal communities are in much more favor of on-shore development with responsible activities by the oil industry. If there is a need for additional energy sources to be extracted from off-shore, perhaps directional drilling can be put to practice. .001

Bonafide plan/contingency plan; the E.I.S. for sales 186, 195 & 202 is very well put together with possible mishaps in mind and that I commend MMS with the plan. What I hear when I am out and about with conversations pertaining to off-shore explorations off of our coast, the people that I talk with says the same thing over and over about the industry lacking a bonafide plan for cleaning up mishaps on the ice infested seas. We believe that clean up would be time consuming, if not impossible and the procedure of a thorough clean-up would be slowed down due to cold weather, etc.We have heard in these public hearings that there are "preventative" plans in place, but are we guaranteed that they will work properly and quickly before our waters and air are contaminated. .002

Endangered species; More than once, we have heard and came to facts that the Spectacled eider and Stellar's eider are currently under the threatened status according to the Fish & Wildlife Service studies, and shall we also contribute to the endangered species of the bowhead whale by permitting the oil industry to develop off-shore oil rigs regardless of preventative measures taken? I think not! Because we as Inupiaq depend on the bowhead whale as a supplement to our diet as it has been for thousands of years, and our lives have centered around this Great Whale traditionally and culturally, and we will continue to defend our "garden" which is the sea in order to keep a strong hold to our identity and reputation as the Bowhead Whale Hunters of the North. .003 Also, the fish species, Arctic Cisco is not as abundant as it has been in the past and that is of a concern to us also, being that the proposed sales of 186, 195 & 202 will no doubt have a negative impact in our subsistence harvesting of this fish we love to consume and that, shall we as Inupiaq contribute to the endangerment of this species? We think not! .004

Traditional knowledge; In the Executive Summary of the E.I.S., as part of the scoping process, MMS has held government-to-government formally including public forum meetings seeking traditional knowledge of ice movement, animal behavior and the like, but the memberships comments and concerns of off-shore exploration activities has not been heeded after this knowledge has been sought. The following statement I will make, will not indicate that the people being impacted by the oil & gas industry are giving up the fight to keep our traditional ways, but if MMS does not even have consideration for the health & welfare in cases of oil spills on the Slope, why do you even bother to hold these public forums and such, to permit & develop oil production in our garden. .005

I will close for now, and thanks for this opportunity to comment.

James

James

Cc: Executive Director, Maggie Ahmaogak of the Alaska Eskimo Whaling Commission
Native Village of Pt. Hope President Rex Tuzroyluk
" " " Pt. Lay President Thomas Nukapigak
" " " Wainwright President June Childress
" " " Barrow President Patsy Aamodt
" " " Nuiqsut President Leonard Lampe
" " " Kaktovik President Isaac Akootchook
" " " Anaktuvuk Pass President Thomas Rulland
" " " Atqasuk President Elizabeth Hollingsworth

MMS Response to Comment Letter L-0006

L-0006.001

Directional-drilling technology is becoming more sophisticated, and some Federal tracts have been drilled from State leases. This EIS deals with a prediscovery situation. Should recoverable quantities of hydrocarbons be located, a developmental EIS will be prepared, which will have detailed mitigating measure that will be place and technology specific.

L-0006.002

The MMS closely scrutinizes all the oil-spill-contingency plans submitted for offshore activities to ensure that the operators meet the requirements of the Oil Pollution Act of 1990 and have provisions to address spill response in the challenging Beaufort Sea environment. The MMS regulations and requirements also demand that industry maintain an effective pollution-prevention program that mandates multiple backup systems to prevent the release of oil to the environment. The MMS regulations governing exploration and development operations on the OCS are designed to ensure that industry is using the best available and safest technology for their operations. The MMS ensures that blowout-prevention equipment is installed and maintained for the operation to be conducted, and that operational personnel are trained on the most current well-control procedures to prevent blowouts. The MMS conducts frequent inspections of OCS facilities to ensure that offshore operations are conducted as approved.

L-0006.003

There is no indication that disturbance from oil and gas exploration and development activities since the mid-1970's has had any significant effect on bowhead whales, either to individual whales or to the population. During the late 1970's, the 1980's, and early 1990's, numerous seismic surveys and exploratory drilling operations were conducted in the Beaufort Sea, some during the bowhead whale migration. The bowhead whale population has been steadily increasing at the same time that oil and gas activities have been occurring in the Beaufort Sea and throughout the bowhead whale's range. Major changes in the bowhead's migration route through the Beaufort Sea are unlikely to result from this noise, although some individuals may be temporarily diverted farther offshore. Overall, exposure to noise from oil and gas operations is not likely to cause any mortality to bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. More information on the effects of oil and gas activities on bowhead whales can be found in Sections IV.C.5.a and V.C.5.a.

There also is no indication that disturbance from oil and gas exploration and development activities since the mid-1970's has had any significant effect on spectacled or Steller's eiders, either to individual eiders or to the population, or any role in the decline of these two species. Although several possible reasons for decline have been suggested (for example, increased predation by gulls and foxes, presence of lead shot in feeding areas, and variable food supply in the wintering areas), there currently is no definite indication which, if any, are most important in causing the declines. Any oil spill during the postbreeding period in late summer and fall could cause mortality. However, most individuals do not stay to molt in the Beaufort Sea; many individuals may migrate from the area overland, and most of those migrating west along the Beaufort coast move through the area quickly. Thus, exposure of these eiders to a spill is likely to be relatively short term or not occur at all.

L-0006.004

In the course of naturally occurring events, fish populations are known to vary considerably from year to year. As is the case for any activity in or near fish-bearing waters, it is possible for oil and gas activities to affect some of the fishes in those waters. However, to the best of our knowledge, oil and gas activities to date have had no measurable effect on arctic fish populations.

L-0006.005

The MMS acknowledges the importance of traditional knowledge and the value of its government-to-government relationships with North Slope tribes. We believe that the best deterrent to any disaster is to build facilities and pipelines that will withstand the rigors of arctic ice and weather forces, and we believe that traditional knowledge and the concerns heard through government-to-government consultation have helped in our understanding of such designs, in the development of mitigation, and in supporting conflict avoidance agreements that minimize impacts. However, nothing is foolproof, and there must be contingencies for oil spills. There are subsistence impact funds administered by the Coast Guard under the Oil Pollution Act of 1990 legislation that would be available to provide for subsistence-food losses, but no escrow accounts or trust funds have been established.

Since 1995, the MMS has tried to take a more collaborative approach in its public involvement. The MMS has hired a community liaison person who spends a large part of his time maintaining contacts with local North Slope Native communities and ensuring that scoping and public meetings are scheduled to not conflict with local activities. We also are now writing executive summaries to our documents that we believe make projects easier to assess. We believe this cooperative approach has lessened the stress of our public involvement mandate and welcome suggestions on how to make it even better.

As an agency fully committed to consultation under the executive orders for environmental justice and government-to-government relations, the MMS believes that the Department of the Interior needs to seriously consider an appropriation to its annual budget that provides funding to assist tribal governments with training and travel funds to assist their participation in Department of the Interior planning and decisionmaking processes under these orders. Without funding, these executive orders are perceived as new “unfunded mandates.” This would be one way of lessening the stress caused by agency public meetings.

L-0007

RECEIVED
AUG 26 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

2200 S. 31st
Marion, Iowa 52302
August 18, 2002

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 E 36th Ave, Room 308
Anchorage, Alaska 99508

RE: Comments on the Off-shore leasing for the Outer Continental Shelf Draft EIS

Dear Mr. Goll:

We are concerned about off-shore leasing in the Beaufort Sea area off the coast of Alaska, and particularly the effect on the Arctic National Wildlife Refuge. .001

These off-shore leases will affect the wildlife that live off the coast of the Refuge. In fact, the entire marine eco-system in that area will be affected. Among the marine animals that depend on the Beaufort Sea near the Refuge are polar bear, bowhead whales, fish, and migratory birds.

Once exploration and development begin, the area will be subjected to pollution, noise from aircraft and ships, and potential oil spills or natural gas spills.

We do not believe that the potential for oil spills near the Refuge is acceptable. One only has to look to the Prudhoe Bay area to get an idea of the frequency of spills. In Prudhoe Bay there is an average of one spill of oil a day. Although Prudhoe is a land-based development while this project is for off-shore development, the off-shore environment is equally, if not more, challenging. .002

We are concerned that the oil industry will not be able to clean up any spills within the area of the Refuge. .003

We believe that there should be no leases of the shore of the Arctic National Wildlife Refuge. .004

Sincerely,

Pam Mackey-Taylor and Wallace L. Taylor

MMS Response to Comment Letter L-0007

L-0007.001

The MMS is considering two deferral alternatives (Alternative VI - Eastern Deferral and Alternative V - Kaktovik Subsistence Whaling Deferral (see Map 2 - Deferral Options) that would defer oil and gas leasing off the eastern half of the Arctic National Wildlife Refuge. If oil and gas exploration and development occurs off the Refuge, it would occur beyond 3 miles of the coast. Animals on the Refuge are not likely to be exposed to noise from air and vessel traffic associated with oil and gas activities that could occur beyond 3 miles of the Refuge's coastline.

The MMS recognizes the importance of the Refuge to polar bears and migratory birds and the importance of the marine waters off the Refuge for bowhead whales and fishes. See Sections III.B.2 - Fishes; III.B.3 - Essential Fish Habitat; III.B.4 - Endangered and Threatened Species (including the bowhead whale); III.B.5 - Marine and Coastal Birds' III.B.6 - Marine Mammals (including polar bears); Figure III.B-3e, polar bear den locations; and Map 8, the distribution of bowhead whale sightings off the Arctic National Wildlife Refuge. The MMS feels that the EIS adequately addresses potential impacts for fish, bowhead whales, migratory birds, and polar bears. A discussion of effects of the proposed action on these animals can be found in Sections IV.C.3, IV.C.5, IV.C.6, and IV.C.7.

Although potential oil spills could contact part of the coast of the Refuge, the probability of a spill greater than or equal to 1,000 barrels is low, at 8-10% (mean number of spills is 0.11; see Section IV.A.4a - Large Oil Spills). Numerous onshore spills have occurred on the Prudhoe Bay area oil fields and along the Trans-Alaska Pipeline System, but most of these spills have been small (average size of 3 barrels; see Section IV.A.4.b - Small Spills). The amount of activity expected to occur under Sales 186, 195, and 202 would be a small fraction of the amount of development ongoing in the Prudhoe Bay area. The MMS expects about a total of 8 production platforms in the entire Beaufort Sea Planning Area, while the onshore Prudhoe Bay fields include 89 production pads, more than 360 miles of roads, more than 500 miles of pipelines, and cover more than 7,120 acres (Table V-3). Most of the small spills that could occur offshore would be contained on the exploration and development pads and would not reach the marine environment.

The MMS will not be proposing to lease the shoreline area of the Arctic National Wildlife Refuge and will require oil companies operating on the OCS to comply with current environmental regulations to reduce the risks of spills and other pollutants from reaching the coast of the Refuge.

L-0007.002

For bowhead whales, the MMS receives comments on the draft EIS from the National Marine Fisheries Service to ensure adequacy on this endangered species. The MMS also consults with the National Marine Fisheries Service on possible effects to bowhead whales in the Beaufort Sea Planning Area. The MMS complies with the regulations on Section 7 consultations very closely. The Section 7 consultation process was ongoing during the review period for the draft EIS. A discussion of the consultation history for the proposed lease sale at the time the draft EIS was made available for public review can be found in Section IV.C.5 in the draft EIS. This section has been updated in the final EIS, and the complete Biological Opinion from the National Marine Fisheries Service is included in Appendix C.

See Response L-0007.001 for an additional discussion.

L-0007.003

While it is true that some fishes would be affected by activities associated with this lease sale, none of those activities is likely to have a measurable effect on fish populations.

L-0007.004

Routine activities associated with oil and gas development are not likely to result in significant adverse effects on birds or marine mammals. This is due in part to the relatively low densities of many bird species in offshore waters of the eastern Beaufort Sea, although some species are still quite abundant, particularly in nearshore waters. With regard to potential disturbance of birds from aircraft or vessels, the MMS has in place a mitigating measure advising lessees that vessels and aircraft should maintain at least a 1-mile horizontal distance separation from and aircraft an altitude of 1,500 feet above known or observed bird concentrations. What may be the principal source of adverse effect on birds is the presence of drilling and production structures or islands with which birds may collide. In an attempt to decrease the probability that this will become an important source of bird mortality, the MMS will cooperate with the Fish and Wildlife Service to develop lighting systems that could warn birds of the presence of such structures under conditions of low visibility. A research proposal to that effect is under review.

The occurrence of small accidental oil spills is not considered likely to be a major source of bird mortality because of the ability of industry to contain and/or clean them up, and the fact that the low volume of oil is not likely to contact substantial numbers of birds even if it reaches aquatic environments. A large spill is more difficult to contain and clean up quickly, so the developer is mandated to have readily deployable a number of bird-scaring devices known as Breco buoys. Tests have shown these noise-making devices to be quite effective at dispersing birds away from the area where they are deployed, in this case a spill area.

L-0007.005

Small spills do occur on a regular basis at Prudhoe Bay. However, most of these spills occur on either on the pad or into containment. Small spills offshore generally would occur on the gravel island and be cleaned up or spill into containment. We acknowledge your judgment regarding the value of the Arctic National Wildlife Refuge and your interest in protecting it from oil spills.

L-0007.006

The MMS has participated in the equipment and tactic demonstrations conducted by industry in the Beaufort Sea during 1999, 2000, and 2002, in conditions ranging from open-water, spring broken-ice, and fall freezeup conditions. The equipment, tactics, and personnel are capable of responding to an oil spill in all of these environments. The oil-spill-response demonstrations conducted to date have identified individual tactic limitations and have led to the addition of new tactics to improve effectiveness in broken-ice conditions. In an actual response situation, industry would be able to use every tool at their disposal; they would not be limited to a single skimming configuration but would mix and match tactics to most efficiently access oil in the environment.

The MMS believes that industry will be able to conduct a credible spill response regardless of the time of year. Industry has an extensive spill-response toolbox that includes mechanical response, in situ burning, and tracking capabilities. Research to improve oil-spill response is being actively pursued by both industry and MMS to add new tools and increase effectiveness of existing methods and equipment.

L-0008

August 26, 2002

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 E 36th Ave., Rm. 308
Anchorage, AK 99508-4363

Dear Mr. Goll:

I am writing to make comments on the draft EIS for lease sales in the Beaufort Sea.

Drilling in the Arctic Ocean and Beaufort Seas north of Alaska threatens the integrity of the wilderness and the wildlife in the marine and coastal ecosystems of this area. Drilling should not be permitted in this area.

If leasing is to proceed, it seems reasonable that individual EIS be produced for each of the three proposed lease sales, so that each area is considered carefully and appropriately and with current information. .001 In the past, leasing was postponed in the ocean north of the Arctic National Wildlife Refuge because, among other reasons, of concern about lack of information on the environmental impact of drilling, pipelines, and possible oil spills. .002

Sincerely,

Will Risser

William L. Risser, MD
3739 Drake
Houston, Tx 77005

MMS Response to Comment Letter L-0008

L-0008.001

See Responses L-0001.005 and L-0002.016.

L-0008.002

See Response L-0021.009.

During Session:
Alaska State Capitol
Juneau, Alaska 99801-1182
(907) 465-4833
Fax (907) 465-4586
1-800-782-4833
epresentative_Reggie_Joule@legis.state.ak.us

L-0009

During Interim:
P.O. Box 673
Kotzebue, Alaska 99752
(907) 442-3880
Fax (907) 442-3022

Alaska State Legislature
REPRESENTATIVE REGGIE JOULE

RECEIVED
SEP 1 1 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 4, 2002

Mineral Management Services
Alaska OCS Region
Attn: Mr. Paul Lowry
949 East 36th Ave.,
Anchorage, AK. 99508

To Whom it May Concern,

I am writing in regard to oil and gas lease sales 186, 195 and 202 in the Beaufort Sea. These proposed sales would occur in 2003, 2005 and 2007. I am joining the North Slope Borough in opposing these sales. However, first I would like to clarify a point. I am the elected official of District 37, an area that runs from the Canadian to the Russian border and contains most of the state's natural resources. I am writing this letter principally as the elected representative of the Inupiat people in my district that will suffer the most sever consequences from these proposed sales.

In spite of its extremely harsh climactic conditions, the Beaufort Sea is a delicate environment unlike anywhere else on earth. Here, where each season the polar ice cap locks against the northernmost shore of the continent, the Inupiat people have lived a subsistence lifestyle for thousands of years. Although the Inupiat generally favor oil and gas development and have been firm allies in the effort to open ANWR, we are keenly aware of the threat these offshore sales pose to the very existence of our ancient culture.

Subsistence activities, including the bowhead whale harvest, are an integral part of the Inuit culture. For us, hunting is not merely a way to get food. The hunt, and its related ceremonies, is what we do, and it defines who we are. It is central to our customs, and it is largely what sets us apart from other peoples. First and foremost, our way of life must be preserved, and this should be the first priority of the government when considering offshore leasing. In the past, industrial noise from oil and gas development has altered the distribution and migration patterns of the bowhead whale and other subsistence resources in our area. In the community of Kaktovik, industrial noise prevented the traditional harvest of bowhead whales for two seasons. The interrupted patterns of life caused the people of that village stress, anxiety, and depression. The people of our area vigorously oppose offshore leasing, wishing instead to preserve our way of life and our environment. Our views should be given serious weight in the consideration of this matter. .001

Offshore development in an area that is covered most of the year with polar ice is a bold adventure that has never been attempted before. It is difficult to understand the awesome destructive power, the speed, and the unpredictably of ocean ice when a person has not witnessed it directly. We are repeatedly told that the chance of an oil spill is "highly unlikely" or that there is a mere 8 to 10% chance of a major oil spill. However small the chance, this is not a risk we are willing to assume. The Arctic waters are home to a unique ecosystem and some rare species of animals. The total impact of an oil spill to the oceans food chain and the wide variety of animals it sustains is unknown and could have a detrimental impact to many species. We are unwilling to risk their existence and our way of life, when other sources of oil are readily available. The prevailing conditions of the area, including its remote location and its extreme, volatile climate limit the ability to mitigate spill damage. Even the industry admits that it is uncertain of its ability to clean up an oil spill. Nobody knows how one would even attempt to contain, much less clean up an oil spill among floating mountains of ice moving at great speeds in unpredictable directions. .002 .003

It is interesting to note that in the Lower 48 most offshore areas have been withdrawn from leasing by Executive Order or under a congressional moratorium. I do not question that these areas should be withdrawn from leasing, but I must wonder why our area is not deemed worthy of the same protection that the rest of the nation enjoys. Most recently, the federal government announced it would buy back oil and gas rights in the Everglades and in federal waters of the eastern Gulf of Mexico. Yet, at the same time, the federal government continues to pursue offshore leasing in one of the harshest climates on this planet, an area containing a unique and pristine environment. I believe this Arctic environment is at least as worthy of preservation as the Everglades. .004

In the event these unwise sales proceed over our objections, the deferral alternatives must be modified so that the subsistence harvest areas in Barrow, Kaktovik, and Cross Island are adequately protected. As currently proposed, the deferral alternatives are inadequate because it appears that they are erroneously based on harvest data alone. In order to sufficiently protect the bowhead whale harvest two areas must be protected. First, the area directly used by the subsistence whalers must be protected. Second, the area of influence must be protected. The area of influence is the area within which migrating whales could be affected by industrial activity, causing a change to their migration patterns. The proposed deferral alternatives need to be modified to accommodate the area of influence adequately for Barrow, Katovik, and Cross Island. .005

Additionally, MMS proposes to cover the three leases in a single EIS with only 5 assumed standard stipulations and 16 advisory clauses, even though there are many unknown conditions regarding offshore leasing in Arctic waters. The Northeast NPR-A sale in 1999 had 79 mitigating measures, and that was not an offshore lease in Arctic waters! An EIS should be developed and a Coastal Management Program Consistency Analysis should be conducted for each sale. Each of the three impacted communities
should be visited, appropriate meetings held, and public testimony heard. These leases represent a bold adventure with untested methods and high risks. They have the potential impact of changing a way of life that has existed for thousands of years. If the sales must proceed, every measure should be taken to insure that development is done right and that all possible mitigating measures are taken. .006

Moreover, the EIS should detail the cumulative impacts of all oil and gas activities on the North Slope. The proposed offshore oil and gas lease sales don't occur in isolation. In fact, more onshore exploration took place this last winter than at any time in decades. Development in the near term is likely from Pt. Thompson to the Brooks Range. The cumulative impacts from this .007

development on the environment, wildlife resources, and the residents of the North Slope needs to be determined. The North Slope Borough now pays for most of the cost of these impacts. The Borough covers an area approximately one-third the size of California. The Borough pays for search and rescue services, a police force, public assistance, crisis lines, shelters, substance abuse treatment, counseling, and much more. Many of these services are required because of the stress and anxiety brought on by past oil development, and the subsequent changes it brought too quickly to our small communities. To protect the public interests, the North Slope Borough hires lawyers, biologists, planners and other specialists to review and monitor the proposed lease sales and development, and it pays for the required travel to fully participate in the OCS process. The EIS should provide a detailed description of the ongoing costs to the Borough and local entities. This information should be a necessary component of the impact assessment and should serve as a means for identifying the appropriate level of impact assistance needed for the communities. .008

In the past, we have been reliable supporters of oil and gas development. Recently, we helped lobby for the development of ANWR, because we feel the benefits of responsible development there outweigh the risks. However, the Beaufort Sea and offshore development in Arctic waters remains an uncharted frontier for the oil industry, and it is a high risk and a high stakes enterprise. Many issues remain unresolved, and even the newest technology is not ready to perform in these Arctic Ocean conditions. The federal government and the industry needs to recognize that their actions in this matter have the potential, indeed the likelihood, of changing a way of life that has existed for thousands of years. The environmental risks represent not merely some impact on a species, but possibly the extinction of species. The stakes in this game are too high for us. Arctic offshore oil development should wait for another day, when technology is more advanced and able to cope with the extreme Arctic environment. If development is rushed into now, at the very least every appropriate mitigating measure must be taken to preserve the Inupiat culture and the Arctic environment. The Inupiat subsistence lifestyle and culture is a prize gem in our nation's collective heritage. When disturbing such a fragile rarity, at least some degree of caution and respect is called for. .009 .010

Thank you in advance for your thoughtful review of my comments.

Best Regards,

Reggie Joule

Representative Reggie Joule
District 37

Cc: Mayor George Ahmaogak, Sr.
Alaska Eskimo Whaling Commission

MMS Response to Comment Letter L-0009

L-0009.001

The MMS believes that its overall discussion of the importance of bowhead whaling to the Inupiat way of life does acknowledge its core cultural importance. We believe we have provided a clear and reasonable analysis of effects as they relate to Subsistence-Harvest Patterns, Sociocultural Systems, and Environmental Justice. We believe that no disproportionate high adverse effects would occur from routine leasing, exploration, and development on the Inupiat population. We believe such effects would occur in the event of a large oil spill, but we believe that such a spill is unlikely. In the event of a large spill, we believe that proposed mitigation and spill-cleanup response would mitigate some but not all potential effects.

Noise effects on Kaktovik's subsistence whaling in the past was done in an era before industry and the Alaska Eskimo Whaling Commission negotiated conflict resolution agreements to prevent such noise conflicts during critical hunting seasons. With such agreements in place since that time, similar disturbance to migrating whales has, thus far, been avoided. We believe that proposed mitigation and the ongoing dialogue between industry and the Commission can prevent such conflicts.

L-0009.002

Endicott was the first offshore development in the Arctic. Endicott started production in 1986 and has been operating for 16 years without a large oil spill occurring. The MMS understands that stakeholders have different values regarding spill probabilities. In Section IV.A.4, we state: "We recognize that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. For some stakeholders, a 10% chance of a large spill over the life of the field may be high. For purposes of analysis, we use the term "low" to mean on the order of 8-10% over the life of the Alternative I for Sales 186, 195, and 202 or their alternatives." We appreciate your clarifying your values regarding the chance of an oil spill occurring.

L-0009.003

See Response L-007.006.

L-0009.004

See Responses PH-Anchorage.005 and L-004.010.

L-0009.005

See Responses PH-Kaktovik.009 and L-005.007.

Excluding areas of the Beaufort Sea that have significant resource potential and industry interest at this stage of the process is premature. That is precisely the purpose of this EIS process. As new information from current studies, developing technology, and continuing monitoring programs becomes available, it will be incorporated into the decision process for all three proposed Beaufort Sea sales. Likewise, this EIS incorporates into its analysis mitigating measures that have been developed and refined over time and with the cooperation of the North Slope Borough, the Alaska Eskimo Whaling Commission, directly affected local communities, whaling captains, and the State. These mitigating measures include the stipulation on the Industry Site-Specific Bowhead Whale-Monitoring Program, which provides site-specific information about the migration of bowhead whales, and the stipulation on Subsistence Whaling and Other Subsistence-Harvesting Activities, which helps reduce potential conflicts between subsistence hunters and whalers from oil and gas activities through consultation efforts. These mitigating measures have been proven to lower effects. Additional opportunities for public review and comment continue throughout the sale-specific leasing process. If further analysis throughout the lease-sale process reveals the need to provide additional protection to areas offshore the Arctic National Wildlife Refuge, or areas adjacent to Alternatives III, IV, and V, they can be withdrawn or new mitigation measures identified.

L-0009.006

See Responses L-0001.006, L-0002.016, and L-0005.008.

In addition, EIS's for different sale areas, in this case for the National Petroleum Reserve-Alaska, which is an onshore area, would have different stipulations and advisory clauses than those for an OCS area. Each depends on the specific area being proposed for leasing, based on the unique physical, biological, and social-cultural attributes of the area under discussion. Under each 5-year OCS oil and gas leasing program, the Director takes a broad view of programs under consideration. Because political strategies and technologies change over time, a particular regulation in effect at one point in time may not necessarily be applicable to a future lease sale in the same general area. The MMS looks at all potential impacts that may arise out of a proposed lease sale and attaches stipulations and advisory clauses applicable to that sale; documentation of these actions are within the text of the final EIS.

L-0009.007

In the EIS, the MMS has attempted to identify and analyze the effects of the known projects of concern as detailed in Section V.B - Activities We Consider and Tables V-1 through V-15. While last year was a busy year for the North Slope, the net production and exploration success continues to decline. Pipeline capacity of 1.7 million barrels per day has dropped to 1.38 barrels per day and is expected to continue to drop, even with the increased level of activities. The major large fields on the North Slope have been discovered, and it will take a moderate-sized field such as Alpine or Northstar each year just to maintain the present volume of production.

We have attempted to systematically identify potential ongoing past, present, and reasonably foreseeable future cumulative effects. No attempt has been made to systematically downplay any effects.

L-0009.008

We address stress and anxiety in Section IV.C.12 - Sociocultural Systems. The commenter indicates that the North Slope Borough hires specialists to review and monitor proposed lease sales and developments and it pays for travel to fully participate in the OCS process. The MMS holds meetings in potentially affected villages at important steps throughout the prelease process so that individuals and representatives of entities do not have to travel. The commenter further indicates that the EIS should provide a detailed description of the ongoing costs to the Borough and local entities to review and monitor proposed lease sales. This comment is similar to that of the Mayor of the North Slope Borough (L-0035.043). Please see our response to that comment.

L-0009.009

The MMS appreciates and concurs with the commenter that the Inupiat subsistence lifestyle and culture is important. The MMS does believe that offshore oil and gas activities can be conducted in the Beaufort Sea in a safe manner that both protects the environment, including the subsistence lifestyle, and allows for development of domestic oil and gas resources. The existing offshore Northstar and Endicott development projects are good examples how offshore oil and gas development can be accomplished in a safe and pollution-free manner.

L-0009.010

See Response L-0009.001.

RECEIVED
SEP 16 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

L-0010

215 Fox Lane
POB 374
Chestertown, N.Y. 12817
Sept. 9, 2002

Mr. John Goll, Regional Director
Alaska OCS Region
Minerals Management Service
949 E 36th Ave, Room 308
Anchorage, AK 999508-4363

RECEIVED
SEP 16 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Dear Mr. Goll,

I am writing to comment on the three proposed federal lease sales in the Beaufort Sea. I am very much opposed to any new oil and gas leasing across America's Arctic Coast. I feel offshore lease sales jeopardize the integrity of the wilderness, the wildlife and coastal habitats of the Arctic Refuge and Teshekpuk Lake. Oil spills pose great threats to this sensitive area. Industry has not yet developed a failsafe means of cleaning up the Beaufort. Therefore, PLEASE SUPPORT ALTERNATIVE # 2 NO ACTION. Please protect this wilderness. .001

Thank you for your time and consideration.

Sincerely,

Kathleen Roberts

Kathleen Roberts

MMS Response to Comment Letter L-0010

L-0010.001

See Response L-007.006.

RR1, Box 326C
Ellwood City, PA 16117

L-0011

September 12, 2002

RECEIVED
SEP 16 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. John Goll
Regional Director
Alaska OCS Region,
Minerals Management Service
949 East 36th Avenue, Room 308
Anchorage, AK 99503-4363

Dear Mr. Goll:

.001 We are concerned about plans for three oil and gas lease sales in the Beaufort Sea stretching from the Canadian border nearly to Barrow. We oppose this plan. Offshore lease sales jeopardize the integrity of the wilderness, wildlife and coastal habitats of the Arctic Refuge and Teshekpuk Lake as well as the marine ecosystem itself. Offshore exploration and development would cause pollution, aircraft and vessel noise and related activity and potential spills

.002 Due to proven lack of ability to clean up oil spills in the Beaufort Sea most of the year, the risks to bowhead whales, polar bears, migratory birds, and subsistence resources are too great to allow new leasing in this sensitive area.

.003 Areas that were deferred or deleted from past Beaufort Sea Sales, including the area north of the coast of the Arctic National Wildlife Refuge and the National Petroleum Reserve-Alaska, and the spring lead system should be permanently removed from the lease sales. None of the environmental impact statement (EIS) alternatives address concerns about potential harm to these areas.

Alternative 2, No Action, is the only alternative that addresses concerns about oil spill risks and impacts to the Arctic National Wildlife Refuge and Teshekpuk Lake (NPR-A) coastline

.004 A full public EIS process, complete with hearings, should be conducted for each lease sale that is held.

Sincerely,

Kimberly Donovan

Kimberly Donovan

Bruce Hazen

Bruce Hazen

MMS Response to Comment Letter L-0011

L-0011.001

The letter explains that offshore exploration and development would cause pollution, noise, and potential spills. The effects of all of these factors–pollution (routine discharges), noise (routine disturbance), and potential spills–are assessed in Section IV and restated in the Executive Summary.

L-0011.002

See Response L-0007.006.

L-0011.003

See Responses L-0021.009, L-0012.001, L-0035.003, and L-0035.005.

The Proposal and the alternatives analyzed in the EIS address concerns and potential risks to the environment and lifestyles of the local communities, and that the mitigating measures developed and analyzed in the EIS minimize or reduce potential risks.

L-0011.004

See Responses L-0001.005 and L-0002.016.

L-0012

P.O. Box 766
Talkeetna, AK 99676
September 12, 2002

RECEIVED
SEP 18 2002
LEASING & ENVIRONMENT
MINERALS MANAGEMENT SERVICE

Mr. John Goll, Regional Director
Alaska OCS Region
Minerals Management Service
949 Ease 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. Goll:

These are my comments on Beaufort Sea Planning Area Sales 186, 195, and 202, Draft Environmental Impact Statement.

I urge you to select Alternative 2 (No Action). First, offshore oil leasing in the icy Beaufort Sea is fraught with enormous environmental risk and should not go forward. Second, the DEIS, because of its clear bias in favor of oil development, does not represent an adequate basis to support any of the leasing alternatives.

The environmental risk of oil exploration and development in ice bound waters is enormous. Risk to the marine ecosystems is why, years ago, the Bristol Bay leases were bought back, and it is bewildering to me that you can turn around and recommend offering leases in an even more risky area. .001 Even though a large spill may be unlikely [you seem to want to ensure the reader gets that point, feeling it necessary to use the words "unlikely" or "low probability" five times in the same paragraph, (ExSum 3)], the fact is, one will eventually occur and industry has no means to clean it up. .002 Field tests of spill clean up failed. Even in the best of circumstances, a very low percentage of spilled oil is recovered. I would guess zero recovery in the icy Beaufort Sea. .003

As with oil spills, the DEIS downplays every other environmental risk. You mention water quality, trophic-level organisms, essential fish habitat, bowhead whales, spectacled and Steller's eiders, marine mammals, and so on, but your impacts are always "potential", "temporary", "short duration", "localized", "could be affected", "recovery expected in about one year", etc. Your failure to adequately assess the environmental risk is actually quite stunning. .004

Along with risk, one, of course, also looks at reward. But, it appears that, as you have understated the risk, you have also overstated the reward. On page II-2, you state "for purposes of this analysis, we assume that 460 million barrels could be produced form each of these sales". On page II-3, you state "these models assume that leasing, exploration, and development are unrestricted by regulations or industry funding." In reality, there are regulations and the industry does incur development costs, and there is a significant difference between what .005

oil may be physically present in the lease area and what may be economically recoverable.

I read the article in the Anchorage Daily News (9-14-02, page D-1) which quoted you (John Goll) as considering the Beaufort Sea (among other places) a "geologist's dream". The article also described MMS Director Johnnie Burton's enthusiasm about Alaska's off shore oil potential. In its zeal to develop off shore, MMS has lost sight of the environmental risk. .006

I, again, urge the no action alternative. Instead, I think you should take a look at the massive heavy oil deposits on state lands, known as West Sack. And, finally, if national security is truly the concern, as Ms. Burton indicates in the ADN article, then the policy response should start with serious investment in energy efficiency that will permanently reduce our dependence on vulnerable fuel supplies, whether they are foreign or domestic.

Thank you for this opportunity to comment.

Sincerely,

John Strasenburgh

MMS Response to Comment Letter L-0012

L-0012.001

The Department of the Interior is responsible for making OCS resources available to meet the Nation's energy needs and balance orderly energy resource development with protection of the human, marine, and coastal environment. The Secretary of the Interior makes OCS leasing decisions based on agency recommendations after weighing all the pertinent facts documented in EIS's, such as this EIS being prepared for the Beaufort Sea Planning Area. As part of the decisionmaking process, all comments and testimony received on the EIS are considered and analyzed, including local concerns and regional environmental conditions and constraints. New information from current studies, developing technology, and continuing monitoring programs that become available are incorporated into the decision process. The EIS also incorporates into its analysis mitigating measures as part of the proposal and the alternatives. Additional opportunities for public review and comment continue throughout the sale-specific leasing process. Further analysis of Sale 186 may reveal that additional areas will be withdrawn from the proposal prior to leasing or new or additional mitigating measures will be developed to provide needed protections to the natural resources and their habitats.

Also see Responses PH-Anchorage.005, PH-Anchorage.045, and PH-Kaktovik.042.

L-0012.002

Section IV.A.4 states "The MMS uses the term "low" to characterize the relative chance of a large spill occurring, and it is based on our familiarity with oil-spill rates and sizes. We recognize that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. For some stakeholders, a 10% chance of a large spill over the life of the field may be high. For purposes of analysis, we use the term 'low' to mean on the order of 8-10% over the life of the Alternative I for Sales 186, 195 and 202 or their alternatives."

Under the current estimates of past present and reasonably foreseeable production in the Beaufort Sea, MMS estimates a mean spill number of 0.65 (Section V, Cumulative Effects, Table V-12). Although a spill is possible it is not an absolute certainty that a large oil spill will occur over the 15-20 year life of the project and the surrounding cumulative development.

L-0012.003

The MMS has participated in the equipment and tactic demonstrations conducted by industry in the Beaufort Sea during 1999, 2000, and 2002, in conditions ranging from open water, spring broken ice and fall freezeup. The equipment, tactics and personnel are capable of responding to an oil spill in all of these environments. The oil-spill-response demonstrations conducted to date have identified individual tactic limitations and have led to the addition of new tactics to improve effectiveness in broken-ice conditions. In an actual response situation, industry would be able to use every tool at their disposal and would not be limited to a single skimming configuration but would mix and match tactics to most efficiently access oil in the environment.

The MMS believes that industry will be able to conduct a credible spill response regardless of the time of year. Industry has an extensive spill-response toolbox that includes mechanical response, in situ burning, and tracking capabilities. Research to improve oil-spill response is being actively pursued by both industry and the MMS to add new tools and increase effectiveness of existing methods and equipment.

L-0012.004

Mr. Strasenburgh comments that the failure of the EIS to adequately assess the environmental risk is quite stunning. However, the low level of environmental risk is consistent with the levels in the previous EIS's for Beaufort Sea lease sales, including Sales BF, 71, 87, 97, 124, and 170. The level is consistent with the levels in the EIS's on the proposals for the Northstar and Liberty developments. The level also is consistent with the environmental reviews for numerous State of Alaska nearshore lease sales.

L-0012.005

The oil-resource estimates assumed for purposes of environmental impact analysis are economically recoverable volumes. These estimates are derived from engineering and economic analysis models that include exploration, development, production, and transportation costs for oil delivered to West Coast markets. The economically recoverable estimates are far less than the total oil volume that could include subeconomic size pools. We apologize for any misconception regarding the statement “unrestricted by regulations or industry funding.” The models assume that the entire area is open for leasing, and subsequent exploration/development is not precluded by the inability to obtain necessary permits in a timely manner. This does not mean that current regulations will not be enforced. “Industry funding” refers to future investments. We cannot predict corporate strategies of unknown industry groups. This means that if companies chose not to commit funds to leasing and exploration in the Beaufort OCS, the full resource potential may never be realized. Industry costs for exploration and development are accounted for, should they choose to commit the funds.

L-0012.006

The MMS is well aware of potential environmental risks in the Beaufort Sea. The purpose of the EIS is to identify, analyze, offer mitigation to minimize risks, and quantify these risks to the coastal, marine, and human environments. These detailed analyses are made on the Proposal and the alternatives identified in the EIS. All comments received on the EIS are considered, analyzed, and either incorporated into the EIS or responses are provided in the final EIS. This information and recommendations are submitted to the Secretary for a final decision on which areas should be offered or deferred from leasing and which mitigating measures are adopted for the lease sale to minimize potential risks. The State of Alaska, Federal Agencies, and potentially affected communities are consulted prior to any final decisions; a consistency determination is prepared and sent to the State of Alaska and any overriding concerns or consideration of unresolved issues are addressed. We strongly believe that the MMS has not lost sight of environmental risks and works closely with constituents throughout the process. Through coordination, consultation, application of good science, and development of new studies and monitoring plans during operations, we trust the process works.

L-00013

September 16, 2002

RECEIVED
SEP 18 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. John Goll, Regional Director
Alaska OCS Region
Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, Alaska 99508-4363

RE: Comment on Beaufort Sea Proposed Lease Sales

Good Day:

.001 The Beaufort Sea is the home of many birds and marine mammals and should be protected at all costs. Offshore development and exploration would cause pollution, noise and potential spills. These spills could decimate the entire ecosystem as was evidenced in Prince William Sound. .002 The oil industry does still, not have in place, a viable method of cleaning up oil spills. The severity of the climate in the Beaufort Sea would make any clean up attempt even less successful than the small percentage that is now actually cleaned up in a spill.

.003 These risks to our environment should not be undertaken. The Arctic National Wildlife Refuge would be impacted with on land support facilities. This would be very bad. Sub Sea pipelines would impose even more risk. Polar bears, whales, migratory birds and our native people's way of life would be seriously threatened.

Please support **Alternative #2, No Action**. This is the only alternative that addresses concerns about oil spill risks and impacts to ANWR and Teshekpuk Lake coastline. .004 The three leases should not be all combined into one EIS process which covers 10 million acres, as these leases and their consequences are far too important to not be carefully evaluated.

Thank you for the opportunity to comment.

Sincerely,

Terry Cummings

Ms. Terry Cummings
6740 East 10th Avenue
Anchorage, Alaska 99504

MMS Response to Comment Letter L-0013

L-0013.001

Ms. Cummings comments that offshore development could cause oil spills that would decimate the entire ecosystem as was evidenced in Prince William Sound. The EIS describes the probable effects in the unlikely event of a large oil spill (Section IV.C) or a very large oil spill (Section IV.I). The assumed spill sizes are much smaller than the massive *Exxon Valdez* tanker oil spill in Prince William Sound. The use of tankers in the Beaufort Sea is not considered feasible.

L-0013.002

See Response L-0007.001.

L-0013.003

See Response L-0007.001.

L-0013.004

See Responses L-0002.016 and L-0005.008. In addition, The Oil-Spill-Risk Analysis has shown that impacts from an OCS oil spill are negligible to NPR-A onshore lands.

L-0016

RECEIVED
SEP 1 8 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 14, 2002

Mr. John Goll, Regional Director
Alaska OCS Region
Minerals Management Service
949 East 36th Avenue, Room 308
Anchorage, AK 99508-4363

Dear Mr. Goll:

I oppose the plans for new oil and gas leasing across Alaska's coasts. The activity from the operation of such leases will certainly jeopardize the integrity of the coastal and wildlife habitats. In addition, there is no proven ability to clean up oil spills in the Beaufort Sea during most of the year. .001

I also ask that for each separate lease sale, there be a full public EIS process, including hearings. .002

Thank you for you consideration in this matter.

Sincerely,

Jim Havlena

Jim Havlena
1040-C Los Osos Valley Road
Los Osos, CA 93402-3237

MMS Response to Comment Letter L-0014

L-0014.001

See Response L-0007.001 for concerns about the Arctic National Wildlife Refuge and Response L-0021.011 for concerns about the Teshekpuk Lake Area.

L-0014.002

See Response L-0013.002.

L-0015

RECEIVED
SEP 18 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Sept. 14, 2002

John Goll
Regional Director
Alaska OCS Region
Minerals Management Service
949 E. 36th Ave., Room 308
Anchorage, Alaska 99508-4363

Mr. Goll:

I ask that you oppose the plans for the new oil and gas leasing across Alaska's coasts. There is no proven ability to clean up oil spills in the Beaufort Sea during most of the year. Also, there will undoubtedly be damage to the sensitive and valuable coastal and wildlife habitats, and methods of a clean up have not been proven in these cold climes. .001

I also ask that for each separate lease sale, there be a full public EIS process, including hearings. .002

Please oppose these oil and gas leases along Alaska's coasts. Thank you.

Sincerely,

K. A. Beckwith

K. A. Beckwith
12001 Chaucer Rd.
Los Alamitos, Calif. 90720-4531

MMS Response to Comment Letter L-0015

L-0015.001

See Response L-0013.002.

L-0015.002

See Responses L-0001.005 and L-0002.016.

Public hearings were scheduled for the Beaufort Sea multiple-sale daft EIS in Kaktovik, Nuiqsut, Barrow, and Anchorage. Public hearing are not scheduled for subsequent Sales 195 and 202, because issues for all three sales were addressed under the original umbrella EIS.

L-0014

Sept. 14, 2002

Mr. John Goll, Regional Director
Minerals Management Service
949 E. 36th Ave., Room 308
Anchorage, AK 99508-4363

RECEIVED
SEP 1 8 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. Goll,

I ask that you oppose any new oil and gas leases across Alaska's coasts. The wildlife and coastal habitats of the Arctic Refuge and Teshekpuk Lake would be in danger of damage from noise, pollution, spills, etc. .001

And there are no proven methods for a clean up of a spill in these areas during the very cold times of the year. .002

Thank you for your support in this matter.

KA Havlena

K. A. HAVLENA
1188 5TH ST.
BAYWOOD PARK, CA 93402-1208

MMS Response to Comment Letter L-0016

L-0016.001

See Response L-0013.002.

L-0016.002

See Response L-0015.002.

Fax Cover Sheet

L-0017

kinko's

1050 Broadripple Avenue
Indianapolis, IN 46220
Tel: (317) 251-2406
Fax: (317) 251-2503

Date: 9/19/02

To: Mr John Goll

Company: Minerals Management Service

Fax: 907-271-6805

From:

Company:

Tel:

Number of pages including this one:

Comments:

~ON THE PROPOSED OIL AND GAS LEASE SALES IN THE BEAUFORT SEA

Dear Mr. Goll,

We are writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, we strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

RECEIVED
SEP 19 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year. .001

We are also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge. .002

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and we encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

Sincerely,
The Undersigned

Name (SIGNED NAME) Home Address

Monika Schultz 2426 Borgman Court Indpls., IN 46229
Sara Bales 1513 Park Vista Court Indpls., IN 46229
Becky Morrow 1388 W 400 N Greenfield, IN 46140
Melanie Sherwinski [signature] 2241 Cowan Ct. Schererville, IN 46375
Katie Yoeke 2991 Homestead Dr. Edgewood, KY 41017
[signature] Emily Peeler 116 HeHimville Rd Bedford, IN 47421

Print name / ~~Name~~	Sign name	Home Address
Helen Straight	[illegible]	1195 Cimarron St louis MO 63132
Jessie Sutton	[illegible]	6101C Georgetown Rd 46254
Ryan Lancaster	[illegible]	131 N. Hager Ave Barrington IL 60010
Darcy Engh	[illegible]	9852 E. Troy Ave Indpls, IN 46239
Kristen Moreno	[illegible]	1[illegible] Detroit Blvd. S Lake Orion, MI 48362
Cathy Barron	Cathy Barron	121 Pleasant Ridge Dr.
Maralee Muscato	Maralee Muscato	1922 Sussex Dr. Bloomington, IN 47401
Chris Ind[illegible]	[illegible]	6906 Longman Ct. Louisville, KY 40207
Katy King	Katie King	1964 CR 66 Auburn IN 46706
Amanda Sharp	[illegible]	PO Box 9160 Middlebury, IN 46540
GRACE MIAZGA	[illegible]	2251 Monroe Ave. Cinti OH 45212
Andrew Wistanski	[illegible]	1201 (N) 3rd St. Wausau WI 54403
Sonnet Gabbard	[illegible]	599 W. Westfield Blvd. Indpls, IN 46208
Stephen Weathers	Stephen Weathers	275 N. Smith pk Rd Blgtn IN 47404
Rachel Islar	Rachel Islar	9985 Hickory Ridge Dr. Zionsville IN
Rachel Richardson	[illegible]	750 West Hampton Indianapolis In
Claire Castania	Claire Castania	3140 Wild Dunes Path Stevensville [illegible]
Jane Breck	Jane Breck	2579 Ravine Way Stevensville MI MI 49127
Marshay Allen		750 West Hampton Drive
JARED PERSINGER	[illegible]	610 W. HAMPTON DR
Angela R. Crull	Angela R. Crull	3934 Kimberly Indpls IN 46222
Nicholas R. Berkeley		629 W. Hampton
Scott Swanson	Scott H. Swanson	6512 Caroline Street; Indianapolis 46220
Marissa Rinehart	Marissa Rinehart	6265 Adams Blvd. W. Dr. Apt. F Indpls IN 462
Christine Faulkes	[illegible]	750 W. Hampton Dr, Indianapolis I
Nic Winters	[illegible]	4200 Haughey Ave, Indianapolis, IN
Annie Sheltz	[illegible]	5110 W. 15th St. Indpls, IN 46224
Kristy Guthrie	[illegible]	599 W. Westfield Blvd, indpls IN 4620
Donna Marsh	[illegible]	630 W. Hampton Dr, Indianapolis
Abby Pickens	Abby Pickens	831 W. Hampton Indianapolis
Ginny Wehdi	Ginny Wehdi	144 W. 49th St., Indy, IN 46208
Liz Sidley	Liz Sidley	6719 Waverly Apt 2A, indy, IN 46
AMANDA SEWELL	Amanda Sewell	7075 W 600 S, Topeka IN 46571
Ryan Scanlan	Ryan Scanlan	2245 Allegany Drive Naperville, IL 60565
Tony Smith	[illegible]	2425 E. Division 46022 [illegible] IN
Ray Biederman	Ray Bieder[illegible]	11738 [illegible] Ct Orland Park IL 60467
Tara Benz	Tara Benz	4301 W. Boehning St. Indpls, IN 46219

MMS Response to Comment Letter L-0017

L-0017.001

See Response L-0013.002.

L-0017.002

See Response L-0007.001.

L-0018

RECEIVED
SEP 19 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

P. O. Box 264
Dundee, Florida 33838
September 15, 2002

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 East 36th Ave. Room 308
Anchorage, AK 99508-4363

Dear Mr. Goll,

I am concerned about the proposed lease sales 186, 195 and 202 in the Beaufort Sea and would urge you to support Alternative 2, No Action, as it is the only alternative that addresses concerns about oil spill risks and impacts to the Artic National Wildlife Refuge and Teshekpuk Lake coastline.

This is a very sensitive area to bowhead whales, polar bear and migratory birds and would be a detriment to their survival. This is too great a resource to allow new offshore leasing which would put the survival of these species in jeopardy. .001

Thank you for your consideration of this matter.

Respectfully,

Jenny Jacobs

Jenny Jacobs

MMS Response to Comment Letter L-0018

L-0018.001

The EIS describes in detail the Beaufort Sea's importance to bowhead whales in Section.III.B.4.a(1), to polar bears in Section III.B.6.e, and to migratory birds in Sections III.B.4.a(2) and III.B.5.

L-0019

Amy & Chris Gulick
44521 SE 166th Street
North Bend, WA 98045
(425) 888-3835 Voice
(425) 888-5278 Fax
amyg@nwlink.com
www.amygulick.com

RECEIVED
SEP 1 9 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 15, 2002

Mr. John Goll
Regional Director
Alaska OCS Region
Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Re: Beaufort Sea Lease Sales

Dear Mr. Goll:

We are writing to ask you to please not allow offshore lease sales in the Beaufort Sea for the following reasons.

· Due to proven lack of ability to clean up oil spills in the Beaufort Sea most of the year, the risks to bowhead whales, polar bears, migratory birds, and subsistence resources are too great to allow new offshore leasing in this sensitive area. .001

· Areas that were deferred or deleted from past Beaufort Sea Sales, including the area north of the coast of the Arctic National Wildlife Refuge, and the National Petroleum Reserve-Alaska, the fall bowhead whale feeding grounds and migratory route, and the entire spring lead system should be permanently removed from the lease sales. None of the EIS alternatives address concerns about potential harm to these areas. .002

· Please support Alternative 2, No Action, because it is the only alternative that addresses concerns about oil spill risks and impacts to the Arctic National Wildlife Refuge and Teshekpuk Lake (NPR-A) coastline.

· MMS is inappropriately lumping three lease sales into ONE Environmental Impact Statement (EIS) Process covering approximately 10 million acres. As these three sales are expected to be held sequentially, not simultaneously, so should there be three full public EIS processes held sequentially. In this way, each EIS will reflect the most current knowledge, experience and technology at the time - not reflect outdated information, as may be the case when using this current EIS process for a lease sale not set to begin for 5 years. .003

Thank you.

Sincerely,

Amy & Chris Gulick

Amy and Chris Gulick

MMS Response to Comment Letter L-0019

L-0019.001

See Response L-0013.002.

L-0019.002

The rationale for the alternatives is explained in Sections II.D, II.E, II.F, and II.G. These sections include summaries of the effects for each alternative. Also, the introduction to Section III explains that the effects of leasing in part or all of these areas were assessed previously in the EIS's for Sales BF, 71, 87, 97, 124 and 170.

L-0019.003

See Response L-0001.005.

This process is discussed in the section titled Overview and General Information and in Section I.A - Purpose, Need, and Description of the EIS.

ALASKA OIL & GAS ASSOCIATION
121 W. Fireweed Lane, #207
Anchorage, AK 99503
(907)272-1481
Fax: (907)279-8114
Judith Brady, Executive Director

AOGA

L-0020

RECEIVED
SEP 2002

REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Fax

To: Mr. John Goll
Minerals Management Service
(907)271-6805

From: Judith Brady

Pages: 3 (including cover)

Date: 9/20/2002

If there are any problems with this transmission, please contact Tamara Sheffield @ (907)277-6494. Thank you.

AOGA Comments on Beaufort Sea Multiple Sale EIS for Sales 186, 195 and 202

Alaska Oil and Gas Association

AOGA

121 W. Fireweed Lane, Suite 207
Anchorage, Alaska 99503-2035
Phone: (907)272-1481 Fax: (907)279-8114
Email: brady@aoga.org
Judith Brady, Executive Director

September 20, 2002

RECEIVED
SEP 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. John Goll, Regional Director
Alaska OCS Region
Minerals Management Service
949 E. 36th Avenue #308
Anchorage, AK 99508-4363

AOGA Comments on Beaufort Sea Multiple Sale Environmental Impact Statement for Sales 186,195 and 202

Dear Mr. Goll:

The Alaska Oil & Gas Association (AOGA) is non-profit trade association whose 19 member companies account for the majority of oil and gas exploration, production, transportation, refining and marketing activities in Alaska. AOGA appreciates the opportunity to comment on the Beaufort Sea Multiple Sale Environmental Impact Statement for Sales 186, 195 and 202.

AOGA would like to compliment the Minerals Management Service for adopting the multiple sale environmental impact model for the Beaufort Sea sales. The multiple sale model is appropriate for those areas, like the Beaufort Sea, that have a lease sale history and have had extensive environmental analysis.

We would also compliment the Minerals Management Service on the thoroughness of this environmental analysis. It meets the letter as well as the spirit of the law and reflects MMS's commitment to environmentally responsible lease sales.

AOGA continues to be concerned about the consideration of new stipulations that add cost and/or risk of delay without adding additional environmental benefits. For that reason we do not endorse Stipulation 6 Permanent Facility Siting in the Vicinity Seaward or Shoreward of Cross Island; or Stipulation 7 Pre-booming Requirements for Fuel Transfers. We believe subsistence hunting of bowhead whale and water quality is securely protected through the five standard lease stipulations and, in fact, is and has been central to the environmental regulation of federal and state lease sales in the Beaufort Sea. .001

AOGA endorses Alternative 1 for all three sales with no deferral areas. We have been consistent in our comments to MMS that the lease sale goal in this area should be all available acreage. The standard mitigation measures related to oil and gas operations are intended to and do provide secure protection for subsistence hunting of the bowhead whale. .002

We also continue to urge MMS to consider incentives that will make the Beaufort Sea an attractive, competitive alternative to offshore areas throughout the world. We understand MMS is reviewing options toward this goal and we endorse that effort. .003

Finally, we continue to urge that MMS continue its initiative to have regularly scheduled and predictable OCS lease sales. With Alaska and the Gulf of Mexico as the only areas where federal offshore acreage is available for oil and gas leasing, it is particularly important that the lease sales scheduled in MMS's 5 Year OSC Leasing Program be held as scheduled. .004

Thank you again for the opportunity to comment.

Sincerely

Judith Brady

JUDITH BRADY
Executive Director

MMS Response to Comment Letter L-0020

L-0020.001

The MMS can appreciate industry concerns that new stipulations may add cost or delay to proposed OCS activities. Stipulations 6a, 6b, and 7 are additional mitigating measures developed for Sale 186 in response to concerns expressed during scoping.

Stipulations 6a and 6b are somewhat duplicative of standard Stipulation 5, in that they are both directed toward reducing potential subsistence conflicts between subsistence-hunting activities and oil and gas activities. They both require consultation and agreement between lessees and subsistence hunters before activities could proceed. However, Stipulations 6a and 6b would apply only to the permanent facility siting of an OCS production facility within key areas inside and outside the vicinity of Cross Island where subsistence whaling for Nuiqsut whalers occur.

Stipulation 7 was developed to reduce potential risks of an oil spill during fuel transfers by requiring oil-spill-containment booms around fuel barges during the bowhead whale migration. A similar procedure is part of the Northstar fuel-transfer plan. Stipulations 6a, 6b, and 7 are optional mitigating measures that the Secretary will consider in her balancing decisions regarding proposed sale configuration and environmental protection requirements. These stipulations were formulated to provide additional protection to specific blocks and within certain time periods during subsistence-hunting activities.

L-0020.002

The Secretary of the Interior decides whether to offer areas for leasing or to continue to exclude areas on a sale-by-sale basis.

L-0020.003

In early 2002, the MMS initiated an incentives task force designed to identify incentives that will make OCS areas a competitive alternative to other offshore areas around the world. It is anticipated that recommendations from this group will be considered for Beaufort Sea Sale 186 proposed lease-sale decisions.

L-0020.004

The Department of the Interior and the MMS recognize the need to have a predictable, reliable OCS leasing program. The OCS Lands Act requires that a proposed 5-year program be developed to provide a consistent timeframe for evaluation and public input into a proposed leasing program. It is important for the Government and all its constituents to be able to plan for and rely on leasing milestones of the proposed lease-sale process. The Administration and the Department are committed to adhering to a predictable and reliable OCS leasing program.

RECEIVED
SEP 2002
3:45
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

THE OCEAN CONSERVANCY
ALASKA CENTER FOR THE ENVIRONMENT
ALASKA COALITION * ALASKA CONSERVATION ALLIANCE
ALASKA WILDERNESS LEAGUE * ARCTIC CONNECTIONS
DEFENDERS OF WILDLIFE * EARTHJUSTICE
NORTHERN ALASKA ENVIRONMENTAL CENTER
SIERRA CLUB * THE WILDERNESS SOCIETY

L-0021

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363
Fax: 907-271-6805

RE: Comments on the Draft Environmental Impact Statement for the Beaufort Sea Planning Area, Oil and Gas Lease Sales 186, 195, and 202. OCS EIS/EA MMS 2002-029

Dear Mr. Goll:

Thank you for this opportunity to comment on the Draft Environmental Impact Statement for three Beaufort Sea Lease Sales (67 FR 41730-41731). These comments are submitted on behalf of our organizations, as listed above, and our members in Alaska and nation-wide.

The Interior Department proposes a series of 3 lease sales over the next five years in the Beaufort Sea stretching from the Canadian border nearly to Barrow. At 9.6 million acres each, these sales are 10 times the size of the most recent Beaufort Sea sale. This sharply contrasts with the past five-year program when Interior held only one lease sale in the Beaufort Sea located north of existing State oil fields and leases. This is also the first time the Interior Department plans to use one Environmental Impact Statement to cover three separate lease sales for the Beaufort Sea, despite the greatly increased geographic scope and pace of leasing. This streamlining severely curtails the opportunities for environmental review of the leasing program. .001

Our organizations and members are concerned about the sensitive marine and coastal environments at risk from the proposed oil and gas activities in the Beaufort Sea. This productive area supports endangered species like bowhead whales and spectacled and Steller's eiders; marine mammals including beluga whale, ringed seal and polar bear; fish such as Dolly Varden (Arctic char), and Arctic cod; millions of migratory birds; rare kelp communities; wilderness coasts of national treasures like the Arctic National Wildlife Refuge; productive wildlife habitats of Teshekpuk Lake area; and coastal residents whose cultures and subsistence depend on these marine resources.

The Beaufort Sea planning process must take into account these important values and ensure that the resources are managed in a sustainable way. It also must recognize the demonstrated lack of oil spill cleanup capability amidst broken sea ice and major risks to resources posed by large spills. As well, the Arctic is the frontline of climate change where severe impacts are already underway. The EIS must address the cumulative impacts associated with these changes, particularly the correlation between fossil fuel use and global climate change. The Minerals Management Service (MMS) must also comply with all applicable federal and state laws. As we outline below and in technical comments, the Draft EIS and planning process do not meet these requirements. Our organizations therefore support Alternative II (No Action).

We have commented previously on these issues. The Minerals Management Service has ignored the environmental impact issues we have raised, as well as those of local governments, tribal governments, local residents, and over 4,000 citizens opposing new offshore lease sales off Alaska's sensitive coasts due to demonstrated lack of oil spill cleanup capability and the critical values put at risk.[1] While Secretary Norton claims to base decisions on science and local community concerns, this proposed action demonstrates the opposite by reinstating massive sales like those launched by Secretary James Watt in the 1980's with severely curtailed public review. .002

Even after detailed written and oral testimony, we find that MMS continues to promote arctic offshore development plans that side-step or pay little regard to the fundamental associated dangers that we have detailed in prior comments. In addition, MMS does not provide a comprehensive alternative regarding energy efficiency and technologies such as solar, wind, and other alternative sources. .003

The Draft EIS understates the potential harm from offshore spills to polar bears, bowhead whales, threatened spectacled and Steller's eiders, and other wildlife populations and their habitats. .004 Furthermore, MMS continues to rely on the mitigation in the form of financial reimbursement for losses in the case of an offshore oil spill. This pays little respect to the national values of these coastal and marine resources and the effects on indigenous cultures that rely on an intimate association with the land and sea for more than economic values. .005

Thirteen years after the Exxon Valdez spill, the Prince William Sound's level of recovery is at best equivocal and oil is still present at toxic levels in many beaches. The Prince William Sound coastal and marine ecosystems as well as most species studied still have not fully recovered, according to the Exxon Valdez Trustee Council's scientific analysis[2]. In the harsh northern environment of the Beaufort Sea, far away from population centers, we can only expect that recovery would be correspondingly slower – maybe even longer than the proposed development scenarios and impact analysis portrayed by the DEIS, missing concerns that the mitigation to address these impacts is inadequate. .006

The DEIS systematically downplays negative environmental and human impacts from oil and gas exploration and development activities and infrastructure, and the cumulative impacts of

---

[1] Please incorporate by reference the thousands of public comments opposing new leasing in sensitive Alaska waters for the Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007 Draft EIS, including the letters submitted by The Ocean Conservancy et al. to the MMS, January 24, 2002 and Natural Resources Defense Council et al., February 1, 2001 and September 20, 2001; comments on the three Beaufort Sea Sales (Sierra Club et al. November 5, 2001); all public comments on Lease Sale 170 and cancelled Lease Sale 176 submitted in writing, at hearings, and at public advisory meetings by our organizations, local governments, tribal governments, the Alaska Eskimo Whaling Commission, local citizens, the U.S. Fish and Wildlife Service, and the Environmental Protection Agency; public comments submitted by our organizations, Greenpeace, the U.S. Fish and Wildlife Service and the EPA on the proposed Northstar and Liberty development projects, and the Warthog and McCovey offshore exploratory wells; and The Wilderness Society et al., October 2, 1997, Petition to the Secretary of the Interior for suspension and prohibition of operations and Activities on Federal Oil and Gas Leases Offshore of the Arctic National Wildlife Refuge.

[2] Exxon Valdez Oil Spill Trustee Council. 2002 Status Report. Available at www.oilspill.state.ak.us and provided with this testimony.

offshore and onshore development to the endangered bowhead whale, polar bears, other marine mammals, migratory birds, fish, wilderness, recreation, subsistence resources, cultural values, fresh water resources including the aquatic ecosystem, and the marine ecosystem. MMS's analysis techniques fail to address the central issues of concern to the public, and rely on a fundamentally flawed set of vague development scenarios. MMS does not place any of the six potential development projects in particularly sensitive areas critical to wildlife resources or subsistence users, or even at specific locations at all. .007

The environmental impact analysis carries out the opposite of a precautionary approach – in the myriad cases where there is scientific "uncertainty," regarding impact, the agency finds there is no proof of harm and therefore disregards its significance. The MMS must place the utmost priority on quantifying and addressing the scientific uncertainty so that the long-term sustainability of this ecosystem, including the surrounding communities is maintained without impairment. .008

Unlike the last Beaufort sale, Interior plans new leasing off the coast of the Arctic National Wildlife Refuge, the Teshekpuk Lake Special Area in the Western Arctic (in the National Petroleum Reserve-Alaska), throughout the important bowhead whale feeding grounds, and throughout the spring lead zone which is a productive open-water path through the sea ice used by migrating whales, birds, and other wildlife. This rolls back incremental steps MMS had taken during past planning processes resulting in leasing deferrals or deletions. MMS ignored our specific requests for deletions made in comments on the Five-Year Plan and scoping. New information on demonstrated failure of oil spill cleanup capability since that time shows increased risks to the environment for the entire sale area. None of the alternatives addressed these critical requests.

Arctic National Wildlife Refuge: The last Beaufort Sea Lease Sale 170 set a precedent of not leasing off the coast of the Arctic National Wildlife Refuge. The Interior Department cited among many reasons, the lack of information on cumulative impacts on the refuge, emergency response plans, and risks posed by sub-sea pipelines. That lack of information still exists. The MMS still fails to fully address the major issues that were the Secretary's basis for deferral of this entire area in Sale 170. .009

Oil development off the coast of the Arctic National Wildlife Refuge poses risks to the wilderness values, Porcupine caribou herd caribou insect relief habitats, bowhead whale feeding habitat, fish, polar bear denning, feeding, and migratory habitats, and migratory birds using the refuge coastline, lagoons, and barrier islands. Offshore exploration and development would cause pollution, aircraft and vessel noise and related industrial activity, and oil spills degrading the wildlife habitats and wilderness qualities of the Refuge, even if there were no construction of infrastructure within its boundaries. In the future, there would be intense pressure to construct onshore airports, pipelines, roads, docks, and other support facilities in the Refuge. In light of these threats to this national treasure, and continued deficiencies of information as outlined by the Interior Department for Lease Sale 170, MMS should delete the entire OCS area offshore of the Arctic Refuge from all three Beaufort Sea Lease Sales. .010

Teshekpuk Lake Special Area: We specifically request that you remove the area off the coast of the Teshekpuk Lake Special Area in the National Petroleum Reserve-Alaska from these lease sales. This deferral is requested in order to protect this internationally significant goose molting, staging, and nesting area, and caribou calving and post-calving habitats from potential oil .011

transportation pipelines, aircraft disturbance, or support activities occurring on land in connection with the offshore development. .011

In light of the Secretary of the Interior's decision not to allow leasing, pipelines, roads, other surface activities along most of the coastline within the Teshekpuk Lake Special Area, we believe that it is common sense to delete the adjacent OCS area. The Final Integrated Activity Plan/ EIS for the Northeast NPRA (BLM 1998) did not analyze the potential impacts from offshore pipelines making landfall in the Teshekpuk Lake area, offshore support facilities on private lands in this area, or helicopter and other aircraft overflights for offshore construction or supply. Even though MMS shows two hypothetical offshore pipeline landfalls in the Teshekpuk Lake Special Area (Atigaru Point and Ikpikpuk River delta), potential negative impacts from construction and operation of pipelines crossings, as well as aircraft traffic to goose molting, waterfowl nesting, and caribou calving habitats were not adequately evaluated in the DEIS. .012

<u>Legal Deficiencies:</u>

The Beaufort Sea DEIS, fails to satisfy six distinct requirements. First, the Department of the Interior (DOI) fails to adequately address the full range of available alternatives to the proposed action as required under the National Environmental Policy Act (NEPA). Second, the DEIS fails to include a sufficient discussion of potential mitigating measures. Third, the DEIS provides an inadequate analysis of affects on endangered species. Fourth, the DEIS insufficiently addresses concerns under the Marine Mammal Protection Act (MMPA). Fifth, the DEIS fails to include adequate and inclusive discussion of current and potential cumulative impacts. Finally, the DEIS inadequately addresses measures necessary under the Oil Pollution Act of 1990 (OPA) and the Outer Continental Shelf Lands Act and Amendments (OCSLAA), Clean Water Act and Clean Air Act.

Alternatives: The Interior Department fails to analyze the full range of reasonable alternatives to the proposed action that could substantially reduce significant adverse impacts, as required under Council on Environmental Quality policy on implementing the National Environmental Policy Act (40 CFR 1502.14). This Draft EIS fails to consider a reasonable range of alternatives regarding the geographic extent, number, and pace of lease sales. Furthermore, alternatives listed in the DEIS are superficially discussed and do not address their environmental impacts in a sufficiently detailed or meaningful fashion. These alternatives, <u>including</u> the "No Action" alternative must be explored and discussed thoroughly in order to comply with the intent and requirements of Section 4332 (2)(C) of NEPA. The Council on Environmental Quality has published guidelines for federal agencies undertaking NEPA reviews which state, "an alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable," (CEQ, 1981, 48 Fed. Reg. 10827.) Therefore, DOI must consider <u>all</u> reasonable alternatives. .013

DOI provides an inadequate discussion of the merits and benefits of Alternative II, the "no action" alternative. For example, in the Executive Summary (pg. 5) description of the effects of Alternative II, the only benefits described are "protection to the environmental resources in the Federal offshore area of the Beaufort Sea." Instead, the summary describes a litany of negative impacts to the global environment, to economic interests, and to jobs, with absolutely no discussion of environmental, economic, and social (e.g., jobs) benefits from developing an industry focused on alternative energy forms. Furthermore, MMS relies on use of the paper *Energy Alternatives and the Environment* (USDOI, MMS, Herndon, 1996) to guide its discussion on alternative power. Not only is this document seven years out of date in a rapidly developing .014

technology sector, it provides at best, a one-sided interpretation of this subject. In requiring consideration of a no-action alternative under NEPA, the Council on Environmental Quality intended that agencies compare the potential impacts of the proposed major federal action to the known impacts of maintaining the current level of activity as a benchmark. *See Association of Pub. Agency Customers, Inc. v. Bonneville Power Admin.*, 126 F.3d 1158, 1188 (9th Cir. 1997); 46 Fed. Reg. at 18027; 46 Fed. Reg. at 18027. Alternative II focuses primarily on the negative aspects of reduction of oil development and the associated reliance on foreign oil supplies, but virtually excludes potential benefits to wildlife, economic, and social systems present in and outside the region. By excluding the positive aspects of a "no action" alternative (while systematically downplaying negative impacts of oil development and use in other alternatives), DOI neglects its duty under NEPA to conduct a meaningful consideration of all potential impacts. .014

The Interior Department simply plans to lease the entire Beaufort Sea Program area. Apart from the proposed alternative and the "no action" alternative, MMS provides piecemeal deferral areas that provide no real meaningful benefit. More critically, the "deferral areas" within the alternatives represent tiny areas that do not correspond to meaningful reductions of environmental impact to the human and natural environment. When MMS compares the effects of leasing 100% of the Beaufort Sea planning area versus leasing 97-99% of it, the ability to make meaningful comparisons is minimized. Each of the additional alternatives focuses on the loss of production capability of oil with only minimal discussion of the potential environmental benefits. Subsequently, the Alternatives presented in the DEIS need to require significantly more analysis. Finally, besides failing to provide a reasonable way of evaluating environmental effects, the proposals are confusing, not scientifically based, and fail to address local community and national conservation interests. .015

Mitigation Measures: The DEIS fails to fully comply with NEPA's mitigation requirements because it fails to discuss the environmental impacts of all resources for each of the alternatives for the proposed action. Under CEQ regulations, agencies must provide a discussion of actions that can be taken to mitigate adverse environmental impacts to guarantee that agencies have seriously contemplated the environmental consequences of proposed federal projects. There must be significant analytic data to support the conclusion that the mitigation measures would be adequate in light of the potential environmental harms. Typically, these measures should include computer modeling to predict the quality and quantity of environmental effects, a discussion of the monitoring measures to be put in place, ranking the probable efficacy of the different measures, detailed steps to achieve compliance should the measures fail, and identification of the environmental standards by which mitigation success could be measured. Moreover, proposed mitigation measures must be "developed to a reasonable degree" and "scientific uncertainties in the mitigation measures" must be discussed during the EIS preparation period. 40 C.F.R. § 1502.22. .016

The suggested mitigation measures in the Beaufort Sea DEIS simply represent token efforts to accommodate the mitigation requirement. The mitigation efforts proposed are broad and vague providing little in terms of reasonable development and discussion of scientific uncertainty. Moreover, the success of the mitigation measures addressed in the DEIS is questionable. Consequently, the mitigation measures suggested in the Beaufort Sea DEIS requires additional as well as more sufficient analysis.

Endangered Species Act: The DEIS inadequately considers possible impacts and reasonable alternatives for species listed by the Endangered Species Act (ESA). Section 7(a)(2) .017

of the Endangered Species Act requires all federal agencies to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction of critical habitats. 16 U.S.C.S. § 1536(a)(2). If an agency determines that its proposed action "may affect" an endangered or threatened species, the agency must formally consult with the relevant service, the Fish and Wildlife Service and/or the National Marine Fisheries Service, depending on the species that are protected in the area of the proposed action. After the formal consultation is completed, the relevant service will issue a biological opinion evaluating the nature and extent of effect on the threatened or endangered species. If the biological opinion concludes that the proposed action is likely to jeopardize a protected species, the agency must modify its proposal. Section 7(d) of the Endangered Species Act prohibits the irreversible or irretrievable commitment of resources during the consultation process. 16 U.S.C.S. § 1536(d). More importantly, NEPA itself directs that public laws of United States must be interpreted and administered in accordance with NEPA to fullest extent possible. 42 U.S.C. § 4332. Therefore, to comply with NEPA, the DEIS must adequately address and consider all the impacts that potentially could occur to any species covered under the ESA. The Beaufort Sea DEIS inadequately considers the ESA because it insufficiently fails to include the Biological Opinion and fails to examine the scope of impacts of the lease sale and fails to address a sufficient range of alternatives. .017

Large portions of the lease area are used by Steller's eider, spectacled eiders, and bowhead whales and should be considered for designation as critical habitat. The agency cannot determine if its obligations under the ESA to protect critical habitat of listed species are being met until a thorough review of potential critical habitat is completed, including on-site surveys of the region. Nonetheless, the DEIS myopically focuses on the effects of an oil spill on the species, (still failing to do an adequate assessment of this impact) and provides short shrift to other cumulative and "non-lethal" effects that could prove significant in the long term. .018

Given the incomplete information available on potential impacts to these protected species from proposed activities, it would be unlawful to proceed at this time without insuring adequate protection by designating critical habitat and determining the impact of proposed activities on that habitat and the species. To go forward without making adequate consideration of endangered species including the bowhead whale, Steller's eider, and spectacled eider constitutes an irreversible and irretrievable commitment of resources with respect to agency action that forecloses the formulation or implementation or any reasonable and prudent alternative measures thus violating the ESA and NEPA.

Marine Mammal Protection Act: The DEIS fails to satisfactorily address significant impacts for marine mammals protected by the Marine Mammal Protection Act (MMPA). The MMPA creates a general prohibition on the taking of any marine mammal subject to certain exceptions. 16 U.S.C. §§ 1361 et seq. The MMPA defines "take" as "to harass, hunt, capture, or kill..." *Id.* § 1362(13). Additionally, "harass" is synonymous with "to disturb." *Strong v. United States*, 5 F.3d 905, 906 (5th Cir. 1993). An exception in the statute authorizes the Secretary to permit upon request the unintentional taking of "small numbers of marine mammals" incidental to activities such as OCS oil development. *Id.* § 1371(a)(5). However, the Secretary of the Interior and the Secretary of Commerce must make specific findings that the taking will have a "negligible impact" on all the species of marine mammals or their habitat present in the lease sale area. The MMPA authorizes the Secretary to judge activities taking place under the leases on an ongoing basis and to suspend any such activity which jeopardizes the environment and further authorizes the Secretary to order a cessation to such activities if environmental safety cannot be ensured. *North Slope Borough v. Andrus*, 642 F.2d 589, 594 (D.C.Cir. 1980). Once again, NEPA .019

itself directs that public laws of United States must be interpreted and administered in accordance with NEPA to fullest extent possible. 42 U.S.C. § 4332. Therefore, to comply with NEPA, the DEIS must adequately address and consider all the impacts that potentially could occur to any species covered under the MMPA. .019

The DEIS only cursorily addresses the disturbance associated with oil exploration and development subsequent to leasing. It also fails to look at past sources and levels of disturbance. Furthermore, the DOI underestimates the direct, indirect, and cumulative effects of this disturbance, including from the combination of activities such as seismic and production platform, shipping, and aircraft. Moreover, the disturbance clearly constitutes "harassment" of the marine mammals in the lease area to which DOI has failed to adequately demonstrate a "negligible impact." Due to the large number and variety of marine mammals in the proposed area including polar bears, walrus, seals, and whales, a more satisfactory analysis of impacts to marine mammals covered by the MMPA must be conducted. .020

Cumulative Impacts: The Beaufort Sea DEIS fails to comply with NEPA because it considers an irrationally narrow scope of impacts. Since the proposed action could ultimately allow long-term exploration and development, it constitutes a critical stage of the decision-making process at which DOI must consider the direct, indirect, and cumulative impacts of the proposed action and alternatives. Additionally a nearly complete absence of any consideration of likely and predictable impacts outside the region exists. DOI failed to assess all the impacts of allowing the lease sale to occur. .021

NEPA requires federal agencies to analyze three types of actions, and three types of impacts. Agencies must consider actions that are connected, cumulative, and similar. Connected actions are those which are "closely related," including those that "[c]annot or will not proceed unless other actions are taken," or those that are "interdependent parts of a larger action and depend on the larger action for their justification." Cumulative actions are those that "have cumulatively significant impacts and should therefore be discussed in the same impact statement." Similar actions include those that have "common timing or geography." The three types of impacts that agencies must consider are those that are direct, indirect, and cumulative. Direct effects are those that are caused by the action and occur at the same time and place. Indirect effects are those "which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." A project's "cumulative impact," is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The DEIS failed to adequately consider these three types of actions and three types of impacts. A notable example is the failure to address cumulative impacts presented by the concurrent development of the NPRA that provides necessary infrastructure for offshore development in the western Beaufort Sea.

Oil Pollution Act: The DEIS insufficiently addresses the concerns under the Oil Pollution Act (OPA) and Outer Continental Shelf Lands Act (OCSLA). The OPA requires the establishment of a spill plan. 33 U.S.C. § 1321(j)(5). Additionally, as part of the spill plan the OPA requires that a vessel or facility that has a worst-case oil spill discharge potential of more than 1,000 barrels of oil (or a lesser amount if the President determines that the risks posed by such facility justify it), shall establish and maintain evidence of financial responsibility. 33 USCS .022a

§ 2716(c)(1)(iii). Furthermore, OCSLA regulations reinforce OPA by requiring that a development and production plan must be accompanied by "an updated oil-spill response plan as described in part 254 of this chapter or reference to an approved plan" which includes a worst-case analysis. *See* 30 C.F.R. § 250.204(b)(3). "Worst-case discharge" means in the case of a vessel, a discharge in adverse weather conditions of its entire cargo or in the case of an offshore facility or onshore facility, the largest foreseeable discharge in adverse weather conditions. 33 U.S.C. § 1321(a)(24). Once more, NEPA itself directs that public laws of United States must be interpreted and administered in accordance with NEPA to fullest extent possible. 42 U.S.C. § 4332. The DEIS completely fails to address a worst-case scenario nor the cumulative impacts consequential to a worst-case spill. Because a worst-case spill represents a real and present concern even at the lease stage, its analysis should be incorporated into the DEIS. To not include this analysis represents a failure under NEPA to include the explicit considerations of the impacts that other statutes and policies consider. .022a

Recommendations:

In conclusion, we endorse Alternative 2 (No Action) because it is the only alternative that adequately addresses the concerns about oil spills to marine and coastal fish and wildlife habitats and subsistence resources of national importance, including the entire bowhead whale fall feeding grounds and the entire spring lead zone used by migrating bowhead whales and millions of migratory birds. It is also the only alternative in the DEIS that adequately addresses our concerns that would not jeopardize the integrity of the Arctic National Wildlife Refuge and Teshekpuk Lake (NPR-A) coastal environments.

Furthermore, we support Alternative 2, because this is the only alternative that fosters development of alternative energy. Alternative energy is the only option that will truly reduce our reliance on Middle Eastern oil and hence provide energy security, improve the health of our environment and hence our own, and reduce long-term potential impacts to an ecosystem that supports a wealth of life and culture. We urge the MMS to more fully develop a comprehensive alternative energy proposal as one of its Draft EIS alternatives.

DOI must prepare a new DEIS for each lease sale because the draft statement is so inadequate as to preclude meaningful analysis as required by NEPA *See* 40 CFR. §1502.9(a). The new DEIS should be one in which the agency sufficiently performs the required analyses. For the Beaufort Sea lease sale, DOI must allow for public comment on the completed analyses in a revised DEIS because performing the analyses and incorporating them into a FEIS without obtaining additional public review would violate the requirement in NEPA and the Administrative Procedure Act (APA) that an agency solicit and obtain public comment on a revised analyses. The only alternative for remedying the NEPA violations in the DEIS is for DOI to prepare a new DEIS for the lease sale and allow for public comment on each individual sale. .022b

We look forward to a full written response to each of these issues, and the technical comments further described in the attachment, pursuant to federal law.

Sincerely,

Martin Robards
Alaska Protected Area Program Manager
The Ocean Conservancy
coho@acsalaska.net

On Behalf of:

Randy Virgin
Executive Director
Alaska Center for the Environment
randy@akcenter.org

Noah Matson
Science Policy Analyst
Defenders of Wildlife
Nmatson@defender.defender.org

Tim Bristol
Executive Director
Alaska Coalition
seaktim@aol.com

Tom Waldo
Alaska Staff Attorney
Earthjustice
twaldo@earthjustice.org

Tom Atkinson
Executive Director
Alaska Conservation Alliance
tom@akvoice.org

Arthur Hussey
Executive Director
Northern Alaska Environmental Center
Arthur@northern.org

Cindy Shogun
Executive Director
Alaska Wilderness League
cindy@alaskawild.org

Jack Hession
Senior Regional Representative-Alaska
Sierra Club
jack@sierraclubalaska.org

Pamela A. Miller
President
Arctic Connections
pammiller@alaska.com

Eleanor Huffines
Alaska Regional Director
The Wilderness Society
Eleanor_Huffines@tws.org

Cc: Peter Van Tuyn, Trustees for Alaska

DETAILED TECHNICAL COMMENTS ON THE DRAFT EIS BEAUFORT SEA OIL AND GAS LEASE SALES 186, 195, and 202

GENERAL

The maps, tables, and figures referred to in the Executive Summary need to be included within that section, not in a separate Vol. II. This is the case for the main volume (OCS EIS/EA MMS 2002-029) and also the free-standing Executive Summary (OCS IES/EA, MS 2002-030). The separate Executive Summary (OCS EIS/EA MMS 2002-030) does not even contain a map showing the alternatives. .023

EFFECT ANALYSIS ASSUMPTIONS

Assumptions about impacts to wildlife

ExSum-3. MMS needs to provide clarification about its assumption of recovery for marine mammals from Routine Permitted Activities as about 1-year. This number appears speculative based on the data provided. If so, MMS should acknowledge this fact. .024

ExSum-4. In the event of a large oil spill, MMS asserts that the seasonal nature of resources makes it unlikely that a large oil spill would contact sea ducks in the Beaufort Sea. This presents a wantonly inaccurate appraisal of the residency of oil. MMS's conclusion negates the fact that oil from a large spill will undoubtedly remain in the Beaufort environment significantly longer than the time that the oil spill is spreading across the water. This is particularly the case in light of the limited clean-up potential demonstrated by spill response exercises. This scenario is further born out in discussion of "water quality." MMS repeatedly asserts that wildlife species will recover (e.g., marine mammals within about 1-year) without providing significant and proven reassurance that oil can and will be cleaned up in a timely manner, or analyzing other factors that may result in longer recovery times. .025

Frequently, and correctly MMS use the example of the *Exxon Valdez* oil spill to illustrate their discussion of effects to wildlife and the environment. However, MMS consistently uses uncertainty in results to draw the interpretation of "no cause-and-effect" or "no impact". For example (IV-34) MMS asserts, "If any such effects did occur [on fish populations], they apparently have remained too small to observe or measure." MMS has made a clear decision to support evidence that suggests minimal to no effects and detract from conflicting information, rather than consider otherwise. The situation for fish was not unique in the use of the *Exxon Valdez* example, it was paralleled for marine mammals (IV-68) "There is a spatial and temporal correlation between the loss of whales and the spill, but there is no clear cause-and-effect relationship." In the environment of uncertainty, the case for a more cautionary approach is both warranted and necessary. Our concerns are furthered by the obvious-in-its-omission discussion of marine and coastal birds in relation to the Exxon Valdez disaster. Whereas impacts to fish and marine mammals may have been scientifically equivocal, MMS still failed to present the full range of evidence on those topics; further, impacts to marine and coastal birds were definitive. MMS should include this discussion in its analysis. .026

Traditional knowledge of effects of an oil-spill is given only cursory attention in this document (IV-105). The first-hand account of the Elson Lagoon oil-spill in 1944 clearly indicates impacts to birds, seals, and whales. This information should be incorporated and discussed in the relevant sections, not separated out and diminished through lack of attention. .027

Infrastructure/ water depth zones

ExSum-2. Infrastructure/ water depth zones. The infrastructure/ water depth zones as mapped and discussed throughout the DEIS are arbitrarily drawn without references to scientific or economic rationale. These zones bear no relationship to the alternatives discussed; yet they are described throughout the impact analysis. If "distance from existing infrastructure is a major economic factor," that would influence development then factual data supporting this assumption to be provided. The so-called mid-range/ medium zone corresponds neither with water depth nor distance from existing development, especially since the zone extends a greater distance to the east where onshore infrastructure is currently prohibited within the Arctic National Wildlife Refuge, as well as offshore the no surface occupancy Teshekpuk Lake deleted area in the National Petroleum Reserve-Alaska. Since sub-sea pipelines as long as 100 miles from existing infrastructure could be needed for leases off the Arctic Refuge coast, the additional risks posed by this technology need to be assessed. The zonal criteria are not an effective tool for analyzing reasonably foreseeable development scenarios that would result in the greatest potential threats to fish, wildlife, and their habitats, the marine and coastal ecosystem, and subsistence uses by local residents. .028

Development scenarios

ExSum-2. Development scenarios for each sale. There is no factual evidence supporting the likelihood of the scenarios, e.g. six oil fields to be developed in which no geographic location is provided. .029

The development scenarios are vague, ill-defined, and not scientifically supported. How hard is it to map the hypothetical development infrastructure needed to conduct an impact analysis? No locations are provided for proposed infrastructure, other than the Hypothetical locations of sub-sea pipelines shown in the oil spill analysis (Map A-4a, A-4b).

The descriptions are tied to the depth-zone descriptions, which have no bearing on the alternatives that are outlined. The geographic location of development facilities can make a difference in the nature of the environmental impacts, yet this is completely ignored. Instead, it is assumed that the potential impacts of any site would be the same. If the entire area in the lease sale is offered in the first lease sale, this EIS must analyze the potential impacts should a development occur anywhere in the sale area, including in the "far zone," which it assumed would not take place until leases offered in the third sale of the series.

Does MMS assume that none of the known oil field discoveries in the OCS will be developed? These are listed as reasonably foreseeable developments on Table V-1a, and therefore they could be mapped as potential production sites, with sub-sea pipelines or tanker transportation shown, as well as pipeline land falls and needed connecting onshore support bases and pipelines that would be needed. If these are not thought to be commercial (seeing that leases were relinquished for many of these), then they may not be reasonably foreseeable and that information should be removed from the table and from prospective energy resources would result from new lease sales. Descriptions of the status of the known offshore prospects and pools, as well as information about how they might be developed should be provided. The dry holes that have been drilled into the OCS, such as Mukluk and others, and what information this provides about the likelihood of finding oil in those regions should also be addressed.

Oil Field Production

ExSum-7. The new concept of the "opportunity index to describe the risk weighted probability of developing an economic field in particular areas" is a concept that is not statistically, geologically, or environmentally justified. Furthermore, this relies on infrastructure and depth zones information that is .030

extremely vague and covers huge geographic areas where a complex variety of wildlife concentrations, subsistence use zones, and fish and wildlife habitats occur. If the "opportunity index" is to be used to derive potential development scenarios, it must take into account industry funding levels, and other economic issues as well as regulations because industry must act within the existing state and federal legal framework. This index is confusing and is not a useful tool for assessing impacts in the event that oil development does occur. .030

PROPOSED ACTION AND ALTERNATIVES

ExSum-5. Alternatives. This explanation of the alternatives is extremely vague. Alternative I, the Proposed action, is not described at all here. Without a map, it is impossible to understand the alternatives. There are no maps in this EIS where you can see the size and extent of the most recent Beaufort Sea lease sales for comparison, nor to view existing leases in the context of the proposed alternatives. .031

EsSum-5. The leasing alternatives in this EIS are meaningless and confusing. Whether inadvertent or intentionally deceptive, the tiny deferral options would not achieve the named goal, such as Kaktovik Subsistence whale deferral and the Barrow Subsistence whale deferral. Apparently, this is a simple line drawn around some whale harvest areas, but it has nothing to do with having permanent oil and gas activities and infrastructure avoid subsistence resources areas – the bowhead feeding grounds located throughout the Beaufort Sea and particularly north of the Arctic Refuge, the whale fall migration corridor, the whale spring migration route, nor the area where oil spills or noise from exploration or production would occur, spread, and could harm the whales' habitat and migration route. In the Sale 170 Final EIS the "Kaktovik Deferral" (Alternative III) was far more extensive than in the current EIS. In fact, that deferral went 35 miles west of Kaktovik and then all the way to Canada. The new so-called Kaktovik Subsistence whale deferral only goes from about Kaktovik and to the east for 30 miles, but then the rest of the zone to the Canadian border is not even included. Yet MMS has the audacity to state: "this area is being considered for deferral in response to a request by the Native Village of Kakovik." (p. E-14). The Kaktovik deferral is arbitrary and needlesslessly confusing especially since it bares no resemblance to any past Kaktovik deferrals that MMS has proposed, nor what the local community has requested repeatedly. .032

Furthermore, the City of Kaktovik and the North Slope Borough requested that the <u>entire</u> area off the coast of the Arctic Refuge be deleted in comments on the Five-Year Plan, as did the Alaska and National environmental organizations, yet this deletion or deferral area was not one of the alternatives. .033

ExSum-5. Alternative II (No Action). MMS assumes in its description that there would be no environmental consequences, even though oil exploration and development could continue to proceed on existing leased OCS areas in the Beaufort Sea and cause noise disturbance, pollution, habitat loss, etc. .034

ExSum-6. The alternatives analysis is fatally flawed because "the same level of activity likely would occur regardless of the alternatives selected... observed differences do not equate to significant differences of effects among alternatives or among sales." MMS needs to consider all reasonable alternatives, and a range of alternatives including those that would have significantly less environmental impact. .035

ExSum-6. Mitigating measures. The MMS has included far fewer mitigating measures as lease sale stipulations, where they are most meaningful in reducing environmental impact, than in past lease sales. .036

I-10, I-11. Alternatives rejected. MMS has rejected all recommendations for deferrals from local communities, traditional subsistence user communities, tribal governments, and others. Furthermore, it rejected their ideas for deferrals, and failed to inform the public of the content of these informed requests. It is impossible to see how the proposed Barrow subsistence whale deferral corresponds with what local communities requested. Furthermore, any information MMS received in the course of meetings related to this lease sale process needs to be included in the record of the lease sale. .037

I-11. MMS failed to provide an alternative that would delete or defer the entire area north of the Arctic National Wildlife Refuge, as we requested for the Five-year plan and in scoping comments (see General comments for further rationale). We are concerned about impacts from offshore spills to the complete range of fish and wildlife that occurs along the Arctic Refuge coastline, not just the endangered bowhead whale and its feeding grounds. We are also concerned about negative impacts to the wilderness quality of this shoreline and coastal habitat that may be harmed by spills, infrastructure, and industrial activities adjacent to the refuge, or within its boundaries (30-miles of the coast is within the Wilderness Preservation System). By rejecting the requested alternative of deleting the entire area north of the Arctic Refuge from the sale, the MMS was not responsive to this issue of significant impacts to wilderness. .038

I-12. It would be less "confusing" if MMS replaced its four deferrals with the proposals specifically requested by the public, including the entire area north of the Arctic National Wildlife Refuge. MMS is clearly resisting larger deferral areas. .039

II-4. Because summer "open-water" season drilling in the deeper waters for all three sales would require ice-breaker support, this should be listed explicitly in the summary in Table IV.A-4. .040

II-5. If you assume that "as each lease sale proceeds, blocks would be leased in increasingly distant zones," and that "the most accessible and easiest tracts should be developed first," it is illogical to plan to offer all areas initially. .041

II-6. Since MMS expects that "scenarios for Sale 186 and 195 expect most of the activities to occur in the central Beaufort Sea," then there is no justification provided for leasing the other areas. Furthermore, since MMS has assumed that few activities in Sale 186 will occur outside the "near and mid-range" zones, it has failed to conduct a worst case environmental impact analysis for the lease sale because it has ignored the possibility that harmful drilling, pipelines, and other industrial activities will occur in many different places across the lease sale area. .042

II-9. Stipulations. These stipulations are inadequate to fully minimize effects of activities in leased areas. We recommend inclusion of new stipulations on 1) Seasonal drilling and production stipulations to reduce the risk from major spills during open water and broken ice seasons, the time period when cleanup is proven impossible should be included (these were in past OCS lease sales); 2) zero discharge of drill muds, cuttings, produced waters and other discharges into the marine waters and onshore wetlands; 3) double-walled sub-sea pipelines. .043

II-20. ITL No. 11, Information on Sensitive areas to be included in oil spill plans. Please add the entire shoreline of the Arctic National Wildlife Refuge, January – December, wilderness values of national importance, polar bear denning, migratory bird feeding and staging, Porcupine caribou herd post-calving and insect relief habitat, nearshore fish habitat, subsistence values. .044

IV-125. MMS needs to provide a suite of alternatives that have enough differentiation between them to allow meaningful comparison. Under IV.C.10. Economy, MMS asserts that the levels of activity between all alternatives (except Alternative II) and sales "are very similar." This does not provide the opportunity to provide meaningful comparison. It also alludes to the underlying failing that all oil development alternatives are essentially the same. .045

IV.B. This section is not adequate for a full analysis of Aternative II. Section IV.C is an analysis of effects by resource by alternative; however, the only mention of Alternative II is an indication of the loss of revenue, jobs, and income, as well as a shorter lifespan for the Trans-Alaska Pipeline (IV-127). This section should provide a full analysis of effects by resource (water quality, lower trophic-level organisms, fishes, EFH, endangered and threatened species, marine and coastal birds, marine mammals, terrestrial mammals, vegetation and wetlands, economy, subsistence, sociocultural systems, archaeological resources, land use plans and coastal zone management, air quality, and environmental justice) for the development of alternative energy in northern Alaska. This development would provide jobs, revenue, and employment. Without this analysis, the DEIS cannot be used to provide a full comparison of the economic effects presented by the alternatives. .046

AFFECTED ENVIRONMENT

Wilderness values, and recreational values also need to be included in this section, and environmental consequences analyzed in the DEIS.

III-35. The importance of the subsistence fishery in the Colville River for whitefish should be included. There has also been a commercial fishery for many decades for whitefish. .047

III-48. A map of polar bear dens should be included, as well as information about feeding concentration areas and migratory movements. .048

ENVIRONMENTAL CONSEQUENCES

Analysis assumptions

IV-1. Basic assumptions. (See also comments above on ExSum-2). This section fails to address the results of past drilling (the discoveries- albeit not commercial—and the dry holes), and implies that no locations of OCS oil deposits are known. .049

IV-3 and 4. Significance thresholds. These definitions are not supported by scientific evidence that they are suitable for each species or environmental component. Significant impacts to fish and wildlife habitats, benthic environment, wilderness are not addressed. The entire focus should not be on populations, as often these are far more difficult to measure than habitat changes in marine environments, e.g. nearshore fish. For species listed under the Endangered Species Act, significant impacts to their critical habitats are of concern, and negative effects that prevent recovery (even if not contributing to further decline) can be significant. The threshold for Environmental Justice does not address many negative impacts that may disproportionately harm minority, low-income, or Inupiat and other Native America people. All of the proposed thresholds understate environmental impacts, causing significant effects to be ignored throughout the DEIS. .050

Effects of so-called "routine permitted activities."
ExSum-2. Effects from routine permitted activities. The term "routine permitted activities," is not defined and is meaningless. The EIS needs to describe all past, present and future activities of offshore oil and gas leasing, exploration, development, and production, as well as other activities that contribute to the cumulative impact on the environment. .051

ExSum-3. The negative environmental effects of a wide range of oil and gas activities and infrastructure are underestimated throughout this DEIS. .052

For example, "caribou could be displaced within 1-2 kilometers along the pipeline and roads, but this should not affected caribou migration and overall distribution," is not supported by the scientific literature which describes displacement of caribou within 4-kilometers of roads and pipelines and that major alterations of caribou calving distributions have taken place from Kuparuk and other North Slope oil fields (U.S. Geological Survey, 2002. Arctic Refuge Coastal Plain Terrestrial Wildlife Research Summaries, Biological Science Report, USGS/BRD/BSR-2002-0001). .053

Effects of large oil spills.
ExSum-3. Effects in the unlikely event of a large oil spill. The MMS downplays the chance of major spills taking place. It fails to provide peer-reviewed documentation of its calculations for the probabilities of a large spill taking place, and the agency appears to have chosen the data sets and calculations that show the lowest chance of spills occurring. .054

The probabilities in the DEIS are inconsistent with MMS's own analyses for the Five-Year Plan, and drastically downplay the chances of spills. MMS's Final EIS for the 5-year plan (April 2002) assumed there would be one large platform spill and one large pipeline spill due to OCS activity. The oil spill studies calculated there would be 81-94% chance of a spill greater than or equal to 500 bbls (21,000 gallons). In the 5-year plan, MMS found there would be 90-150 spills greater than 50 bbl (2,100 gallons) over 35 years of activity resulting from the sales, and 7-12 spills in the size 50-999 bbl (2100 –21,158 gallons) [Table 4.1e, p. 78]. .055

So what has changed since April? In the DEIS for the Beaufort Sea sales, MMS states that the chance of one or more pipeline spills is 4-5% and one or more platform spills is 5-6%, with the total chance of a spill is 8-10%. (p. ExSum-3; p.A1-11; p. IV-13) What is this based on? Is it based on a peer-reviewed published study? .056

At appears that these estimates do not include all cumulative impacts, including existing development such as the Northstar field where the U.S. Army Corps of Engineers projected up to 24% chance of a major spill for that project alone. Furthermore, the Final EIS for the last Beaufort Sea Sale 170 estimated a 46-70 percent chance of one or more spills [p.IV-B-4] for an area roughly 1/10 that of the proposed lease sale area. At any rate, we know that accidents happen and that the risk if a spill does occur it would be devastating to the coastal and marine environment. .057

ExSum-3. The environmental effects of spills on coastal and marine resources are underestimated throughout the entire document. .058

For example, the DEIS downplays the number of polar bears that could be oiled and die in a spill, and fails to fully report on the recent spill modeling analyses conducted by U.S. Fish and Wildlife Service and U.S. Geological Survey biologists (S.C. Amstrup, 1999, Estimating potential effects of hypothetical oil .059

spills on polar bears [Northstar], U.S. Geological Survey; Amstrup, S.C., G.M. Durner, and T.L. McDonald. 2000. Estimating potential effects of hypothetical oil spills from the Liberty oil production island on polar bears: Report to the MS for including in the EIS for Liberty Oil Production Island). The DEIS executive summary states that "from routine permitted activities... small numbers of marine mammals... polar bears... could be affected, with recovery expected in about 1 year" (p.ExSum-3), and "a large oil spill could result in the loss (lower reproductive rates or death of individual animals) of small numbers of ... 6-10 polar bears," (p. ExSum-4). The actual detailed text contains contradictory statements, an "estimated 5-30 bears could be harmed...annual recruitment would probably replace lost bears within 1 year up to more than one generation (7-10 years)" [DEIS, p. IV-107]. .059

More detailed modeling of just two separate offshore oil production facility proposals show greater potential for mortality. The U.S.Geological Survey modeling done for the Northstar development project estimated .4 to 78 bears for open water season and 0.1 to 108 during October broken ice, with an average of 21 bears oiled, and therefore killed. (Amstrup 1999) The analysis done for the Liberty project estimated 0-61 bears could be oiled and die (Amstrup et al. 2000). The U.S. Fish and Wildlife Service and U.S. Geological Survey's modeling studies contained trajectory maps, as well as polar bear concentrations, and these were very useful for understanding the potential impacts from oil drilling at two different locations. However, those analyses had limitations, including the fact that they tracked the trajectories for only 4 or 10 day periods, only looked at one project at a time, did not evaluate a worse case spill size, and did not consider the cumulative effect of additional developments.

ExSum-4. We question the scientific basis for the statement, "we expect less than a 0.5% chance of a large oil spill occurring and contacting nearshore Beaufort Sea fish habitat." First, this depends on The "environmental resource area" nearshore fish habitat, was not evaluated. We note that if a spill occurs, for spills from all locations looked at, the chance of a summer spill contacting land within 360 days ranges from 61% to 83% (Table a.2-24). Presumably, the spill would oil the nearshore waters before it struck land, and therefore there is a high chance of an oil spill harming this critical fish habitat. .060

V-15. Constraints on spill response, containment, and collection equipment. This section fails to present a clear picture of the proven failure of spill cleanup response in most open-water and broken ice conditions. Traditional knowledge exists on this topic that was ignored. Industry failed a series of required oil spill drills. The information in these documents raises key points regarding the limitations that were not fully explained in the DEIS: .061

Robertson, T.L. and E.DeCola. December 18, 2000. Joint agency evaluation of the Spring and fall 2000 North Slope broken ice exercises. (Alaska Department of Environmental Conservation, Minerals Management Service, North Slope Borough, Alaska Department of Natural Resources, U.S. Coast Guard).

Alaska Department of Environmental Conservation and Minerals Management Service Joint Evaluation. January 18, 2000. Fall 1999, North Slope Drills and Exercises Response Tactics for BP's Northstar, Prudhoe Bay Western Operating Area and Endicott Operations, and ARCO's Prudhoe Bay Unit and Greater Pt. McIntyre Area.

Alaska Department of Environmental Conservation. January 18, 2000. Letter to ARCO and BP regarding the Fall 1999 joint evaluation.

Alaska Department of Environmental Conservation. May 11, 2000. Letter to BP containing signed Compliance Order by Consent dated May 3, 2000-- Failure to Comply, Oil Discharge Prevention and Contingency Plans and on Conditions of Approval, Oil Discharge Prevention and Contingency Plans. .061

IV-15. In-situ burning limitation. This section fails to describe the limitations of containment of oil in booms during broken ice conditions, a necessary requirement for burning; air pollution impacts; movement of spilled oil with the pack ice; constraints posed by bad weather like .062

Environmental effects

IV-18. Alternative II-No Action. This section fails to consider the impacts of offshore oil and gas activities that will occur on existing leases, as well as the cumulative effects from adjacent oil and gas development on State offshore and onshore leased lands, and in the National Petroleum Reserve-Alaska. .063

IV-32. This section needs to analyze impacts to fish from docks and other sold-fill gravel causeways, and also to nearshore habitat alterations that may result from the Pt. Thomson and Smith Bay landfall locations. The negative effects to critical overwintering fish habitat, which is very limited in extent during winter in lakes, rivers, and streams, from ice-road and other water withdrawals, and from gravel mining in floodplains need to be assessed. .064

IV-44. New Biological opinions for all species listed under the Endangered Species Act need to be done because circumstances have changed since the last one was done that apparently covered Beaufort Sea leasing in 2001—the Northstar offshore oil field is now in production and this changes the baseline level of activities that may affect the spectacled and Steller's eiders and the bowhead whale. The assumptions of the level of activity differ for the three proposed lease sales than for prior sales, and there is also the assumption that harmful ice-breakers will be required for drilling in the deeper waters – an activity which may occur as a result of the first lease sale. There is also new information available about the importance of the Beaufort Sea for bowhead whale feeding. .065

IV-63. This section on the effects of noise on bowhead whale behavior does not include traditional knowledge; this should be added. The summary of noise effects on bowhead whales understates the scientific evidence of displacement during the fall migration from seismic noise and the generally accepted displacement zone based on the recent studies. Instead, it gives more credence to the old, discredited studies. There is much evidence from traditional knowledge observations and monitoring studies of seismic and drill ship activity that the combination of drill ships and icebreakers resulted in significant displacement of bowhead whales during the fall migration. The potential impacts of drilling using drill ships during the bowhead whale fall migration were not evaluated. .066

IV-70. The effects of an oil spill on bowhead whales considering 360 days after the spill should be considered for spills that start in both the summer and winter. The descriptions of spill impacts using the terminology of LAS1-LA18, ERA's 19-28, etc. are impossible to understand without looking at a series of many maps. Please translate this technical jargon into plain language that explains the impacts. .067

No oil spill trajectory analysis was done that considered the entire bowhead whale spring migration path (it was only looked at in many pieces), nor at the entire fall migration route as one unit. What does it mean that there is a 37% chance of a spill from a spill at a site called "LA10" from a launch site 32. This does not mean a thing to a local resident who knows this coastline and marine waters, or to the general public. Please describe or map the geographic locations with the highest oil spill changes relative to the .068

fall bowhead migration pathways and feeding areas. The pipeline route offshore apparently overlaps with the bowhead whale's fall migration route (this is not entirely clear from the verbiage in the DEIS). .068

IV-71. This section on impacts to bowhead whales does not analyze the impacts to bowhead whale habitats, including critical habitats. .069

IV-87. The potential effects of exploration and development activities on migratory birds during the migration period, including collisions with drill rigs, temporary and permanent towers, and with offshore and coastal production buildings are downplayed and poorly evaluated. Many species, currently suffering population declines are susceptible to collisions, including threatened spectacled and Steller's eiders, king and common eiders, and long-tailed ducks. The DEIS fails to contain all available information on migrating bird use, including in the marine environment, as well as a comprehensive effects analysis. In particular, close attention of migratory bird concentration areas just west of the existing oil fields, such as Harrison Bay and Cape Halkett deserves close scrutiny since the oil company development expansion seems to be most rapid in the western direction. Recent monitoring studies of migrating birds at Endicott and Northstar production facilities have revealed bird mortality of king and common eiders and long-tailed ducks caused by collisions, so this is a real issue. .070

IV-94, 95. MMS needs to consider the effects on all birds migrating across the Beaufort Sea, in addition to nesting species. This is especially important for species like King Eiders which nest primarily in Canada but migrate across the Beaufort Sea in large numbers. .071

IV-100. The potential negative effects of winter seismic oil exploration on polar bear maternity dens needs to be evaluated. Furthermore, the disturbance of feeding bears, including those with cubs, from openwater seismic activities needs to be described. These 3-D seismic operations can be in a region used by individual bears for more than 1 day. .072

IV-207. Low probability, very large oil spill. The analysis of a worst-case oil spill should not be segregated into a separate section of the DEIS, but should be integrated into the main discussion of environmental consequences and cumulative impacts. It appears that this section greatly under-estimates the potential effects from a blowout, by limiting the analysis to spill "launch sites" in only two locations, whereas drilling may occur in far different geographic sites. .073

IV-215, 216. MMS shows that a major spill could result in significant population-level harm to a waterfowl species. This provides strong support for the deleting these areas from the lease sales. .074

CUMULATIVE EFFECTS

V-2 to V-3. Cumulative effects. The entire analysis is fundamentally flawed because it focuses on describing the small contribution sale 186 will have on the entire cumulative effect, and therefore needs to be expanded for effects including fish and wildlife, habitat, wilderness, endangered species, water use, subsistence. Under the requirements of NEPA, the agency is required to evaluate the incremental step of the proposed project (in this case 3 lease sales), plus all the rest, and this total effect must be characterized. MMS needs to look at the contribution of these three sales, plus its existing offshore developments e.g. Northstar, and proposed, e.g. Liberty, and any other reasonably foreseeable on the existing OCS leases; plus past, present, and future state offshore and on shore, and onshore in the National Petroleum Reserve-Alaska. Other activities, such as military operations, cleanup activities of abandoned, contaminated sites, research operations (especially icebreaker supported), and other activities taking place on the North Slope and Beaufort Sea need to be evaluated. MMS also fails to conduct a .075

cumulative effects analysis for a reasonable range of alternatives. We urge MMS to wait to complete this analysis until the National Research Council's report on the Cumulative Environmental Effects of the Oil and Gas Industry on Alaska's North Slope is available. .075

VOL. II - TABLES, MAPS, FIGURES

Table IV.A-4, This summary of basic exploration, development, and transportation assumptions for Alternatives I,III-VI, does not give a complete picture of the expected activities and infrastructure during any particular year or geographic area, nor does it show the cumulative effects of all sales. It also fails to provide the level of activities and infrastructure that is expected to take place under existing federal OCS leases (Alternative 2, No Action), nor for the cumulative effects of offshore activity in State waters and for onshore coastal areas. Furthermore, the intensity of industrial activity in each year cannot be discerned because each lease sale is described separately, whereas activities overlap during particular years. .076

Tables IV.A-1, A-2, and A-3, similarly give the Representative development schedule for each sale separately (and none is given for existing OCS leases), but these are not consolidated into one table where the total industrial activity is shown. On all of these tables, some key activities are ignored, even though they are essential for drilling, and contribute to the cumulative impact: seismic exploration surveys, water withdrawals for ice roads, gravel mine excavation, contaminated waste site cleanups, construction of docks / causeways, and new onshore support sites. Tables F-3, F-4, and F-5 seem to be identical to Tables IV.A-1, A-2, and A-3, and suffer from the same inadequacies. .077

Table V-8. This table greatly under-estimates aircraft support needed for Alpine oil field. Flights are made daily, and multiple flights are made in a single day, not a total of 4 round-trips monthly. There is no evidence that actual numbers of vehicle and vessel trips was obtained. .078

Table V-11. Summary of cumulative effects. This only gives a superficial summary of effects for proposed sale 186, and apparently does not include the cumulative effects of all three sales, in addition to past and present effects. There is also no comparison of cumulative effects levels for the other alternatives, including No Action (Alt. 2). .079

Table V-11, marine mammals. No scientifically accurate "potential losses of perhaps up to 10 polar bears... In likely cumulative effects, ... polar bear... populations are expected to recover within 1 year, assuming only one large spill (greater than or equal to 1,000 barrels) occurs." See earlier comments on polar bear effects. .080

Table V-11, Archeological Resources. No discussion of shoreline or barrier island archeological resources is made, even though pipeline crossings and landfalls, roads, and seismic surveys could affect sodhouses, graves and other sites. .081

Table V-11, Environmental Justice. We believe that leasing, seismic exploration, exploration drilling, and development activities have a disproportionate impact on Native American communities. What is the justification for the claim that "effects are not expected from routine activities and operations"? .082

Fig. Iii.A-2. While this map showing all historical leases is useful, it would also be very helpful to provide another map that just shows the active leases relative to the proposed action and alternatives. .083

Fig.III.A-11. Boulder Patch in Camden Bay, near the Warthog Prospect. We find it interesting that this EIS describes this boulder patch. The Environmental Assessment conducted for the Warthog well did not acknowledge the geographic extent of boulder patch, located off the coast of the Arctic National Wildlife Refuge, and did not assess potential impacts to this sensitive community. It appears that the drilling structure (Concrete Island Drilling System) was placed right in this sensitive habitat, without baseline or scientific follow-up on the unique biological community. .084

Map. 7. Please correct this map. Kaktovik is show in the wrong location. The area labeled "arctic Coastal Plain" should be shaded with the same shaded layer as the rest of the Arctic National Wildlife Refuge, as it is done on Map 8. Correct "1002 KIC area" to "1002 area," or simply label as "arctic coastal plain." .085

Map. 7. This map, fall bowhead whale sightings on transect, does not portray all bowhead whale use. Please provide another map showing spring bowhead whale migratory use. .086

Map 8. Location of Kaktovik needs to be added. Please correct "1002 KIC area," to "1002 area." .087

Map. 12. While this map shows historical subsistence land use for Nuiqsut, no comparable maps are provided for Kaktovik and Barrow. Furthermore, the lands that support the subsistence resources used by each of the villages should also be portrayed, not just the harvest locations. .088

Map. 13. Essential fish habitat. This map is clearly incomplete, for example, the Nechelik Channel of the Colville River is a key migratory and overwintering area. There are also many additional streams and rivers in the National Petroleum Reserve-Alaska. .089

Map 14a. Known permitted gravel and water sources. This map is incomplete, and inaccurate. What is the source of this information? MMS should not rely solely on BP data for this information. It fails to show all the gravel and water sources used for the Trans-Alaska Pipeline within the region shown. The category "rehabilitated gravel sites," is not scientifically justified, as this habitat is altered from its original condition. Many additional gravel mines are not shown. Old gravel removal areas in river floodplains should also be shown. Are the "water sources" all existing permitted sources; does it include all sites used in the past? .090

Map 14b. This map is outdated and incomplete. It only shows a small region of the North Slope, not the entire area where ice roads were built and water was withdrawn. All of the ice roads should be mapped, including those built for Northstar, Badami, Pt. Thomson cleanups, and all exploratory wells. .091

Vol. III - APPENDICES

Appendix A1: The information, models, and assumptions we use to analyze the effects of oil spills in this EIS. .092

In general, the EIS does not use the worst case spill information for its modeling to calculate the chance of spills taking place, or to analyze the trajectory of spills from various exploration and development activities. It fails to evaluated the cumulative effects of spills from existing OCS leases, as well as the new leasing program. It also fails to address the effects of spills from dozens of toxic substances that may be spilled, including drilling muds, acids, biocides, etc. (only oil and refined oil products are looked at).

p.A1-2. There is no justification for why the median spill size is used, instead of the average.

p.A1-2. All data for well blowouts in the OCS should be included.

p. A1-2. Behavior and fate of crude oils. This description ignores the fate of oil spills during open water and the broken ice period, and the influence of the pack ice on carrying the ice, plus the oil, hundreds if not thousands of miles in a single season. Please note the journey of the shipwreck Karluk between August 12, 1913 and January 10, 1914, from Flaxman Island off Alaska to Wrangel Island off Russia (McKinlay, W.L. 1976, Karluk: The great untold story of Arctic exploration). .092

p. A1-4. Estimates of where an offshore oil spill may go. C.1. Inputs into the oil-spill-trajectory model. A major flaw with the model and analysis is that it minimizes the biological resource areas and ignores many key biological and subsistence resources altogether. The various "segments" or "resources" are merely listed, with no scientific justification for their boundaries or extent. Some of them are not even named or mapped, e.g. #85,ERA 6.

Some resources were not analyzed at all. For example, the entire fall bowhead whale migration route, the entire spring bowhead whale migration path, the entire spring and fall beluga whale migration route needs to be analyzed. Although #45, a "whale concentration area," is shown in Canadian waters, no explanation of its importance is given. Polar bear denning, feeding, and migratory sites were not analyzed at all. Coastal lagoons used by molting and staging migratory birds were not analyzed. .093

By dividing up the ocean and the shoreline into many "boundary segments," "biological resource areas,"and "land segments," the overall risk to a certain resource – regardless of its exact location – may be minimized. For example, the barrier islands within the Arctic National Wildlife Refuge are divided up into 6 different resource areas, yet the chances of oil striking any barrier island may be more meaningful for this regional scale of analysis. The entire coastline of the Arctic National Wildlife Refuge, a prized wilderness resource and ANILCA conservation unit, should be analyzed as one unit (other site specific resources like river deltas could also be evaluated). Similarly, Ivvavik National Park (a wilderness park) and Hershel Island Territorial Park coasts need to be analyzed as units. If one is concerned that <u>any</u> of the coastline of the Teshekpuk Lake Special Area, important for goose molting, is oiled, then the trajectory analysis should look at that shoreline in its entirety, not broken into many small pieces (it was not analyzed at all as a resource).

Some resources are substantially underestimated. The Nuiqsut subsistence resource area is shown as a tiny triangle around Cross island, not as the coastal and marine areas portrayed in Map 12, Historical Subsistence Land Use for Nuiqsut. As well, the "Kaktovik subsistence area, and Kaktovik ERA" is shown as a semicircle around the village, but does not encompass all of the region historically or currently used by the village for its harvests. Furthermore, the Nuiqsut and Kaktovik subsistence resource areas should be even bigger than the zone where actual harvests take place, because subsistence is not just about access to it, but the long-term maintenance of the resources upon which the subsistence way of life depends. There is no map in the EIS depicting the Kaktovik subsistence land use areas in the body of the EIS. .094 Similarly, the Barrow subsistence resource areas are not meaningful for analyzing oil spill impacts. This is crucial, since the analysis is summarized in a number of tables that are also meaningless, and seriously downplay the potential effects (see Table A.2-61 to A.2-72). These all need to be reanalyzed, taking into account the actual subsistence use areas for each village, for all living resources not just bowhead whale strikes. .095

MMS Response to Comment Letter L-0021

L-0021.001

See Response L-0002.016.

L-0021.002

The MMS believes this EIS complies fully with NEPA and Council on Environmental Quality guidelines. We disagree with your statement that the MMS has ignored public comments received on previous environmental impact issues raised by the Ocean Conservancy and all other commenters. In addition to soliciting and considering all scoping comments received from all commenters, the MMS has worked extensively with the Alaska Eskimo Whaling Commission, the North Slope Borough, local subsistence communities, and whaling captains to obtain detailed information on subsistence-whaling activities in formulating alternatives to the proposal in the EIS. The proposal and alternatives analyzed in the EIS address concerns and potential risks to the environment and lifestyles of the local communities. The standard mitigating measures include stipulations to minimize or reduce potential risks.

The Secretary of the Interior is committed to implementing her responsibilities under the OCS Lands Act. This includes making available for leasing OCS offshore areas while protecting the marine, coastal, and human environments. The MMS OCS safety and pollution-prevention regulations in place reduce the risk of oil spills. The MMS oil-spill-contingency plan regulations ensure that appropriate oil-spill-response capabilities, providing a variety of cleanup methods, are in place. The EIS is but one part of the OCS leasing process, and no decisions have been made concerning any specific areas the MMS may offer in Sale 186. Subsequent to the EIS process, the MMS will prepare a coastal zone management consistency determination and proposed Notice of Sale and submit it to the Governor of Alaska for State review. After consultation with the State, and the North Slope Borough through the State, the Secretary considers recommendations as to what, if any, areas to offer for lease. Her final decision whether or not to offer areas for lease would result in the publishing of a Notice of Sale and would identify the sale configuration and required mitigation. As you are well aware, the number of blocks analyzed in an EIS is considerably larger than the number of blocks that will receive bids. The number of block drilled is even much smaller.

See Responses L-0012.001, L-0021.009, and L-0035.003.

L-0021.003

The MMS discusses the effects of the No Lease Sale Alternative in Section IV.B. As a part of this analysis, the MMS analyzes the effects of energy substitution for production that would be lost should resources of the proposed action not be developed. Please review Section IV.B. and documents referenced in this section for a further discussion of energy-substitution issues.

L-0021.004

Additional information on the effects of oil spills on coastal habitats has been added to Section IV.C.2 - Lower Trophic-Level Organisms and to Table IV.A-4 on the comparison of alternatives. The additional information, which notes the decade-long persistence of *Exxon Valdez* oil in shoreline sediments, also is included in the recent EIS's on proposed leasing in the Northwest National Petroleum Reserve-Alaska and lower Cook Inlet.

L-0021.005

The Department of the Interior, through the MMS, is responsible for making OCS resources available to meet the Nation's energy needs and balance orderly energy resource development with protection of the human, marine, and coastal environment. This EIS was prepared in compliance with the OCS Lands Act, as amended, and NEPA. The MMS has analyzed the Proposal, various alternatives, and potential direct, indirect, and cumulative impacts that may result from exploration and/or development activities on the OCS. Furthermore, the protections analyzed in this EIS help mitigate effects to the human, marine, and coastal environments, as mandated by the OCS Lands Act. The MMS does not rely solely on financial reimbursements in the event of an oil spill as mitigation.

Impact assistance to directly affected communities adjacent to OCS activities is important to the MMS. This concern has been documented in the numerous letters, scoping comments, scoping reports, and public hearing testimony received over the years for previous OCS lease sales. We have acknowledged and addressed impact assistance repeatedly in our EIS's and decision documents. The MMS continues to support development of additional impact-assistance compensation for reimbursement of losses in case of an offshore oil spill. Congress has provided for impact assistance through various laws and programs, including the OCS Lands Act, as amended, and the Oil Pollution Act of 1990. Please refer to Responses PH-Nuiqsut.001a and L-0034.027 and Section I.C.1.e(1) for detailed information concerning impact assistance.

Regarding protection of coastal and marine resources and the effects on indigenous cultures that rely on the OCS for subsistence, the MMS places special emphasis on mitigation of potential harm from offshore spills to biological resources, their habitats, and protection of subsistence lifestyles. Such protections include stipulations on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities, Protection of Biological Resources, and an Industry Site-Specific Bowhead Whale-Monitoring Program. These stipulations require the lessee to work with directly affected subsistence communities, the North Slope Borough, and the Alaska Eskimo Whaling Commission to discuss and reduce potential conflicts with the siting, timing, and methods of proposed operations and safeguards or other mitigating measures that could be implemented by the operator to prevent unreasonable conflicts. The Orientation Program stipulation, which requires lessees to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in the area also provides additional mitigation. The MMS has worked closely with the State, the North Slope Borough, directly affected subsistence communities, and the Alaska Eskimo Whaling Commission to discuss, develop, and improve mitigating measures from previous EIS's, including Stipulation 5 (Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities), which evolved from the Oil/Whaler Cooperative Program required for Sale 97, and which has been adopted from and in conjunction with the State, North Slope Borough, and the Alaska Eskimo Whaling Commission. The MMS believes these, and other mitigation developed for OCS leasing activities, protects the local and national values of coastal and marine resources on the effects on indigenous cultures and their subsistence lifestyles and uses of the OCS.

L-0021.006

Additional information on the persistence of oil-spill effects on shoreline habitats has been added to Section IV.C.2 – Lower Trophic-Level Organisms. The new information references the ongoing research for the *Exxon Valdez* Oil Spill Trustee Council, explaining that small amounts of oil might persist in shoreline sediments for more than a decade. However, part of the reason for the long persistence of oil in Prince William Sound coastlines might be due to the massive size of the spill, which was many times larger than the size of the unlikely spills that we appropriately hypothesized for the EIS.

L-0021.007

Hypothetical development scenarios are designed to be plausible predictions of future events, even if those events are unlikely. Numerous factors could lead to a variety of other possible scenarios, and a true set of circumstances will not be known for decades. Meanwhile, the scenarios provide a uniform set of assumptions for each analyst to use in their respective environmental impact analysis. No one can accurately predict the timing, location, and configuration of future commercial oil fields in a frontier area such as the Beaufort Sea. We would mislead the reader if we placed the locations of new fields in specific areas, but analysts generally attempt to evaluate the effects of development activities in all parts of the OCS program area. Additional NEPA-specific impact analysis will be prepared using site-specific information if and when an Exploration Plan or Development and Production Plan are submitted.

L-0021.008

The uncertainty of future activities and potential effects has been addressed quantitatively with the projection of development scenarios that in the past have been overestimates of potential effects. In addition, extensive quantification has been applied to the oil spills and disturbance to determine the incremental contribution of the proposed action as required by NEPA. Oil-spill transport has been quantified by transport modeling, weathering models, and toxicity laboratory and field studies, when available. A recovery factor for affected resources also is factored into the analysis, based on previous incidents and long-term population monitoring studies.

Actions the MMS took in the past regarding the OCS are not particularly relevant to leasing in the National Petroleum Reserve-Alaska. That program is run by BLM under different programmatic laws than those that guide the MMS. The MMS has not ignored specific requests but rather selected reasonable alternatives prudently to produce an informative EIS. A variety of spill-cleanup methods exist and are appropriate for use in the Beaufort Sea. Experience may show that one method has more limitations than initially expected, but that does not mean than other available methods cannot be effective.

L-0021.009

As stated in the Secretary's 5-year oil and gas leasing program for 1997-2002, Beaufort Sea Sale 170 specifically was intended as a focused, single sale in the Beaufort Sea Planning Area, and the EIS was written to reflect that. The current 2002-2007 program called for a single EIS to be prepared for multiple sales (Sales 186, 195, and 202) in the Beaufort Sea Planning Area, and this EIS was written to reflect that. The Secretary decides whether to offer areas for leasing or to continue to exclude areas on a sale-by-sale basis. The area offshore the Arctic National Wildlife Refuge has been deferred from some of the past OCS oil and gas lease sales in response to concerns related to the bowhead whale and the potential for this area to be an important feeding area during their fall migration. The area offshore the Refuge has been offered and leased in four of the seven previous Beaufort Sea OCS lease sales, and exploratory activity has taken place with no significant impacts to the area of the fall bowhead whale migration. Further, the State of Alaska has offered, leased, explored, and maintains producible areas (both on and offshore) adjacent to the western boundary of the Refuge (the Point Thomson Unit).

Excluding areas of the Beaufort Sea that have significant resource potential and industry interest at the 5-year stage of the process is premature. Deferral alternatives are evaluated in this EIS and may be chosen by the decisionmaker. That is precisely the purpose of this EIS process. As new information from current studies, developing technology, and continuing monitoring programs becomes available, it will be incorporated into the decision process for all three Beaufort Sea proposed sales. Likewise, this EIS incorporates into its analysis mitigating measures that have been developed and refined over time and with the cooperation of the North Slope Borough, the Alaska Eskimo Whaling Commission, directly affected local communities, whaling captains, and the State. These mitigating measures include the stipulation on Industry Site-Specific Bowhead Whale-Monitoring Program, which provides site-specific information about the migration of bowhead whales; and the stipulation on Subsistence Whaling and Other Subsistence-Harvesting Activities, which helps reduce potential conflicts between subsistence hunters and whalers from oil and gas activities through consultation efforts. Additional opportunities for public review and comment continue throughout the sale-specific leasing process. Further analysis throughout the Sale 186 process may reveal that additional areas offshore the Arctic National Wildlife Refuge be withdrawn or new mitigation measures identified.

Regarding information on cumulative effects, emergency-response plans, and subsea pipelines, the commenter could not be more wrong. Since Sale 170, the MMS totally overhauled the approach we use to assess cumulative effects in our EIS's. Also, the MMS has been working diligently with the companies who are responsible for preparation of oil-spill-contingency plans to ensure they are comprehensive and adequate. In addition, the MMS has hired a spill-cleanup expert as part of our permanent staff in Anchorage. Finally, the MMS has conducted three very substantial in-depth studies of subsea pipelines and BP did an independent assessment to help address the issues. The studies were all peer reviewed; for the MMS studies, the statement of work, selection of the contractors, and the review of the draft reports were all done by an interagency team that included among others the Environmental Protection Agency, the U.S. Army Corps of Engineers, the North Slope Borough, and the Fish and Wildlife Service. Collectively these studies provide adequate information about pipelines to meet the informational requirements of an EIS.

L-0021.010

See Response L-0007.001.

L-0021.011

The Teshekpuk Lake Special Area is inland from the Beaufort Sea coast and is not at risk from potential offshore oil spills. The MMS does not assume or expect that potential offshore pipelines or other facilities would be placed within the Teshekpuk Lake Special Area; we also do not anticipate or project that aircraft associated with OCS activities would traverse the area. Thus, geese and other wildlife species and habitats within this area are not likely to be affected by offshore development.

L-0021.012

To evaluate the effects of potential oil spills, the MMS assume hypothetical pipelines and landfalls near the Teshekpuk Lake special use area. The land fall locations shown in Maps A-4a and A-4b are near but within the areas of "no surface activity" and "not available for oil and gas leasing" identified by the Bureau of Land Management (see USDOI, BLM and MMS, 1998:Figure II.C.1). Therefore, such activities are not prohibited in these areas. These hypothetical pipeline locations are for analysis purposes, and it should not be construed that MMS or industry plans to build a pipeline to those location. Additional NEPA analysis would be required before any construction of any pipeline going from offshore facilities to existing onshore pipelines.

See Response L-0021.011.

L-0021.013

While the EIS does not look a every possible alternative that could reduce environmental effects, it does evaluate a reasonable range of alternatives. The Council on Environmental Quality NEPA regulation noted by the commenter at 40 CFR 1502.14 (a) states " Rigorously explore and objectively evaluate all reasonable alternatives and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." This EIS (see Section IV) evaluates four deferral alternatives and a no-action alternative. Section I.C.2.b provides analysis and information about alternatives suggested during scoping that were not considered further in this EIS.

Also, see Response L-0001.015.

The MMS has evaluated alternatives that would affect the size or location of the sale. In the 5-year program and EIS, the Secretary evaluated the geographic extent and pace of OCS leasing and the number of lease sales to be held. This EIS also looks at the timing of the sale(s) by evaluating the environmental impacts of holding three OCS sales (Sales 186, 195, and 202) in the Beaufort Sea as identified by the Secretary in the 5-year program for 2002-2007. For each sale, the Secretary has the option of holding or not holding the sale. If the Secretary decides to hold the sale, she can accept one or all of the deferral alternatives or various combinations thereof. In addition, the Secretary can consider and adopt any, all, or a combination of stipulations and ITL clauses that provide mitigation and lessen the potential adverse environmental effects.

L-0021.014

The MMS believes that the discussion and analysis of the No Lease Sale Alternative (Alternative II) provides the Secretary of the Interior with sufficient information to generally determine the effects on America's energy needs, should the resources estimated for the proposed action not be found or produced. Inherent in a no-action alternative is the reality that those effects associated with the Proposal will not occur, and that the current situation or baseline will continue. To repeat the extensive analysis with the addition of the phrase "the following effects would not occur" would be a redundant and wasteful exercise.

The EIS clearly identifies in Section IV.B.2.a (the analysis of Alternative II) that "By not producing our own domestic oil and gas resources and relying instead on imported oil, we are, from a global perspective, contributing to at least a sizeable portion of the environmental impacts to those countries from which the united States imports and through or by which our imported oil is transported. Most advocates of the "no-action alternative" for energy projects either omit or downplay this important point. It is misleading to try to lead anyone to believe that simply by not developing our domestic resources the global environmental effects of the United States' dependence on oil will somehow disappear. The MMS has not neglected its duty under NEPA but rather has done its best to give a clear picture of all the important effects, whether domestic or global.

L-0021.015

The Department of the Interior does not plan to lease the entire Beaufort Sea Planning Area. That phraseology is inaccurate and misleading. The MMS offers tracts for lease and companies may buy a few. A primary purpose of the OCS Lands Act is to make lands available for oil and gas leasing in an environmentally acceptable manner, taking into consideration protection of the marine, coastal, and human environments.

Deferral areas are considered on a sale-by-sale basis. For each OCS sale, deferral areas are designed to address specific concerns existing at the time of the Proposal. Any area considered for deferral or actually deferred in a previous sale does not automatically get carried over into the next proposed sale for that area. Decisions on deferral alternatives are based on information current at the time the deferral areas are designed. This includes concerns expressed during the Call for Information and the scoping process and in conjunction with consideration of previous mitigating measures, completed studies, or monitoring programs. At each specific step in the prelease planning process, data and information obtained from public comments are analyzed and the Proposal and alternatives are identified. The multiple-sale EIS addresses environmental analyses and potential impacts to all the resources in the planning area. After such analysis, the MMS consults with other Federal Agencies, the State of Alaska, local governments, and affected communities, and the sale area is further refined. There is nothing preventing the decisionmaker from choosing more than one alternative for deferral. For both the second and third sales covered under this EIS, a detailed environmental assessment will be conducted and public comments sought.

The MMS believes that our process satisfies NEPA requirements in that the Secretary of the Interior is provided sufficient scientifically based information with which to make a reasoned decision on whether or not to proceed with the lease sale, and that local community concerns are balanced with the national interest.

To say that the alternatives need significantly more analysis is to deny the more than 200 pages of analysis in Section IV exist or to imply that the MMS should repeat text over and over for each alternative. The EIS indeed does provide readers a very reasonable way to evaluate environmental effects of the lease sales, is scientifically based, and addresses the Inupiat communities' concerns in addition to issues raised by national conservation organizations such as the Ocean Conservancy.

See also Response L-0001.002.

L-0021.016

This multiple-sale EIS was prepared in accordance with NEPA and Council on Environmental Quality requirements and as required by the OCS Lands Act, as amended. This included a detailed analysis of the Proposal, deferral alternatives, and mitigating measures to minimize potential risks to the environment and resources. The EIS analysis includes all the relevant environmental impacts of the key resources affected by the alternatives while still focusing the EIS on the important issues.

The standard mitigating measures analyzed in this EIS do not, as the commenter suggests, simply represent token efforts to accommodate the mitigation required under NEPA. The five standard stipulations proposed for Sale 186 (Stipulations 1 through 5) are the result of considerable consultation, coordination, and effort over several years, and they are refined for each subsequent proposed lease sale as new technology is developed, studies are completed and incorporated into EIS analysis, and differing environmental and other constraints are identified. Coordination and consultation on proposed mitigating measures has taken place among the MMS, the Alaska Eskimo Whaling Commission, the State of Alaska, the North Slope Borough, local affected communities, other Federal Agencies, individual whaling captains, and industry. Beaufort Sea Sale 186 additional stipulations (Stipulations 6a, 6b, and 7) were identified as a result of scoping comments and new procedures implemented on Northstar. Proposed mitigating measures were scrutinized, and potential direct and indirect effects were analyzed in the EIS by staff analysts, using comments provided during testimony at public hearings and through written comments on the EIS.

See also Responses L-0021.035 and L-0035.003.

L-0021.017

The MMS believes that the EIS adequately addresses possible impacts and alternatives for threatened and endangered species. The MMS receives comments on the draft EIS from the National Marine Fisheries Service and the Fish and Wildlife Service to ensure adequacy on threatened and endangered species and consults with both agencies on threatened and endangered species in the Beaufort Sea Planning Area. The MMS complies with the regulations on Section 7 consultations very closely. The Section 7 consultation process was completed since the draft EIS was issued. A discussion of the consultation history for the proposed lease sale at the time the draft EIS was made available for public review can be found in Section IV.C.5 in the draft EIS. This section has been updated in the final EIS, and the complete Biological Opinions of both agencies are included in the final EIS in Appendix C.

L-0021.018

Designation of critical habitat for this species falls under the jurisdiction of the Fish and Wildlife Service and the National Marine Fisheries Service. The Fish and Wildlife Service did consider designation of critical habitat for Steller's eiders and spectacled eiders in the Beaufort Sea, and the National Marine Fisheries Service considered designation of critical habitat for bowhead whales in the Beaufort Sea. Both agencies determined that designation of critical habitat for these species in the Beaufort Sea was unnecessary. Critical habitat was designated for spectacled eiders for areas other than the Beaufort Sea on February 6, 2001 (46 *FR* 9146), and for Steller's eiders on February

2, 2001 (66 *FR* 8849). The National Marine Fisheries Service determined there was no need to propose designation of critical habitat for bowheads on August 30, 2002 (67 *FR* 55767). However, the MMS has consulted with both agencies on potential effects of the proposed lease sale on these species. The Biological Opinions are included in the final EIS in Appendix C.

L-0021.019

The MMS receives comments on the draft EIS from the National Marine Fisheries Service and the Fish and Wildlife Service to ensure adequate discussion on marine mammals in the Beaufort Sea Planning Area. The MMS also advises lessees about disturbance to marine mammals from their activities and that lessees need to apply for specific regulations under the Endangered Species Act and the Marine Mammal Protection Act and obtain a Letter of Authorization or an Incidental Harassment Authorization allowing an incidental take of marine mammals during the conduct of their activities. This information can be found in Section II.H.3 of the EIS. The MMS believes the EIS adequately addresses and considers all impacts that could occur to marine mammals that are protected under the Marine Mammal Protection Act.

L-0021.020

See Response L-0021.019.

L-0021.021

The three types of actions and three types of impacts the commenter refers to are covered in this analysis. Connected action is the overall leasing process from exploration to development and production. Oil-spill modeling is an example of both connected and interdependent actions, dependent on spatial and temporal aspects of each resource. Cumulative effects are addressed in considerable detail for each resource, based on these and other factors (see Section V). Concerning the three types of impacts the commenter refers to, each resource has been assessed with a generic analysis and an analysis of the likelihood of contact from a spill and disturbance event. Indirect effects are addressed in the population dynamics of a resource and recovery factors, which also carry over into the cumulative analysis. Cumulative effects are considered for onshore and offshore activities. Most resources do not occupy both biomes but where they do, as is the case with the polar bear population, this has been incorporated into the analysis. Complementary infrastructure for both onshore and offshore activities is not necessarily a negative thing in a cumulative-effects context.

The commenter quotes NEPA regarding cumulative effects and then says MMS does an inadequate job in assessing cumulative effects. The MMS disagrees. The first 16 pages of Section V identify the basis for cumulative analysis, which is consistent with Council on Environmental Quality NEPA guidance and requirements; the balance of the section analyzes the cumulative effects on each of the 16 key resources.

L-0021.022

The EIS includes an extensive analysis of the effects of a very large oil spill. The commenters reference to a “worst-case discharge” pursuant to 30 CFR 254 relates to the oil-spill-response planning standard for a facility’s specific contingency plan and is different than the oil-spill-risk analysis provided in the EIS for NEPA. The Council on Environmental Quality NEPA regulations do not require a worst-case analysis indicated by the commenter; nevertheless, the EIS does consider and evaluate a very large but very unlikely oil spill in Section IV.I.

L-0021.023

The maps, tables, and figures were published in a separate volume. The Executive Summary contains a synopsis of the EIS. A separate stand-alone Executive Summary will be available for the final EIS--Map 2 will be included. The final EIS comprises an Executive Summary, with accompanying referenced maps, figures, and/or tables, and four volumes: Volume I, the text of Sections I, II, III, IV, and V; Volume II, the text of Sections VI and VII, the Bibliography, and the Index; Volume III, all of the tables, figures, and maps for the text of the EIS; and Volume IV, the appendices with the accompanying referenced maps, figures, and tables.

L-0021.024

Clarification on the recovery of marine mammals from routine permitted activities is given in Section IV.C.7. These activities are likely to have short-term and local effects on marine mammals, with recovery from such effects expected to occur within 1 year or less.

L-0021.025

The statement referenced specifically refers to an oil spill that enters an area where and when spectacled eiders are present, and the risk certainly might extend over more than just the season of occurrence. The MMS does not believe a detailed analysis is necessary or appropriate for this Executive Summary. For a detailed analysis, the reader must go to Sections IV.C.5.b and IV.C.6.a of the EIS. A clarifying statement on this point has been added to the Executive Summary.

L-0021.026

See Responses L-0021.004 and L-0021.006 for information on the *Exxon Valdez* oil spill.

The MMS has in some cases found effects “too small to observe or measure” or “no clear cause-and-effect relationship.” To advocate that in such circumstances the MMS should take a more cautionary approach and, by implication, adopt the no-action alternative would, if made a Nationwide policy, subvert the OCS Lands Act, which indicates that MMS should promote environmentally sound exploration and development. Most governmental decisionmaking requires decisions in the face of incomplete information. The safeguards built into the OCS exploration and development program are sufficient to allow leasing to proceed under the terms of the OCS Lands Act. The purpose of the EIS is to help lay out the environmental effects of leasing. This EIS adequately meets the requirements of both NEPA and the OCS Lands Act.

L-0021.027

This is the type of information taken into consideration by the analysts for birds, seals, and whales in their consideration of oil-spill effects on these species. The information literally has been incorporated and discussed in the subsistence and endangered species (bowhead whales) analyses. The MMS does not feel the placement of this information is inappropriate, as it is a statement made by the late Thomas Brower, Sr., Elder and hunter, and is considered legitimately traditional knowledge. The full text of this quote is found in Section IV.C.11 - Effects of Oil Spills on Subsistence-Harvest Patterns in the subsection entitled Native Views on Oil Spills.

L-0021.028

The infrastructure/water-depth zones are generalized, because the definitions are approximate and the contacts are gradational. Distance from infrastructure is an obvious economic consideration affecting the logistics of transportation to the site in addition to the new infrastructure costs (long pipelines cost more than short pipelines). Factual cost data is project specific and cannot be provided for undefined projects in unknown locations. Water-depth zones were used to represent the likely exploration and development activities (Near Zone shallow-water platforms would be artificial gravel islands). The extension of the Midrange Zone to the east acknowledges the likelihood of a new facility constructed for the Point Thomson project. It is premature to assess the technical feasibility of subsea pipelines off the coast of the Arctic National Wildlife Refuge, because no commercial discoveries have been made there and technology advancement over the next decade is speculative. However, thousands of miles of subsea pipeline have operated safely for decades throughout the world in a wide variety of water depths and environmentally sensitive areas. We believe that a general model of zones is a valid tool to analyze the effects of three consecutive lease sales in a frontier area such as the Beaufort Sea. The potential threats to biological and cultural resources will be more accurately assessed, when the location of future commercial fields is known. Each exploration and development plan requires separate NEPA analysis.

L-0021.029

See Responses L-0021.007 and L-0021.028.

No attempt has been made to relate distance-depth zone definitions to the leasing alternatives, because they represent entirely different concepts. Distance-depth zones are used as a general model where activities expand away from existing infrastructure during a series of lease sales. The alternatives define the areas offered in each lease sale. Although it is logical to assume that activities would occur near existing infrastructure first and later expand into more remote areas over time, it is quite possible that industry groups will adopt different strategies. It is important to offer large areas for leasing in each sale to maximize the possibility that commercial discoveries will be made. Environmental analyses presented in this EIS cover the activities for all three sales. If the distinction between activities assumed for individual sales becomes somewhat blurred in the future, all of the consequences of the three-sale program are still evaluated. Should any significant new information come to light between the individual sales, additional environmental documentation will be prepared as an update.

It would be unrealistic to assume that all of the discoveries listed under reasonably foreseeable would be developed along with new discoveries in the timeframe covered by this EIS. However, the scenarios could include a mix of new and previous discoveries in the hypothetical schedules provided. The decision to proceed to commercial development is an industry decision, and it would be misleading to single out specific discoveries prior to commitments by industry. Many of the previous discoveries listed as reasonably foreseeable presently are not leased, having been leased, studied, and then relinquished by different industry groups as noncommercial. New development plans and technologies could lead to future commercial projects, but it is very speculative to offer site-specific plans for unidentified industry groups. Public data concerning previous exploration activities, such as Mukluk, are discussed in the EIS under the Regional Geology and Resource Assessment sections.

L-0021.030

Probability weighting (which we call the Opportunity Index) is a valid way of partitioning a whole into the sum of its parts. In this case, the undiscovered petroleum potential represents the whole. Individual subareas represent the parts. No one can predict with any accuracy where commercial oil fields eventually will be discovered and developed. However, we can determine which areas are more likely to hold commercial-sized fields based on geologic play analysis and exploration trends. The Opportunity Index is a simple way to distinguish high-potential areas from low-potential areas. It is reasonable to assume that future development, and its associated impacts, is more likely to occur in higher-potential areas.

The Opportunity Index is a completely different concept than distance-depth zones. The former is used to estimate the potential loss in petroleum potential, if areas are removed under various leasing alternatives. The latter is a generalized model where offshore industrial activity progressively expands into more remote areas as a result of a series of areawide lease sales. Nowhere in the EIS is the Opportunity Index linked to the distance-depth zones, as these concepts are used for different purposes.

L-0021.031

See Response L-0021.023.

The Executive Summary provides only a summary of the overall three-volume draft EIS (now a four-volume final EIS). Alternative I (the proposal of offering all lease sales) is described near the bottom of page 2 of the draft Executive Summary. For details within each EIS volume, the reader must go to the appropriate EIS Table of Contents for that volume. In the final EIS, we include a map (Map 15) with all past lease sales offered in relation to the proposal (Alternative I), plus a map (Map 16) showing existing leases in relation to the Proposal (Alternative I).

L-0021.032

See Responses L-0021.015 and L-0001.002.

L-0021.033

See Responses L-0035.001 and L-0021.009.

Please also note that nothing prevents the Secretary of the Interior from selecting more than one alternative, if she believes that this area(s) requires protection in addition to the stipulations identified and analyzed in this EIS.

As to a total deferral of all offshore areas off of the Arctic National Wildlife Refuge, deferring these blocks would reduce the opportunity of discovering and developing an economic oil field by 23%. Alternatives V and VI defer about 60% of the Refuge's coastline and reduce the opportunity of discovering and developing and economic oil field by 6%.

L-0021.034

As previously indicated, the Executive Summary is just that–a summary. The detailed analyses are found in the Sections III, IV, V, and VI. Inherent in the No Lease Sale Alternative is the fact that baseline (current situation) conditions, including oil and gas activity, would continue. Furthermore, we do point out other environmental consequences in the second paragraph of Section ES.1.f: "…from a global perspective, selection of Alternative II (No Lease Sale), would be a decision for the U.S. to export these environmental effects. This same transfer of environmental consequences holds true for any oil not produced if any of the other deferral alternatives are chosen." We also indicate that in a little more detail in the last paragraph of Section II.C of the EIS: "From a global perspective, by importing oil [as a consequence of selection of the no action alternative] we are exporting at least a sizeable portion of the environmental impacts associated with oil we consume to other countries where oil is produced and to those countries along the tanker routes."

L-0021.035

The MMS does not agree with the commenter. The alternatives were developed based on the comments received during scoping, and they reflect the issues and concerns raised at that time. In addition to the alternatives evaluated in the EIS, the MMS also considers and evaluated the effectiveness of mitigating measures, including 5 standard stipulations, 4 optional stipulations, 16 standard ITL clauses, and 1 additional ITL.

The standard mitigating measures are assumed to be part of the Proposal and all of the deferral alternatives. They have been developed and refined over the past 20-plus years and have proven to be effective in reducing potential impacts. Because the Proposal with the standard mitigating measures included does not find significant adverse impacts from routine activities, it is not surprising to the MMS that the deferral alternatives that eliminate a portion of the area also would not generate significant differences.

Section I.C.2.b of the EIS provides the analysis and the rationale we considered when we determined that a suggestion did not warrant additional analysis and consideration. The NEPA requires agencies to use a standard of reasonableness, and the MMS does not need to include alternatives, other than the No Lease Sale Alternative, that eliminate such large portions of the available hydrocarbon resources. While the No Lease Sale Alternative lowers the probability of an offshore oil spill, it does not eliminate all risk of an offshore spill, and a large offshore spill is an unlikely event. Please note that we found that even the No Lease Sale Alternative would not have "significantly less environmental impact" than the Proposal. The environmental consequences would, in essence, be transferred to somewhere else.

See Response L0021.034 and also see Section IV.B.

L-0021.036

Since the late 1970's, the MMS has engaged in oil and gas leasing activities in the Beaufort Sea. An EIS has been prepared prior to each lease sale, in conformance with NEPA and Council on Environmental Quality guidelines and as required by the OCS Lands Act. Identification and analysis of potential effects to the resources, environment, culture and lifestyles of local communities were part of each EIS alternative. To minimize potential risks, mitigating measures were developed and analyzed. The MMS has worked closely over the years with the State of Alaska, the North Slope Borough, the Alaska Eskimo Whaling Commission, directly affected subsistence communities, whaling captains, and industry to discuss, develop, and improve mitigating measures from previous EIS's and to identify habitat and feeding areas of the bowhead whale to minimize effects to subsistence whaling activities and oil and gas activities.

Proposed mitigating measures have received close scrutiny from commenters on each draft EIS. The MMS takes pride in working with all parties to establish continuing dialogue to further refine and improve mitigation protections, incorporating new technology, sound science, study results, and continued monitoring to minimize potential conflicts, and we will continue to do so at each step of the prelease planning process for each subsequent sale. Those mitigating measures are now considered standard, and they are evaluated as part of the proposal and all deferral alternatives. The continuing dialogue between the MMS and the North Slope Borough and Alaska Eskimo Whaling Commission on study needs and results also has improved the quality of our scientific research on the North Slope. We strongly believe that, by working together with all affected constituents, oil and gas leasing exploration, production, and development can occur safely on the OCS.

See also Response L-0021.005, paragraph 2.

L-0021.037

The MMS disagrees with this comment. The MMS has included among the deferral alternatives some recommended by traditional subsistence users, communities, and tribal governments. The NEPA Council on Environmental Quality regulations require scoping as part of the EIS process. However, this process is not the same as the hearing process, and information gathered is evaluated by the MMS and summarized into a scoping report. The information provided during scoping is used by the MMS in its evaluation process. Under NEPA, agencies are not required to respond either publicly or privately to each and every scoping comment or suggestion, nor are agencies obliged to make each and every scoping comment available for public review and comment. The scoping information provided is used by the agency to develop the issues and concerns to be evaluated in the EIS in addition to the suite of alternatives considered by the agency to be reasonable. See Sections I.C. of the EIS for a summary of the scoping process.

The information the MMS receives becomes part of the administrative record.

See also L-0021.036.

L-0021.038

We disagree with this comment. The MMS looked at the bowhead whale-strike data provided by the Alaska Eskimo Whaling Commission, the Oil-Spill-Risk Analysis for oil spills in the OCS areas north of the Arctic National Wildlife Refuge, and the analysis of impacts to individual wildlife that inhabits this wilderness area. We determined that the standard stipulations and ITL clauses provide protection for the Refuge's shoreline and onshore lands. If the MMS Director and/or the Secretary of the Interior feels that this area needed further protection, one or both of Alternatives V and IV could be chosen to provide additional protection for a portion of this area. Current law prohibits onshore support facilities on Arctic National Wildlife Refuge lands; therefore, OCS activities cannot rely on landfalls in the Refuge.

L-0021.039

See Response L-0021.038.

Under this proposed leasing program, the MMS has determined that an equitable balance has been drawn between protecting environmental resources and offering OCS acreage for lease.

L-0021.040

While the proposal would allow for leasing in all three zones for all three leases sales, the scenario we evaluate in the EIS does not hypothesize leasing in the Far Zone until Sale 202. Development in the Far Zone includes nearshore and medium-depth water in addition to deep water. We would be misleading the public and the decisionmakers to assume icebreaker support would be needed and used for all three of the sales.

If icebreaker support is needed, it will be identified in the exploration plans, which will undergo NEPA analysis. The effects of supporting the proposed exploration activities with icebreakers would be fully evaluated and considered at that time.

L-0021.041

We disagree with this comment. Tracts have been leased throughout the Beaufort Sea Planning Area in previous areawide lease sales. This implies that exploration targets have been identified by numerous industry groups. Mapping and resource-assessment work by the MMS also has identified attractive plays throughout the area. Exploration strategies are likely to differ among companies. Some companies are attracted to areas close to infrastructure where the geology is better known and development costs are probably lower. However, these areas have been more heavily explored and offer the opportunity for generally smaller fields. Remote areas are less explored and offer the opportunity for larger fields. Although for purposes of analysis in this EIS we assume that the timing and character of new development will expand from small fields near existing infrastructure to large fields in more remote areas, we have no accurate way of predicting when or where commercial discoveries will be made. To maximize the opportunity for successful exploration it is important to offer large areas for leasing so that industry groups can pursue different strategies.

L-0021.042

The nature of leasing is such that the MMS cannot determine where subsequent exploration and development will occur. The MMS creates and uses scenarios for this EIS to aid the decisionmaker and the reader in understanding what may occur if the decision is made to proceed with leasing, and the EIS provides an analysis of potential effects. As we noted in the in the Development Scenarios in the Executive Summary and in Section IV.A, this EIS evaluates the effects of leasing in all zones, and the effect attributed to any zone could occur as a result of any lease sale, if they occur at all. If readers or decisionmakers would like to see our evaluation of the effects of leasing in the Midrange or Far zone, they are directed and encouraged to read the effects identified in Section IV.B for Sales 195 and 202. We also note in Table II.A-1 that some leasing could occur in all of the zones for all or any of the sales. We believe this EIS adequately covers the effects of leasing in all areas. Furthermore, under NEPA, we are not obliged "to conduct a worst-case environmental impact analysis." We do, however, include estimated environmental effects of some unlikely and very unlikely events.

L-0021.043

The MMS does not agree that additional stipulations (seasonal drilling and production, zero discharge, and double-walled pipelines), as suggested by the commenter, are necessary. Seasonal stipulations were considered and included in early OCS sales in the Beaufort Sea, but over time they were replaced by existing regulatory requirements and the standard mitigating measures that address the types of mitigation sought by the commenter. The Environmental Protection Agency's National Pollution Discharge Elimination System permits provide for regulation of discharges, and this EIS found no significant effects from discharges that require mitigation. The MMS safety and pollution-prevention regulations already reduce the risk of oil spills. The MMS oil-spill-contingency plan regulations ensure that appropriate oil-spill-response capabilities are in place. Pipeline design and operation are subject to multiple existing regulatory jurisdictions, and standards and must be designed to meet the specific conditions for each potential pipeline route. While double-walled pipelines may be appropriate technology for use in the arctic offshore, they are not necessarily the best technology for all pipelines. Pipeline design is an integral part of project development, and it would be inappropriate to evaluate or designate specific pipeline designs in a lease-sale EIS without the benefit of site-specific data and project requirements.

L-0021.044

The MMS did not add the entire shoreline of the Arctic National Wildlife Refuge to the Notice to Lessees on Sensitive Areas. The MMS does not dispute that the Refuge's coastline includes many important wildlife resources and habitats. These resources and habitats have been mapped and identified in the existing Alaska Clean Seas technical manuals for oil-spill cleanup and incorporated into the Alaska Federal/State Unified Plan.

L-0021.045

As explained in Section IV.C.10, the exploration and development scenario in Section IV.A.1 and Appendix A are the basis for analysis of potential economic effects in this section. Using the scenario, we do not find economic differences among sales or alternatives. The economy is just one of 16 resources and aspects we analyze in the EIS. If we do not find differences among alternatives for just one resource, it does not mean that differences are not found for other resources and aspects. Consequently, this does not allude to an underlying failing that all alternatives are essentially the same. To help clarify this point, in the first sentence of Section IV.C.10 Economy, we have added the word "economy" so the sentence reads in part: "…for the purposes of economic analysis…."

L-0021.046

Inherent in the No Lease Sale Alternative is the fact that baseline (current situation) conditions, including oil and gas activity would continue. Our discussion of the existing environment in Section III is a baseline for the no-action discussion and for the cumulative analysis; to repeat it in the No Lease Sale Alternative would not provide any additional useful information.

L-0021.047

Arctic cisco and whitefish are discussed in Section III.B.2.

L-0021.048

A figure showing recent polar bear maternity den locations was included and referenced in the draft EIS in Section III B 6.e - Polar Bears (see Figure III.B-3e). Polar bears do not normally "migrate." Satellite data show that the bears move throughout the Beaufort Sea, and these movements are highly variable depending on ice coverage from one season and one year to the next. In other words, they move all over the map (see the sightings on Figure III.B-3e). Feeding concentrations of bears along the coast are shown as sighting clusters in Figure III.B-3e.

L-0021.049

Section IV evaluates the effects of the Proposal and alternatives. Section V - Cumulative Analysis deals with effects of past activities on the North Slope. However, the effects of past drilling, including dry holes and discoveries, have, relative to past production, little or no bearing on the effects analysis. In turn, the effects of past development are considered in the description of the existing environment. Contrary to the comment offered, the MMS does consider the Beaufort Sea to be prospective with substantial undiscovered oil and gas resources available. In fact, our scenarios are optimistic and assume that 460 million barrels of oil could be discovered as a result of each of the proposed lease sales. A dry hole or a noncommercial discovery does not mean that anyone, including the MMS, knows where commercial oil deposits are or are not located. Before the first commercial discovery was made in the North Sea, more than 60 wells had been drilled before the first successful well was drilled.

Section V of the EIS analyzes the effects of past, present, and future activities.

L-0021.050

The thresholds used to identify significant impacts are compatible with NEPA regulations and reflect the information and definitions of impacts used in our previous EIS's in Alaska, which have undergone extensive public review and comment. A focus on populations is an appropriate way to assess effects on a species. For fish, terrestrial and marine mammals, and lower trophic-level organisms evaluated in the EIS, we use a significance standard for biological resources that depends on an assessment of potential effects on the population. We use a different standard for Endangered and Threatened Species. No designated critical habitats were identified by either the Fish and Wildlife Service or the National Marine Fisheries Service for either of the endangered species in the Beaufort Sea.

No areas in the Beaufort Sea are designated as wilderness. No wilderness areas were identified during the scoping process, and no areas were identified by MMS as an issue of concern that warranted further analysis.

Executive Order 12898 (Environmental Justice) requires agencies to consider and analyze the disproportionately adverse effects that will occur to minority and low income populations as a result the proposed projects. The analyses in Sections IV.C.16 and V.C.16 do identify the environmental impacts that could occur from routine activities to the minority and low income populations near the Beaufort Sea Planning Area. That analysis properly concludes that no disproportionate adverse effects are estimated to result from these activities. On the other hand, it also concludes that disproportionate effects could occur in the unlikely event that a large oil spill occurred and contaminated essential whaling areas.

The significant thresholds are defined and used by the analysts to provide the decisionmaker and reader with the standards that the MMS has applied to our analyses. That definition of significance is a standard we have identified for a particular resource or group of resources and, if an estimated impact exceeds that standard, we label it significant. If it does not, we find that the estimated impact is not significant. Our analysts have the necessary scientific education, training, and skills to make well-reasoned estimates of the effects using the best scientific information available. The significance thresholds are used as a way to categorize these effects. We have not ignored effects in the EIS, nor do we use the standards in any way to understate the environmental impacts. If the author of these comments could be specific about charges of ignored effects or understated environmental impacts, we would address the specifics.

The MMS has reviewed the analysis and the conclusions reached for each of the resources, and we believe we have appropriately identified the significant effects.

L-0021.051

The term "routine permitted activities" is not meaningless. It indicates those activities that are estimated to occur as part of day-to-day activities associated with exploration, delineation, development, production, and abandonment of oil and gas facilities used to produce hydrocarbon resources from a field or reservoir, should the lessee proceed with such activities on the lease. These activities include transportation, construction, and operations. Following the issuance of a lease, exploration and development activities would occur, including seismic surveys, facility construction, well drilling, transportation of workers and equipment from staging areas to facilities, and processing and transportation to market of oil and gas. Such activities, whether onshore or offshore, are similar and happen on a daily basis in any oil and gas development.

The analysis summarized on page 2 of the Executive Summary is for those activities associated with scenarios we developed for the Proposal. The effects of past, present, and future activities, as requested by the commenter, are evaluated in a separate analysis in Section V – Cumulative Effects. The cumulative effects also are summarized in a separate section of the Executive Summary.

L-0021.052

We disagree with this comment. The MMS staff and managers have reviewed the analyses and findings in Sections IV and V of this EIS, and we find them to be accurate and complete. They reflect our professional evaluation and understanding of the activities that likely would be associated with the development of resources projected (460 million barrels of oil for each of the three sales).

L-0021.053

The U.S. Geological Survey (2002) misinterpreted the displacement of some caribou cows during June along the Milne Point road. Dau and Cameron (1986) in their final report state that fewer cow caribou were found within 1 kilometer (either side of the road equaling 2 kilometers) of the road during the June calving season. An earlier draft report suggested that there was displacement beyond 2 kilometers, but that this difference in caribou numbers was not statistically significant.

Changes in the distribution of calving caribou in the Kuparuk River area are circumstantial to the development of the oil field. There is no evidence that the change in calving location is related to disturbance from oil development in the Kuparuk oil field. The Central Arctic Caribou Herd has and continues to increase in spite of the extensive oil development on its calving and summer range.

L-0021.054

See Response PH-Anchorage.029.

The MMS released a request for *Alternative Oil Spill Occurrence Estimators for the Beaufort and Chukchi Seas* proposals in July 2000. This effort was aimed at alternative methods to estimate oil-spill occurrence for areas where historical spill data are lacking. The final report became available in August 2002 (OCS Study, MMS 2002-47). Prior to its publication, this report was peer reviewed. The MMS did not pick the data sets. Fault trees are a method for modeling the occurrence of failure when adequate history is not available to provide failure statistics.

L-0021.055

See Response PH-Anchorage.029.

The statistics on small spills (less than 1,000 barrels) have changed based on best available information. The 5-year estimates were conservative and use the Gulf of Mexico small-spill rate. The small-spill rate on the Alaska North Slope is approximately 660 spills per billion barrels produced. This compares to the Gulf of Mexico and Pacific OCS rate of approximately 3,460 spills per billion barrels. The MMS feels it is most relevant to use the Alaska North Slope small-spill rate as the analog for small spills offshore rather than the Gulf of Mexico and the Pacific OCS rate. The current operators on the North Slope of Alaska are most likely to be the operators who work offshore. With respect to aspects of the environment that would affect oil-spill statistics, offshore Alaska is more similar to the Alaska North Slope than to the Gulf of Mexico or the Pacific OCS.

L-0021.056

See Response PH-Anchorage.029.

L-0021.057

Cumulative impacts are evaluated and analyzed in Section V. Oil-spill-probability estimates are based on the spill rate and the volume of resources. The size of the area being offered has no effect on the oil-spill-probability estimate; it depends on the location of the reserve and resource estimates. Regardless of the probabilities, for analytical purposes, the MMS assumes a spill occurs and analyzes the impacts to environmental, social, and cultural resources.

L-0021.058

See Responses L-0021.059 and L-0021.060.

L-0021.059

See Response PH-Anchorage.028.

L-0021.060

The commenter is mixing conditional and combined probabilities. The combined probability (expressed as percent chance) for offshore is a less than 0.5% chance of one or more large spills occurring and contacting nearshore Beaufort Sea fish habitat. The equivalent combined probability for land after 360 days is 6%. The conditional probabilities assume a spill occurs. The combined probabilities factor in the chance of a spill ever occurring in the first place and then contacting. The analysis of Beaufort Sea nearshore fish habitat is evaluated in Section IV.C.4.a(3)(b).

L-0021.061

The broken-ice barge-based trials conducted during the spring and fall of 2000 were not failures. The trials were conducted to establish realistic maximum operating limits for the equipment and tactics. The trials demonstrated that the tactic R-19A was more limited in application than initially put forth in the Alaska Clean Seas Technical Manual, but had oil been present, oil would have been recovered. It should be recognized that the operators were limited to one single tactic and required to maintain the configuration in the manual. In a real-world situation, responders would be able to mix and match spill-recovery tactics and equipment to best fit conditions.

The outcome of the Joint Agency Report called for Alaska Clean Seas and industry to develop new tactics to use in greater ice concentrations. The Compliance Order by Consent was signed by industry primarily because one of the two spill-response barges had not been adequately outfitted and in a state of readiness described in their oil-spill-contingency plans. Industry outfitted the vessel *Beaufort 20* with the requisite equipment.

L-0021.062

In situ burning in broken-ice conditions relies more on ice than boom to collect and concentrate oil for burning. Tracking oil in icefloes is done using tracking buoys.

Regarding air pollution impacts, Sections IV.A.6.b and IV.C.15.b(2)(b) include a reasonable discussions of how an oil spill might affect air quality and the effects of oil-spill-cleanup activities on air quality. Specific pollutants are identified, along with an explanation that in situ burning would temporarily adversely affect air quality but, although ambient levels of volatile organic compounds could be high within about 100 meters of the fire, it would be significantly lower than those associated with a nonburning spill. We also explain that, "In situ burning would be less effective in areas of broken ice than in open water, but it still would reduce the effects of volatile organic compounds on the ambient air quality." The conclusion for the effects of an oil spill on air quality is that "Concentrations of criteria pollutants would remain well within Federal air quality standards. The overall effects on air quality would be minimal." Please see those sections for greater detail and the references for additional information.

L-0021.063

Inherent in the in the No Lease Sale Alternative is the fact that baseline (current situation) conditions, including oil and gas activity, would continue. Our discussion of the existing environment in Section III is a baseline, or no-action discussion. Appropriate issues related to cumulative effects are discussed in Section V.

L-0021.064

To the best of our knowledge, no causeways or docks are proposed for these lease sales. In addition, no nearshore habitat alterations are expected that would have a measurable effect on fish populations. Discussion of possible impacts related to elements of other projects not central to the Proposal and alternatives in Section IV of this EIS would confuse and mislead the reader. This is why they were not discussed here.

L-0021.065

The MMS did reinitiate formal consultation with the Fish and Wildlife Service and the National Marine Fisheries Service for these proposed lease sales. The Biological Opinions issued by these agencies can be found in Appendix C.

L-0021.066

The section that discusses bowhead whales does include statements by whaling captains about how the whales and subsistence-whaling activities are affected by industry activities. There are several pages of discussion on drilling operations from drillships and how these activities may affect bowhead whales. This discussion is found in Section IV.C.5.a(1)(a)2)c). The summary of noise effects presents general results from the whole range of seismic noise studies and did include a discussion of the most recent studies on seismic noise. None of the studies have been "discredited," although some studies may have some limitations. Many variables should be considered in assessing these studies, including the type and size of airgun arrays; the activity of the whale (resting, feeding, migrating, socializing, etc.); tolerance of individual whales to noise; depth of water; distance from shore; and other activities in the area. The MMS presents in this EIS the most complete and best scientific and traditional knowledge information available for the decisionmaker to consider.

L-0021.067

The first part of Section IV.C.5.a(1)(e) of the EIS discusses possible kinds of effects to bowhead whales if an oil spill occurred. The last part of this section discusses the probability of the spill occurring and contacting important bowhead whale habitat. The discussion does include analysis of both summer and winter spills. Based on the oil-spill-risk model, the probabilities of a summer oil spill contacting the resource areas discussed in the EIS within 360 days are the same as for contact within 180 days. The probabilities of a winter oil spill contacting the resource areas discussed in the EIS within 360 days are slightly higher than for contact within 180 days. For 180 days, there is a 27% chance of contact to ERA's 25 and 28 from a winter spill occurring at LA2 and LA7, respectively. For 360 days, the percent chance of contact from these launch areas increases to 29% at ERA's 25 and 28.

While the "technical jargon" may not be easy to understand, it is necessary in determining the probability of impacts to a particular species. In simpler language, the MMS, with input from the National Marine Fisheries Service, determines, to the best of our abilities, what areas are important to bowheads and where bowheads are likely to be present. The oil-spill-risk model then determines the probabilities that an oil spill originating at various locations, including from a rig or pipeline, would contact the important bowhead habitat. For more information, see Response L-0021.068.

L-0021.068

The environmental resource areas for bowhead whales were selected based on areas where bowheads are likely to be present. Although bowheads are present across the Beaufort Sea during the spring migration, they are well offshore in leads through the ice. The referenced sentence in the EIS does not say there is a 37% chance of a spill occurring at a site called LA10 from a launch site 32. The reference states the greatest percent chance of contact from a launch area occurs at ERA 32, which has a 37% chance of contact from a spill occurring at LA10.

Breaking this down into pieces, ERA 32 is one of the resource areas selected for analysis in the oil-spill model for bowhead whales, because it falls within the normal bowhead whale fall migration corridor. We know that bowheads likely will be in this area during the fall migration. The launch area is referred to as LA10. Launch areas, including LA10, are hypothetical spill sites. Keep in mind that although we use these hypothetical spill sites in the oil-spill model, it is very unlikely that a spill will occur at this particular site. We also use conditional probabilities in the EIS. A conditional probability assumes a spill has occurred and the model estimates the chance that the spill will contact a specific environmental resource area over a period of time. This approach does not take into account the low probability of a spill actually occurring. Combined probabilities are lower than conditional probabilities, because they combine both the probability that an oil spill will occur (which is low) and the probability that the spill will contact a particular resource area.

For the case in question, the oil-spill-risk model assumes that a spill has occurred, models this hypothetical spill from launch area LA10, and estimates the probability that a spill from that location would contact ERA 32. Based on the oil-spill model, if a spill occurred at LA10, there is a 37% chance that the spill would contact ERA 32. That also means there is a 63% chance that the spill would not contact ERA 32. ERA 32 has the highest chance of contact, because LA10 and ERA 32 are in close proximity to or overlap each other. Similarly, the highest chance of contact in other environmental resource areas occurs when the spill-launch area and the environmental resource area are in close proximity to or overlap each other.

Tables A.2-23 and A.2-41 in Appendix A2 show the percent chance of contact by resource area and launch site. The analysis in the EIS referenced the highest chance of contact. For additional information, see Responses L-0021.067 and L-0021.093.

L-0021.069

The MMS believes this section adequately addresses potential impacts to bowhead whales and their habitat. No critical habitat has been designated for bowhead whales. The National Marine Fisheries Service found no need to propose designation of critical habitat for bowheads on August 30, 2002 (67 *FR* 55767). The MMS has consulted with the National Marine Fisheries Service on potential effects of the proposed lease sale on this species. Their Biological Opinion is included in the final EIS in Appendix C.

L-0021.070

The discussion of potential collision hazards has been clarified and details added in Sections IV.C.6.a(1)(a)3) and IV.C.5.b(1)(a)1)c), the bird and spectacled eider sections. Contrary to the suggestion in the comment, the effects analysis makes use of all available information including, for example, recent satellite telemetry data that highlights apparent eider use of Harrison Bay. The comment notes collision mortality of sea ducks at Northstar Island and Endicott. This is discussed under the collision sections for marine birds and threatened spectacled eider.

An EIS need not contain "all available information," on the best and most relevant. The Fish and Wildlife Service found the information in the EIS sufficient to assess the effects and write their Biological Opinion.

L-0021.071

The MMS has considered the risk of major adverse factors for all birds that seasonally occupy the Beaufort Sea, whether migrating, staging, or nonbreeding, regardless of where they spend most of their period of summer residence. King eiders in particular have been noted (for example, Section IV.C.6.a(2)(b)2)b)) as present in substantial numbers in offshore waters and, thus, would be vulnerable to any oil spill.

L-0021.072

Seismic activities associated with OCS offshore exploration would occur during the open-water season and are not likely to have any effect on polar denning, which occurs during the winter season on the ice or on land.

L-0021.073

The Council on Environmental Quality NEPA regulations do not require a worst-case analysis. We include the analysis of a very unlikely very large oil spill to provide additional information to the readers and decisionmakers (note that there has never been a blowout on the North Slope of Alaska). The likelihood of such an event occurring is so remote, that it should not be included and discussed with the other effects that are expected to occur from routine activities or even events that may occur from unlikely large oil spills. See Response L-0035.030 for additional information.

L-0021.074

The fact that there potentially is some risk of significant harm from the proposed action does not mean that the risk cannot be reduced to an acceptable level by incorporating appropriate constraints and mitigating measures into the operating plan. The determination of potentially significant effects on some sea duck species from a large oil spill assumes, for purposes of analysis, that such a spill will occur. If the probability of such a spill occurring (8-10%) is included in the equation, the long-term effect decreases to a rather low level and does not provide nearly as strong an argument for deleting specific areas from the lease sale.

L-0021.075

The contribution of Sale 186 to cumulative effects is determined only after estimating the overall cumulative effects that are part of the total past, present, and reasonably foreseeable future activities for each resource. In meeting this NEPA requirement, we have used oil and gas production as an indicator of these activities. This analysis has included all resources and includes fish and wildlife and their habitats, endangered species, water resources, and subsistence, among others. A more detailed analysis of water usage will be provided in the proposed development EIS when more specifics are known. Each sale would have a similar contribution based on the similar resource estimates for each of the three sales. Other activities such as military operations, cleanup activities of abandoned sites, and research with icebreaker support have not translated to measurable effects. The more extensive spatial and temporal parameters of the cumulative case obscure any minor changes in effect the alternatives have on the proposed action. We would like to have the National Research Council's report for this analysis and will study it carefully when it is available to ascertain if any new information or differences in magnitude of impacts are projected from what is covered in this EIS.

L-0021.076

The analysis of effects of the Proposal and the various alternatives is provided in Section IV of this EIS. The cumulative analysis is provided in Section V of the EIS and evaluates the effects of past, present, and future activities, including an assessment of the contribution of the activities associated with the Proposal to those cumulative effects. The analysis of Alternative II (No Lease Sale) is presented as comparison to the effects analysis of Alternative I (the Proposal).

The separate cumulative analysis in Section V provides the decisionmaker and readers with the "big-picture" analysis the commenter is requesting. Such an analysis would be inappropriate in Section IV.

Each of the proposed lease sales is a separate and unique decision, and the options chosen for each lease sale may be different. It would be inappropriate for the MMS to assume that each will occur and combine all three timelines into a single analysis, and provide a single analysis. Tables IV.A-1, IV.A-2, and IV.A-3, provide the activities by year such that the information requested by the commenter is readily available.

The cumulative analysis does evaluate and consider the effects of past activities; activities on existing onshore and offshore leases; other activities and effects, including the effects of estimated activities for proposed Sale 186; and the effects that could follow from future leasing on OCS, including Sales 195 and 202.

L-0021.077

As noted in comment L-0021-076, the analysis in Section IV and the information in Tables IV.A-1, IV.A-2, and IV.A-3 are specific to the Proposal. The cumulative effects for all past, present, and future activities are presented in Section V. The analysis in Section IV is specific to evaluating the effects and impacts of proceeding with the Proposal or alternatives. The analysis includes the effects of all of the listed activities to, and in some cases beyond, the level of specificity appropriate for an environmental assessment of leasing. That is, in many cases our analysis goes well beyond that envisioned by NEPA. The EIS evaluates the issues and concerns that were identified during scoping, including seismic activities, exploration activities, development and production activities, and even the effects of unlikely events such as large oil spills. Those activities and effects of those activities are identified in Sections IV and V of this EIS.

Offshore ice roads, if needed, primarily use seawater. If the exploration activities occur during the open-water season, no ice roads would be needed. If certain technologies are used, such as the SSDC at the McCovey site, no ice roads or gravel sources would be needed. The EIS estimates that most of the activities that could occur following the proposed lease sales would occur in the Near Zone in the central Beaufort Sea near existing infrastructure, which could eliminate the need for new gravel mines, docks, causeways, etc. Under our scenario, offshore facilities would use existing gravel and/or ice roads that support onshore activities to the maximum extent possible. Transportation of oil and gas from the OCS would use existing common carrier pipelines and infrastructure when possible. No contaminated waste sites are anticipated from the proposed activities.

We know that uncertainty surrounds oil and gas leasing, exploration, and development offshore Alaska. Based on experience, most of the offshore leases issued on the Alaska OCS are never explored. Most potential oil and gas fields have not been drilled. The majority of past exploration efforts did not find commercial quantities of oil and gas. However, the scenarios developed by the MMS in Section IV provide an adequate and appropriate estimate of the levels, locations, and timing of activities that may occur, so that we can evaluate the projected environmental effects to enable the decisionmaker to make a reasoned decision.

Additional NEPA analysis is required and will happen if, after acquiring a lease in the Beaufort Sea, a company proposes to explore their lease. This step, or tiered approach, builds on the premise that as both the agencies and companies involved move from general planning, to leasing, to exploration, and to possible development, the specificity of the information improves. The accompanying environmental analysis that flows from each stage also is more specific with respect to location, timing, and magnitude. By the time a project, such as the Northstar field is proposed, specific information is available that allows Federal, State, tribal, and local agencies to evaluate the effects from specific activities to the physical, biological, and human environment at those locations. If significant effects are identified in any of these environmental reviews, new mitigation may be developed and required to reduce or eliminate adverse effects, or the projects may be denied. The staged review and assessment is a reasoned and proven process for energy development that allows companies to explore and hopefully develop additional energy to meet our country's needs in an environmentally sound manner.

L-0021.078

The Alpine facility is still under development and multiple flights are made on a daily basis, especially during the summer season when overland traffic is not permitted between the Kuparuk road system and the Alpine pad. However, frequent vehicular movement occurs between the airstrip and the work camp. Table V-8 has been updated to more accurately reflect projected Alpine aircraft use.

L-0021.079

The focus of this EIS is the first of the three sales, and the two sales to follow are expected to yield similar results and pose similar effects. Following the first sale, there will be an assessment or update on this assumption. The alternatives have not been treated in this table or in the text of the cumulative analysis, because the changes in effects of alternatives do not translate to measured differences on the expanded scale of time and space for the cumulative analysis (Section V.C). The No Lease Sale Alternative would be the same for the cumulative analysis as for the proposed action.

L-0021.080

See Response PH-Anchorage.028.

L-0021.081

The text in Section V.C.13.b has been revised to reflect that mitigating measures will avoid damage or destruction to potential archaeological resources.

L-0021.082

We direct the reader to the full analyses that can be found in Section IV.C.16 - Effects on Environmental Justice and Section V.C.16 - Cumulative Effects on Environmental Justice. We believe that leasing, seismic exploration, exploration drilling, and routine development activities would not produce disproportionate, high adverse effects on the minority Inupiat population, based on the effects analyses for bowhead whales, birds, seals, and fishes (see Section IV.C.16). However, in the event of an unlikely large oil spill, we do believe a disproportionate impact could occur.

L-0021.083

As suggested, Map 16 has been added to the EIS to show the past and current leases issued relative to the proposed action (Alternative I) and other alternatives.

L-0021.084

The description of the kelp community in Camden Bay is similar to the description provide in the Proceedings of the Arctic Kelp Workshop (USDOI, MMS, Alaska OCS Region, 1988a) held in Anchorage, Alaska and accurately depicts the kelp community in the area. The workshop proceedings explain that the presence of rock and kelp in Western Camden Bay was confirmed during surveys for the Warthog drilling platform, and that the surveys identified areas both with and without rocks (i.e., kelp holdfasts). The workshop proceedings also explain that the drilling platform was debalasted outside of the area where rocks were detected. A follow-up study entitled *Distribution and Abundance of Kelp and Associated Species in Western Camden Bay* has been proposed for FY 2004, as listed in the Alaska Annual Studies Plan, Final FY-2003.

MMS prepared an EA on the Warthog Exploration Plan (EP), as the comment implies. We prepared Categorical Exclusion Reviews (CERs) later on minor modifications to the EP, such as delayed removal of the platform. The EA discussed kelp at only an inshore location because no one expected kelp at the proposed drill site in 30' of water. After the EA was prepared, kelp was found during bottom-hazards surveys. The Arctic Biological Task Force (BTF) reviewed the benthic video and concluded the coverage was less than 10%--i.e., that it was not officially a "Boulder Patch." Regardless, the proposed drill site was moved to an area which appeared to have less rock (primarily so that the Concrete Island Drilling Structure (CIDS) skirt could penetrate the bottom) but the new location had not been surveyed. After the CIDS was moved, a site-clearance survey showed that there was probably sparse kelp there also. No other surveys or studies were conducted. It is our understanding from our Studies Section that the Coastal Marine Institute has proposed more kelp research; it might be conducted on the distribution and abundance of kelp in Western Camden Bay, but would not include a drill-site assessment.

L-0021.085

The suggested corrections have been made to Map 7.

L-0021.086

A map showing the spring migration route for bowheads was not included for several reasons. The MMS does not anticipate any exploration activities in the spring lead system area during the bowhead whale spring migration as a result of OCS Lease Sale 186. This area is far removed from existing infrastructure, and industry interest in the area is likely to be limited. Available technology and cost of operations most likely would preclude operating in the spring lead system during the ice-covered period, which would include the spring migration period. Finally, should industry acquire leases in the area and technology is developed allowing operations to occur during the spring migration, the National Marine Fisheries Service's May 25, 2001, Biological Opinion for the Beaufort Sea requires the MMS to reinitiate Section 7 consultation under the Endangered Species Act before such operations could be approved and proceed.

L-0021.087

The suggested changes have been made to Map 7.

L-0021.088

It should be noted that comparable maps for Barrow are provided. They are Figures III.C-2, and III.C-3, and they do, in fact, show historical land use. Figure III.C.-1 shows historical land use for Kaktovik, and Figure III.C-16 shows subsistence use for the 1994-1995 harvest season. Harvest location numbers that related to a place name table were omitted on the draft EIS version of Figure III.C-16 but are included in the final EIS figure.

L-0021.089

We appreciate the comments and apologize for any lack of clarity. Map 13 has been revised to read Essential Fish habitat for Salmon to clarify that this map applies only to salmon. However, essential fish habitat for salmon fisheries in Alaska include all streams, lakes, ponds, wetlands, and other waterbodies currently or historically accessible to salmon in the State. While small runs of pink and chum salmon sometimes occur in the Colville River and in some of the drainages west of the Colville River, neither species has established populations anywhere on the North Slope (Bendock and Burr, 1984). Based on available information, we have concluded that there are no self-sustaining salmon populations using the Colville and Sagavanirktok rivers, and we have added text to that section to make that clear.

We also added the following sentence to the effects on freshwater essential fish habitat in Section IV: "The freshwater habitat shown on Map 13 includes stream sections likely to be downstream of potential ice roads."

L-0021.090

The data portrayed on Map 14a is primarily from BP and was originally provided for the Liberty draft EIS. Although this is data approximately 4 years old, it is the best data we have available, which is adequate for leasing decisions being evaluated. The Council on Environmental Quality NEPA regulations require we use the best available data. We believe that the portrayed data will provide the Secretary with a reasonable picture of the gravel activities that have occurred on the North Slope in those areas that may be affected by the proposed multiple-sale leasing program. Any proposed exploration or development plans the may result for any of the three OCS sale evaluated in this EIS, would require additional NEPA environmental analysis using site specific information.

L-0021.091

This information was compiled for the draft EIS for the Northwest National Petroleum Reserve-Alaska (January 2003). It is a composite of data provided to the Bureau of Land Management and the State of Alaska by both Phillips and BP. This map was included because it shows the active direction of the oil industry regarding potential drilling in the Reserve. The map reflects the best available information, which is the standard required by NEPA regulations. We believe that the portrayed data will provide the Secretary with a reasonable picture of the industrial activities that have occurred on the North Slope in those areas that may be affected by the proposed multiple-sale leasing program. As drilling in the Reserve continues farther west, the likelihood of a major find that ties into a significant offshore find in the Beaufort Sea becomes possible. Accordingly, this map was included in Section V. Any exploration or development projects resulting for these proposed OCS activities, should the Secretary decide to hold the sales, would need further NEPA environmental evaluation using site-specific data, which is not available or needed in the current lease sale EIS.

L-0021.092

The NEPA does not require a worst-case analysis. The regulations retain the duty to describe the consequences of a remote but potentially severe impact, but they ground the evaluation in scientific opinion. We analyze a very large oil spill in Section IV.I. Cumulative impacts of oil spills are analyzed in Section V.

The following is a list of hazardous-substance spills by number of spills and volume in pounds or barrels reported by the Alaska North Slope industry to the Alaska Department of Environmental Conservation from July 1, 1995, to March 30, 2001. These types of spills generally are into containment and are cleaned up, and they have not been identified as the source of environmental effects that warrant additional analysis in the EIS. The exceptions to that rule are seawater and produced water, which are transported in a pipeline and can leak to the tundra. Such spills would be handled essentially the same as an oil spill, but the seawater or produced water is not toxic and would cause very small if any environmental effect.

Hazardous Substance	No of Spills	Pounds	Barrels
2,4,5-T	1		0.05
acid (type unknown)	9		3.14
ammonia (anhydrous) *	0		0.00
Biocide	1		0.95
biozan gel	3		135.88
Calcium chloride (solid)	3		0.38
Cement	5		21.21
corrosion inhibitor	34		539.43
drag reducing agent	15		57.33
emulsion breaker	5		6.10
ethyl alcohol (ethanol)	1		0.02
ethylene glycol (antifreeze)	131		24317.83
freon (dichlorodifluoromethane all types)	1	6	
hexylene glycol	3		3.69
hydrofluoric acid *	1		0.02
methyl alcohol (methanol)	89		590.05
Other	215		3131.43
produced water	49		163.86
propylene glycol	16		170.19
seawater	65		341.24
Sodium hydroxide	1		0.02
source water	6		35.98
Sulfuric acid *	2		0.38
therminal	5		4.02
unknown	4		9.00

We have provided a discussion of why we use the median spill size instead of the average. Appendix A, Section A 1.b now includes a table of data for well blowouts on the OCS and a discussion in the text. The section on behavior and fate of oil spills has been expanded to include more information discussed in previous EIS's. The oil-spill-trajectory analysis follows hypothetical spills for up to a year in ice tracking their movement over hundreds of miles. The boundaries used by the resource areas are developed by the MMS analysts and are based on resource information and professional judgment. The key biological resources that are evaluated in the EIS were those identified by MMS through the scoping process. While the commenter suggests that the EIS "ignores many key biological resources and subsistence resources altogether, no species or resources were listed by the commenter. The MMS is unaware of any key species that are not evaluated, and NEPA does not require that the EIS evaluate all possible species; it requires analysis of the key resources.

See Response PH-Kaktovik.032.

L-0021.093

The objective of the Oil-Spill-Risk Analysis is to estimate relative oil-spill risks associated with the production and transportation of oil and gas from the proposed lease sale. The MMS Alaska OCS Region uses this analysis in the EIS prepared for the lease sale. Analysts who prepare the EIS identify environmental resource areas at risk from oil spills based on their experience and knowledge.

The resource areas that define the bowhead whale migration corridor range from 500-1,000 square kilometers. The MMS estimates a spill would cover a discontinuous area of 440 square kilometers after 30 days. It is unlikely that an oil spill would cover the entire whale migration corridor from the McKenzie Delta to the Chukchi Sea. In addition, the migration proceeds in a staggered way geographically, with the majority of whales in one area at one time. This is why different villages go whaling at different times. The MMS is interested in impacts to the resource and, therefore, looking at segments is the most meaningful way to look at impacts to the resource.

The conditional probabilities for land segments are additive. The land segments are divided up equally to allow the analyst the maximum flexibility when looking at resources. They can either combine land segments or look at them individually. We have added tables to Appendix A summarizing the conditional probabilities of the areas you are interested in. The analysis of the impact of spills to birds in coastal lagoons is located in Section IV.C.6.a(2). The analysis of the impact of spills to polar bears is located in Section IV.C.7.a(2)(b).

L-0021.094

We are unclear what the commenter means by the Nuiqsut subsistence-resources area being “shown as a tiny triangle around Cross Island.” On Map A-2c, the Nuiqsut ERA is an arc with a radius that ranges from 10-15 miles, which was designed to include traditional areas where whales have been harvested in the past. For onshore harvest areas, land segments have been used; the pertinent land segments can be seen on Map A-3b and are analyzed in the Section IV.C.11.b(2)(c) - How Oil-Spill Contact May Affect Subsistence-Harvest Patterns. Contrary to the commenter’s statement, the semicircular environmental resource area for Kaktovik is a fair representation of Kaktovik’s historical whale-harvest area. If there is more up-to-date information on whale harvests than that provided by the North Slope Borough, we ask the commenter to provide it to the MMS.

The Oil-Spill-Risk Analysis model used in the Beaufort Sea multiple-sale EIS to evaluate the probability of spilled oil contacting specific bowhead whale subsistence-harvest areas uses a number of specific environmental resource areas (and land segments) that represent primary whaling areas. If a large area is used as an environmental resource area, the probability of contact would always be 100% and, therefore, no realistic measure of oil-spill risk could be achieved. By using discrete resource areas, a realistic measure of contact can be predicted. Figures III.C-1 and III.C-16 depict Kaktovik subsistence-use areas (see Response L-0021.088). The MMS believes that Barrow environmental resource areas and land segments are of realistic geographic scope for which to measure spill contact.

See Response L-0021.095.

L-0021.095

The analysis of subsistence resources is analyzed in IV.C.11.b(2)(b). This section discusses impacts to subsistence-resource areas using land segments and various environmental resource areas, including mapped resource areas for whaling. The analysis of the impact of oil spills on subsistence resources is not solely based on mapped resource areas for whaling. The MMS used the best available information on the locations where subsistence whalers go, which was based on whale strikes. No other geographic information was provided to the MMS. The MMS currently has a study for Nuiqsut that is looking at where subsistence-whale hunters hunt and not just where they succeed in hunting.

GREENPEACE

125 Christensen Dr., Suite 2
Anchorage, AK 99501
Tel.: 907-277-8234
Fax: 907-272-6519

L-0022

RECEIVED
SEP 2 ? 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 20, 2002

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363
Fax: 907-271-6805

RE: **Comments on the Draft Environmental Impact Statement for the Beaufort Sea Planning Area, Oil and Gas Lease Sales 186, 195, and 202. OCS EIS/EA MMS 2002-029**

Dear Mr. Goll:

Greenpeace, inc. hereby endorses the comments submitted by Martin Robards, The Ocean Conservancy, on this lease sale. Our organization was inadvertently left off the listing of signatories on that letter.

Sincerely,

Melanie Duchin
Climate Campaigner
Alaska Office

MMS Response to Comment Letter L-0022

No comments were identified in comment letter L-0022 that required responses.

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Assistant Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

September 6, 2002

RECEIVED
SEP 2 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

L-0023

Regional Director
Minerals Management Service (MMS)
Alaska OCS Region
949 East 36th Avenue
Anchorage, Alaska 99508

Dear Sir:

Enclosed are comments from the National Oceanic and Atmospheric Administration (NOAA) on the Outer Continental Shelf Oil and Gas Lease Sales 186, 195, and 2002 in the Beaufort Sea, Alaska. We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

for James P. Burgess, III
NEPA Coordinator

Enclosure

cc: Director, Minerals Management Service
Department of the Interior
Mail Stop 4230
1849 C Street, NW
Washington, DC 20240

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

September 3, 2002

RECEIVED
SEP 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

MEMORANDUM FOR: Steven Kokkinakis
Office of Strategic Planning

FROM: James W. Balsiger
Administrator, Alaska Region

SUBJECT: DEIS for Beaufort Sea Planning Area: Comments

The Alaska Region has reviewed the June 2002 Draft Environmental Impact Statement (DEIS) prepared by the Minerals Management Service (MMS) Alaska Outer Continental Shelf Region for Lease Sales 186, 195, and 202 in the Beaufort Sea. Please refer any questions to Brad Smith or Jeanne Hanson in our Anchorage office at (907) 271-5006.

General Comments

Seven (7) previous oil and gas lease sales have occurred in this area. Past sales have resulted in the drilling of 30 exploration wells. One development and production facility has been approved and is now operational (Northstar). The Minerals Management Service's proposed action (also described here as Alternative I) consists of offering 1,877 whole or partial blocks for lease, covering 9,770,000 acres of the Beaufort Sea planning area off Alaska. These blocks would be offered through three (3) individual sales which would occur sequentially between 2003 and 2007. Water depths in the sale area range up to 120 feet. Resource estimates indicate the range of potential oil here to be between 340 and 570 million barrels per sale. The DEIS projects 23 exploration and delineation wells would be drilled for these lease sales. The DEIS assumes a total of six new fields would be developed under these sales.

The DEIS offers five (5) additional alternatives; the no action alternative and four (4) alternative deferral areas. While it is not clear whether the DEIS intends for these alternatives to be mutually exclusive, we are recommending the adoption of Alternatives III, IV, V, and VI. These alternatives present small, but potentially valuable, improvements from the proposed action. Alternative III would reduce potential conflicts between bowhead whale subsistence hunters and offshore oil and gas operations by removing an area of 138,000 acres in waters

east of the Point Barrow (one percent of the sale area). The
deferral area is used by bowhead whales for migration and
possibly feeding, and is within the traditional hunting areas of
the village of Barrow. The MMS projects this alternative(and the
others)would reduce potential effects to subsistence harvest
patterns when compared to the proposed plan. While exploratory
activities adjacent to the deferral area would continue and may
present many of the same impacts expected in the proposed plan,
Alternative III offers meaningful benefit to the protection of
fish and wildlife and to locally important socio-cultural values
(subsistence). We believe support for this alternative is
justified. The actual area proposed for this (and all) deferrals
may not fully represent the area in which bowhead whales are
traditionally hunted, or in which disturbance to these whales may
impact subsistence hunting. The recommendations of the AEWC and
the North Slope Borough should be considered in refining the
boundaries for these deferrals.

Alternative IV would reduce potential conflicts between bowhead
whale subsistence hunters and offshore oil and gas operations by
removing an area of 200,000 acres in waters near Cross Island
(two percent of the sale area). The deferral area is used by
bowhead whales for migration and possibly feeding, and is within
the traditional hunting areas of the village of Nuiqsut.

Alternatives V and VI would reduce potential conflicts between
bowhead whale subsistence hunters and offshore oil and gas
operations by removing an area of 400,000 acres in waters north
and east of the Kaktovik (four percent of the sale area). The
deferral area is used by bowhead whales for migration and
feeding, and is within the traditional hunting areas of the
village of Kaktovik.

We remain concerned over the individual and cumulative effects of
oil and gas activity on the Western Arctic population of bowhead .001
whales. The MMS has responded to these concerns in its
environmental studies program; researching many issues and
providing decision makers with important data. NMFS, through
the Marine Mammal Protection Act, has required comprehensive
monitoring of oil and gas activities which result in the
incidental take by harassment of bowhead whales and other marine
mammals. The issue of industrial noise and its impact on marine
mammals, especially bowhead whales, remains a subject of debate
and concern. Traditional Native experience has found bowhead
whales react strongly to such noise, avoiding seismic sources at
distances up to 35 miles. However, research into this matter has
provided data which do not suggest avoidance reactions are strong
enough to yield population-level impacts to bowheads. Despite

problematical limitations in these studies and their relatively brief duration, we feel they support a decision to allow OCS lease sales in the Beaufort Sea, supported by a comprehensive monitoring effort. Both MMS and NMFS (through the small take authorization program) have interests here and we are hopeful future monitoring will extend the information gathered through past research. .001

This is the first time MMS has written a multi-sale EIS for the Alaskan Outer Continental Shelf. NMFS believes meeting NEPA requirements through this approach is reasonable, although the Environmental Assessments for future sales in the Beaufort Sea must be written carefully and fully document individual and cumulative impacts. One of the most contentious, and potentially harmful, activities associated with leasing of the Beaufort Sea OCS has been marine geophysical (seismic) exploration. These high-energy, low-resolution surveys employ multiple vessels operating an energy source which introduces very high noise levels into the water. NMFS has worked extensively with industry, MMS, the North Slope Borough of Alaska, the Alaska Eskimo Whaling Commission, and the communities of the North Slope of Alaska in the processing of incidental take permits under the Marine Mammal Protection Act for these seismic actions. The potential for seismic activity to disturb (harass) bowhead whales has now been demonstrated through research and monitoring. Displacement of migrating bowhead whales or heightened sensitivity to noise may, in turn, adversely impact traditional subsistence use of these whales by Alaska Natives. While these effects are discussed to a degree in the DEIS (e.g., under the effects of noise on bowhead whales section), geophysical exploration through low-resolution seismic is not specifically documented as one of the actions associated with these lease sales. We believe it is necessary to provide additional detail on this activity, particularly as it concerns the cumulative effects of OCS leases in the Beaufort Sea and any impacts to marine mammals. Just as the DEIS provides projections of the number of exploration wells, production fields, and production platforms for each sale, it should also provide similar information as to geophysical seismic research. .002

In accordance with the procedures outlined in the May 12, 2002, letter from Rolland A. Schmitten, Director of the Office of Habitat Conservation for NMFS to Thomas A. Readinger, Associate Director for Offshore Minerals Management, MMS has provided information on Essential Fish Habitat (EFH). The DEIS never clearly states whether or not the actions proposed would adversely affect EFH. The trigger for EFH consultation is a Federal action agency's determination that an action may .003

adversely affect EFH. If a Federal action agency determines that an action will not adversely affect EFH, no consultation is required, and the Federal action agency is not required to contact NMFS about their determination. NMFS believes that while the exploration, development and production scenarios generated by MMS are plausible, possible adverse effects to EFH should be identified on a project specific basis. Therefore, no further EFH consultation is necessary at this time. The need for additional EFH consultation should be determined as specific projects are designed. .003

Specific Comments

Pg I-10, I.C.2.b(1). The second paragraph here indicates the Secretary has previously removed from leasing sections of the Beaufort Sea OCS west of the Barrow deferral area (Alt. III). This represents a positive action by the MMS which responds to concerns over bowhead whales and traditional hunting practices. We believe, then, the area mentioned should be identified in Map 3 and included in the discussion of deferrals. .004

Pg. I-10, I.C.2.b(2). This defends the need to lease blocks near Cross Island based, apparently, on preventing adjacent State of Alaska tracts from draining oil reserves from Federal OCS areas. This matter should be adjudicated through the courts, and does not seem to be justification for leasing. .005

Pg.II-11. II.H.1.c. The DEIS does not adequately assess the potential impacts of additional causeways. Therefore, we would consider the DEIS deficient if the proposed activities include additional causeways. .006

The individual and cumulative effects of causeways on coastal fisheries has long been the focus of controversy. The debate centers on fish passage around the structures and possible adverse changes to habitat which may impact population productivity. Changes to habitat (i.e. changes in temperature and salinity regimes) have been documented to occur as a result of causeway induced deflections of currents and entrained waters away from the coast.[1]

---

[1]. Thorsteinson, L.K., L.E. Jarvela, and D.A. Hale. November 1990. Arctic Fish Habitat Use Investigations: Nearshore Studies in the Alaskan Beaufort Sea, Summer 1988. U.S. Dept. of Commerce and U.S. Dept. of Interior, OCSEAP Final Report, 71: 349-485.

Regardless of whether or not these changes have biological significance, there is implicit agreement that preserving the integrity of the warmer, brackish coastal boundary layer during summer months is crucial in sustaining the biota of the region. We consider the brackish nearshore corridor critical to the success of marine and anadromous fish stocks. In addition, freshwater flows from coastal rivers and streams are important to the creation of the brackish warm zone, and it is essential to sustain natural flows to avoid impacts. .007

Therefore, we believe that Stipulation No. 3, Transportation of Hydocarbons, should be modified to reflect the MMS's position regarding causeways. This would clarify that no new causeways would be constructed. Extensive causeways have many undesirable impacts on nearshore processes and resources and should be prohibited outright. .008

Pg.II-12. II.H.1.d. We recommend the third sentence in the second paragraph here, beginning with "Scientific studies" be replaced with the following statement: Monitoring studies of 3-D seismic exploration (6-18 airguns totaling 560-1500 c.i.) in the nearshore Beaufort Sea during 1996-1998 have demonstrated that nearly all bowhead whales will avoid an area within 20 km of an active seismic source, while deflection may begin at distances up to 35 km. .009

Pg. II-15. II.H.2.a. Stipulations 6a and 6b provide that permanent facilities within 10 miles of Cross Island should not preclude "reasonable subsistence access" to whales. Earlier in the DEIS we learn that noise from such facilities must comport with the small take authorization program under the MMPA. The regulations for that program require these takes "will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses." We recommend that Stipulations 6a and 6b adopt this language in order to bring consistency among these efforts and to clarify intent. .010

Pg. III-37. III.B.4a(1). The first paragraph on this page mentions the possibility that bowhead whales may occupy the northeastern portion of the Chukchi Sea more often than previously thought, and that these whales may occur regularly along the northwestern coast during summer. Monitoring during the towing of the Steel Drilling Caisson drill rig during summer of 2002 recorded five bowhead whales off Point Barrow on July 21, further supporting these findings. .011

Pg. III-40. III.B.4.a(1) It is more than unfortunate the final report of the bowhead whale feeding study is not included within .012

this discussion, or available for planning purposes. This multi-year effort represents a comprehensive research effort intended to identify and characterize the use of the eastern Beaufort Sea as feeding habitat for bowhead whales, and to place some perspective on the importance of that habitat. NMFS personnel participated in the Scientific Review Board for this work, and a draft final report on the study was released in December of 2001. We strongly encourage MMS to complete this important work and incorporate its conclusions and data into the final NEPA document. .012

Pg. IV-4. IV.A.1. The significance threshold described here for threatened or endangered species should be considered further. We believe it is unreasonable to limit this to effects lasting a generation or more; particularly for long-lived animals such as the bowhead whale with a life span possibly exceeding 100 years. Would an activity that displaces bowheads from a traditional feeding area for 50 years then be considered insignificant? .013

Pg. IV-5. IV.A.2.B. The projections are that a maximum of two drilling rigs would operate at any time under Sale 195 (and one for Sale 202). Are these estimates specific to those sales, or is this an absolute maximum? In other words, could we see two rigs drilling on Sale 195 tracts, and another drilling a Sale 202 tract? .014

Pg. IV-6. IV.A.2.b(1)(a). As previously stated, we recommend the final EIS present additional discussion on geophysical seismic research, in addition to the site survey seismic work described here. .015

Pg. IV-13. IV.A.4.a. The spill modeling assumes the oil will be similar to Alaska North Slope crude oil. How typical is this? We understand that Northstar crude is markedly different than that from the Prudhoe Bay field. Is it logical to assume offshore oil from newly developed reservoirs would be more similar to North Slope crude? .016

Page IV-10. IV.A.2.b(3). Information on the impacts of dredging needs to be included or referenced in this section. While suspended sediments per se have very low direct toxicity values, the composition of sediments should be tested prior to assessing the potential impacts from dredging. In Norton Sound, for example, nearshore sediments contain high background levels of mercury and other metals. Dredging activities may resuspend such materials and make them available to aquatic organisms, with resultant adverse effects. .017

Page IV-13. IV.A.4.a. On page IV-3, the DEIS states the analyses presented consider whether the mitigation that is proposed as part of the project can reduce or eliminate all or part of the potential adverse effects. Here, however, the analysis of large oil spills assumes there is no clean up or containment. This seems illogical, as oil spill response and preparedness are very much part of the mitigative measures directed at OCS activities. .018

Page IV-15. IV.A.6. This section should also include a description of dispersants and any considerations or restrictions on their use in the Beaufort Sea. .019

Page IV-16. IV.A.6.a. Please provide further description of the experience(s) of using the described small-vessel skimming system "successfully" in Cook Inlet amid broken ice. .020

Page. IV-16. IV.A.6.c. The stated response technology for a spill occurring during late fall freeze-up is to allow the spill to freeze in place, then mining the oil from the pack ice. Is there any reasonable prediction of the efficiency of this technology, or examples of its testing or actual use? .021

Page IV-21. IV.C.1.a(1). The DEIS states that trace metals would be added to the water by drilling muds and cuttings. It further states that the Environmental Protection Agency (EPA) prohibits the discharge of drilling muds and cuttings in less than 5 meters. Additional discussion regarding the dispersion of these pollutants and the ability to meet water quality criteria at the edge of mixing zones seemingly dismiss the possible impacts from these pollutants. What would be the impact if these pollutants from exploratory activity were re-suspended during activities such as dredging for subsea pipelines? MMS should consider putting this information in their "Information to Lessees" and encourage lessees to discharge of such materials downhole whenever possible. .022

Page IV-22-23. IV.C.1.a(3). This section discusses the effects of permitted discharges of produced waters. While it is noted that to date for exploration, the EPA has prohibited the discharge of formation waters into waters of less than 10 meters, the section does provide information on the maximum amount of oil and grease in produced waters over the next 21 years. The document goes on to state that if produced waters were discharged for a project, "the effect on water quality would be local, but would last over the life of the field." What would be the cumulative impacts for all the proposed exploration and development projects for all three leases? Also, what kind of impacts could be expected inside the "mixing zone"? By contrast .023

an entire section is spent describing the probable effects of an accidental oil spill on various resources. Should an oil spill occur, presumably it would be a one time event. A discharge of production waters would occur on a consistent basis. What would this mean to resources and habitat? .023

Page IV-144. IV.C.11.b(3). NMFS is supportive of Stipulation 4, and believe such monitoring is necessary to fully assess the effects of OCS actions on bowhead whales. However, we feel the first sentence on this page (This stipulation helps to reduce effects to subsistence-harvest patterns and to the overall socio-cultural systems which place special value on the bowhead whale harvest and the sharing of this harvest with other members of the community) overstates the benefits of this monitoring. The statement that this stipulation is considered to be a positive action by he Native community under environmental justice should be referenced. .024

It is not clear why Stipulation 6 is presented in two parts, a and b. Would both apply? .025

Page IV-146. IV.C.11.c(1)(a). The DEIS states in the second paragraph that potential disturbances to bowhead whales from seismic operations would be limited to areas west of Cross Island, because of the provisions of (past and existing) conflict avoidance agreements. The DEIS should consider that these agreements are primarily for the protection of the subsistence hunt. These agreements often allow for seismic work to proceed once a village has reached its quota, after which the potential for seismic to disturb these whales may be very high. .026

Page IV-219. IV.I.2.k(1). In describing the potential effects of an oil spill on subsistence uses, this analysis very correctly states that there would be long term effects, often based in part on the perception that a marine mammal could be tainted. This analysis may be somewhat flawed in basing discussions on the results of the oil spill model, which estimates the chance of an oil spill contacting a particular environmental resource, such as Point Barrow. This approach may not fully account for seals and whales which move among these resource areas. If a seal became oiled near Cross Island, and was harvested near Barrow some time later, subsistence use of the area would certainly be affected even though no oil had contacted that resource area. .027

Page V-1. V. Cumulative Effects. This section seems to confine its analysis to other oil and gas projects, rather than the cumulative impacts of the lease sales when added to <u>all</u> other past, present, and foreseeable future actions. .028

Page V-5. V.A.7. We believe that repeated exposure of migrating bowhead whales to noise sources may be an example of synergistic impact. While whales may avoid a source by moving further offshore before resuming their normal course, and may make such avoidance movements around several sources (additive impact), there may be a point at which the whales remain offshore after exposure to multiple sources, even once the source is no longer present. Given the many potential noise sources associated with exploration, development, and production on the Beaufort Sea OCS, Natives and scientists have considered this a real possibility. .029

Page V-28. V.C.5.a(1)(b). The FEIS should present an expanded discussion of development and exploration within the Canadian Beaufort, particularly off the McKenzie delta, as well as vessel movement into and out of Canadian waters necessary to support activities within the Alaskan Beaufort Sea OCS. Expansion of the Canadian fleet to support U.S. development would present several concerns with respect to bowhead whales and subsistence hunting, as late season traffic in the eastern Beaufort Sea would be most likely to encounter, and harass, these whales. .030

MMS Response to Comment Letter L-0023

L-0023.001

The MMS shares the concern of the National Marine Fisheries Service about potential effects on bowhead whales. The MMS has conducted many studies on bowhead whales over the past 25 years. In addition, monitoring studies have been conducted during seismic surveys and drilling operations during the past 15 years. As a result of all these studies, the overall level of knowledge on bowhead whales likely exceeds the level of knowledge on many other species. Studies to date show that some whales may avoid industrial activities, but there is no indication of harm to either the population or to individual whales. During 1978-1993, the bowhead whale population was estimated to have increased at an average rate of about 3.2% per year in spite of the annual subsistence-whale harvest by Alaska Natives. The most recent bowhead whale census indicated the population is still increasing, although possibly at a slower rate of increase. During the last 10 years, the overall level of OCS activities in the Beaufort Sea has decreased substantially compared to the 1980's. The MMS has worked closely with the National Marine Fisheries Service in the past and will continue to work closely with them in the future.

L-0023.002

Multiple seismic vessels are not used to explore for oil and gas. Seismic surveys can only be done with one vessel, and that cannot be closer than 15-20 miles of another seismic vessel because of interference. For more than 10 years, there has been only one operator in the Beaufort Sea, and that operator did not conduct a survey every year. That operator left the Alaska Beaufort 2 years ago. If seismic operations were resumed over the period of this EIS, we would anticipate only one operator and one source vessel.

The EIS addresses oil and gas exploration activities related to leased acreage. Seismic activities are almost always conducted prior to leasing. Prelease seismic activities go through a separate NEPA review process. In nearly all cases, the only postlease seismic activities are site-clearance surveys employing low-energy seismic tools to evaluate geohazards and archeological concerns. Nevertheless, the discussion on the effects of seismic operations on bowhead whales presented in Section IV.C.5.a(1)(a)1) includes studies on the effects of prelease seismic surveys.

Deflection may be a more appropriate term than displacement when discussing the effects of seismic activity on bowhead whales, because the deflection is relatively temporary. Deflection is the term used in the monitoring studies and the peer-review workshop where the monitoring studies are discussed.

There is a discussion in Section IV.C.5.a(2)(c)1)c) regarding seismic operations anticipated in conjunction with Lease Sale 186. Seismic surveys already have been conducted over much of the proposed sale area. The MMS expects that any seismic surveys associated with Lease Sale 186 would be shallow-hazards surveys conducted over a relatively small area. Although it is possible that a prospective lessee could conduct a prelease 3-dimensional seismic program to better define a prospect, the MMS does not anticipate any prelease seismic surveys associated with Lease Sale 186. Considering that multiple seismic vessels are not expected and that a Conflict Avoidance Agreement will ensure that any seismic operations conducted will not interfere with subsistence-hunting activities, the potential effects from seismic operations to either bowhead whales or to subsistence whaling is likely to be negligible. The MMS believes the overall discussion on the effects of seismic operations on bowhead whales presented in Section IV.C.5.a(1)(a)1) and the discussion of seismic activities anticipated for Lease Sale 186 are adequate.

L-0023.003

The MMS completed a request for Essential Fish Habitat consultation on leasing and exploration activities in the Beaufort Sea and submitted to the National Marine Fisheries Service. The National Marine Fisheries Service responded that they had no conservation recommendations and that no further Essential Fish Habitat consultation is necessary at this time. When a project-specific development and production plan is presented to the MMS, we will review the plan at that time to determine whether there is a need to reinitiate Essential Fish Habitat consultation.

L-0023.004

The MMS believes it is unnecessary to include any additional discussion (Section I.C.2.b(1)) about the area west of the Barrow deferral that the Secretary removed from additional consideration during the area identification process. Because this area is not part of the proposal or a deferral alternative in this EIS, it need not be discussed further.

L-0023.005

A primary purpose of the OCS Lands Act is to make lands available for oil and gas leasing in an environmentally acceptable manner, taking into consideration protection of the marine, coastal, and human environments. The Act and implementing regulations require that OCS leasing should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner that is consistent with the maintenance of competition and other national needs, including preventing the drainage of OCS resources. The Secretary of the Interior selects areas for leasing; the issue of potential drainage of Federal OCS reserves is only criteria. The MMS believes the statute clearly sets out responsibility for expeditious and orderly development of OCS resources through offering areas for industry to bid on, lease, explore, and develop. Drainage issues are not a matter for adjudication in the courts; it is the responsibility of the Secretary of the Interior to prevent such possible drainage situations from occurring. This is accomplished through the OCS leasing process.

L-0023.006

Long causeways are not part of the anticipated facilities for development and production resulting from this sale, but buried pipelines at landfalls might be elevated on short gravel causeways (Section IV.A.2.b(3)(a)); also, a short dock is part of the Point Thompson development plan, and similar docks might be needed for future developments (Section IV.A.2.b(2)(c)). Information on short docks has been added to the sections on water quality (Section IV.C.1.a(2)) and lower trophic-level organisms (Section IV.C.2.a(2)). The information points out that the 1-mile (1.5-kilometer) long East Dock was constructed about 30 years ago. During that time, there have been many studies of nearshore water quality, but none have documented adverse water-quality effects (for example, circulation changes or temperature and salinity discontinuities) due to East Dock. If a causeway were to be proposed at some time in the future, it would be subject to NEPA evaluation at the time, as allowed by the OCS Lands Act.

L-0023.007

See Response L-0023.006.

L-0023.008

The use of causeways is not prohibited by law. The MMS has not determined that it should adopt a policy that absolutely prohibits constructing of any new causeways. Should a request for a causeway be submitted in an exploration or development application, additional NEPA analysis will be required. The MMS and the other Federal and State Agencies will take a close look at that request, based on specific data provided by the applicant, and its potential effects to the physical and biological environments. The MMS also would be required to meet the consistency standards of the Alaska Coastal Management Plan in addition to consulting with other Federal and State Agencies and, given the specifics of the project under consideration at that time, they can make their own permitting-related decisions.

L-0023.009

The original intent of the stipulation is to require lessees to conduct site-specific monitoring programs for exploratory drilling operations in addition to seismic surveys. The suggested wording changes would orient the stipulation more toward monitoring programs for seismic surveys. We prefer to stay with the original intent of the stipulation and the broader coverage provided by the current wording.

L-0023.010

We understand the concern over consistency and clarity between MMS stipulations and requirements under the Marine Mammal Protection Act. Regardless of whether the Cross Island stipulation is adopted, modified, or not adopted, operators must comply with the Marine Mammal Protection Act and its regulations. It is better to not include “regulation specific” language in a stipulation, in case the regulation changes in the future.

L-0023.011

The comment is noted regarding the monitoring program for the SDC. A sentence has been added to the text in Section III.B.4 that five bowhead whales were observed off Point Barrow on July 21 from the SDC as a platform of opportunity.

L-0023.012

Findings from the revised final report, *Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information* (OCS Study, MMS 2002-012), are included in Section III.B.4.a of this EIS.

0023-013

The significance threshold for threatened and endangered species is applicable to all species and was developed from the thresholds that the MMS has used in past EIS's. The thresholds we use in this analysis are based on generations and reproductive cycles, because we are evaluating population-level impacts and assessing impacts over a time continuum. The length of that time period needs to relate to the species being affected; hence, the MMS has chosen a "generational" verses a fixed-time period, which would not make sense when applied to different species that have very different live spans and reproductive cycles.

The appropriateness of significance threshold definitions used in the EIS received comments during the public review process; however, none of the commenters provided or suggested alternatives definitions with a rationale for that definition. The MMS acknowledges that a definition of NEPA "significance" may be questioned; however, we feel that the approach we have taken, which incorporated standards developed and used in past EIS's in the Alaska Region and uses the information and comments we have received in the past, is still our best approach. The definitions can be applied to all relevant species and populations in addition to individual species and populations. The current definition for significance is still the best standard. If we receive suggestions for a better definition with supporting information that provides us with a better standard, is demonstrated to be more appropriate, and can be applied to all threatened and endangered species, we will adopt the new standard.

The commenter specifically asked if an activity that displaces bowheads from a traditional feeding area for 50 years would be considered insignificant. We find nothing in our analysis of effects indicating that bowhead whales would be displaced from traditional feeding areas for up to 50 years. Bowhead whales, which have been increasing in numbers, could be temporarily displaced from a traditional feeding area without a significant impact to the population. The National Marine Fisheries Service has not designated any of the area in the Beaufort Sea as critical habitat or essential feeding areas. The EIS has evaluated the effects of proposed leasing to subsistence, and whether the effects to subsistence activities would be affected. The analysis found that no significant effects would result from normal routine activities.

L-0023.014

Projections are for one to two exploration drilling rigs to be operating each year in the Beaufort Sea. We do not assign drilling rigs to tracts leased in a specific sale. In addition to exploration drilling rigs, we assume that one development drilling rig will operate on each production platform. Depending on the timing of discovery and development drilling, more than two drilling rigs may be operating in a single year. According to the hypothetical scenarios offered for analysis, in 2013 as many as four rigs could be operating, two for exploration drilling and two on production platforms. However, in most years during the next 2 decades, the typical number of rigs operating will be one to two.

L-0023.015

See Response L-0023.002.

L-0023.016

The MMS cannot know what the oil chemistry will be prior to discovery. We use Alaska North Slope crude because it has a" typical" range of properties for the known oil fields on the North Slope of Alaska. Northstar is a light crude that would evaporate faster and disperse more rapidly than Alaska North Slope crude. The MMS prefers to use a more conservative oil as an analog to what might be found. We use an oil that will not evaporate as rapidly or disperse as quickly as Northstar.

L-0023.017

A reference to a recent example of a site-specific assessment of the effects of dredging has been added to the text of the EIS. The reference is to the EIS on the proposed Liberty Development in Foggy Island Bay (USDOI, MMS, 2002).

L-0023.018

The MMS agrees with the commenter that oil-spill-cleanup activities can reduce or eliminate all or part of the potential effects of an oil spill. The potential benefits of oil-spill-response activities to reduce effects are recognized and addressed in the summary of effects section for each resource.

L-0023.019

Dispersants currently are not considered a viable nonmechanical spill response tactic for the Beaufort Sea. To date, exploration and development activities have taken place in shallow waters where dispersants are not used due to toxicity concerns. Dispersants also generally are considered to be ineffective in cold water. The MMS, however, is funding research to determine the effectiveness of dispersants in cold water and, should they prove to be a feasible response tactic, future EIS documents will incorporate a discussion on dispersants.

L-0023.020

A more in-depth description of the Cook Inlet broken-ice oil-spill-response tactics has been added to the EIS in Section IV.A.6.a.

L-0023.021

The ice-mining tactic has not actually been used in a spill situation but is expected to be highly effective in removing oil from the ice. The ice-mining tactic would be used if oil were imbedded deep in the ice sheet, where an ice trimmer would be unable to access it. For oil located nearer to the ice surface, the ice trimmer would be used to chip the oil layer into small pieces. The oiled ice chips would then be removed by scooping up the chips and loading them into dump trucks. This tactic is used routinely to clean up spills that occur onshore on gravel pads, or on snow- and ice-covered roads and tundra. It is extremely effective and efficient in removing oiled ice.

L-0023.022

If drilling muds and cuttings were discharged, they would be a “permitted” discharge—permitted by the Environmental Protection Agency. The possible impacts of discharge have been assessed only in a general way in the EIS. If discharges were proposed later by an offshore operator, site-specific authority for the discharges would have to be obtained from the Environmental Protection Agency. That agency would assess the site-specific effects of the discharges, including possible resuspension of the discharged material by subsequent operations.

L-0023.023

The EIS does not include an estimate of the maximum amount of oil and grease in produced waters over the next 21 years, partly because it would disregard the Environmental Protection Agency’s practice of approving discharges only in waters more than 10 meters deep. In addition, the comment fails to note an explanation in the EIS that reinjection projects to maintain field pressure have become almost standard operating procedure in the Beaufort Sea. For example, formation waters from the Endicott and Northstar fields, the first offshore fields in the Beaufort Sea, are reinjected into the oil formation to help maintain field pressure.

L-0023.024

The text in Section IV.C.11.b(3) - How Stipulations and Mitigating Measures Help Reduce Noise, Disturbance, and Oil-Spill Effects, has been changed to reflect the suggestions of this comment.

L-0023.025

Stipulation 6a for Cross Island (see Map 3) includes those waters outside the barrier islands where bowhead whales are more likely to be, and Stipulation 6b includes those waters inside the barrier islands where bowhead whales, because of shallower water depths, are less likely to be.

L-0023.026

The text has been changed to more specifically represent seismic effects on the subsistence hunt. See Section IV.C.5 - Endangered and Threatened Species for an analysis of seismic effects on bowhead whales. This section also has been referenced in Section IV.C.11.c(1).

L-0023.027

The text in Section IV.I.2.k(1) - Subsistence-Harvest Patterns, Effects of a Blowout Spill, has been changed to reflect this comment.

L-0023.028

Sections V.A and V.B focus primarily on the assumptions and projects considered in the cumulative analysis with respect to past, present, and reasonably foreseeable future activities. The primary analysis for the cumulative effects and contribution the proposed action is found in Section V.C. This extensive section is treated resource by resource and focuses primarily on the more immediate proposed action.

L-0023.029

To achieve a synergistic effect from repeated exposure of migrating bowhead whales to noise, such as permanent displacement of the migration farther offshore, we believe several things would have to happen: (1) the noise-producing activity or activities would have to be operating during the whale migration for at least several years; 2) the activity would have to be in a location or locations where the noise would reach a substantial portion of the migration route; and 3) a large portion of the population and the same individual bowhead whales in the population would have to be exposed to the noise annually for at least several years. We do not believe this has happened.

Based on noise-producing activities conducted to date and monitoring programs for those activities, there appears to be some avoidance of an activity by bowheads. However, this avoidance/displacement appears to be localized and temporary (on the order of 24 hours). Subsistence whalers continue to harvest whales during the fall subsistence whale hunt.

L-0023.030

The MMS believes that expansion of the Canadian fleet or vessel movement into and out of Canada to support U.S. development is unlikely. Generally, it is cheaper to transport materials and supplies via the haul road or by sealift for operations in the Alaskan Beaufort Sea than to get supplies from Canada. In the past, Canadian icebreakers were used to support the Kulluk drilling in U.S. waters. Our understanding is that the Kulluk and the icebreakers are no longer in the Canadian Beaufort Sea.

Our understanding is that the seismic vessel that conducted the surveys in 2001 also has left the Canadian Beaufort Sea.

L-0024

STATE OF ALASKA

OFFICE OF THE GOVERNOR

TONY KNOWLES, GOVERNOR

OFFICE OF MANAGEMENT AND BUDGET
DIVISION OF GOVERNMENTAL COORDINATION

☐ SOUTHCENTRAL REGIONAL OFFICE
550 W. 7TH AVENUE, SUITE 1660
ANCHORAGE, ALASKA 99501
PH: (907) 269-7470/FAX: (907) 269-3981

☑ CENTRAL OFFICE
P.O. BOX 110030
JUNEAU, ALASKA 99811-0030
PH: (907) 465-3562/FAX: (907) 465-3075

☐ PIPELINE COORDINATOR'S OFFICE
411 WEST 4TH AVENUE, SUITE 2C
ANCHORAGE, ALASKA 99501-2343
PH: (907) 271-4317/FAX: (907) 272-3829

September 20, 2002

Mr. John Goll
Regional Director
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue
Anchorage, AK 99508-4302

RECEIVED
SEP 2? 2002
4:45 p.m.
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Dear Mr. Goll:

Thank you for the opportunity to comment on the draft environmental impact statement (EIS) for the three proposed Beaufort Sea Outer Continental Shelf (OCS) oil and gas lease sales included in the current five-year program. The Minerals Management Service (MMS) prepared the draft EIS for Lease Sale 186 scheduled for 2003, Lease Sale 195 scheduled for 2005, and Lease Sale 202 scheduled for 2007. These comments represent a consolidated state response from the State of Alaska on the draft EIS.

The state supports the concept of completing a single EIS for the three lease sales. Unless evidence is presented that would justify the need for a supplemental EIS, an environmental assessment would likely be sufficient for the individual sales.

.001

We look forward to reviewing separate consistency determinations prepared by MMS for each of the three lease sales after issuance of the final EIS. During a meeting last month, your staff discussed the possibility of issuing a "negative determination" under the provisions of 15 CFR 930.35, instead of a consistency determination for each lease sales. A negative determination would not be appropriate for these lease sales because federal agency activities are subject to the consistency provisions of the federal Coastal Zone Management Act. A federal agency activity is any function "performed by or on behalf of a Federal agency in the exercise of its statutory responsibilities" and includes a wide range of activities "which initiate[s] an event or series of events where coastal effects are reasonably foreseeable" (15 CFR 930.31(a)). Even though a lease sale is essentially a paper transaction, preparation of a consistency determination is necessary because the sale initiates events that would have reasonably foreseeable coastal effects. During the five-year period for these lease sales, new information about coastal effects may become available. In addition, the North Slope Borough has initiated a revision of their coastal program that is expected to be completed in this timeframe. .001

The state supports the proposed stipulations and Information to Lessees (ITLs) for the lease sales as described on pages II-9 through II-22 of the draft EIS. In an attempt to have more coordinated measures between the federal and state governments, the state has adopted Beaufort Sea mitigation measure language similar to that used by MMS in its stipulations and ITLs. For example, the Cross Island stipulation is similar to one we have adopted for state lease sales in the Beaufort Sea. The state requires a consultation process among the lessees, local communities and whaling groups, but it does not specifically require whale-monitoring programs that is required by MMS Stipulation 4, (p. II-12).

The state continues to defer from its lease sales acreage between Pt. Barrow and Tangent Point and between Barter Island and the Canadian Border. We will review these deferrals on an annual basis. The Barrow, Kaktovik and Eastern subsistence whale deferrals in the draft EIS are approximate to these state deferrals. The Alaska Department of Natural Resources (ADNR) notified me that they think it would be appropriate to keep the MMS deferral alternatives as options in the final EIS for these sales so they may be considered in future environmental assessments or supplemental EISs. Also, the ADNR questions the need for the Nuiqsut deferral area seaward of Cross Island in light of the proposed 10-mile buffer around the Island. .002

The state remains concerned about industry's demonstrated inability to clean up oil spills in broken ice conditions, the timelines associated with relief well drilling, and the potential need for seasonal drilling restrictions in response to these limitations. .003

From the perspective of oil spill response planning, there is a difference between exploration and production phases. While the alternatives presented in the EIS do not differ significantly for exploration activities, once the projects move into the production phase, the increase in the number of producing wells can also lead to an increase in the risk of spills. For this reason, the state supports the use of drilling restrictions or other spill prevention measures during open water periods and until the ice thickness is sufficient to support heavy equipment as described in the Alaska Clean Seas Tactics Manual. After initial entry into a formation, production well shutdown and start-up present the next highest spill risk. Current drilling restrictions such as those employed at the Northstar Project can reduce the spill risk. In addition, most oil spill response resources for the North Slope are located in the Deadhorse area. The geographically expanded exploration and production activities in the lease sale area may require the establishment of other oil spill response depots east and west of Deadhorse to ensure timely oil spill responses. .004

With regard to the discussion on emissions from evaporation or *in situ* burning, the assumptions may hold true for a static release or single "burp" of oil, but a continuing release might pose additional risk. Volatile emissions may impede response, depending on the type of release, wind speed and direction, and other incident-specific factors. .005

In closing, we note an error in ITL No. 12 on page II-21, Information on Coastal Zone Management. This ITL references the Cook Inlet rather than North Slope Borough coastal management program. .006

Again, thank you for the opportunity to submit comments on the draft EIS. Please contact me at (907) 789-7822 if you or your staff have any questions about these comments.

Sincerely,

Glenn Gray
Project Analyst

cc:
Kurt Fredriksson, Deputy Commissioner, DEC
Marty Rutherford, Deputy Commissioner, DNR
Chip Dennerlein, Director Habitat and Restoration, DFG
John Katz, Office of the Governor, Washington, D.C.
John Sisk, Office of the Governor
Thomas Napageak, Chairman, Alaska Eskimo Whaling Commission
Honorable George Ahmaogak, Mayor, North Slope Borough
Honorable Lon Sonsolla, Mayor Kaktovik
Honorable Edith Vorderstrasse, Mayor, Barrow
Honorable Eli Nukapigak, Mayor, Nuiqsut
Tom Warren, MMS, Anchorage
Jeff Mach, DEC
Al Ott, DFG
Jim Hansen, Pam Rogers, DNR
Rex Okakok, NSB
Johanna Munson, Special Assistant, DNR
Mark Myers, Director, Division of Oil and Gas, DNR
Tom Chapple, Director, Division of Air & Water Quality, DEC
Larry Dietrick, Director, Spill Prevention and Response, DEC
Lelenia Rexford, Village Coordinator, Nuiqsut
Leonard Lampe, Village Coordinator, Nuiqsut
Fenton Rexford, Village Coordinator, Kaktovik
Tom Lohman, NSB, Anchorage
Kaye Laughlin, Nina Brudie, DGC, JPO, Anchorage
Gordon Brower, Sheldon Adams, NSB, Barrow
Marilyn Crockett, AOGA
Nancy Wainwright
Mike Frank, Trustees for Alaska

MMS Response to Comment Letter L-0024

L-0024.001

The MMS will prepare a separate Consistency Determination for each of the sales proposed in this EIS.

The regulations at 15 CFR 930.35 address the process and content of negative determinations. A negative determination is a consistency determination that reaches the conclusion that there will be no coastal effects under the criteria of the Coastal Zone Management Act. A negative determination must contain all of the components of any other consistency determination: a description of the activity, the activity's location, and the basis for the agency's determination that the activity will not affect any coastal use or resource. In determining effects we must evaluate the enforceable policies of the Alaska Coastal Management Plan and include it in the negative determination. The level of detail must be sufficient for the State to evaluate whether coastal effects are reasonably foreseeable. The review and comment timeframes are the same as with any other consistency determination.

The analysis required by the Coastal Zone Management Act regulations will determine whether or not to issue a negative determination for Sale 186. The lease sale itself is a paper transaction that conveys only the rights for lessees to **pursue** exploration and production of the leased areas. These activities cannot occur without additional MMS and State review, evaluation, and approval or concurrence. This process provides for a more detailed site-specific coastal consistency review at the project-proposal stage. The sale itself may not initiate events that have a reasonably foreseeable effect on any coastal use or resource. Only at the time that specific proposals are submitted is it feasible to more precisely identify reasonably foreseeable events.

In designing a lease sale, great consideration is given to the Alaska Coastal Management Plan and its standards and applicable enforceable policies. Mitigating measures are developed to address these concerns and deferral alternatives are analyzed in the environmental document based in part on concerns related to the standards and enforceable policies. The results are that by adoption of specific mitigating measures and by implementation of the MMS' rigorous regulatory regime, a sale can be designed with terms and conditions that result in no reasonably foreseeable effects at the time of sale.

L-0024.002

This is a multiple-sale EIS. The deferral alternatives are evaluated and available for consideration for all three of the proposed lease sales. In addition to the Nuiqsut Subsistence Whaling Deferral, the MMS evaluates other additional potential mitigation relevant to Nuiqsut in Stipulations 6a and 6b, and the decisionmaker could chose both, one, or none. All of the action alternatives include 5 standard stipulations and 16 ITL clauses. The evaluation of deferral alternatives and optional mitigating measures in the EIS does <u>not</u> mean they have been adopted for the upcoming sales. If the Secretary decides to proceed with the proposed sale or sales and determines that additional protection is needed, the Secretary can chose one or more of the alternatives and/or the optional mitigating measures individually for each sale.

L-0024.003

The MMS believes that industry has the ability to respond effectively in the broken-ice environment. The MMS regulations recognize and require that industry include provisions for nonmechanical response such as in situ burning of oil. In situ burning is well suited to the broken-ice environment and has proven to remove significant quantities of oil from the ocean surface. Use of in situ burning in turn reduces reliance on mechanical-only means of spill response. Trials in broken ice to date have tested only individual tactics in a very rigid framework and have not allowed spill responders to adapt equipment and tactics to the prevailing conditions. Industry, if given the latitude to mix and match tactics and equipment to current ice and weather conditions, would present a more effective spill response using all the tools available. There is no compelling reason to impose additional constraints on OCS lessees, such as seasonal drilling restrictions, to create a window for drilling a relief wells. There has never been a major blowout and oil release on the North Slope from drilling operations. There are response methods available to respond to an oil spill on the OCS in addition to the mechanical methods required by the State, which can be effective in removing oil from the environment in the very unlikely event of a blowout.

L-0024.004

The MMS conducts a rigorous review of industry proposed exploration and development activities to ensure that proper safeguards are in place to prevent the release of oil into the environment. These include employee training in well control, requiring that well-control safety equipment include blowout preventors be used and requiring that the sufficient primary well-control measures are available during the drilling of the well (drilling-fluid components). The MMS also has established a standard set of requirements that must be followed to establish platform suitability and that the drilling equipment is sufficient for the proposed operation. The MMS also believes that industry has sufficient oil-spill-response capabilities to address control and removal activities year-round, either through mechanical or nonmechanical means. We do not feel that drilling restrictions beyond what already is required are necessary.

L-0024.005

The text in the first paragraph of Section IV.C.15.b(2)(a) has been revised to include the concern expressed in the comment received.

L-0024.006

The reference has been corrected to cite the North Slope Borough Coastal Management Program.

L-0025

RECEIVED
SEP 2 2002
5:30 p.m ?
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

PAMELA A. MILLER
P.O. Box 101811
Anchorage, AK 99510
pammiller@alaska.com

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363
Fax: 907-271-6805

RE: OCS Beaufort Sea Oil and Gas Lease Sales 186, 195, and 202
Draft Environmental Impact Statement

Dear Mr. Goll:

This letter supplements my comments from the public hearing in August. As a member of the former public advisory committees on Beaufort Sea Lease sales, I am extremely disappointed that MMS has reverted to old proposals to simply lease the entire area. Is it really a blank slate, as if the public had never spoken before on these issues? .001

When you talk about the Arctic Ocean, people often think it is flat like water that freezes in your ice cube tray. They think the ocean bottom is empty sand. But, near the coast, the Beaufort Sea is an estuary zone, like Cheasapeake Bay or Puget Sound. .002

The exact area where new oil leasing is proposed in the Beaufort Sea is part of the *Arctic Ring of Life*, that bountiful zone where the sea ice meets the land, named by a Russian polar bear biologist.[1]

The endangered bowhead whales and beluga whales migrate and feed there, millions of migratory birds fly from many continents. And it supports the local Inupiat residents as it has for millienia, with the bowhead whale, fish, and other subsistence resources. The remote coastline of the Arctic National Wildlife Refuge is spectacularly beautiful. I traveled there most recently in August and saw polar bear tracks on the sand, the eroding coastal bluffs where permafrost is melting, long-tailed ducks and king eiders flying over icebergs at midnight "sunset."

Interior Department's proposed leasing plans sharply contrasts with leasing moratoria imposed elsewhere in the nation off sensitive coastlines due to citizen pressure. For over 25 years, local citizens of Alaska have opposed offshore oil drilling, yet our reasonable concerns are not heard as they rightly were in the lower 48. Whereas the past Administration offered one Beaufort Sea lease sale offshore the state lands between the Colville and Canning Rivers, Interior Secretary Norton's aggressive .003

[1] See Miller et al. 1993. *Oil in Arctic Waters.*

program includes 8 new offshore lease sales covering millions of acres in the Beaufort, Chukchi, and Bering Seas, and Cook Inlet. This is a return to the massive sales off Alaska first launched by Interior Secretary James Watt in the 1980's. .003

These three lease sales in the Beaufort Sea -- 9.6 million acres each, or larger than the entire expanse of states like New Jersey or Maryland or Massachusetts -- go from just east of Barrow all the way to the Canadian border. The 3 proposed Beaufort Sea sale are 10 times as big as the last one, yet the public only gets to review this bad idea once, with a single environmental impact statement covering all three sales. There are no maps in this EIS where you can see the size and extent of the most recent lease sales to get the perspective on what a change this is. .004 .005

I have three major issues to address in this letter including 1) opposition to leasing off the sensitive coasts of the arctic refuge, Teshekpuk Lake, blwhead whale feeding grounds, and spring lead zone, 2) that oil spill risks are downplayed, and 3) meaningless alternatives are considered in terms of reducing environmental impact including the cumulative impacts of infrastructure such as causeways.

I am disappointed that despite the broad base of support -- even including the City of Kaktovik and the North Slope Borough -- Interior plans new leasing off the coast of the Arctic National Wildlife Refuge as well as off the Teshekpuk Lake area of the National Petroleum Reserve-Alaska. This is a step backwards from the incremental steps MMS had taken where there were leasing deferrals or deletions, such as the area off the coast of the Arctic Refuge, and the spring lead zone and coastal waters from Barrow to Cape Halkett off NPRA in Sale 170. .006

Offshore lease sales jeopardize the integrity of the wilderness, wildlife and coastal habitats of the Arctic Refuge and Teshekpuk Lake as well as the marine ecosystem itself. Offshore exploration and development would cause pollution, aircraft and vessel noise and related industrial activity, and potential spills. Sub-sea pipelines in the ice-infested waters of the Beaufort Sea are very risky, even if 6-miles long like Northstar, much less ones that could be 30-100 miles long. .007

In the future, there would be intense pressure to construct sprawling onshore airports, pipelines, roads, docks, and other support facilities within the unique national treasure -- Arctic Refuge. The last Beaufort Sea lease sale 170 set a precedent of not leasing off the coast of the Arctic National Wildlife Refuge. At that time, the Interior Department cited among many reasons, the lack of information on cumulative impacts on the refuge, emergency response plans, and sub-sea pipelines, a deficiency that still exists. .008

The failure of four field tests showed industry's inability to contain and clean up an oil spill in Arctic waters during most of the year. I watched those drills and saw how daunting the task is. Oil spills pose great threats to endangered bowhead whale migration and feeding areas, polar bear habitat, migratory bird, fish and other sensitive environments. .009 .010

The Karluk shipwreck shows us how extensive an area could get oiled from a pipeline break or blowout. August 12, 1913, the research ship Karluk was abandoned by Stephannson in Camden Bay near Flaxman Island. Over the next five months it drifted 100's of miles west in the pack ice until it sank north of Wrangel Island, Russia on Jan. 10, 1914. While the EIS presumes that spilled oil would stay stuck in one place, this example questions that premise. .011

The EIS downplays the number of polar bears that could be oiled and die in a spill. In contrast to the "few" that would die, according to the executive summary of the EIS, modeling studies have shown that up to 108 polar bears could be oiled and die from a single spill at one of the offshore development projects. A comprehensive analysis of the effects of many offshore production projects, as well as the cumulative effects of all onshore and offshore developments needs to be done. .012

The MMS is inconsistent in its various calculations of the chance of a spill. I see that in MMS's Final EIS for the 5-year plan published in April of this year, they assumed that there would be one platform spill and one pipeline spill, with a total 81-94% chance of a spill greater than or equal to 21,000 gallons (Table 4.1e). .013

So has something really significant changed since MMS's April calculations, or were the numbers capriciously changed to downplay the risks? In the EIS for the Beaufort Sea sales, MMS states that the chance of one or more pipeline spills is 4-5% and one or more platform spills is 5-6%, with the total chance of a spill is 8-10% (p.A1-11). What is this based on? A new study was apparently done by the Bercha Group which is "in press," according to the DEIS, but has it had peer review? The new probabilities also sharply contrast with the Beaufort Sea Sale 170 Final EIS (p.IV-B-4) which predicted 46-70 % chance of one or more spills when it analyzedan area roughly 1/10 of the proposed lease sale area. The DEIS also ignores other predictions, such as for the Northstar field where the U.S. Army Corps of Engineers projected up to 24% chance of a major spill for that project alone.

We all know that accidents happen and that if a spill does occur it would be devastating to the coastal and marine environment. Yet, the worst-case scenarios are downplayed or ignored throughout your analysis.

The oil spill modeling was not done for a reasonable range of alternatives, nor were key resources like the bowhead whale feeding grounds or fish nearshore habitat analyzed. The trajectory analysis breaks down resources, such as the bowhead whale migration route into small pieces, or the shoreline of the Arctic Refuge into 9 segments. So, the chances of hitting any one piece may be small, but the chance of hitting a larger area might be much greater. Would you want to be the official in charge if a blowout washed onto the Arctic Refuge coast?

Due to proven lack of ability to clean up oil spills in the Beaufort Sea most of the year, the risks to bowhead whales, polar bears, migratory birds, and subsistence resources are too great to allow new leasing in this sensitive area. .014

The leasing alternatives in this EIS are meaningless, confusing, and do not meet the presumed goals of protecting subsistence resources, the bowhead whale feeding grounds, or reducing impacts to other sensitive areas. Whether inadvertent or intentionally deceptive, the tiny deferral options would not achieve the named goal, such as Kaktovik Subsistence whale deferral. Apparently, this is a simple line drawn around some whale harvest areas, but it has nothing to do with avoiding the subsistence resources areas – the bowhead feeding grounds located off the shore of the Arctic Refuge, the whale fall migration corridor, the whale spring migration route, nor the area where oil spills or noise from exploration or production would occur and could harm the whales' habitat and migration route. The Kaktovik deferral is arbitrary and needlesslessly confusing especially since it bears no resemblance to any past Kaktovik deferrals that MMS has proposed. .015

Furthermore, the City of Kaktovik and the North Slope Borough requested that the entire area off the coast of the Arctic Refuge be deleted, as did the Alaska and National environmental organizations, yet this reasonable deletion or deferral area was not one of the alternatives. .016

I am concerned that the environmental impacts, especially the cumulative effects of activities and infrastructure that occur both onshore and offshore are systematically downplayed. .017

In conclusion, the MMS needs to conduct a new Draft EIS for the first Beaufort Sea lease sale due to the inadequacies of the environmental impact review. A full public EIS process, complete with hearings, and coastal zone consistency analysis should be conducted for each lease sale that is held. .018

At this time, I recommend Alternative 2, No Action, because it is the only one that would address my concerns about major oil spills and unacceptable long-term risks to the wilderness values of the Arctic National Wildlife Refuge and the important migratory bird habitats of the Teshekpuk Lake Special Area.

I recommend that areas that were deferred or deleted from past Beaufort Sea Sales, including the area north of the coast of the Arctic National Wildlife Refuge and the National Petroleum Reserve-Alaska, bowhead whale feeding grounds, and the spring lead system should be permanently removed from the lease sales. This simply takes into account past public input.

Sincerely,

Pamela A. Miller

Pamela A. Miller

MMS Response to Comment Letter L-0025

L-0025.001

The MMS has not "reverted to old proposals to simply lease the entire area" as your letter states. The MMS has worked closely with locally affected communities to define and refine the Proposal and deferral alternatives, and developed two new stipulations (Stipulations 6a and b and Stipulation 7) in addition to the five "standard" stipulations in place and analyzed in the EIS.

The MMS has incorporated comments and concerns expressed since the mid-1970's regarding leasing offshore OCS areas in the Beaufort Sea, and will continue to do so for each proposed sale. The MMS has identified the lack of baseline and scientific data on which to base leasing decisions and contracted for and conducted biological, environmental, and sociocultural studies for more than 30 years to enable the Secretary of the Interior to make a reasoned and balanced decision whether to offer or defer areas from leasing in the Beaufort Sea. Studies results have been incorporated into each EIS as data became available. The MMS continues to conduct additional studies as the need for a study arises through comments and discussions with the North Slope Borough, the Alaska Eskimo Whaling Commission, whaling captains, the scientific and environmental communities, and Federal and State agencies. The MMS requires companies conducting exploration activities on the OCS to conduct monitoring studies and requires consultation with potentially affected subsistence communities. Over the years, mitigating measures have been developed and refined through dialogue and consultation with the Borough, the Commission, local communities, industry, and the State to reduce or minimize any effects from oil and gas activities.

The program has proceeded in accordance with the requirements of the OCS Lands Act, and all other relevant laws and regulations. The MMS recognizes the value of public comments and concerns raised at each step of our prelease process.

See Responses L-0001.005, L-0021.009 and L-0021.036.

L-0025.002

Information on Beaufort Sea storms is included in Section III.A.2.d, and information on the coastal zone has been added to the section on Lower Trophic-level Organisms (Section III.B.1.a). The information refers in part to Figures III.B-1a and III.B-1b, satellite photos of the Beaufort Sea that illustrates the extent of sediment-laden, estuarine water.

L-0025.003

The MMS acknowledges current leasing moratoria in OCS offshore areas of the lower 48 and recognizes that the Beaufort Sea is a productive and sensitive area with a unique environment. Since 1979, the MMS has safely engaged in oil and gas leasing activities in the Beaufort Sea, in accordance with the OCS Lands Act, NEPA, and Council on Environmental Quality guidelines. Through the years, the MMS has developed mitigation designed to reduce or minimize potential risks to the environment, resources, and lifestyles of local subsistence communities. We have worked closely with all parties to ensure activities are conducted as safely as possible to reduce potential effects of oil spills. However, the Secretary of the Interior decides whether to offer areas for leasing or to continue to exclude areas on a sale-by-sale basis. The various steps of the EIS and prelease processes ensure that the Secretary is provided with sufficient, detailed scientific information and environmental constraints to enable her to make a balanced and reasoned decision on an OCS area.

This process further refines and reduces an area analyzed in an EIS at each phase of the leasing process. In actuality, from past leasing experience we know that very few blocks are actually offered and leased, and considerably fewer of those leased blocks ever has any exploration activity. Since 1979, seven Beaufort Sea OCS lease sales were held; of these, 30 wells have been drilled, and only one, the Northstar Unit, has any OCS producing wells. Although three Beaufort Sea lease sales are on the OCS approved 5-year leasing program for 2002-2007, the MMS does not expect "massive sales" to occur, given past leasing history.

See responses L-0001.005, L-0001.007, L-0004.010 and L-0021.009.

L-0025.004

See Response L-0002.016.

L-0025.005

See Response L-0021.023.

L-0025.006

See Responses PH-Anchorage.020, PH-Anchorage.021, PH-Anchorage.045, PH-Anchorage.047, PH-Kaktovik.009, L-0005.007, and L-0021.009.

L-0025.007

See Response L-0007.001.

L-0025.008

Each proposed lease sale is treated separately by the Secretary of the Interior. With each lease sale, the passage of time and the increase of information are circumstances that may affect the Secretary's decision. This EIS and the Liberty Development and Production Plan EIS contain a much-improved cumulative analyses from the one prepared for the Sale 170 EIS. Additional environmental analyses pertaining to pipelines and other issues were prepared for the Northstar and Liberty projects offshore in the Beaufort Sea. There is adequate information available to the Secretary to make an informed decision about whether to lease offshore the Arctic National Wildlife Refuge or whether to choose one or both deferral alternatives (V and VI). The Secretary will review all available and pertinent data before making an informed decision.

L-0025.009

See Responses L-0007.001 and L-0003.001.

The MMS has participated in the equipment and tactic demonstrations conducted by industry in the Beaufort Sea during 1999, 2000, and 2002, in conditions ranging from open water, spring broken ice and fall freezeup. The equipment, tactics, and personnel are capable of responding to an oil spill in all of these environments. The oil-spill-response demonstrations conducted to date have identified individual tactic limitations and have led to the addition of new tactics to improve effectiveness in broken-ice conditions. In an actual response situation, industry would be able to use every tool at their disposal and would not be limited to a single skimming configuration; they would mix and match tactics to most efficiently access oil in the environment.

The MMS believes that industry will be able to conduct a credible spill response regardless of the time of year. Industry has an extensive spill-response toolbox that includes mechanical response, in situ burning, and tracking capabilities. Research to improve oil-spill response is being actively pursued by both industry and MMS to add new tools and increase effectiveness of existing methods and equipment.

L-0025.010

The EIS assesses the probable effects on wildlife from large oil spills in Section IV.C and very large oil spills in Section IV.I.

L-0025.011

We acknowledge the historical context of the Karluk shipwreck and the commenter's knowledge of the cyclonic and anticyclonic gyres whose currents move water and ice in predictive ways. The Oil-Spill-Risk Analysis does, in fact, take these factors into account and does not presume to imply that oil stays in one place. If that were the case, the time, expense, and analytical rigor of an oil-spill model would be irrelevant.

L-0025.012

See Response PH-Anchorage.028.

L-0025.013

For the first portion of the comment, please see Response PH-Anchorage.029.

The MMS does not agree that we downplay or ignore worst-case scenarios. For purposes of analysis, the MMS assumes a spill occurs and analyzes impacts from an oil spill, even though statistically we do not expect a spill to occur. We also evaluate events such as a blowout in Section IV.I, even though the probability of occurrence is remote.

The oil-spill modeling was done for the range of alternatives analyzed in the EIS. Section IV.C.4.a(3)(b) - Effects of a Large Oil Spill discusses the effects of a large spill on freshwater, estuarine, and marine fish habitat.

The MMS examined the impacts of oil spills to whales specifically and habitat in general. For a whale to be impacted by a spill, it must occupy the same space as the spill. If a spill is in whale habitat, but there is no whale, then the whale will not be impacted. The National Marine Fisheries Service received a petition on February 22, 2000, requesting that portions of the U.S. Beaufort and Chukchi seas be designated as critical habitat for the Western Arctic stock of bowhead whales. On August 30, 2002, the National Marine Fisheries Service made a determination not to designate critical habitat for this population of bowheads (67 *FR* 55767), because (1) the population decline was due to overexploitation by commercial whaling and habitat issues were not a factor in the decline; (2) the population is abundant and increasing; (3) there is no indication that habitat degradation is having any negative impact on the increasing population; and (4) existing laws and practices adequately protect the species and its habitat.

The conditional probabilities for shoreline can be added. We have added Tables A.2-73 through A.2-90 showing the conditional and combined probabilities for refuges, parks and special uses areas.

L-0025.014

See Response L-0025.009.

L-0025.015

See Responses L-0001.009, L-0001.011, L-0001.012, L-0001.013, and L-0001.014.

L-0025.016

See Responses L-0021.009 and L-0035.001.

L-0025.017

The complexity and uncertainty associated with cumulative impacts have made it necessary to analyze this important ongoing issue with a systemized approach for some consistency to past and future assessments that meet NEPA requirements.

L-0025.018

See Responses L-0001.005 and L-0002.016.

L-0026

RECEIVED
SEP 1 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 18, 2002

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Via e-mail to: akeis@mms.gov.

Also via fax to: 907-271-6805

RE: Comments on the draft Environmental Impact Statement for the proposed Beaufort Sea Planning Area Oil and Gas Sales 186, 195, and 202, OCS EIS/EA MMS 2002-029.

Dear Mr. Goll:

We are hereby submitting the comments of Environmental Defense on the draft Environmental Impact Statement for the proposed Beaufort Sea Planning Area Oil and Gas Sales 186, 195, and 202, pursuant to OCS EIS/EA MMS 2002-029.

Environmental Defense stresses that the underlying imperative for the Beaufort Sea planning process must be one in which the living resources, human communities, wetlands, watersheds, and other important values of Alaska and its waters will be protected and managed in a sustainable manner. This process must also be one in which the Minerals Management Service complies with all applicable federal and state laws. The present DEIS does not indicate that the current planning process and the proposed activities are able to meet these criteria. We therefore support Alternative II as outlined in the DEIS.

Our range of technical comments at this time fall into these general areas of concern:

1) Under the requirements of the National Environmental Policy Act (NEPA), the Department of Interior is not within the law if it relies only on an Environmental Assessment (EA) in preparing for any subsequent Beaufort Sea lease sale in the current 5-Year Outer Continental Shelf OCS Leasing Program. A full sale-specific EIS for each Beaufort Sea sale must be conducted to ensure that sound science and all necessary lease stipulations are applied to leasing decisions in this region. .001

2) When the federal government and the oil industry first proposed development of the Prudhoe Bay fields and the construction of the TAPS system, they made a contract with the American people and with all Alaskans that produced crude oil would be delivered safely to the Lower-48 markets. Promised safety equipment was never built and environmental shortcuts became a matter of daily practice, leading to the tragic Exxon-Valdez oil spill, which continues to poison the ecosystems of Prince William Sound today. Recently, lax industry safety practices led to a fatal explosion on the North Slope. .002

The record of the petroleum industry in Alaska is not reassuring, and includes countless spills, equipment failures, and broken promises. Cook Inlet watershed oil and gas spills from pipeline failures and maintenance problems have exceeded 50,000 gallons per year in total and spills occurred on average once per month, according to an analysis of data reported to the Alaska Department of Environmental Conservation (ADEC). The lush marine life of the Beaufort Sea is too valuable to put at risk to an industry with this kind of documented track record. .003

3) Very low levels of hydrocarbon compounds have now been found to be producing mutagenic effects on eggs of Pink salmon in Prince William Sound (PWS) as a result of the lingering petroleum pollution from the 1989 Exxon Valdez tankship oil spill. The three Final Environmental Impact Statements for the proposed Beaufort Sea OCS lease sales must address the implications of the compelling scientific evidence that very low levels of PAH compounds, at concentrations of parts per billion, trigger long term life-cycle mutagenic impacts on biological resources. The FEIS's should delineate what these discoveries in PWS mean for the biological systems of the Arctic should OCS development proceed there. .004

4) The DEIS fails to address the need for adequate OCS lease stipulations that will be necessary to accommodate the new engineering and environmental challenges encountered in the severe meteorological conditions of the Beaufort Sea, and fails to respond to the lack of oil spill cleanup capability in broken sea-ice conditions in the Arctic. The current technological inability of industry to respond to spills -even in the relatively less treacherous waters of Prince William Sound - creates a compelling case that cleanup capability must be a precursor to new OCS leasing in the Arctic. The DEIS fails to consider the present inadequacy of oil spill cleanup and containment technology, particularly as this inadequacy relates to the sensitive biological resources of the Arctic. The FEIS's must quantify the minimum and maximum percentages of anticipated oil recovery for spills in various sea states, meteorological conditions, and sea ice conditions. .005

5) The DEIS fails to consider newly emerging information about the concentration of hazardous levels of mercury around existing drilling operations in the Gulf of Mexico. The FEIS's must evaluate the substantial cumulative polluting effects of concentrating the impacts of a number of successive sales within the Beaufort Sea OCS Planning Area. The FEIS's must also evaluate the cumulative effects of elevated mercury discharges from the expected number of new drilling activities likely to result from anticipated OCS activities on fisheries as well as on ecosystem and human health. .006

6) The DEIS fails to specify the fate of produced natural gas from OCS production activities that may result from the proposed lease sales in the Beaufort Sea, given that no gas pipeline to markets is presently in place. The FEIS's should specify the total volume of produced natural gas that has been reinjected to date in Alaska's North Slope terrestrial oil and gas fields, and how much of that reinjected natural gas has already been wasted and is beyond recovery. .007

7) The DEIS fails to identify whether or not geophysical data indicating the potential for methane hydrate resources may be playing any role in industry interest expressed in the earlier Call for Information for the Beaufort Sea OCS Planning Area. .008

8) There are severe deficiencies in the current DEIS, including the lack of an impartial evaluation of the need to establish and maintain an adequate dismantling, removal, and restoration escrow account to ensure that all future decommissioning and habitat restoration costs will be met. In the Lower-48, OCS lessees who promised to carry out full dismantling, removal, and restoration processes as a precondition of their OCS lease contracts are now engaged in lobbying efforts to cut corners on their decommissioning costs by reneging on their agreed-to abandonment programs. In most cases, lessees are promoting their controversial and unproven "Rigs to Reefs" program of at-sea disposal of spent jackets as an alternative to full compliance with their present contractual obligations regarding decommissioning. Coastal states and fishing interests should not be left with seafloor obstructions such as "mud mounds" and discarded spent jacket structures as hazards to commercial fisheries and to navigation. .009

9) The DEIS fails to adequately consider the cumulative impacts of the proposed leasing actions in combination with previous OCS leasing actions and with other uses of the sea and seabed. The DEIS fails to adequately disclose the combined adverse impacts of all such activities on marine mammals, fish stocks, water quality, coastal ecosystems, and human communities. The DEIS fails to evaluate the direct and indirect implications of the proposed OCS-related activities on local and regional economic, social, subsistence, and environmental resources. Failure to evaluate cumulative impacts of the project in conjunction with other impacts on the regional marine environment has resulted in an inadequate EIS process, which fails to comply with the National Environmental Policy Act (NEPA). .010

10) The DEIS fails to explain how activities conducted as a result of each of the Beaufort Sea lease sales will fully comply with relevant sections of the Clean Water Act (CWA). Fates and effects of mercury, lead, and cadmium, which are associated with discharges of mud and cuttings from OCS operations, must be evaluated. "Produced water" impacts resulting from the discharge of toxic pollutants including benzene, arsenic, lead, naphthalene, zinc, and toluene downcurrent from the discharge must be quantified and mitigations identified. Fates and effects of NOx, carbon monoxide, sulfur dioxide, and all volatile organic hydrocarbons must be evaluated pursuant to the likelihood of compliance of OCS activities with the federal Clean Air Act. .011

11) The DEIS fails to explain how activities conducted as a result of the three anticipated Beaufort Sea OCS lease sales will comply with the Magnuson-Stevens Fishery Conservation and Management Act. The sale-specific FEIS's must quantify and identify the locations of biological resources comprising Essential Fish Habitat (EFH) within all project impact areas. EFH in the project areas must be delineated as to specific locations. Effective mitigation measures for project-induced EFH impacts must be incorporated in the NEPA process. .012

12) The DEIS fails to comply with the federal Endangered Species Act (ESA), including the provision of Section 7 consultations relative to all potentially impacted species subject to ESA listing. .013

13) The DEIS fails to adequately identify and evaluate the probable efficacy of specific mitigation measures, including oil spill cleanup technologies, air quality controls, and marine discharges from drilling operations. .014

14) The DEIS fails to evaluate the implications of additional hydrocarbon development expected to occur as a result of the three proposed OCS lease sales on global climate change, on the need to dispose of or sequester carbon dioxide in the ocean environment, and on public health. .015

15) The DEIS fails to adequately disclose the implications of OCS activities on coastal jurisdictions, including adverse impacts on air and water quality, shoreline industrialization and subsistence use issues within the coastal zone, and on public safety and wildlife damage risks associated with the current state of OCS technologies and the limitations of current oil spill cleanup capabilities. .016

16) The DEIS fails to consider the lack of availability of adequate scientific information needed to support reasoned leasing decisions, and the FEIS's must disclose the anticipated impacts derived from the proposed actions on existing uses of the sea and seabed. .017

17) The DEIS fails to provide detailed information about the probable implications of OCS oil and gas development on the fragile and productive Arctic environment in Alaskan waters and along Alaska's coastline. In particular, the cumulative impacts of new and existing federal OCS activities and state tidelands oil activities in Alaska must be evaluated and effective mitigations identified. The FEIS's should each disclose the full range of development pressures likely to result within the Arctic National Wildlife Refuge if the three Beaufort Sea lease sales proceed offshore. As a result of the activities proposed in the 5-Year OCS Program, the Alaskan OCS is likely to be subjected to drilling impacts from hundreds of exploration, delineation, development, and production wells, construction impacts from many miles of pipelines, impacts from the construction of causeways, docks, and pipeline landfalls, wildlife disturbance resulting from hundreds of aerial overflights, and fisheries impacts derived from the conduct of thousands of miles of seismic surveys. Statewide, the fishing industry in Alaska provides more private sector jobs than does any other source. Subsistence use of fish and other marine animals is both an established economy of Native coastal communities and is central to the survival of Alaska's indigenous cultures. .018

18) The FEIS's must each provide a full cost-benefit analysis which compares the actual costs (including transportation to markets, losses incurred in reinjection of unmarketable natural gas, and one-time social and environmental costs, such as the Exxon Valdez oil spill, plus ongoing day-to-day costs incurred by the environment) and benefits of OCS oil and gas leasing to an equivalent level of energy benefits generated by secure diversified renewable energy sources located closer to markets, including commercial wind electric generation, biofuels, alcohol fuels, photovoltaics and energy conservation. .019

19) The DEIS fails to adequately justify the decision by the Secretary of Interior to propose three sales in the Beaufort Sea planning area in the OCS Oil and Gas Leasing Program for 2002-2007 (The Program). The preliminary Program called for the first Beaufort Sea OCS lease sale to be held in 2003, with subsequent sales in 2005 and 2007. The September 19, 2001 publication of the Call for Information and Comments erroneously alleged that a single EIS could be utilized to justify all three of these sales. In light of the .020

fact that the final decision on the 2002-2007 5-year Program had not yet been made, and final delineation of the program areas and number of sales had not been completed at the time, this Call for Information and Comments on the Beaufort Sea planning area was clearly premature. In addition, the cumulative impacts of three lease sales within this area, the severe meteorological and sea-state conditions encountered, and the lack of oil spill cleanup technology are among the evidence that separate NEPA processes are necessary for each and every subsequent lease sale in the 2002-2007 Program. .020

20) The DEIS fails to provide the reviewer with an analysis of all direct, indirect, and cumulative impacts of all three of the proposed lease sales and on the composite impact of their cumulative effects. The identified deficiencies in the DEIS cannot be remedied by the publication of sequential Environmental Assessments (EA's) nor by the preparation of a draft supplemental document, but rather must be addressed by the scoping, preparation, and collection of public comments on a new lease-sale-specific DEIS document for each sale that discloses a full range of reasonable alternatives to each individual proposed action. .021

21) The DEIS fails to offer any reassurance whatever that the industry can safely monitor, detect, and respond to leaks from, pipelines under the sea ice. .022

22) Lease stipulations which prohibit the export of produced crude to markets outside of the U.S. should be a pre-requisite for any lease sale in federal waters in Alaska. .023

Thank you for this opportunity to provide comments on the draft Environmental Impact Statement for the proposed Beaufort Sea Planning Area Oil and Gas Sales 186, 195, and 202, OCS EIS/EA MMS 2002-029. We look forward to a full written response to each of these issues, pursuant to federal law.

Sincerely,

Richard A. Charter

Richard Charter
Marine Conservation Advocate
Environmental Defense
5655 College Avenue
Oakland, CA 94618

MMS Response to Comment Letter L-0026

L-0026.001

See Response L-0005.008.

L-0026.002

The MMS appreciates the commenter's concerns regarding industry's record for spills and accidents. The MMS has stringent safety and pollution-prevention regulations in place. Industry has a good operating and safety record on the OCS under the MMS regulatory program. The EIS includes discussions on OCS operating experience, spill risks, and operating requirements that reduce the potential for spills and accidents.

L-0026.003

See Response L-0026.002.

L-0026.004

The fact that very low hydrocarbon levels can adversely affect individual fish is not new and was mentioned in the draft EIS in Section IV.C.3.a(2). The issue is not so much about how individual fishes can be affected by hydrocarbons, but rather about how fish populations are likely to be affected, which is addressed at length in the EIS. While recent studies in Prince William Sound by Rice et al. suggest some long-term oil-spill-related effects for a large tanker spill, no tanker is proposed in the Beaufort Sea as a result of these lease sales. A spill of similar magnitude to the *Exxon Valdez* spill is very unlikely. Furthermore, the life histories of fish species in Prince William Sound are quite different than those in the Beaufort Sea, and the magnitude of the impacts on fish populations are diminished.

L-0026.005

The MMS disagrees with the commenter that additional stipulations are required to address environmental and engineering challenges in the Beaufort Sea and lack of oil-spill-cleanup and -containment technology. Existing regulatory requirements are considered mitigation in place and would address the type of concerns expressed by the commenter. The MMS safety and pollution-prevention regulations already reduce the risk of oil spills. The MMS has stringent regulatory requirements for safety and pollution prevention for drilling and production facilities. Several Federal and State Agencies will have jurisdiction over the design and operation of pipelines. The MMS oil-spill-contingency plan regulations ensure that appropriate oil-spill response-capabilities are in place. The EIS includes discussions of these safety requirements and oil-spill-response capabilities.

See Responses L-0024.003 and L-0024.004

L-0026.006

The EIS uses site-specific mercury information from the area of oil-industry development within the Beaufort Sea. Standard practice in Beaufort Sea exploration and development drilling is to inject muds and cuttings downhole rather than to discharge them. Based on mercury measurements in water, sediment, and biota in the vicinity of offshore oil development, both methylmercury and total mercury concentrations are at background and not increasing (Naidu et al., 2001; Boehm, 2001b). We are continuing to monitor mercury levels in sediment, biota (bivalves, amphipods, and fish), and water (total, dissolved, and particulate). We are identifying sources of mercury to the Beaufort Sea industrial area and are looking at historical rates of mercury accumulation in dated sediment cores. We are studying the partitioning of mercury between dissolved and particulate phases in the water. We have developed a very sensitive ratio technique that will detect any increase in mercury concentrations in Beaufort Sea sediments long before levels of biological concern are reached.

L-0026.007

Associated gas produced with oil from future OCS fields will be used as fuel for onsite facilities or reinjected for reservoir pressure maintenance. No gas is wasted. Gas consumed for fuel on leases does not pay royalties; however, royalties will be collected from gas transported off lease. Reinjected gas will be available for future production, when a transportation system is built from the North Slope. The disposition of gas produced on State lands on the North Slope is available from the Alaska Department of Natural Resources. In 1999, associated gas production on the North Slope totaled 3,162 billion cubic feet, of which 219 billion cubic feet (or about 7%) was consumed and the remainder was reinjected. Ultimate recoveries from gas reservoirs typically are in the range of 70-90%, and advanced technologies spurred by higher prices generally support higher recoveries of oil and gas reserves.

L-0026.008

At the present time, methane hydrates are a scientific curiosity, not a proven hydrocarbon resource. Although numerous studies are being conducted to test the feasibility of recovering commercial quantities of gas from methane hydrates, no cost-effective method has been identified. Methane hydrate deposits are associated with permafrost in onshore areas of the North Slope and are the most economically attractive, because they could be produced through existing infrastructure. Widespread methane hydrate deposits on the continental shelf are much less attractive, because infrastructure is not present and recovery methods could be different. For these reasons, it is highly unlikely that the methane hydrate potential on the Beaufort OCS played any role in the industry interest related to the current leasing program.

L-0026.009

The MMS is not familiar with the lobbying efforts by industry to cut corners on decommissioning costs referred to by the commenter. Lessees must remove all facilities at the time of abandonment unless otherwise approved by the MMS, and that approval would be given only after a determination has been made that leaving a facility in place would not result in impacts to other users of the area. The OCS lessees are fully responsible for total decommissioning costs. Lessees are not required to maintain an escrow account. The MMS does require lessees to post a bond or other financial surety sufficient to cover the cost of abandonment of facilities.

L-0026.010

Past, present, and reasonably foreseeable future activities and effects have been identified (See Section V.B.1, V.B.2, and V.B.3) and analyzed in this EIS in Section V.C. For specific cumulative analyses, please read the following sections: Marine Mammals – V.C.7 and V.C.5.a;, Marine and Coastal Birds – V.C.6 and V.C.5.b; Vegetation and Wetlands V.C.9; Fish – V.C.3 and V.C.4; Water Quality – V.C.1; Economy – V.C.10; Sociocultural Systems– V.C.12; and, Subsistence – V.C.11. Most of these effects are transitory, the affected resources recover within a few generations, and do not translate to long-term measurable effects. Use of the sea and seabed is limited in the arctic environment to migratory species in conjunction with subsistence-hunting activities. Tankering, cruise ships, and commercial fishing do not occur in this challenging environment. With the exception of potential pipelines to shore or offshore drilling and production platforms, which are analyzed in this EIS, the use of the seabed is very limited. Migratory epibenthic invertebrates such as a crab fishery, typical of the Bering Sea offshore benthic environment, were not identified as a concern in the Beaufort Sea during the scoping process for this EIS.

L-0026.011

Potential effects to water quality are evaluated in this EIS in Sections IV.C.1, IV.H, IV.I, and V.C.1. Discharges and emissions are regulated primarily by the Environmental Protection Agency through the Clean Water Act and National Pollutant Discharge Elimination System and Prevention of Significant Deterioration permit processes. All lessees are required to obtain permits for any proposed discharges from the Environmental Protection Agency for all exploration, development, and production activities, before the activities take place. The EIS describes the existing water and air quality, the nature and scope of discharges and emission from oil and gas activities, and the Environmental Protection Agency permitting authorities and contribution to reducing potential effects to water and air quality.

L-0026.012

The analysis requirements for essential fish habitat are summarized in Section III.B.3.

The draft EIS was submitted to the National Marine Fisheries Service to fulfill the consultation requirements. See Appendix G- Essential Fish Habitat for our submittal letter and a summary of the response. The National Marine Fisheries Service incorporated their response to our essential fish habitat consultation with their response on the consultation for the Marine Mammal Protection Act. Their letter is reproduced in full in Appendix G. The biological resources comprising essential fish habitat are identified and quantified in Sections III.B.3 and IV.A.1 of this EIS.

The MMS evaluated the potential effects of the proposed lease sales on the essential fish habitat and determined there were no significant impacts. We provided the National Marine Fisheries Service with our analysis and consulted with them, and they concurred with our findings. The regulations do not require all potential effects be mitigated. The essential fish habitat analysis in this EIS is adequate and complies with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act.

L-0026.013

The MMS believes that the EIS adequately addresses impacts for threatened and endangered species under the Endangered Species Act. The MMS receives comments on the draft EIS from the National Marine Fisheries Service and the Fish and Wildlife Service to ensure adequacy on threatened and endangered species. The MMS also consults with both agencies on threatened and endangered species in the Beaufort Sea Planning Area. The MMS complies very closely with the regulations on Section 7 consultations. The Section 7 consultation process was ongoing during the review period for the draft EIS. The discussion of the consultation history for the proposed lease sale at the time the draft EIS was made available for public review has been updated, and the complete Biological Opinions of both agencies are included in this EIS in Appendix C.

L-0026.014

The MMS does not agree that the EIS needs to identify and evaluate additional stipulations as suggested by the commenter. The MMS has included a suite of standard stipulations and ITL clauses that have been proven effective in reducing potential adverse effects. A summary of the effectiveness of these mitigating measures and other potential stipulations can be found in Section II.H.1. Existing regulatory requirements are considered mitigation in place and would address the types of mitigation sought by the commenter. The MMS safety and pollution-prevention regulations already reduce the risk of oil spills. The MMS oil-spill-contingency plan regulations ensure that appropriate oil-spill-response capabilities are in place. The Environmental Protection Agency's National Pollution Discharge Elimination System permits and air quality permit authority provide for regulation of discharges and emissions, respectively.

L-0026.015

Climate change in the Arctic is not uniform either in time or location. The ocean's carbon retention and release cycle ("carbon budget") also is a factor that may not be uniform in time, location, or expression of release. These factors, coupled with other terrestrial and maritime events, may influence climate over the coming decades.

The MMS has determined that analysis of programmatic issues is inappropriate in a project-specific EIS. The MMS has determined that climate change should be evaluated in the context of the overall 5-year offshore leasing program or programmatic level and not within lease-sale or development project environmental analyses. As we note in Section IV.C under the No Lease Sale alternative, if oil and gas resources are not produced domestically, nearly all the resources would be imported. Therefore, the amount of carbon dioxide produced by the Nation and the global effects will not be altered substantially by these proposed lease sales and the domestic production of oil and gas. If over the long term some of the emissions and any consequent global change could be eliminated by increased energy efficiency, energy conservation, and the use of alternative energy sources, greenhouse effects could be lowered; however these efforts are independent of the proposed lease sales. They are connected to the national and global policy decisions and their implementation, which are considerably beyond the scope of this EIS.

A World Bank study incorporated by the Corps of Engineers into the Northstar EIS (Section 10.4.2.3, pages 10-27 and 10-28) estimated the contribution of North Slope production to global warming to be about 1%. We believe this to be the best relevant information currently available. The potential consequences of climate change from global greenhouse gas emissions are presented in detail in reports by the Intergovernmental Panel on Climate Change (2001a,b). An assessment of climate change impacts on the United States is given in a report by the National Assessment Synthesis Team (2000). These reports indicate a wide range in the possible effects and many uncertainties, especially on a regional basis. However, with regional oil production accounting for about 1% of global emissions, the contribution to global climate change would be virtually imperceptible.

Exploration and development projects are engineered with margins of safety to handle other normal fluctuations, such as tides and spring runoff from melting snow, in addition to unusual events, such as storm surges. The changes that have and are occurring in the sea level would be considered and incorporated in the engineering design and approval process, and facilities will be monitored over the life of the project to ensure they are safe. A more complete discussion of global climate change, particularly as it applies to Alaska, can be found in Section 4.1.2. of the EIS for the MMS's 2002-2007 Outer Continental Shelf Oil and Gas Leasing Program.

L-0026.016

The MMS does not agree with the commenter that the EIS fails to disclose the impacts on air and water quality and other coastal impacts and limitations of oil-spill-cleanup capabilities. The EIS includes a full discussion on the potential effects on the human and marine environment in Sections IV.C and V.C, including effects to air and water quality. The EIS includes an extensive discussion of the various oil-spill-response technologies and strategies that would be used in different environmental conditions. The analysis of potential effects to Land Use Plans and North Slope Coastal Management Plan can be found in Sections IV.C.14 and for cumulative effects in Section V.C.14.

L-0026.017

This EIS provides adequate information to make a reasoned assessment of potential environmental effects for each of the proposed lease sales. Nevertheless, the MMS considers acquisition of additional information through its Environmental Studies Program, which seeks to obtain information useful for the prediction, assessment, and management of potential effects on the human, marine, and coastal environments. If new information becomes available, it will be considered and evaluated in an environmental assessment or supplemental EIS as determined appropriate for Sales 195 and 202.

L-0026.018

The EIS is limited in detailing potential effects, because it is not known exactly where exploration will be successful. Additional site-specific details and effects are provided in the next phase of the assessment process, which would be a development and production EIS for a particular discovery. This EIS has detailed the effects to be expected from these activities, as far as we know at this time, with one or more discoveries in each of the three sales, in addition to the cumulative impacts. At this stage in the process, there are seven stipulations and 16 ITL clauses that address scoping concerns. Support and logistical activities are described in this EIS from the assumed scenario. Details of effects are given for each of the resources in this EIS. This EIS represents the total activities expected in the Beaufort Sea for the present 5-year program (2002-2007).

Any discovery in the eastern portion of the lease sale would not come onshore to Arctic National Wildlife Refuge but would be moved offshore and onshore at some point west of the Refuge. The discovery and production of 460 million barrels of oil from each of the three sales is optimistic but would only offset the present rate of declining production on the North Slope. The number of wells and support activities can seem excessive but, when factored in a 20- to 30-year period over an area that covers hundred of square miles, it does not readily translate to great effects from these activities.

While commercial fishing is a major contributor to Statewide employment and ranks closely with the oil and tourism industries, it is not a major contributor to the economy or employment in the Beaufort Sea area, or on the North Slope. Subsistence fishing is adequately evaluated in the EIS in Section IV.C.11.b(1)(b)4). While commercial fishing is important to the single entity engaged in the activity, it was not a major issue identified during scoping (See Appendix E) or during the subsequent hearings (See Section VII.E) on the North Slope.

There is no question that fish and marine mammals along with terrestrial mammals need to be protected for the indigenous people of Alaska.

L-0026.019

To the extent required by NEPA, we consider and analyze these issues in the final EIS for the OCS Oil and Gas Leasing Program: 2002-2007. This analysis is in Section 4.7 - Environmental Impacts of Alternative and Section 5 - No Action of that document. In Section V, the Cumulative Case of this EIS, we analyze potential effects of the unlikely event of a spill of 250,000 barrels of oil in the Gulf of Alaska. In that section we analyze both social and environmental effects, which would be similar to the effects of the *Exxon Valdez* spill. In Section IV - Environmental Consequences of this EIS, we analyze effects of routine, day-to-day activities, on all resources. For a lease-sale EIS, the NEPA requires an analysis of environmental effects; however, NEPA does not require translating these effects into dollar costs.

L-0026.020

The September 19, 2001, Call for Information and Comments for a proposed Beaufort Sea oil and gas lease sale clearly was the initial step in the Secretary's OCS program planning process long established in determining whether to offer areas for lease and, if so, what areas to include or exclude from a proposed sale area. This process generally takes 32-36 months to complete. To comply with the OCS Lands Act and implementing regulations to conduct lease sales in an approved 2002-2007 5-year oil and gas leasing program, the MMS initiated its preliminary planning process. The Call clearly stated that it was being issued at that time recognizing that the final decision on the 2002-2007 5-year program had not been made. The OCS Lands Act requires that no lease sale may be held and no leases issued unless and until it complies with the Secretary's approved final 5-year program and the requisite steps in the prelease process are completed. Beaufort Sea Sale 186 is not scheduled to be held until September 2003. Although the prelease planning process was initiated before the Secretary' final approved program was released (June 2002), all prelease planning documents state that no **final** decisions will be made until the entire process is completed. An important part of the prelease process is the receipt of comments on the draft EIS.

As pointed out in the process section/introduction of this Beaufort Sea EIS, further NEPA analysis will be performed after both the first and second lease sales are held. This will highlight any new information and analyze any new facts not covered in the initial multiple-sale EIS. For both Sales 195 and 202, an Environmental Assessment will be written that will include a public review process. If the Environmental Assessment finds that further NEPA documentation is warranted, a Supplemental EIS will be written to cover the missing analysis. The MMS believes that with the many previous lease-sale EIS documents written for the Beaufort Sea area, we have addressed issues raised over the years by North Slope residents. We do not repeat the same statements each time but reference previous MMS documents.

L-0026.021

The EIS addresses an analysis of the direct (Sections IV A, IV.B, IV.C, and IV.D); indirect (Sections IV E, IV.F, IV.G, and IV.H); and cumulative (Section V) impacts of all three of the proposed sales and on the composite impact of their cumulative effects. Following successful leasing under Sale 186, an Environmental Assessment will be made for the two remaining sales (Sales 195 and 202) and, if deficiencies are found from that information in the parent Beaufort Sea multiple-sale EIS, further NEPA documentation will be forthcoming. A public review process will be incorporated into the Environmental Assessment process.

L-0026.022

The MMS disagrees with the commenter that the EIS fails to offer any reassurance that industry can safety monitor, detect, and respond to under-ice pipeline leaks. The EIS includes a discussion on pipeline oil-spills risk, leak-detection technologies, and potential spill sizes resulting from different leaks rates at different times of year.

L-0026.023

Any oil produced from the Federal OCS in the Beaufort Sea would be transported to shore via undersea pipeline and through the Trans-Alaska Pipeline System. In 1995, Congress passed legislation for Alaska North Slope crude exports outside the U.S. The issue of prohibiting the export of produced crude oil to markets outside of the U.S. from Federal waters has been a matter of debate for the past few years. Recent controversy over the effects of Alaska North Slope crude exports has resulted in the introduction of several bills to reinstate the Alaska North Slope export ban. It is Congress, and not the Department of the Interior, that determines whether to reinstate a ban on exporting of Alaska North Slope crude.

L-0027

Sept. 18, '02

Dear Ms. Dall,

Concerning plans to drill off the coast of A.N.W.R., Alternative #2 is the only one that addresses our concerns about oil spills risks, & the impact on ANWR's coast. And there will be spills — & impacts! Please vote for Alternative #2. Thank you!

.001

Sincerely,

Nancy & Sebastian Sommer
2653 Monticello Dr.
Winston-Salem, N.C. 27106

MMS Response to Comment Letter L-0027

L-0027.001

We have noted the comments and have taken these points into consideration during preparation of the final EIS.

L-0028

RECEIVED
SEP 2 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Elizabeth MacGowan
1580 Jackson St. #15
San Francisco CA
94109

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Mgmt Svc.
949 East 36th Avenue, Rm 308
Anchorage, AK 99508

Mr. Goll:

I am writing to comment on the proposed Federal lease sales of oil + gas in the Beaufort Sea (Lease sales 186, 195, 202) Alaska is a unique area, and should not be jeopardized by the numerous effects of any oil + gas exploration + development, not to mention the inevitable spills and attendant harm to polar bear habitat, migratory bird + fish environments, + the bowhead whale migration + feeding areas. .001

Thank you for your consideration.

Sincerely,

El MacGowan

Elizabeth MacGowan

Sept. 18, 2002

MMS Response to Comment Letter L-0028

L-0028.001

We have noted the comments and have taken these points into consideration during preparation of the final EIS.

Advocates for Wild, Healthy Oceans

Alaska Regional Office
425 G Street
Suite 400
Anchorage, AK 99501
907.258.9922 Telephone
907.258.9933 Facsimile
www.oceanconservancy.org

Formerly the Center for
Marine Conservation

RECEIVED
SEP [illegible] 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

L-0029

The Ocean Conservancy

FAX COVER SHEET

DATE: 9/23/02

TO: Mr. John Bell
MMS

FAX #: (907) 271-6805

FROM: Martin Robards

PAGES (including cover): 3

SUBJECT: Comments on Beaufort DEIS

MESSAGE:

Thank you for attaching this cover-letter to our detailed comments provided Friday. Please call me (258-9941) if there is any problem or you have questions.

Sincerely
Martin Robards

The Ocean Conservancy strives to be the world's foremost advocate for the oceans. Through science based advocacy, research, and public education, we inform, inspire and empower people to speak and act for the oceans.

Sep-23-02 11:44A Kris balliet 9072589922 P.01

THE OCEAN CONSERVANCY
ALASKA CENTER FOR THE ENVIRONMENT
ALASKA COALITION * ALASKA CONSERVATION ALLIANCE
ALASKA WILDERNESS LEAGUE * ARCTIC CONNECTIONS *
DEFENDERS OF WILDLIFE * EARTHJUSTICE * GREENPEACE
NATURAL RESOURCES DEFENSE COUNCIL
NORTHERN ALASKA ENVIRONMENTAL CENTER
SIERRA CLUB * THE WILDERNESS SOCIETY

September 23, 2002

RECEIVED
SEP [illegible]
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363
Fax: 907-271-6805

RE: Comments on the Draft Environmental Impact Statement for the Beaufort Sea Planning Area, Oil and Gas Lease Sales 186, 195, and 202. OCS EIS/EA MMS 2002-029

Dear Mr. Goll:

On our comment letter of September 20, 2002, we listed our e-mail addresses, but neglected to provide our full contact information and do so with this letter. Because we are stakeholders who have provided comment before, we believe you should already have this information, but we wanted to ensure that it is current. Furthermore, Greenpeace and Natural Resources Defense Council were inadvertently left off the letter as signatories, so please add them onto the list.

Sincerely,

Martin Robards
Alaska Protected Area Program Manager
The Ocean Conservancy
425 G Street
Anchorage
AK99501
coho@acsalaska.net

On Behalf of:

Randy Virgin
Executive Director
Alaska Center for the Environment
807 G Street, Suite 100
Anchorage, AK 99501
(907)274-3621
randy@akcenter.org

Tim Bristol
Executive Director
Alaska Coalition
122 C St. NW, Suite 240
Washington, DC 20001
(202)628-1843
seaktim@aol.com

Tom Atkinson
Executive Director
Alaska Conservation Alliance
750 W. Second Ave. Suite 109
Anchorage, AK 99501
(907)258-6174
tom@akvoice.org

Cindy Shogun
Executive Director
Alaska Wilderness League
122 C St. NW, Suite 240
Washington, DC 20001
(202)544-5205
cindy@alaskawild.org

Pamela A. Miller
President
Arctic Connections
519 W. 8th Ave. Suite 212
Anchorage, AK 99501
(907)272-1909
pammiller@alaska.com

Noah Matson
Science Policy Analyst
Defenders of Wildlife
1101 – 14th Street NW
Washington, DC 20005
(907)789-2844
Nmatson@defender.defenders.org

Tom Waldo
Alaska Staff Attorney
Earthjustice
(907)586-2751
twaldo@earthjustice.org

Melanie Duchin
Climate Campaigner
Greenpeace, Inc.
125 Christensen Drive #2
Anchorage, AK 99501
(907)277-8234
Melanie.duchin@dialb.greenpeace.org

Chuck Clusen
Senior Policy Analyst
Natural Resources Defense Council
1200 New York Ave. N.W.
Washington, DC 20005
(202)289-2412
Cclusen@nrdc.org

Arthur Hussey
Executive Director
Northern Alaska Environmental Center
830 College Road
Fairbanks, AK 99701
(907)452-5021
Arthur@northern.org

Jack Hession
Senior Regional Representative-Alaska
Sierra Club
201 Barrow Street, Suite 101
Anchorage, AK 99501
(907)276-4088
jack@sierraclubalaska.org

Eleanor Huffines
Alaska Regional Director
The Wilderness Society
430 W. 7th Ave. Suite 210
Anchorage, AK 99501
(907)272-9453
Eleanor_Huffines@tws.org

MMS Response to Comment Letter L-0029

No comments were identified in comment letter L-0029 that required responses.

Mr. John Goll
Regional Director
Alaska OCS Region,
Minerals Management service
949 East 36th Ave
Anchorage, AK 99508

L-0030

RECEIVED
SEP 2_ 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

9/17/02

Mr. Goll,

,001 Due to proven inability to clean up oil spills in the Beaufort Sea most of the year, the risks to bowhead whales, polar bears, migratory birds, and subsistence resources are too ~~great~~ to allow new offshore leasing in this sensitive area.

Areas that were deferred or deleted from past Beaufort sea sales, including the area north of the Arctic National Wildlife Refuge, and the coast of the Arctic National Petroleum Reserve-Alaska, the fall bowhead whale feeding grounds and migratory route, and the entire spring lead system should be permanently removed from the leasing system. None of the EIS alternatives address concerns ~~about~~ potential harm to these areas.

PLEASE support Alternative 2, NO ACTION - because it is the only alternative ~~that~~ adequately controls oil spill risks and impacts to the Arctic National Wild Refuge and Teshekpuk Lake (NPR-A) coastline.

Sincerely,

Alexandra Howles
Sierra Club Member, CA

MMS Response to Comment Letter L-0030

L-0030.001

The EIS assesses the probable effects on wildlife in the unlikely event of a large oil spill (Section IV.C) and a very large oil spill (Section IV.I). The EIS explains that the chance of one or more spills occurring and entering the offshore waters is 8-10%, and the chance of one or more spills occurring and contacting resource areas important to these species is lower, on the order of 2% or less. We recognize that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. For some stakeholders, such as this commenter, a 10% chance of a large spill over the life of the field may be considered high.

The rationale for the alternatives is explained in EIS Sections II.D, II.E, II.F, and II.G. These sections include summaries of the effects for each alternative. Also, the introduction to Section III explains that the effects of leasing in part or all of these areas were assessed previously in the EIS's for Sales BF, 71, 87, 97, 124, and 170.

See Responses L-0003.003 and L-0019.002.

George L. Pettit
1454 Willowmont Avenue
San Jose, Ca. 95118 - 1153
408 264 8310
georpett@pacbell.net

L-0031

RECEIVED
SEP 2 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

To: Mr. John Goll
Regional Director, Alaska OCS Region, Minerals Management Service
Anchorage, Alaska

Dear Mr. Goll, The following comments concern the pending lease sales off the Arctic coast, numbers 186, 195, and 202.

I am opposed to any leasing.

I support the "No Action" alternative. As a former resident in Alaska, I am concerned about any impact this resource development would have on the Wildlife and lands of this area. In the past, it has been determined to be unacceptable to incur risks to the environment, especially in the areas of the ANWAR, the National Petroleum Reserve, and the Migration routes of Bowhead Whales and Migratory birds. Also impacted would be the Teshekpuk Lake area. .001

It is, in addition, unacceptable to complete only one EIS for all three leases. This is patently not in compliance with the intent of the law. .002

It is generally recognized that we must begin to change from a fossil fuel energy policy to one of sustainable sources, and conservation. That time has come. Already , our impact upon the Earth is indefensible.

The Bush administration's push to develope oil and gas sources is wrong, and if followed, will only result in massive impact on this countries few remaining wild and natural areas.

THERE IS A BETTER WAY. And you can help by choosing NOT to develope leases 186, 195, and 202.

Thanks for your consideration. Please enter this into the official record.

George L. Pettit
1454 Willowmont Ave.
San Jose, CA 95118
408 264 8310
georpett@pacbell.net

MMS Response to Comment Letter L-0031

L-0031.001

Mr. Pettit describes the spill risk as unacceptable, especially to the coastlines of the Arctic National Wildlife Refuge and the National Petroleum Reserve in Alaska and the bowhead whale-migration corridor. The spill risk is calculated in Section IV.A.4. For example, the chance of one or more large spills occurring and entering the offshore waters where bowheads migrate is 8-10%, and the chance of one or more spills occurring and contacting resource areas important to this species is lower, on the order of 2% or less. We recognize that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. For some stakeholders, such as the commenter, a 10% chance of a large spill over the life of the field may be considered high.

L-0031.002

See Responses L-0001.005 and L-0026.021.

This process is discussed in the Overview and General Information section of the EIS and in Section I.A - Purpose, Need, and Description.

SIERRA CLUB
FOUNDED 1892

ALASKA TASK FORCE

L-0032

September 17, 2002

Mr. John Goll, Regional Director
Minerals Management Service
Alaska OCS Region,
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

RECEIVED
SEP 2 ? 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Dear Director Goll:

The Sierra Club is extremely disturbed to learn that the federal government is considering three new lease sales in the Beaufort Sea stretching in an area that stretches over more than 500 miles from the Canadian border nearly to Point Barrow. The area covered is 10 times the size of the last sale held in this region. Moreover, we are concerned that a single environmental impact statement is planned to cover all three of these prospective sales (Lease sales 186,195, and 202.) The size of the individual sales, plus the extent of environmental impacts to be anticipated in so sensitive a far-north area, should mandate the more comprehensive review of separate, individual EISes for each sale. .001

We ask that you support Alternative 2, No Action, which is the only alternative that adequately prevents oil spill risks and impacts to the sensitive Arctic National Wildlife Refuge and the coastline of the Special Area of Teshekpuk Lakewithin the National Petroleum Reserve-Alaska (NPR-A) Offshore exploration and development would cause unacceptable pollution, aircraft and vessel noise, other industrial activity, and potential spills. In the Beaufort Sea, during most of the year the risks of spills to bowhead whales, polar bears, migratory birds, subsistence resources, and to the vauable marine ecosystem itself, are too great to allow new offshore leasing. At least four tests for ability to clean up oil spills in this fragile area failed completely. .002

We request that a full EIS process be conducted for each separate lease sale that is offered, complete with individual public hearings both in Alaska and in key Lower 48 cities. .003

Areas that were deferred or deleted from past Beaufort Sea Sales, including the area north of the coast of the Arctic National Wildlife Refuge, and the National Petroleum Reserve-Alaska, the fall bowhead whale feeding grounds and migratory route, and the entire spring lead system should be permanently removed from the lease sales. None of the EIS alternatives address concerns about potential harm to these areas. .004

Thank you for your attention to these comments.

Sincerely,

Edgar Wayburn

Edgar Wayburn, M.D.
Chairman
Alaska Task Force

85 Second Street, Second Floor San Francisco, CA 94105-3441 TEL: [415] 977-5500 www.sierraclub.org

MMS Response to Comment Letter L-0032

L-0032.001

See Responses L-0001.005 and L-0026.021

L-0032.002

The MMS does not agree with the commenter's statement that the test for ability to clean up oil spills in broken ice failed completely, and that this should be the basis for adopting the No Lease Sale Alternative. The EIS includes an extensive discussion of oil-spill-response capabilities in broken-ice conditions, including the results of recent field trials. The EIS reflects that there are multiple response options for responding to different ice conditions.

L-0032.003

See Responses L-0001.005 and L-0026.021.

The proposed 5-year OCS oil and gas leasing program is discussed nationally at various locations around the United States. More specific OCS lease sales are discussed in the locally affected communities adjacent to proposed lease-sale areas; thus, public hearings for the Beaufort Sea multiple sales will be held only in appropriate Alaska communities and not in lower 48 cities.

L-0032.004

See Responses L-0001.005 and L-0026.021.

The MMS believes the EIS complies with NEPA and Council on Environmental Quality guidelines regarding consideration of alternatives, and that concerns have been addressed. Mitigating measures have been analyzed as part of the Proposal, and the alternatives and conclusions considered these measures in place.

Alaska Oil and Gas Association

AOGA

121 W. Fireweed Lane, Suite 207
Anchorage, Alaska 99503-2035
Phone: (907)272-1481 Fax: (907)279-8114
Email: brady@aoga.org
Judith Brady, Executive Director

L-0033

RECEIVED
SEP 2 , 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 20, 2002

Mr. John Goll, Regional Director
Alaska OCS Region
Minerals Management Service
949 E. 36th Avenue #308
Anchorage, AK 99508-4363

AOGA Comments on Beaufort Sea Multiple Sale Environmental Impact Statement for Sales 186,195 and 202

Dear Mr. Goll:

The Alaska Oil & Gas Association (AOGA) is non-profit trade association whose 19 member companies account for the majority of oil and gas exploration, production, transportation, refining and marketing activities in Alaska. AOGA appreciates the opportunity to comment on the Beaufort Sea Multiple Sale Environmental Impact Statement for Sales 186, 195 and 202.

AOGA would like to compliment the Minerals Management Service for adopting the multiple sale environmental impact model for the Beaufort Sea sales. The multiple sale model is appropriate for those areas, like the Beaufort Sea, that have a lease sale history and have had extensive environmental analysis.

We would also compliment the Minerals Management Service on the thoroughness of this environmental analysis. It meets the letter as well as the spirit of the law and reflects MMS's commitment to environmentally responsible lease sales.

AOGA continues to be concerned about the consideration of new stipulations that add cost and/or risk of delay without adding additional environmental benefits. For that reason we do not endorse Stipulation 6 Permanent Facility Siting in the Vicinity Seaward or Shoreward of Cross Island; or Stipulation 7 Pre-booming Requirements for Fuel Transfers. We believe subsistence hunting of bowhead whale and water quality is securely protected through the five standard lease stipulations and, in fact, is and has been central to the environmental regulation of federal and state lease sales in the Beaufort Sea.

AOGA endorses Alternative 1 for all three sales with <u>no</u> deferral areas. We have been consistent in our comments to MMS that the lease sale goal in this area should be all available acreage. The standard mitigation measures related to oil and gas operations are intended to and do provide secure protection for subsistence hunting of the bowhead whale.

We also continue to urge MMS to consider incentives that will make the Beaufort Sea an attractive, competitive alternative to offshore areas throughout the world. We understand MMS is reviewing options toward this goal and we endorse that effort.

Finally, we continue to urge that MMS continue its initiative to have regularly scheduled and predictable OCS lease sales. With Alaska and the Gulf of Mexico as the only areas where federal offshore acreage is available for oil and gas leasing, it is particularly important that the lease sales scheduled in MMS's 5 Year OSC Leasing Program be held as scheduled.

Thank you again for the opportunity to comment.

Sincerely

JUDITH BRADY
Executive Director

MMS Response to Comment Letter L-0033

No response required, please see Letter L-0020.

L-0034

Alaska Eskimo Whaling Commission

P.O. Box 570 • Barrow, Alaska 99723 • Phone: (907) 852-2392

September 20, 2002

Via U.S. Mail
John Goll
Regional Director
Alaska OCS Region
Minerals Management Service
949 East 36th Avenue
Room 308
Anchorage, AK 99508-4363

Re: CALL FOR COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED BEAUFORT SEA OIL AND GAS LEASE SALES 186, 195, AND 202 FOR YEARS 2003, 2005, AND 2007

Dear Mr. Goll:

The Alaska Eskimo Whaling Commission appreciates this opportunity to comment on MMS's Call for Comments on the Draft Environmental Impact Statement for Proposed Beaufort Sea Oil and Gas Lease Sales as noticed in the Federal Register on June 19, 2002.

Thank you for your time and attention in considering our comments. Please call me if you have any questions.

Sincerely,

Maggie Ahmaogak

Maggie Ahmaogak
Executive Director

cc: Thomas Napageak, Chairman
Senator Ted Stevens
Senator Frank Murkowski
Congressman Don Young

Fax: (907) 852-2303 • Toll Free: 1-800 478-2392

September 20, 2002

Via Email (*akeis@mms.gov*) and U.S. Mail

Mr. Paul Lowry
Alaska OCS Region
Minerals Management Service
949 East 36th Avenue
Room 308
Anchorage, AK 99508-4363

Re: CALL FOR COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED BEAUFORT SEA OIL AND GAS LEASE SALES 186, 195, AND 202 FOR YEARS 2003, 2005, AND 2007 OCS EIS/EA MMS 2002-029

Dear Mr. Lowry:

The Alaska Eskimo Whaling Commission appreciates this opportunity to comment on MMS's Call for Comments on the Draft Environmental Impact Statement for Proposed Beaufort Sea Oil and Gas Lease Sales as noticed in the Federal Register on June 19, 2002.

Thank you for your time and attention in considering our comments. Please call me if you have any questions.

Sincerely,

Maggie Ahmaogak
Executive Director

cc: Thomas Napageak, Chairman
Mayor George Ahmaogak
Senator Ted Stevens
Senator Frank Murkowski
Congressman Don Young

COMMENTS OF THE ALASKA ESKIMO WHALING COMMISSION ON THE MINERALS MANAGEMENT SERVICE'S DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED OIL AND GAS LEASE SALES 186, 195, AND 202

Endorsement and Incorporation of North Slope Borough Comments

The Alaska Eskimo Whaling Commission hereby endorses and incorporates by reference all comments and analyses submitted by the North Slope Borough on the three proposed lease sales.

Introduction to Alaska Eskimo Whaling Commission Comments

MMS is in the process of conducting an environmental review for proposed oil and gas Lease Sales 186, 195, and 202. The National Environmental Policy Act (NEPA) and the OCS Lands Act require that MMS use this process to do more than help fulfill the agency's responsibility to oversee offshore oil and gas development. Through these Acts, Congress also has required that the Secretary of the Interior, acting through MMS, undertake concrete, proactive measures to protect the marine and human environments affected by OCS development. These responsibilities can be met through a review of appropriate alternatives and the conduct of the most thorough environmental review appropriate to the affected region. In addition, MMS must institute appropriate mitigation stipulations.

Given the unique situation the agency faces in overseeing proposed development in the Arctic Ocean, the AEWC finds MMS' proposed environmental review process inadequate. The AEWC further believes that MMS has not presented adequate alternatives. As a means of enhancing its environmental review and expediting the current process, the AEWC strongly encourages MMS to support our community's efforts to participate more fully in the process, including participation in the development of mitigation measures.

In recent years, representatives of the AEWC, North Slope Borough, and Inupiat Community of the Arctic Slope (ICAS) have met with representatives of MMS, the National Marine Fisheries Service (NMFS), British Petroleum, Phillips Alaska, regarding OCS development in the Arctic Ocean. Our goal has been to develop monitoring and mitigation measures to protect the Arctic Ocean and our subsistence community from adverse impacts of offshore oil and gas development.

The issues our community faces as a result of OCS oil and gas activities fall into two broad categories: environmental and socio-cultural. Under federal law, MMS is responsible for working with local communities to address impacts in both of these categories. We are aware of MMS' presence among our people as it gathers information and traditional knowledge to include in the EIS. We read promises in the Draft EIS that our input will be considered in the final decisions regarding these three lease sales. Yet in northern Alaska, MMS, historically, has shown little willingness to take on the issues that it must face in order to address these impacts.

As we review the list of mitigation stipulations that fall short of our expectations and our recommendations, we are afraid that MMS once again is prepared to make decisions that do not address our needs and fears. Furthermore, we see the public participation process cut short by combining the environmental review of the three proposed lease sales into one EIS. In this way, we believe MMS is foreclosing the possibility for a thorough and accurate review of activities it wishes to conduct in an extremely sensitive and ever changing environment.

We disagree with MMS's characterization of the environmental justice issues as arising only in the "unlikely event" of a large oil spill. Environmental justice issues arise during exploration, construction, operations, and decommissioning of oil and gas development facilities.

Finally, AEWC reminds MMS of our repeated requests for impact assistance as part of MMS' responsibility to balance the orderly development of the OCS with protection of the human and marine environments.

Given the harsh and unpredictable environmental conditions of the Arctic and the lack of data on which to base a risk analyses, MMS is compelled to undertake the most thorougth approach possible to environmental review and protection. .001

In combining its environmental review for the three proposed lease sales into one EIS, MMS apparently relies on 40 C.F.R. §1502.4 (a):

> proposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall be evaluated in a single impact statement.

This constitutes tiering, per 40 C.F.R. § 1508.28, which may be used when appropriate to provide for a broad EIS at the outset, with a narrower environmental analysis (EA) undertaken at subsequent steps in the program under review.

However, this tiering process is not appropriate for application to the proposed lease sales. Tiering is appropriate for proposed development when the scope of development is known at the outset. In this case, impacts of the development can be identified and evaluated at the outset. Such is not the case with the three proposed Arctic Ocean lease sales. .001

MMS has insufficient information to conduct a cumulative effects analysis for all three proposed lease sales. .002

MMS is required to provide an analysis of "cumulative impacts" as part of its environmental analysis. MMS states in the Draft Environmental Impact Statement (DEIS) that for the current review, the agency has based this cumulative impacts analysis on present, reasonably foreseeable future, and speculative development/production. However, a review of MMS's discussion at pages V-8 and V-9 of the DEIS reveals a very high degree of uncertainty regarding the scope and timing of future development/production, as well the potential level of recovery from existing sources.

The addition of leases sold under proposed Lease Sale 186 could well affect the level of foreseeable and future development. In this case, a revised cumulative effects analysis would be required for proposed Lease Sale 195, and similarly for proposed Lease Sale 202. Thus, given the speculative nature of MMS's current knowledge regarding foreseeable and future development/production, and the probability that this knowledge will change as the proposed lease sales are undertaken, attempting to limit the environmental review process and public input to that process is inappropriate. .003

MMS has insufficient information to conduct a risk analysis for all three lease sales.

MMS is required to conduct an analysis of the risk that adverse events could occur as a result of development/production under the three proposed lease sales, as well as an analysis of the potential impacts that could result. The fact that only one offshore oil production platform is operational in the arctic OCS (and this for less than a year) creates a situation where MMS has no reliable data set upon which to base its analysis of production risk under the three proposed lease sales. Similarly, its data set for exploration risks is limited. .004

While MMS has attempted to create a data base for risk and impact analysis using data from the Gulf of Mexico and onshore development in the Arctic, the agency has failed to produce a viable justification for its proposed reliance on these data sets. Nor has the agency provided a reasoned argument, including confidence intervals, to support its presentation of probabilities regarding the risks associated with OCS oil and gas development/production in the Arctic. .005

The only way for MMS to develop the data necessary for the analysis of risks and impacts in this situation is through experience, which will provide the appropriate data over time. This argues strongly against the use of a tiering process that will reduce environmental scrutiny and foreclose public input on the second and third of the three proposed lease sales. .006

<u>The current state of rapid and unpredictable change in arctic environmental conditions argues strongly in favor of a very conservative approach to environmental review of proposed development/production in the Arctic Ocean.</u>

The environment of the arctic OCS is not only harsh and unpredictable, in recent years it appears to have entered a period of rapid change. Thus, MMS cannot provide assurance that the environmental conditions built into the agency's assumptions during this current environmental review will continue to prevail as the time for Lease Sales 195 and 202 approach. .007 Furthermore, without a complete EIS process, including public comment during environmental review of Lease Sales 195 and 202, the agency cuts itself off from information that might highlight subtle changes not accounted for in MMS's subsequent Environmental Assessments. .008

<u>MMS's attempt to combine the environmental review for the proposed lease sales drastically reduces the opportunity for potentially critical public input.</u>

It is extremely disturbing to the AEWC that MMS would curtail substantially the public participation process when it combines the environmental review for three lease sales into one EIS. The AEWC believes that public comment on each individual sale is vital to incorporating information on locally observed impacts, environmental change, and traditional knowledge into the decision-making process. As it is, there will be EAs for lease sales 195 and 202—this means no scoping and no commenting on a Draft EIS. AEWC, theoretically, could only comment on the agency's Finding of No Significant Impact. This is unacceptable. .009

Scoping is crucial if MMS is to gather enough information, isolating the "real" issues, and enabling itself to make a reasoned decision. Scoping is a chance for the AEWC to tell MMS the issues that have arisen since the last lease sale, e.g., the effect that oil development has had in the previous two years on bowheads and the hunt, ice and weather conditions, and anything else that may have become a factor in the preceding two years. MMS eliminates the scoping process, and therefore the opportunity to receive valuable information, when it conducts an EA rather than an EIS for lease sales 195 and 202. The AEWC strenuously cautions MMS against cutting short the public process that each lease sale deserves.

The AEWC believes that in issuing Executive Order 13212, the President of the United States did not intend to sacrifice the "hard look" required by NEPA. The lives and culture of our people are not an acceptable trade for saving a few weeks or months in the crucial information gathering procedure that NEPA requires. .090

If MMS cannot conduct an EIS for each lease sale, it should designate the North Slope Borough as a "cooperating agency" per 40 C.F.R. §§1501.6 & 1508.5.

In a memorandum to the heads of Federal Agencies dated January 30, 2002, CEQ Chairman James Connaughton advised agencies that "It is incumbent on Federal agency officials to identify as early as practicable in the environmental planning process those Federal, State, Tribal and local government agencies that have jurisdiction by law and special expertise with respect to all reasonable alternatives or significant environmental, social, or economic impacts associated with a proposed action that requires NEPA analysis. The Federal agency responsible for the NEPA analysis should determine whether such agencies are interested and appear capable of assuming the responsibilities of a cooperating agency under 40 C.F.R § 1501.6." The memorandum specifically refers to "States, Tribes, and units of governments that have received authority by Federal law to assume the responsibilities for preparing NEPA analyses." The North Slope Borough is a local government that has jurisdiction and special expertise with respect to alternatives and the range of impacts Eskimos face in the wake of offshore oil project development in their subsistence hunting waters. MMS should extend cooperating agency status to the North Slope Borough per the Connaughton memorandum and 40 C.F.R. § 1501.6. In this way, MMS and Eskimo leaders and scientists can build a relationship of collaboration and trust. .010

MMS should include a scoping process in the two EAs to follow the EIS for Sale 186.

Minerals Management has adopted agency procedures pursuant to 40 C.F.R. 1501.7(1)(b)(3) which provide for adding a scoping process into the EA level of environmental review. The Department of Interior's Departmental Manual specifies that "the scoping process may be applied to an EA. DM 3.3, Public Involvement. .011

As discussed above, the AEWC very strongly encourages MMS to conduct a full environmental review for each of the three proposed lease sales. If, however, MMS elects not to follow this recommended course, the AEWC would encourage MMS to add the scoping process to its EAs for lease sales 195 and 202. This action could help to address our community's concerns, raised above, that we be relegated to commenting on a Finding of No Significant Impact, rather than contributing meaningful comments at the beginning of the review.

MMS has chosen to combine the three lease sales into one under the auspices of curbing "review burnout"when its focus should be proper information gathering and searching analysis of environmental effects of the proposal and alternatives.

MMS can curb review burnout in several ways that do not involve cutting short the public participation process or slicing the comprehensiveness of its environmental review. CEQ has provided for "paperwork reduction" in its regulations: 40 C.F.R. 1500.4(g) provides that agencies use the scoping process to "de-emphasize insignificant issues, narrowing the scope of the environmental impact statement process accordingly." CEQ further provides that agencies shall reduce delay by using the scoping process for early identification of the real issues and by preparing the EIS early in the process. 40 C.F.R. 1502.5, 40 C.F.R. 1501.7. As part of scoping, the agency can set page limits, time limits, and combine the EA process and scoping process under 40 C.F.R. 1507.3 (as recommended above). 40 C.F.R. 1501.7(1)(b). .012

MMS should include the McCovey Prospect in the Oil Spill Cumulative Effects Analysis.

In mid November, a drilling barge is scheduled to begin exploratory drilling at the McCovey Prospect, which is situated 15 miles north of the Prudhoe Bay oilfield and consists of seven leases totaling 28,504 acres. It is difficult to understand why MMS would ignore this as a "reasonably foreseeable development/production site in its cumulative impacts analysis. Not including this site as part of its cumulative impacts analysis, without a reasoned explanation, opens MMS to the charge that it is failing to engage in the required "hard look" and severely hinders MMS's ability to make a "reasoned" decision regarding environmental impacts under NEPA. .013

MMS should analyze cumulative effects in the context of global climate change.

MMS should include analysis of the impacts of global climate change. The DEIS contains several sections entitled "Changes in the Arctic" with regard to climate, oceanography, and sea ice, but none of these analyzes global climate change. Because the lives of the projects that follow these lease sales is estimated at some thirty years, global climate change could become quite problematic in terms of weather conditions and sea ice conditions. What are the implications? Where is the analysis? .014

MMS needs to analyze the effect of lower water quality from chronic spills and waste on bowhead whales.

In section IV.C.1 (p. IV-21), MMS discusses water quality in general and discusses trace metals from drilling muds and cuttings. The DEIS reports that small oil spills could exceed the federal water quality parts per million (ppm) criterion. MMS also mentions the possibility of chronic local contamination. However, MMS offers no analysis of the potential impacts of these sources of chronic pollution on marine mammals or arctic human communities. Where is this analysis? (p. IV-23) .015

MMS has included a section in its cumulative effects analysis on the effects of oil spill on bowhead whales, but it limits its analysis to "prolonged exposure to freshly spilled oil" (p. V-31) News concerning high levels of mercury bioaccumulation in Norwegian whale catches has sparked concerns about the trace metals from drilling muds and cuttings. How much mercury and dioxin is building up in whales who yearly migrate through chronic regional contamination areas? .016

The Cumulative Sociocultural Effects analysis is flawed.

In section V.C.10.e, "Cumulative Effects of Subsistence Disruptions on the North Slope Borough's Economy" (p. V-57), MMS discusses subsistence disruptions in terms of additive revenue and increases in personal income. It does not discuss the loss of subsistence lifestyle and the subsistence economy of the traditional Inupiat. It does refer to Section V.C.9.b to instruct the reader to find more information, but Section V.C.9.b is actually entitled "Risks of Offshore Oil Spills from Production Contacting Vegetation and Wetlands." It should refer to the immediately previous section, V.C.10.c on "Cumulative Effects on Employment and Personal Income," which includes 60-190 jobs for six months for cleanup of "unlikely" oil spills. Furthermore, MMS has failed to note that the vast majority of the cash jobs that oil and gas work bring to the Arctic go to non-Native workers who are brought in by the oil companies and their contractors. .017

MMS' analysis of Cumulative Effects on Subsistence Harvest Patterns (p. V-58) continues to disregard important facts.

In section V.C.11.a. of the DEIS, MMS acknowledges that subsistence hunting is a central cultural value to the Inupiat way of life, and that cumulative effects to bowheads is a "serious concern." The AEWC could not agree more. .018

MMS continues to assert difficulty in assessing the cumulative effects of social change, due to the apparent difficulty it has in separating the effects of offshore development from those of general social change. However, the fact that oil development speeds social change in primarily destructive ways is indisputable, requiring that these adverse impacts be incorporated into MMS's analysis of cumulative effects.

MMS's cumulative effects analysis in section V.C.a(2), "Cultural Values," is another example of MMS' rudimentary and often self-serving approach to analysis in this extremely important area.

MMS acknowledges that cumulative effects on social organization could include decreasing importance of the family, cooperation, sharing, and subsistence as a livelihood, and increasing individualism, wage labor, and entrepreneurship. The AEWC appreciates MMS' recognition of these dangers, but wonders why these impacts are not raised in the environmental justice sections of the DEIS in a way that warrants an EJ mitigation strategy. MMS again reports what has been known for decades: "historically, more income in these communities has been connected somewhat to the abuse of alcohol and increased violence." .019

The AEWC believes that it is time for MMS to attempt to understand this connection and to address it.

Mitigating Initiatives for Environmental Justice are all process and no substance: MMS continues to commit to studies, but not to action.

The AEWC understands that MMS is committed to learning all it can about the Inupiat way of life and cultural. However, MMS appears to study these matters *ad infinitum*, without reaching conclusions that result in real mitigation for the impacts to our community. Section V.C.16 on Environmental Justice (p. V-76-77) is filled with endless studies that MMS or others have done and plans to do. MMS spends millions of dollars on this—money MMS could put toward impact assistance or other substantive mitigation such as an oil spill trust fund, funds for a counseling center, or funds to the AEWC and North Slope Borough to help "protect cultural values" to borrow MMS's words. As noted by the National Research Council in its 1992 publication on MMS's environmental studies program for Alaska. Further studies will not solve the issues raised by OCS development in the Arctic. At this point action is required of the agency. .020

The AEWC applauds MMS's one substantive mitigation initiative: its proposal for a "standing interagency-intergovernmental working group that would include local and regional North Slope governments and industry to consult, coordinate, design, and monitor solutions to subsistence and sociocultural cumulative impacts on and offshore." (p. V-76) This is an excellent idea if it includes the AEWC and the North Slope Borough as consulting agencies. In this case, the AEWC would fully endorse the proposal. ,021

MMS erroneously asserts that Environmental Justice issues arise only if a major oil spill were to occur.

The Environmental Justice analysis is incomplete and the information and analysis provided do not support MMS's conclusions, rendering them arbitrary and capricious.

Environmental Justice (EJ) issues abound outside the context of a major oil spill. Central to the EJ concept is the presence of a disproportionately high effect on a recognized minority. Innumerable impacts will occur that have a disproportionately high impact on Inupiat people. .022

- Increased numbers of oil workers in Inupiat villages will demand infrastructure for oil workers: hospitals, lodging, services, etc. This cost will be borne by the North Slope municipal budget, which is strained by increasingly reduced royalties as the Prudhoe Bay oil field reaches its production limits.
- Cultural differences between white oil workers who have western values and the people of our traditional Inupiat community will speed the pace of social change in our villages, which are already stressed by similar effects flowing from existing oil infrastructure. Our traditions and values already are at risk. Instances of alcoholism, violence, and other stress-induced negative individual behaviors will multiply.
- The presence of even more oil development offshore will compound our people's fears of the loss of their culture and food source.

MMS carefully documents these concerns in the DEIS, but it concludes that Environmental Justice problems would arise only in the event of a major oil spill. MMS outlines negative social changes and cites to rampant alcoholism, suicide, and violent crime as indirect results of offshore oil development. However, the agency then concludes that the only environmental justice effects are related to the physical incidence of a major oil spill. This is an entirely unsupported, self-serving, and arbitrary and capricious conclusion.

MMS's mitigation response to the cultural change issues is a stipulation regarding "sensitivity orientation" for white oil workers. This is insufficient. The AEWC is dumbfounded by MMS' conclusions in this area and its proposed mitigation solution. Environmental Justice concerns arise at every single stage of oil production, from lease sale to the end of the projects in thirty years. It is time for MMS to acknowledge this fact and to address it appropriately. .023

MMS has not met the requirements of Executive Order 12898.

The AEWC does not see the Department of the Interior's environmental justice strategy in the DEIS. Executive Order 12898 directs that each agency identify and address "disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations." Executive Order No. 12898, 59 Fed. Reg. at 7630 (section 1-101). The Executive Order requires the development of agency-specific environmental justice strategies. MMS appears to eliminate the need to implement any environmental justice strategy because it says that the only EJ issues are tied into an oil spill—an event MMS repeatedly characterizes as "highly unlikely." Because MMS does not anticipate the occurrence of an oil spill, it appears to relieve itself of all environmental justice responsibility. .024

MMS continues to ignore the AEWC's and North Slope Borough's recommendations for mitigation, despite Executive Order 12898's requirement that agencies' mitigation measures should address significant and adverse environmental effects of proposed federal actions on minority populations, low-income populations, and Indian tribes. Memorandum from the President to the Heads of Departments and Agencies. Comprehensive Presidential Documents No. 279. (Feb. 11, 1994). .025

Furthermore, MMS either has dismissed our mitigation recommendations, or it has attenuated them to the point where they are ineffective. CEQ directs that, .026

> throughout the process of public participation, agencies should elicit the views of the affected populations on measures to mitigate a disproportionately high and adverse human health or environmental effect...and should carefully consider community views in developing and implementing mitigation strategies. Mitigation measures...should reflect the needs and preferences of affected low-income populations, minority populations, or Indian tribes to the extent practicable.

Environmental Justice Guidance under the National Environmental Policy Act (Dec. 10, 1997). MMS has failed to do this in the following ways:

- MMS has spurned the AEWC's requests for impact assistance mitigation because, as MMS continues to assert, it does not have the authority to budget for mitigation of this nature. The AEWC continues to contest this assertion. MMS has authority to provide impact assistance as part of its responsibility to balance the orderly development of mineral resources with the impact to the human and marine environments. 43 U.S.C.

1332(4)(A) and (B).[1]

- MMS pushed a Coastal Impact Assistance idea toward lawmakers in October of 1997, but apparently has not moved to revise it to make it more palatable to Congress, nor has MMS been persistent in talking about impact assistance or repeating the message of its importance to Congress. MMS likewise has failed to ask Congress to attach language to potential energy legislation that appropriates impact assistance monies to affected states; nor has it attempted the relatively simple task of asking for the appropriations in its yearly budget requests. All of these things are in MMS' power, and MMS has pursued none of them, in violation of Executive Order 12898's direction that agencies carefully consider mitigation reflecting minority needs and preferences. MMS has not tried hard enough.
- MMS says that Conflict Avoidance Agreements worked out directly between the AEWC and industry operators are important mitigation, but costs for research, consultants and legal counsel required for contract negotiation are borne exclusively by the Alaskan Natives. In citing to this work as a means of mitigating federally-approved activities, MMS effectively creates an unfunded mandate and requires our community to fulfill it. This is a highly disproportionate effect from the proposed Federal activities. Furthermore, it continues to be a significant fiscal drain on an already thin budget. In drafting the OCS Lands Act and NEPA, Congress did not intend that the Department of the Interior rely upon *Inupiat-funded* mitigation to fulfill its statutory obligations.
- MMS has prepared a two-part mitigation stipulation that would defer permanent facilities siting in the vicinity of Cross Island. Its areas of deferral are too small and misplaced. MMS proposes a ten-mile seaward or shoreward deferral radius. Ten miles is totally insufficient, for the reasons stated by the North Slope Borough in its comments. As proposed by the North Slope Borough, MMS needs to increase this distance as an interim measure, and then work with the community to identify an appropriate boundary for a deferral areas around Cross Island. Therefore, Under Executive Order 12898, the AEWC insists that MMS revise its ten-mile deferral area around Cross Island and expand it to reflect the boundaries of Nuiqsut's true hunting waters in consultation with Nuiqsut's whaling captains. That would make it a useful and appropriate mitigation measure, reflecting the hunters' needs and preferences as minorities experiencing a highly disproportionate effect from a proposed Federal activity.

.026

[1] (B) "the distribution of a portion of the receipts from the leasing of mineral resources of the outer Continental Shelf adjacent to State lands, as provided under section 1337(g) of this title, will provide affected coastal States and localities with funds which may be used for the mitigation of adverse economic and environmental effects related to the development of such resources"

MMS should include funding for mitigation of OCS industrial exploration and development impacts in its discussion of alternatives.

MMS is required to discuss and analyze the effects of all reasonably available alternatives. 42 U.S.C. § 4332(2)(iii). Mitigation in the form of impact assistance funding is reasonably available, and should be included in the "alternatives" section of the DEIS. Even if MMS declines to accept CEQ's advice that proper EJ evaluation includes the suggested mitigation from the affected minority communities, MMS should include mitigation impact assistance in its list of proposed alternatives. .027

MMS's primary claim in rejecting the AEWC's request for impact funding is that MMS has no authority to offer mitigation impact assistance, nor even request such authority. But according to the law, an alternative need not be in the agency's cognizance in order for the agency to include it in the EIS:

> When the proposed action is an integral part of a coordinated plan to deal with a broad problem, the range of alternatives that must be evaluated is broadened. While the Department does not have the authority to eliminate or reduce oil import quotas, such action is within the purview of both Congress and the President, to whom the impact statement goes. *The impact statement is not only for the exposition of the thinking of the agency, but also for the guidance of these ultimate decisionmakers*, and must provide them with the environmental effects of both the proposal and the alternatives, for their consideration along with the various other elements of the public interest." *Natural Resources Defense Council v. Morton*, 458 F.2d 827, 836 (D.C. Cir. 1972). (Emphasis added.)

MMS's inclusion of impact assistance in its discussion of alternatives would alert the President and Congress to the need for impact assistance in northern Alaska. The D.C. District Court recently affirmed that a solution that lies outside of an agency's jurisdiction might be a reasonable alternative; so might an alternative within that agency's jurisdiction that solves only a portion of the problem, given that other agencies might be able to provide the remainder of the solution. *City of Alexandria v. Slater*, 198 F.3d at 868 (Dist. D.C. 1999), citing *NRDC v. Morton*, 458 F.2d at 835. Impact assistance would solve a portion of the problem, and MMS should consider it as part of an alternative so that other agency heads, Congress, and the President may recognize impact assistance as an option in conducting oil and gas development on the OCS. Discussion of alternatives is at the heart of NEPA—even alternatives that the agency believes are out of its jurisdiction.

MMS's Alternatives III-VI involve making an unfair and unacceptable choice among deferral alternatives.

MMS lists four deferral alternatives around the whaling areas of Barrow, Nuiqsut, and Kaktovik, and an "Eastern Deferral" option. All of these deferral areas are important to our subsistence hunters, and all ought to be combined in one alternative. The deferral areas are intended not only as a means of protecting our subsistence resources, but also as a means of protecting our subsistence hunting from the noise and other adverse effects of industrial development. .028

MMS's opportunity index shows that combining all the alternatives would, at the most, reduce the opportunity to find commercially recoverable oil by only 11% if all the deferral areas were combined. This leaves a not inconsiderable 89% chance of finding all the commercially recoverable oil in the other blocks of leasing space.

The AEWC strongly urges the MMS to consider an alternative that combines all of the deferral areas and implements the deferrals for all three leases.

Conclusion

Congress has required that the Secretary of the Interior, acting through MMS, undertake concrete, proactive measures to protect the marine and human environments affected by OCS development. MMS has yet to meet this statutory mandate with respect to its work in the arctic OCS.

Given the unique situation the agency faces in overseeing proposed development in the Arctic Ocean, the AEWC finds MMS' proposed environmental review process inadequate. The AEWC further believes that MMS has not presented adequate alternatives or mitigation measures.

Furthermore, MMS seeks to cut short the public participation process by combining the environmental review of the three proposed lease sales into one EIS. In this way, we believe MMS is foreclosing the possibility for a thorough and accurate review of activities it wishes to conduct in an extremely sensitive and ever changing environment.

We disagree with MMS' characterization of the environmental justice issues as arising only in the "unlikely event" of a large oil spill. Environmental justice issues arise during exploration, construction, operations, and decommissioning of oil and gas development facilities.

Finally, AEWC reminds MMS of our repeated requests for impact assistance as part of MMS' responsibility to balance the orderly development of the OCS with protection of the human and marine environments.

MMS Response to Comment Letter L-0034

L-0034.001

See Response L-0005.008.

L-0034.002

Reasonably foreseeable future development in the Beaufort Sea or anywhere in Alaska within the next 15-20 years is subject to numerous variables. Development costs in the Arctic are major considerations and, without some big-pool discoveries, many discoveries will go undeveloped, depending on their proximity to existing infrastructure. Speculative development after 20 years represents an exponential increase in variables that places it outside the bounds of an EIS analysis as determined by the Council on Environmental Quality and NEPA.

The NEPA does not require agencies to wait for more definitive information before assessing cumulative effects of future activities. Implicitly, assessing potential effects of future projects entails great uncertainty. The NEPA requires us to do the best job we can given this uncertainty, and we believe we have.

L-0034.003

The cumulative analysis compares the incremental effect of the proposed activity to the effects of past, present, and reasonably foreseeable activities. All three proposed sales (186, 195, and 202) are considered in the cumulative analysis, and there is sufficient information available to provide a reasoned analysis of potential cumulative effects. The proposed activity would make a relatively small contribution to the overall effects, and the MMS would have to underestimate the effects of the proposed activity for it to make a substantial contribution to cumulative effects. We do not expect that to be the case. An Environmental Assessment will be conducted at the end of the first sale to assess and update the NEPA decision process. In the unlikely event substantially more commercial discoveries than estimated occur or unforeseen events present themselves, a supplemental EIS would be a consideration. In that event, additional public review and input would be requested.

L-0034.004

Under NEPA, the MMS must use the best publicly available information we can find for our analysis. Offshore oil is produced from three facilities in the Beaufort Sea. Endicott has been producing since 1986. The Satellite Drilling Island has been producing since 1989, and Northstar started production in October of 2001. We also rely on an assessment of effects from exploration in the Beaufort Sea, whether in State or Federal waters. We also use information from exploration and production elsewhere in the Arctic and on the North Slope and, to some extent, from the Gulf of Mexico, the Pacific, and elsewhere. Both of these sources contain a lot of data and is considered the best information available for our required analysis.

L-0034.005

The MMS Alaska OCS Region uses oil-spill-occurrence estimates as part of their impact analysis. In 1999-2000, a study (OCS Study, MMS 2000-007) was completed to collate readily available information on oil-industry spills in the Alaskan North Slope and Arctic Canada, to verify spill information for spills of at least 500 barrels and to estimate spill rates for use in the near shore Beaufort Sea OCS. Based on this study, MMS has been able to estimate pipeline and oil-field spill rates from Alaskan North Slope and Trans-Alaska Pipeline onshore oil-spill experience to shallow coastal waters and the nearshore Beaufort Sea. This information is relevant, because the same companies operate onshore that operate offshore, gravel islands are similar to gravel pads, and environmental conditions are similar. Ultimately, risk is based on the engineering standards, which are well understood.

The MMS is aware of stakeholder concern about using historical datasets that are not from direct experience in the offshore Arctic. In response to those concerns, in 2001 the MMS implemented a study to develop and apply alternative methodologies for the assessment of oil-spill rates associated with exploration and production facilities and operations in deeper waters in the Beaufort Sea. The prediction of the reliability (or failure) of systems without history can be approached through a variety of mathematical techniques, the most preferable and accepted is fault-tree analysis and its possible combination with numerical distribution methods, such as Monte Carlo simulation. In the current study, fault-tree methodology was applied to the prediction of oil-spill rates for oil and gas developments, such as those now operational or contemplated for the Beaufort Sea, and used to generate predictions of oil-spill estimators. We have added text on confidence intervals in Appendix A.

L-0034.006

We agree that historical data are best; however, a number of methods are available to assess spill risk in the absence of such data. The MMS intends to prepare an Environmental Assessment for subsequent Sales 195 and 202. Any new or additional information on oil-spill occurrence will be evaluated at that time. The Environmental Assessment process will not foreclose any public input or environmental scrutiny. If warranted, we will prepare a supplemental EIS for either or both of the subsequent sales.

L-0034.007

The EIS analyses do not assume a static environment and, where appropriate, implications of environmental change and uncertainty have been considered. For example, stochastic variation in oil-spill trajectories is presented in a conservative manner. Underlying circulation models rely on updated data and a continual process of improvement in predictive approaches. The Environmental Studies Program's continuity and participatory planning provides the MMS with additional sources of quality scientific information, which we build into our NEPA evaluations.

L-0034.008

See Response L-0005.008.

In addition, Environmental Assessments for the subsequent sales will account for any such new information that is significant. Furthermore, our regulatory responsibilities include issuance of appropriate specific orders, if new environmental information so warrants.

L-0034.009

Although The MMS is preparing a single EIS for all three proposed sales, we are not eliminating or reducing the public participation process. We still will issue a public Call for Information and Nominations at the start of the process for Sales 195 and 202. As stated in Section I.F, the MMS will issue a Request for Information to the public to gather information and concerns, prior to starting our NEPA analysis. As identified by NEPA, the first step is to prepare an Environmental Assessment to determine if there is new information and/or concerns that were not considered or evaluated in the EIS. The analysis will be released to the pubic for comment (see Section I.F). If the analysis, which will include public review and comment, finds no new significant impacts are likely, then the NEPA analysis will be complete. If new significant impacts are found, then a supplemental EIS will be prepared.

This EIS is the eighth EIS prepared for OCS leasing in the Beaufort Sea in the last 25 years. The issues and concerns in all of these documents are similar. The technology and modeling work for these documents are similar. These similarities are reflected in the analysis. While new issues are added when each document is prepared, they frequently are slight modifications of issues previously raised and addressed. The process of following NEPA and preparing an Environmental Assessment to assess any new technology, issues, and concerns rather than generating new documents that basically repackage the same issues over and over again is a better way to proceed. The public and local communities still will have input into the process at the start of the process. They still will have the opportunity to review the NEPA analysis, although it will be much more focused on the new and important issues. The process still will include review under the coastal zone management regulations, and the Governor of Alaska still will have input into the sale process as required under Section 19 of the OCS Lands Act.

This process is consistent with Executive Order 13212 and NEPA. It is in the interest of NEPA and the public to reduce the costs and burden to the Government and the public, both of whom spend time and effort reviewing and commenting on the NEPA analysis provided. The North Slope Borough and the Alaska Eskimo Whaling Commission continually comment on the burden of participating in the public process. This process serves the public interest by focusing efforts on any new issues and reducing both the preparation and review processes.

L-0034.010

The Call for Information and Nominations, which starts the lease-sale process, was issued on September 19, 2001. Scoping meetings were held in October 2001. The Area Identification decision was made on January 10, 2002. To meet the schedule for release of the draft EIS, much of the document preparation and analysis had to be completed before MMS was informed of this memorandum. To meet the scheduled filing dates, the document had to be ready for the printer in late spring. To invite the North Slope Borough to be a "participating agency" in a process that essentially is complete would add little but delay, because the North Slope Borough and Inupiat leaders already have provided the MMS with extensive comments during the scoping process, which included government-to-government meetings. Furthermore, this document is a lease-sale EIS. The decision that flows from this EIS is made by the Secretary of the Interior. While those decisions must be consistent with the State and local coastal zone management policies, no permits or licenses are required or issued for the sale process. No other Federal, State, tribal, or local agency has jurisdiction for leasing minerals rights in the OCS.

Although the North Slope Borough was a cooperating agency in the preparation of the EIS for the Northstar Project, they chose not to be a cooperating agency in the preparation of the EIS for the Liberty Project. Instead, they opted to participate in a lesser role, as a participating agency. The MMS has met with and will continue to meet with potentially affected tribal governments pertaining to this and other OCS projects. The NEPA regulations encourage other entities that wish to become a cooperating agency to notify the lead agency of those wishes. Prior to this letter, the North Slope Borough had not indicated such a wish, nor did they request to be a cooperating agency in their comment letters (see L-0001 and L-0035).

If projects occur resulting from these sales that might require an EIS and for which the Borough has some permitting authority, the MMS will consult with the Borough on whether or not it would wish to be a cooperating agency.

L-0034.011

See Response L-0034-010.

The MMS intends to issue a Call for Nominations and Information and an Information Request, which will precede the preparation of the Environmental Assessment. The Information Request can serve the same function as the scoping process and give interested parties the opportunity to provide information and concerns prior to the NEPA analysis. In addition, the MMS intends to distribute the Environmental Assessment for public review and comments. We have built two comment periods into the NEPA process for Sales 195 and 202. They should afford North Slope communities the desired opportunity to provide input.

L-0034.012

The process we have identified of using a single EIS for all three sales and preparing an Environmental Assessment for Sales 195 and 202, rather than moving immediately to full EIS's, is consistent with the regulations. We already use the scoping process to focus the EIS on the issues. Also, the issues that have been discussed and evaluated in all of the previous EIS's and this document are quite similar. Previous efforts to streamline the EIS were tried for the Sale 170 process. We tried to incorporate by reference rather than repeat information, and we to reduce the discussion of insignificant issues. This procedure, however, was criticized as being inadequate in comments to the draft Sale 170 EIS. We believe trying to enforce page limits and time limits, however effective in concept, would meet similar responses from the public.

The modifications we have proposed for the NEPA process for Sales 195 and 202, which have been used successfully in the Gulf of Mexico Region, provide the public, including local and tribal governments, with substantial opportunity to participate while focusing the NEPA evaluation on the new and salient issues.

L-0034.013

As we explain in the introduction to Section V - Cumulative Effects, we limit the definition of reasonably foreseeable projects to actual oil and gas discoveries. At this time, McCovey is simply an exploration project. The activities associated with testing a prospect such as McCovey are important from a short-term standpoint, but they certainly entail no measurable long-term effects as yet. Notwithstanding the current enthusiasm regarding the prospects for the success of McCovey, most exploration prospects drilled in the Beaufort Sea have not resulted in petroleum discoveries, and many past discoveries are not economic under current conditions. At this point, the McCovey Prospect falls into the category of undiscovered offshore resources that are listed in Table V-7c. Producing oil fields are considered as past activities (Table V-1a). Oil-field projects in final planning stages are considered as present activities. Discoveries that could have economic potential under future conditions are considered as reasonably foreseeable activities.

L-0034.014

See Response L-0026.015.

L-0034.015

The comment letter points out that the EIS discusses the potential impact of discharges on water quality but does not discuss the possible transfer of these impacts through the food web to marine mammals and subsistence communities. This is partly because the potential impacts would be very temporary, as described in discharge assessments for water quality (Section IV.C.1.a(3)), lower trophic-level organisms (Section IV.C.2.a(1)), and bowhead whales (Section IV.C.5.a(1)(b)). These sections explain in part that during the development and production phases, discharges are unusual because drilling muds, cuttings, and produced water generally are reinjected, such as they are at the Northstar development. These sections also point out that during the exploratory phase, the Environmental Protection Agency, in some cases, probably would permit the discharge of drilling muds and cuttings. The Environmental Protection Agency generally permits discharges where water currents can rapidly disperse the material (i.e., in water greater than 5 meters deep). Information has been added to the sections on lower trophic-level organisms (Sections III.B.1.a and IV.C.2.a(1)) describing an ongoing study by Dehn et al. (2002) of heavy metals in arctic seals. The investigators attribute the differences to the natural transfer of heavy metals through the seals' food webs in the Canadian Beaufort Sea and Alaskan Beaufort Sea.

L-0034.016

The level of trace metals, PCB's, and chlorinated hydrocarbons in the fat, organs, and muscle tissues of bowhead whales is discussed in Section IV.C.5.a. The comment provided insufficient information about the Norwegian study for us to obtain a copy of the study. However, studies referenced in the text are likely to be more pertinent than the Norwegian study, because these studies provide information specific to bowhead whales. Some information on this issue has been added into the cumulative section in Section V.C.5.a. Based on studies in 1995 and 1997, bowhead whales have relatively low levels of mercury compared to some other marine mammals and are considered safe for human consumption.

L-0034.017

We have corrected the cross references in Section V.C.10 – Economy, as noted by the commenter. We discuss the historical proportion of non-Native workers in the North Slope oil industry in Sections IV.C.10 and III.C.1. We have corrected Section V.C.10 to indicate that we assess cumulative effects on the economy in terms of economic effects from Alternative I for Sale 186 described in Section IV.C.10 in addition to current conditions and other activities. In the draft EIS, that part referred incorrectly to Section IV.D.10.

L-0034.018

Ongoing and potential cumulative social effects, both from on- and offshore sources are discussed in Section IV.C.12.a - Cumulative Effects on Sociocultural Systems. It is only after this discussion that the problem of disaggregating root causes of ongoing social pathologies in North Slope communities is discussed. Social science and research has not demonstrated direct linkages from offshore sources any more than it has onshore sources. The MMS believes that it has done more than a credible job in studying offshore impact sources, and that the data gap is onshore where the responsible State and Federal agencies have never collaborated to acquire baseline data, perform long-term monitoring, or conduct scientific studies on social impacts. It is onshore where the most evident and demonstrable effects have taken place, and where the least amount of research has occurred.

L-0034.019

The MMS believes that it has addressed Environmental Justice mitigation in the ways that it can under the structure of the OCS Lands Act. See Section IV.C.16 - Environmental Justice for a discussion of suggested mitigation and its effectiveness. For a discussion of the MMS position on impact assistance, see Response L-0034.020.

L-0034.020

While the MMS does not disagree that impact assistance and other such funding would be beneficial to the North Slope Borough, local communities, tribes, and the Alaska Eskimo Whaling Commission, under the U.S. Constitution, Congress is responsible for approving the Federal budget and allocating financial resources for the Executive Branch, which includes the Department of the Interior and the MMS. The budget designates and commits to specific line items. See Section I.C.1.e(1) for additional information.

L-0034.021

The MMS continues its support of a interagency-intergovernmental working group, and will determine its feasibility with other Federal, State, tribal, and local agencies.

L-0034.022

We agree that the Inupiat community meets the definition of a minority population. This EIS describes and evaluates potential impacts to the Inupiat community in Sections III.C.6, IV.C.16, IV.E.16, IV.F.16, IV.G.16, IV.H.16, IV.I.2.p, and V.C.16. We document and discuss the environmental justice issues that have been noted by the Alaska Eskimo Whaling Commission in this EIS. Ongoing and potential cumulative social effects, both from on- and offshore sources, are discussed in Section IV.C.12.a - Cumulative Effects on Sociocultural Systems, and this discussion is extended in the Environmental Justice analysis in Section IV.C.16. Reviewers are reminded that the Executive Order on Environmental Justice established a "disproportionately high/adverse" threshold that "will" occur. Unlikely and probable events such as oil spills are not included unless they are certain to happen; our analysis states that effects from routine activities are not expected to exceed that threshold.

Social science and research have not demonstrated direct linkages from offshore sources any more than it has onshore sources. The MMS believes that it has done more than a credible job in studying offshore impact sources, and that the true data gap is onshore.

See Responses L-0034.018, L-0034.020, L-0034.021, and L-0034.027.

L-0034.023

The MMS's mitigation response to social and cultural change is not merely the orientation stipulation. All the other mitigation proposed is there largely to protect biological populations that often are important to the subsistence hunt and, more specifically, to monitor bowhead whales and to prevent conflicts with whaling activity. We believe this mitigation goes a long way in responding to cultural concerns.

See Responses L-0034.018 and L-0034.019.

L-0034.024

See Response L-0034.022.

The MMS believes that the mitigation and the ongoing mitigation initiatives addressed in Section IV.C.16 - Environmental Justice encompass a viable "environmental justice strategy."

L-0034.025

See Responses L-0034.019, L-0034.022, L-0034.023, and L-0034.024.

L-0034.026

The Department of the Interior and the MMS, as an institution and its individual employees, have been very actively involved on a continuing basis in providing support for the concept of revenue sharing and impact assistance related to the OCS oil and gas program since at least the late 1970's. In fact, the MMS's current Alaska Regional Supervisor for Leasing and Environment, Paul Stang, while serving as the staff for an Administration Cabinet Council task force on impact assistance in the early 1980's, personally developed a formula and drafted legislative language to provide funds allocated to both the coastal states and local coastal governments based on their proximity to offshore oil and gas activities. Legislation was introduced but, in the end, passed only in the House.

Throughout the 1980's and 1990's, the MMS continued working diligently on impact-assistance efforts requested by Congress. They used this proximity formula as the core of the impact-assistance formula and drafted additional legislative language for several bills that were introduced in the Congress. These, however, also failed to become law. Finally, the original proximity concept was the key part of the Coastal Impact Assistance Program legislation, supported by members of the Alaska Congressional delegation that provided FY 2001 funds directly to the North Slope Borough. This program authorized a one-time appropriation of $150 million to be divided among the seven states with offshore oil activities, which included Alaska. Funds were distributed to coastal communities based on a formula set by law. The North Slope Borough allocation was $1,939,680. Because of these efforts over the last 20 years, the MMS's commitment within its Executive Branch authority to support impact assistance should not be underestimated or demeaned.

As for the Alaska Eskimo Whaling Commission exclusively bearing the expense of mitigation negotiation, it was the MMS's understanding that a large portion of the Commission's operating budget came from annual NOAA Fisheries grants. Hence, the Federal Government is providing substantial support to the Alaska Eskimo Whaling Commission.

The MMS welcomes the Alaska Eskimo Whaling Commission to initiate a dialogue under the conflict resolution language of Stipulation 5 among the MMS, the Commission, and NOAA Fisheries to use the data from ongoing noise-monitoring studies at Northstar to evaluate the observed and potential effects of production noise on bowhead whales. If that research identifies noise impacts that require mitigation, the MMS will continue working with the North Slope Borough, local tribal governments, the Alaska Eskimo Whaling Commission, and NOAA Fisheries to develop adequate mitigation to protect the bowhead whaling and Native subsistence needs.

See also Responses L-001.013, L-0034.019, L-0034.020, L-0034.022, L-0034.023, L-0034.024, L-0034.027 and Section I.C.1.e(1).

L-0034.027

Impact assistance is important to the MMS; please see Section I.C.1.e(1) for additional information. Although the Alaska Eskimo Whaling Commission is correct that "an alternative need not be in the agency's cognizance in order for the agency to include it in the EIS" and that "MMS's inclusion of impact assistance in its discussion of alternatives would alert the President and Congress to the need for impact assistance in northern Alaska," impact assistance does not affect the size, timing, or location of the sale or the terms that would be put on potential lessees. These are the items under NEPA review in this EIS in accordance to the OCS Lands Act.

Impact assistance is a programmatic issue that affects all the States, counties (boroughs), cities, and villages near OCS activities and was discussed in the MMS's new 5 year plan. Comments received on impact assistance were included within the material forwarded to the President and Congress in the *Proposed Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007, April 2002*. This programmatic document was the more appropriate forum to address this nationwide issue. For additional information about revenue sharing, please see, in particular, Section 1.2.5.1 of the final 5-year program EIS (USDOI, MMS, 2002) for additional information about revenue sharing.

As a Federal Agency, we continue to support the efforts of those who are working towards this goal, including increasing the awareness of those in a position to further advance the issue, within the bounds of the relationship between the Executive and Legislative Branches. As noted in Section I.C.1.e(1), some impact assistance already is available through several existing laws: The Land and Water Conservation Fund, the Historic Preservation Fund, the Reclamation Fund, the Tribal Preservation Fund, Section 8(g) of the OCS Lands Act, and the recent amendments to the OCS Lands Act establishing the Coastal Impact Assistance Program.

Section 8(g) of the OCS Lands Act provides for a sharing of all Federal revenues for areas lying wholly or in part between the State's seaward boundary out to 6 miles. Twenty-seven percent of all Federal revenue goes to the State. Alaska has received more than $520 million as a result of this revenue-sharing provision. The State of Alaska distributes these 8(g) funds (royalty payments, bonus bids, and rental payments) as follows:

- 50% of all 8(g) royalty payments, bonus bids, and rental payments go to the Alaska Permanent Fund Dividend Program
- 0.5% of all 8(g) royalty payments, bonus bids, and rental payments go to the school fund
- 49.5% of royalty payments and bonus bids go to the Alaska Constitutional Budget Reserve
- 49.5% of rental payments go to Alaska's Unrestricted General Fund

The Land and Water Conservation Fund can provide the National Park Service up to $900 million in the fund each year, if authorized by Congress. Since 1971, Federal offshore leasing has provided about 90% of this money. The law provides for a system of funding for Federal, State, and local parks and conservation areas. It gives States and local governments incentives to plan and invest in their own park and recreational use systems. The State has received more than $29 million from this fund. For more information on this program and the grant process, please contact:

Alaska Department of Natural Resources
Division of Parks and Outdoor Recreation
State Historic Preservation Office
Grants Administrator
550 W 7th Street, Suite 1380
Anchorage, AK 99501-5921
Tel: 907-269-8703
Website: www.dnr.state.ak.us/parks/grants

The Historic Preservation Fund also is used to make grants to local communities. Revenues from Federal offshore mineral leases sustain this fund at $150 million. Since 1968, more than $1 billon in grant funds has been awarded to states, territories, tribal organizations, and the National Trust for Historic Preservation. The State of Alaska has received more than $9 million from this fund. Additional information is available at the Land and Water Conservation Fund at the address given above.

The Tribal Preservation Program assists Native Americans in preserving their historic properties and cultural traditions and is administered by the National Park Service. The program is dedicated to working with tribes, Alaska Native groups, Native Hawaiians, and national organizations to preserve and protect resources and traditions that are of importance to Native Americans. For more information on this program, please contact:

Tribal Preservation Program
Heritage Preservation Services
National Park Service
1849 C Street, NW, NC200
Washington, DC 20240
Phone: Bob Ruff (202) 343-9572

Information on grants, applications, and background information is available on the web at www2.cr.nps.gov/tribal/index.htm

For FY 2000, the Village of Barrow received $48,915 from this grant program for Documenting Commercial Whaling History in the Western Arctic from the Inupiat Perspective.

The Coastal Impact Assistance Program provides funds to the State from Federal offshore mineral leasing revenues. This program authorized a one-time appropriation of $150 million to be divided among the seven states with offshore oil activities, which includes Alaska. Funds were distributed to coastal communities based on a formula set by law. The North Slope Borough allocation was $1,939,680.

See also Response L-0034.026.

L-0034.028

The Secretary of the Interior has the option of choosing all, some, or none of the alternatives or the No Lease Sale Alternative. The preference of the Alaska Eskimo Whaling Commission will be noted in the documents that are prepared for the Secretary during her deliberations pertaining to Sale 186.

North Slope Borough
Office of the Mayor

P.O. Box 69
Barrow, Alaska 99723
☎ 907 852-2611 ext. 200
Fax: 907 852-0337
email: george.ahmaogak@north-slope.org

L-0035

George N. Ahmaogak, Sr., Mayor

RECEIVED
SEP 30 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 20, 2002

Mr. Paul Lowry
Minerals Management Service
949 East 36th Avenue, Room 308
Anchorage, AK 99508-4363

Re: BEAUFORT SEA MULTIPLE SALES DRAFT ENVIRONMENTAL IMPACT STATEMENT - OCS EIS/EA MMS 2002-029

Dear Mr. Lowry:

Thank you for this opportunity to provide comments to the Minerals Management Service (MMS) on your Beaufort Sea Multiple Lease Sales Draft Environmental Impact Statement (DEIS). The DEIS considers three Beaufort Sea Oil and Gas Lease Sales under MMS' 2002-2007 5-Year Leasing Program. Oil and Gas Lease Sales 186, 195, and 202 would be held in the years 2003, 2005, and 2007, respectively. The Borough, as well as other North Slope organizations and individuals, provided testimony on the DEIS at hearings in Nuiqsut, Kaktovik, and Barrow on July 24, July 26, and August 1, respectively. I expect MMS to carefully consider all submitted testimony and written comments, and that appropriate changes will be seen in the Final EIS. The testimony that we provided for the Barrow hearing was prepared before we had the opportunity to thoroughly review the document. In addition to other points which will be expanded upon here, I also made substantial comments on two topics which I will not revisit now in great detail as they are already a part of the record in this review. It is important, however, that you understand how critical it is that MMS more fully explain in the Final EIS 1) the environmental justice implications of its failure to undertake a comprehensive environmental and cultural risk/benefit analysis of nationwide leasing choices, and 2) the decision to move ahead over Borough and other objections with this multiple lease sale document. Our subsequent review has revealed significant shortcomings in the DEIS with respect to other subjects discussed in our earlier testimony, as well as in other areas not addressed at the hearing. The following comments will detail those shortcomings, as well as identify specific resource and effects information which should be modified. In addition, more technical comments prepared by Borough staff on specific DEIS language and information are attached hereto and made fully a part of these comments.

FUNDAMENTAL FLAWS OF THE DEIS

At the heart of the National Environmental Policy Act (NEPA) process is the identification of alternatives to the proposed action which triggered the review. This DEIS is fundamentally flawed both in the way it has identified alternatives, and in the way it approaches the analysis of the alternatives it identifies. MMS' analysis has three essential components. First, there is the identification of Alternatives. Second, there is the division of the Beaufort Sea into three zones. Finally, there is the evaluation of development scenarios tied to those zones. We find that the analytical method as applied does not address the central questions with which our people, the directly affected community, are most concerned regarding continued leasing and prospective development in the Beaufort Sea. What is most disconcerting is the apparent inability of MMS to put itself in our shoes, to perceive the environmental, social, and cultural threats as we perceive them, and to deal head-on with reasonable scenarios which highlight issues that are of most concern.

MMS' analytical structure is as follows: Alternative I is the proposed action, and would offer for lease an area extending from 3 miles to approximately 60 miles offshore, and from the Canadian border on the east, to Barrow on the west. Alternative II is the No Sale alternative. Four deferral Alternatives (III through VI) would eliminate various subareas from leasing. These are, respectively, a Barrow-area deferral, a Cross Island-area deferral, a Barter Island and eastward-area deferral, and a deferral eastward of that to the Canadian Border. MMS also divides the Beaufort Sea Planning Area into three zones (Near/Shallow, Midrange/Medium, and Far/Deepwater) defined primarily by their proximity to existing industry infrastructure and secondarily by water depth. Finally, MMS presents development scenarios tied to the three zones, with a high 70% percent of leasing for the first Sale 186 occurring in the Near Zone, 20% in the Midrange Zone, and 10% in the Far Zone. Successive Sales 195 and 202 would see increasingly higher percentages of leasing in the Midrange and Far Zones. For purposes of analysis, MMS assumes two potential developments in the Near Zone and one in the Midrange Zone for Sale 186. For Sale 195, one development is assumed in the Near Zone, and one in the Midrange Zone. For Sale 202, a single development is assumed in the Far Zone. In summary for the three sales then, MMS foresees six total developments, with three occurring in the Near Zone, two in the Midrange Zone, and one in the Far Zone. Below, we will discuss each of MMS' three analytical components, Alternatives/deferrals, zones, scenarios.

Alternatives/Area Deferrals

The North Slope Borough believes that areas around Barrow, Kaktovik, and Cross Island sufficient to protect vulnerable resources and the subsistence harvests of bowhead whales and other species should be deferred from leasing. The deferral Alternatives developed by MMS for the Draft EIS do not fully provide this essential protection. They are inadequate, and, as I explained in my testimony, MMS has to some extent misused data we provided to define them. Working with the Alaska Eskimo Whaling Commission (AEWC), we released to MMS bowhead whale subsistence harvest locations for the three .001

Beaufort Sea whaling communities. It was made very clear in subsequent written and e-mail correspondence that it would be inappropriate to use the harvest locations alone to define either subsistence whaling zones or deferral areas purporting to protect subsistence whaling opportunities. That, however, is exactly what MMS has done in this Draft EIS. Highlighting the inappropriate direct linkage between bowhead subsistence harvest locations and area deferrals is the naming of Alternatives III, IV, and V, respectively, the Barrow, Nuiqsut, and Kaktovik "Subsistence Whale" Deferrals. The implication that deferral of any of these areas alone will avoid adverse effects on the subsistence harvest of bowhead whales by the named community is reinforced throughout the document by equally misleading text. .001

The harvest data were provided as one tool to assist MMS in determining the appropriate extent of offshore areas around Barrow, Kaktovik, and Nuiqsut's Cross Island subsistence whaling base which should be considered for exclusion or heightened protection in future Beaufort Sea OCS oil and gas lease sales. We made it clear to MMS prior to release of the information that harvest data alone do not provide a true picture of the entire zone utilized by and essential to subsistence hunters in the successful harvest of bowhead whales during the animals' fall westward migration. Harvest locations are simply points on a map. Additional areas critical to the successful subsistence harvest of bowhead whales include staging areas for crews, supplies, and harvested product, areas of pursuit, routes used for the transportation of crews, supplies, and harvested whales and whale product, and areas used for the processing of harvested whales. Harvest data alone also do not define the area east, or "upstream" of the full area utilized by subsistence crews from Barrow, Nuiqsut, and Kaktovik within which industrial disturbance would adversely impact subsistence efforts. As we have explained numerous times before, this distinction is important. To provide a reasonable chance of a successful bowhead whale subsistence harvest, protection must be provided to a combination of two areas. First, there is clearly the area utilized directly by subsistence whalers for all of the activities noted above. This is the subsistence use area. Next, there is the area east of the subsistence use area we can call the area of influence. That is the area within which migrating whales could be affected significantly enough by industrial activities so that they are deflected beyond the subsistence use area or are made more difficult to harvest within the subsistence use area. These qualifications should have accompanied any publication and use of the harvest location data, and any conclusions drawn from the data. Familiarity with subsistence whaling practices and western science and traditional knowledge regarding noise impacts on migrating bowheads, as well as plain common sense, should tell you that appropriate deferral areas must be based on a combination of both subsistence use areas and the "upstream" areas of influence.

Also with respect to the harvest location data provided, Figure III. C-15 includes a table listing subsistence whaling captains which is supposedly keyed to the strike data appearing on the accompanying map. The table incorrectly includes the names of Barrow captains. Figure III.C-14 likewise lists captains associated with Nuiqsut strikes. The tables and names should be removed from both figures. In the recent past, several Barrow whaling captains received threats from sources claiming to represent an animal rights group which obtained their names from a newspaper article. The EIS is a public .002

document with wide distribution. Publication of subsistence hunter names could lead to renewed threats, and serves no purpose in the document. You should also note that on Figure III.C-16, the Kaktovik Subsistence Harvest Place Names are not properly indicated. .002

The Borough's hearing testimony detailed why Alternative III is inadequate to protect the concentrated and vulnerable resources associated with the spring lead system, and safe subsistence harvest opportunities for Barrow hunters. The testimony also detailed why Alternatives V and VI, separately or in combination, 1) are inadequate to protect important bowhead whale feeding habitat, 2) do not address a lack of information on cumulative impacts to the adjacent Arctic National Wildlife Refuge (ANWR), insufficient information on emergency response plans, or the inability to make direct landfall with a subsea production pipeline, and 3) are inadequate to protect safe subsistence harvest opportunities for Kaktovik hunters. Finally with respect to deferral areas, our testimony detailed why Alternative IV is inadequate to protect safe subsistence harvest opportunities for Nuiqsut hunters.

The Barrow Deferral Area should extend considerably farther to the east. We have noted that MMS' own Stipulation 5 describes the timing and area utilized by Barrow hunters for subsistence whaling in the fall. It recognizes that occasional use may extend to Cape Halkett. More consistent use extends at least as far as the western reaches of Smith Bay. Certainly, development and production in the areas offshore as far east as Cape Halkett holds a great potential for disruption of the subsistence harvest of whales and other resources by Barrow hunters. That entire area should be deferred from leasing. .003

With respect to the eastern Alaskan Beaufort Sea, the appropriate deferral would encompass all waters offshore of ANWR. MMS has yet to fully address the issues which were the basis for deferral of that area in Sale 170. In addition, Kaktovik subsistence hunters have consistently utilized areas west of the defined Alternative V Kaktovik Subsistence Whale Deferral Area for the pursuit and harvest of bowheads and other resources. While text implies otherwise, Figure III.C-15 clearly shows these more western strikes. .004

With respect to Cross Island, a deferral area extending at least 20 miles north and 25 miles east of the subsistence whaling base is a reasonable deferral area, encompassing much of the actual area of subsistence use and perhaps some of the upstream area of influence. Again, your Stipulation 5 recognizes that Nuiqsut whalers use an area extending east to Flaxman Island. We note also that Figure III.C-14 shows whale strike locations east to 146° 30'. MMS' proposed deferral area is considerably smaller and does not include such points. Furthermore, the location for whale 73N1, harvested by the Nuiqsut community (70° 6.03' N, 145° 36.76' W), is omitted from the map. This is a serious omission since it shows that the hunting area extends considerably farther east than the map indicates. Our suggested deferral would reduce the threat of disturbance which could significantly disrupt the subsistence harvest of bowhead whales by Nuiqsut hunters. We continue to believe that MMS should now be willing to consider the available harvest data as a starting point in defining the actual extent of a zone around .005

Cross Island requiring heightened protection. A new zone which includes the full subsistence use area plus the upstream area of influence should be defined in consultation with the AEWC, Nuiqsut, and the National Marine Fisheries Service, and refined as noise monitoring studies, including those associated with British Petroleum's Northstar Development Project, produce more accurate information on noise impacts to migrating whales. Recognizing the ongoing stress and anxiety caused by continued leasing within Nuiqsut's critical subsistence use area, our approach seeks deferral of an area larger than the 10-mile radius now subject to heightened protection as an appropriate interim measure until the necessary work is done to identify an area based on use and science acceptable to all parties. .005

Beaufort Sea Zones

We understand MMS' desire to construct a means of dividing the entire Beaufort Sea Planning Area into more manageable parcels for the purposes of analysis. It is no surprise to us that the agency has chosen a system which looks at the planning area from the standpoint of industry, rather than the affected community. The MMS zones are based on water depth and proximity to existing North Slope industry infrastructure. These factors are used to assess the likelihood that tracts will be leased and production facilities will be constructed. The result is "development scenarios" for which MMS then evaluates effects. Neither criteria is useful for addressing reasonably foreseeable development scenarios which pose the greatest potential threat to subsistence resources and uses. Such scenarios are of most concern to the Inupiat people of the North Slope and others who utilize the migratory resources of the Beaufort Sea. .006

Development Scenarios

If MMS wants to design and evaluate development scenarios which have meaning for local residents, it should pay closer attention to the fears and concerns expressed during scoping for these sales, and for sales and other offshore proposals dating back thirty years. It should be no secret or surprise that Barrow's primary concern is the potential for one or more drilling structures to be placed north or up to 40-50 miles east of Point Barrow. Nuiqsut is fearful that one or more structures located north or east of its subsistence whaling base at Cross Island will render migrating whales more difficult and dangerous to harvest. Kaktovik's concerns are similar in focussing primarily on the possibility of development north or eastward of the community. All communities have experienced disruption of subsistence whaling as the result of exploratory operations in the past. All are concerned with the potential for single or multiple operations occurring in these sensitive areas. All are concerned with the cumulative effects of such operations with other industrial operations, including seismic, barge, mobilization and demobilization operations, support vessel and aircraft traffic, and non-industrial operations, including commercial, military, scientific, and tourism vessel traffic.

MMS should develop and evaluate the potential effects of scenarios specifically placing structures in the proximity of subsistence zones, especially "upstream" of those zones in the fall bowhead whale migration. It should evaluate the potential effects of single structures, the effects of multiple structures in relatively close proximity to each other, the effects of multiple structures not in close proximity, but subjecting migrating resources to multiple exposures in a single season, and the potential effects of all of these structure-based scenarios acting in combination with other foreseeable operations. .006

Faulty Effects Analysis

The analysis of the potential effects of leasing, exploration, and development in the DEIS is driven largely by the development scenarios used. Because those development scenarios do not get at the essential questions posed by Beaufort Sea leasing and potential development, MMS' effects analysis is correspondingly faulty. An essential problem with the MMS approach is illustrated by the conclusion reached concerning the Alternative III Barrow deferral and two Eastern Beaufort deferrals, Alternatives V and VI. As we said in our hearing testimony, the conclusion defies logic. The Draft EIS first finds that because these areas are far from existing infrastructure, they are less likely to be leased and developed. We agree. MMS then goes on to say that because these areas are less likely to be leased and developed, the consequences to resources and subsistence harvest patterns with or without the deferrals would be essentially the same. That reasoning is simply not of any use in addressing the known concerns regarding Beaufort Sea leasing. It equates a projected lack of industry interest with a lack of effects. That reasoning avoids the most critical question of what effects there could be if the deferrals are not adopted and leasing and development occurs in those areas. The basis of our desire to see these areas deferred is the belief that if activities occur there, the likely and potential impacts will be greatest as compared with other blocks within the Beaufort Sea planning area. A reduced likelihood of activities occurring in the far eastern or western portions of the planning area does not mean that the effects would be insignificant if exploration and development do take place there. .007

Again, the fundamental flaw in the development scenarios applied in the DEIS is that they do not consider the specific potential effects if one of the projects predicted is located in a particularly sensitive area. The very reason deferral areas are being discussed at all is in recognition of the fact that the Beaufort Sea is not a homogeneous environment. Some areas contain resources or see subsistence uses which are more concentrated or sensitive. MMS must do impact analyses of alternatives using scenarios which place one or more developments squarely within proposed deferral areas. Only then can the relative risks of leasing or deferring those areas be evaluated. Only then can the issues most important to the affected North Slope Inupiat community be meaningfully addressed.

SPECIFIC COMMENTS ON THE DOCUMENT

Executive Summary

ES-1: MMS identifies "major issues" from the scoping comments, but fails to include the issue of preparing a multiple sale EIS. This was certainly an important issue to the Borough, and should be thoroughly discussed. .008

ES-2: MMS states that the "EIS found that no significant effects are anticipated from routine permitted activities." This again highlights the uselessness of MMS' development scenarios. That statement simply cannot be made without knowing where predicted developments will occur. MMS assumes development somewhere in the Near Zone, which extends just seaward of Cross Island. It assumes development somewhere in the Midrange Zone, which includes waters no more than 5 miles north and east of Cross Island and three miles from Barter Island. It assumes development somewhere in the Far Zone, which encompasses all of the planning area north and east of Barter Island, waters 12-15 miles north and east of Cross Island, and waters east of Point Barrow and seaward of Cooper Island. There most certainly would be significant impacts on subsistence uses if a production island were constructed, for instance, up to 20 miles east of Point Barrow, Cross Island, or Barter Island. The most MMS can truthfully say with respect to potential effects on subsistence whaling is that for routine permitted activities located well outside of subsistence use areas and associated areas of influence no significant effects are anticipated. .009

ES-5: Here too, MMS "does not expect any significant cumulative impacts to result from any of the routine activities associated with Alternative I for Sale 186." Here too, MMS maintains that the cumulative effects of leasing the full sale area (Alternative I) for Sale 186 would not change with the two subsequent sales, or if any of the deferral Alternatives were chosen for any of the three sales. This conclusion, and the explanation given for it, are confounding. MMS' reasoning seems to be the following: 1) if the "estimated contribution" of Sale 186 to the combined estimated effects of all past, present, and reasonably foreseeable activities that are likely to affect the same resources likely to be affected by Sale 186 is not expected to be significant, than 2) neither the two subsequent sales, nor selection of any deferral alternatives for any of the sales, will change that finding of no significant cumulative impacts in a measurable way. That may be true if MMS could actually state with any confidence that routine activities associated with Sale 186 will not result in any significant effects. As discussed above, however, faulty development scenarios resulted in MMS' unjustified conclusion that Alternative I for Sale 186 would produce no significant effects. That flawed conclusion taints the entire analytical structure of the DEIS. Conclusions substantially similar to a statement that "effects would essentially be the same as Alternative I for Sale 186" appear throughout the document, and must all be questioned. MMS assumes that six developments will occur. Without explanation, however, it does not evaluate the potential effects of any of these developments occurring within the proposed deferral areas. More realistically focussed development scenarios constructed to highlight differences in effects between leasing and deferring certain areas would certainly produce a different sale-specific and cumulative effects conclusions. .010

ES-5-6: For each of the proposed Deferral Alternatives, a statement appears that deferring the area from any of the three sales "would provide limited protection to all the resources of the area, but the overall effects likely would be essentially the same as Alternative I." Following that statement in each case there is then some acknowledgement that deferral could reduce effects on subsistence resources or more .011

particularly, the bowhead whale hunts in "the vicinity" of Barrow, Cross Island, and Kaktovik. If you propose simple scenarios under Alternative I envisioning a development directly within each of those "vicinities", it dramatizes the lack of justification for a conclusion that deferral would produce no significant reduction in effects. .011

Section II Alternatives

Page II-19: In ITL Clause No. 4, MMS should explain why it is only "*recommended* that all aircraft operators maintain a minimum 1,500-foot altitude when in transit between support bases and *exploration* sites" for the protection of endangered whales and marine mammals. We believe that the flight restriction should be required, and that it should apply to development and production facilities, as well as exploration sites. .012

Section III Affected Environment

Page III-59: It is not accurate to say that the "bowhead whale is the preferred *meat* and the subsistence resource of primary importance…" The reference to "meat" should be deleted, as other whale products are of equal importance. .013

Section IV Environmental Consequences

Page IV-7: Vehicle, aircraft, and vessel support for exploratory drilling operations is discussed. On Page IV-9: Vehicle, aircraft, and vessel support for development and production is discussed. As we have repeatedly stated in previous comments to MMS and others, any reference to aircraft or vessel "trips" should be considered vague for purposes of assessing potential effects. MMS must recognize that a round-trip between onshore facilities and offshore sites is really two impact-producing transits of offshore waters, typically separated in time by an interval spent loading or off-loading personnel or materials. A doubling of "trip" numbers to identify actual transits of the marine environment does not produce insignificant totals when considering potential effects. It is stated, for example, that estimates for surface transport during the construction phase for Northstar and Liberty were "roughly" 400 round trips per day. That means perhaps 800 daily transits between shore and offshore sites. Marine transport for Northstar during construction was estimated at 125-150 trips, or 250-300 transits, during the open-water season. MMS predicts 150-250 vessel trips, or 300-500 transits, during construction for far/deepwater facilities. For Liberty, 10-20 helicopter trips per day, or 20-40 transits, were projected during construction. These are significant numbers, especially when considered in combination for a single project, and even more so when the potential for multiple projects in a single season is considered. Nowhere in the DEIS is a scenario evaluated which assumes these volumes of traffic occurring in areas critical to wildlife resources or subsistence users. .014

Page IV-15: MMS must acknowledge that potential drilling operations in the far eastern or western reaches of the proposed sale area would likely require either the staging of substantial additional spill response equipment (bulldozers, dump trucks, front-end loaders, snowblowers, trenching equipment, ditch witches, pumps, and skimmers) in .015

locations remote from the existing Prudhoe Bay/ Kuparuk complex, or substantially longer response times for incidents in those areas. .015

Page IV-16: It is stated that burning can remove in excess of 90% of oil from the aquatic environment. It should be added that this can only occur under ideal conditions. .016

Page IV-19: The potential volume of recoverable oil projected for the three lease sales seems, at 1.38 billion barrels, to be overstated. MMS assumes recoverable quantities of 460 million barrels for each of the three sales despite development scenarios predicting three developments for Sale 186, two for Sale 195, and only one for Sale 202. Estimates of recoverable oil volumes from the existing Northstar facility are in the 160-million barrel range. If the resource potential of the three sales is overstated, then the predicted environmental and other effects of replacing the "lost oil" from alternative oil sources or alternative energy sources are correspondingly overstated. .017

Page IV-47: The high peak level and impulsive nature of seismic airgun noise has not caused concern just in the "environmental community". The subsistence and scientific communities, as well as the interested public, are also concerned about potential effects of seismic noise on marine mammals and other resources. .018

Page IV-52: In discussing seismic noise effects on bowhead whales, the statement in the third paragraph that "overall, the 1996-1998 results show that most bowheads avoided the area within about 20 kilometers of the operating airguns", seems to conflict directly with the statement in the fourth paragraph that "based on 1996-1998 data, there was little or no evidence that bowhead headings, general activities, or swimming speeds were affected by seismic exploration." .019

Page IV-53: There is no basis for the conclusion of the third paragraph that "whales avoiding seismic operations during the 1996-1998 whaling seasons did not affect the accessibility of bowheads for subsistence whaling." Harvest success does not necessarily equate with ease of harvest. Subsistence hunters have consistently reported that whales become more "skittish" and difficult to pursue and strike following exposure to industrial noise during their migration. Seaward deflected whales must be pursued over greater distances by subsistence hunters, and successfully harvested animals must be towed over greater distances to processing sites. Hunts occurring farther from subsistence whaling bases expose hunters to greater risks, are more expensive, and present a greater likelihood that whale meat and other products will spoil before they can be processed. .020

Page IV-63: MMS repeats a statement that we have consistently refuted in the past. The fourth paragraph begins, "Several studies indicate that most bowheads exhibit avoidance behavior when exposed to sounds from seismic activity at a distance of a few kilometers but rarely show avoidance behavior at distances of more than 7.5 kilometers (4.7 miles)." Only later is it noted that more recent monitoring programs have shown most bowheads avoiding an area around an operating seismic vessel by a radius of about 20 kilometers (12.4 miles). MMS must clearly acknowledge that the earlier studies were flawed, and are no longer accepted as comparably reliable as the more recent studies. .021

Page IV-67: The third paragraph on the effects of baleen fouling makes only passing reference to the dramatic differences between bowhead baleen and the baleen of the four whale species which were the subject of the cited Braithwaite study. The paragraph ends, however, with the conclusion of Geraci and St Aubin that based on that study, "it appeared that the concern for oiled whales (baleen fouling) is becoming less defensible". This is highly misleading. There is no data to suggest that fouling of bowhead baleen, which is long, flexible, and characterized by many hairlike filaments, should not be a significant concern in the event of an oil spill. .022

Page IV-137: The section presents a good discussion of the potential serious effects of tainting concerns following a large oil spill affecting any part of the migration route of the bowhead whale. The section properly identifies the whale as being "culturally pivotal" to the Inupiat people, and recognizes that tainting concerns would exist in all Inupiat and Yup'ik Eskimo communities adjacent to the migratory corridor of the whales and other migratory subsistence species. It is unclear why this discussion does not lead to a clear conclusion that a large or very large spill anywhere within the migratory route of the bowhead whale would result in a significant impact on affected subsistence communities. That conclusion should be clearly stated here and elsewhere as appropriate in the document. .023

Page IV-147: As noted above, MMS concludes that because the Barrow and Kaktovik deferral areas are far removed from the infrastructure at Deadhorse, they are less likely to be leased and developed. The agency then concludes that the lower probability of leasing and development means that the effects of noise, disturbance, and oil spills on all resources with the deferrals are likely to be the same as they would be without the deferrals. Here, after claiming that the effects with or without the deferrals would be "about the same", the second paragraph ends with the statement that "differences in noise and oil spill effects to bowhead whales from these deferrals as compared to Alternative I for Sale 186 would likely be difficult to measure." That simply could not be true if any number of reasonable development scenarios we can think of were used in the analysis. .024

The same perplexing reasoning is applied at the bottom of the page to reach the conclusion that effects of exploration and production activities on bowhead whales associated with Alternative I for the second sale, Sale 195, are "likely to be similar to those described under effects common to all alternatives and in effects of Alternative I for Sale 186." The paragraph concludes with the statement that "although more activities are expected to occur in deeper water, the differences in effects to bowhead whales between the two sale scenarios probably are not measurable." Her once again, the scenarios drive the evaluation of effects, and MMS has chosen to define the scenarios in a way that does not highlight potential differences in effects between Alternative I (leasing) and Alternatives III-VI (deferrals).

Page IV-149: The same faulty analysis is applied in evaluating the effects of Alternative I for the third sale, Sale 202. MMS continues to claim that effects will not increase measurably despite leasing, exploration, and development progressively moving into .025

deeper waters. This is contrary to assertions made in both the Northstar and Liberty EIS documents which argued that those projects would likely have minimal impacts on bowhead whales precisely because they were in shallower waters, rather than in the deeper waters more consistently encompassing the animals' migratory path. .025

Page IV-151: This section on Sociocultural Systems begins with the statement that communities that potentially could be affected by activity generated by the Beaufort Sea multiple sales "include" Barrow, Nuiqsut, and Kaktovik. No other communities are then discussed. The discussion on page IV-182 concerning the Consumption of Fish and Game likewise focuses only on Barrow, Nuiqsut, and Kaktovik. It is incorrect to assert that only these three communities could be affected by Beaufort Sea industrial operations. Clearly, all subsistence whaling communities, and other communities which trade for and receive whale products and other resources from the whaling communities, could be affected. A large oil spill anywhere within the habitat of bowhead whales or other migratory subsistence resources could have multi-year impacts on the harvest of those species by all communities which utilize them. Harvests could be affected by oiling of subsistence use areas, deflection and heightened noise sensitivity of whales due to spill response efforts, concerns over the safety of subsistence foods, and potential action by the International Whaling Commission to limit harvest quotas in response to a perceived increased threat to the bowhead population. Beyond the effects of a catastrophic oil spill, long-term deflection of whale migratory routes or increased skittishness of whales due to the effects of increased industrialization of the Beaufort Sea would make subsistence harvests more difficult, dangerous, and expensive. The document is correct in recognizing in the last paragraph on page IV-151 that "the sharing of subsistence foods is profoundly important to the maintenance of family ties, kinship networks, and a sense of community well-being." Clearly, any disruption of subsistence harvests through actual or perceived exposure of resources to spilled oil or reduced harvest success would have cascading effects on these social underpinnings of the Inupiat culture. .026

Page IV-152: At the top of the page, the document properly recognizes that because of the psychological importance of subsistence in sharing networks within Alaskan Native communities, perceived threats to subsistence activities from oil development are a major cause for anxiety. On page IV-154, and again on page V-66, the DEIS identifies a variety of particular fears which contribute to stress associated with the general fear of an oil spill. That pervasive stress is properly recognized as a "distinct predevelopment impact-producing agent within the human environment." These recognitions represent a breakthrough of sorts for MMS, and we applaud the inclusion of these and other related discussions in the DEIS. It is disappointing however, that MMS does not appropriately use these findings to conclude that the contribution to this ongoing community-wide stress and anxiety is a significant effect of the proposed lease sales meriting immediate mitigation in the form of cancellation of the sales or, at the very minimum, deferral of all intensive subsistence use zones from leasing. The EIS should acknowledge that this planning process alone, before any one of the lease sales is actually held, significantly exacerbates a level of stress and anxiety in our communities associated with expanding oil and gas development on the North Slope and adjacent waters. .027

Page IV-153-154: Here and elsewhere in the DEIS, MMS states flatly that staging for exploration and development would be from exiting infrastructure in Deadhorse, or that .028
development and production activities would be enclave based. There is no foundation for these claims, which are the basis for conclusions that the communities of Barrow, Nuiqsut, and Kaktovik would experience little direct disturbance or social disruption associated with these activities. The assumptions are baseless, and recent evidence indicates that Barrow, at least, may be used for staging. The 1999 EIS prepared largely by MMS staff evaluating oil and gas leasing in the Northeast National Petroleum Reserve-Alaska (NPRA) also assumed that all post-lease exploration and development activities would be staged from Deadhorse. No one anticipated the recent proposal by Phillips Alaska to possibly stage continued exploratory drilling this coming winter at its Northeast NPRA Puviaq site out of Barrow using an ice road more than 60 miles in length. Leasing of Northwest NPRA lands approaching 10-million acres is expected next year. If the area sees active leasing, it is likely that additional operations will be staged out of Barrow. MMS should evaluate the potential effects of routinely staging future NPRA operations out of Barrow. It should also consider the possibility that successful staging for NPRA operations from Barrow might stimulate greater industry interest in the western reaches of the Beaufort Sea Planning Area, recognizing that Barrow could serve as a base for exploration, development, and production operations. That possibility casts further doubt on the usefulness of the three Beaufort Sea zones identified for analytical purposes by MMS and defined, in part, by proximity to Deadhorse infrastructure.

Page IV-186: We are pleased to see that MMS has finally and directly acknowledged with respect to oil spill response that "present mechanical-cleanup technology has not demonstrated cleanup capability in broken-ice conditions."

Page IV-207: It is incorrect to conclude, as MMS does in the sixth paragraph, that the State of Alaska's Northstar drilling restriction "eliminates the environmental effects .029
associated with a well blowout during operations in the Beaufort Sea during broken-ice or open-water conditions." At best it can be said that the restriction reduces the potential for environmental effects.

Page IV-209: It is unclear, but seems from Subsection IV.I.1.d. under the heading of Blowout Assumptions, that the estimates of how much oil would reach specific .030
shorelines and resources of concern following a large spill only evaluates spills originating in Launch Areas 10 and 12, both of which are located in the central Alaskan Beaufort Sea. If so, the analysis greatly underestimates the risks to resources and uses concentrated in leased areas remote from those launch areas.

Page IV-215-216: MMS properly concludes that a very large spill under certain conditions could cause significant population-level harm to a number of waterfowl .031
species. We believe that this risk alone is grounds for deferring the described concentration areas from leasing.

Page IV-217: The DEIS uses several different figures to describe the potential losses of polar bears following a large or very large oil spill. This page seems to indicate that up to .032

128 bears could be "exposed to oil". It is unclear whether or not this means that 128 animals could suffer lethal effects. The conclusion assumes "a very high bear density of 1 bear/25 square kilometers". Pages IV-107 and V-46 simply note this as the reported approximate bear density without identifying it as "very high", and estimate variously that 5-30 or 6-10 bears could be lost following a large spill. EIS discussions of risks to polar bears should be modified to reflect that 60 or more animals have concentrated in the Barrow vicinity since early August this year. The entire number would be vulnerable to oiling if a spill were to occur in the area. .032

Section V Cumulative Effects

Page V-4: The structure of MMS' analysis is biased toward repeated conclusions that the contributions of these sales to cumulative effects would be insignificant because the DEIS analysis of the potential effects of Alternative I for each sale is flawed as we described above. If the conclusion if erroneously reached that the effects of leasing will be minimal, then of course it would follow that the contribution of the sales to cumulative effects will be minimal. The cumulative effects analysis also appears to focus exclusively on the broad question of the contribution of the three proposed sales to overall, long-term, regional effects on resources and uses. While this approach is valid as one component of the cumulative effects equation, it ignores shorter-term effects which can significantly impact resource behavior and subsistence uses. .033

Page V-6-7: MMS does not include activities in its cumulative effects analysis which we feel merit consideration. These include the potential for increased commercial, military, scientific, and tourist vessel traffic through the Beaufort Sea as the area becomes more accessible through Canadian waters with significant recent reductions in ice coverage. With evidence that the polar ice cap in the Canadian Arctic melting, a northern maritime route - the Northwest Passage - is opening for more consistently longer periods. Reports in recent years project that in the relatively near future, commercial and other ships may begin routinely plying the Arctic route instead of utilizing the Panama Canal. For European and other shippers, the Northwest Passage represents a shortcut of more than 4,000 nautical miles. .034

Page V-17: The last full paragraph discounts the likelihood that resources will encounter multiple disturbances or oil spill events near in time and space or prior to recovery. We see multiple exposures as far more likely. Migrating whales could encounter multiple support vessels or aircraft making transits between shore facilities and offshore structures. They could encounter mobile seismic vessels and stationary drilling structures in succession. A variety of resources could encounter multiple oil slicks or accumulations as they surface through or land on oiled surfaces, particularly in broken-ice conditions. .035

Page V-19-20: We reject the strained reasoning which produces the MMS conclusion that the contribution of each deferral alternative to cumulative effects cannot, in any measurable way, be differentiated from the contribution of the proposal, Alternative I. We strongly disagree with MMS' assertion that "an attempt to focus on the small differences in effects among the three lease sales and their deferral alternatives in .036

comparison to the effects of the past, present, and reasonably foreseeable actions would be an exercise in illusion." We are the affected community which will directly deal with the effects of these sales. That statement makes no sense to us. Ask any whaling captain in Barrow, Nuiqsut, or Kaktovik how he feels about the relative risks of these three lease sales, first with the planning area fully leased, and then with critical subsistence whaling areas deferred from leasing. There is a single production facility in Beaufort Sea federal waters today. It is not located within or directly upstream of a core subsistence whaling area. MMS assumes that with leasing there will be six more facilities. One, more, or all of those six facilities could be located within or upstream of critical subsistence whaling areas. How can you argue that full leasing which would allow the siting of those facilities within subsistence areas would contribute equally to cumulative effects as compared to leasing with deferrals which would prevent the siting of facilities within those areas? MMS' entire sale-specific effects analysis and cumulative effects analysis should be scrapped, and reworked to focus on the issues of real concern. .036

Page V-29: As on page IV-63, MMS presents the findings of 1980s studies and 1996-1998 studies on the effects of seismic activities on bowhead whales without sufficient and clear acknowledgement that the older studies had serious limitations, and that the results of the later studies are now accepted as more reliable. It is particularly inappropriate on an issue of such critical concern to refer readers to the Lease Sale 170 Final EIS for a discussion about some of the limitations of the 1985 Ljungblad study. Those limitations should be fully discussed in this document if the study is cited at all. In addition, rather than stating that various limitations of the 1980s studies "also were pointed out by Dr. Tom Albert, North Slope Borough during the Arctic Seismic Synthesis and Mitigating Measures Workshop, MMS should clearly acknowledge and accept those limitations as other agencies have done. .037

Page V-33: Here too, the potential for a heavily traveled northern sea route utilized by commercial, military, scientific, and tourist vessels should be discussed. In addition to disturbance effects on marine resources, MMS should also discuss the potential adverse effects on water quality associated with increased traffic. .038

Page V-47: It is unclear how MMS reaches the conclusion that Alternative I for Sale 186 is expected to contribute only 2-4% of the local short-term noise and disturbance effects on seals and polar bears. That figure seems low if based on 10-20 flights per day (20-40 transits) and 450 helicopter round trips (900 transits) per day during construction periods. .039

Page V-58: It is stated that "ideally, ongoing seismic operations are seasonally timed and monitored to prevent conflicts with the (bowhead) migration and the subsistence hunt." It would be more accurate to say that seasonal limitations "minimize" disturbance of the subsistence hunt, rather than "prevent" them. Past seismic limitations have separated operating seismic vessels from subsistence hunters from the traditional onset of the subsistence whaling season until harvest quotas are met. Whales can still be exposed to seismic disturbance, with the result that they become more skittish and difficult to harvest when approached by hunters from communities farther along the migration route. .040

Page V-63-64: It is noted that a serious concern among North Slope Inupiat is that potential increases in noise from cumulative oil development could disrupt the normal migration of bowhead whales, forcing subsistence hunters farther from shore. A quote is included from Eugene Brower, President of the Barrow Whaling Captains' Association, recounting how an idling exploration platform 9 miles offshore deflected all fall migrating bowhead whales seaward of the structure. It seems that MMS chose not to factor this direct observation into its analysis, as at the bottom of page V-64 it concludes that "cumulative effects on subsistence-harvest patterns include effects from Alternative I for Sale 186 exploration and development and other past, present, and reasonably foreseeable projects on the North Slope with one or more important subsistence resources becoming unavailable or undesirable for use for 1-2 years, a significant adverse effect." It is unclear how the disruptive effect of a production island or drilling structure similarly situated and in place for perhaps 15-20 years would be limited to only 1-2 years. If a 1-2-year disruption of subsistence whaling would be a significant adverse effect, MMS must acknowledge that a disruption on the order of 15-20 years would represent a far more severe effect, and is absolutely unacceptable. .041

Likewise, the section also discusses the potential effects of a large oil spill on subsistence harvest patterns. It is stated that "even if whales were available for the spring and fall seasons, *traditional cultural concerns of tainting* could make bowheads less desirable and alter or stop the subsistence harvest in Barrow, Nuiqsut, and Kaktovik for up to two seasons." We agree with MMS' conclusion that this would be a significant adverse effect. We do not agree that concerns over tainting would be limited to only two seasons. Studies of the effects of the Exxon Valdez oil spill on subsistence communities indicate that concerns over the safety of harvested resources persisted for many years following the incident. Also, the use of the phrase "traditional cultural concerns of tainting" here and elsewhere in the document unfairly implies that concern over the safety of harvested food is somehow peculiar to the Inupiat people. We contend that under comparable circumstances, any people, of any culture, would be hesitant to harvest traditionally consumed resources following a discharge of any toxic substance into the habitat of those resources.

Page V-64-65: It is unclear why MMS specifies that major significant effects that could occur following a large oil spill which contaminates essential whaling areas would be only "additive" rather than "synergistic". In the event of a large spill, all of the effects listed would likely occur. There would be contamination of the shoreline (as well as the marine environment), tainting concerns, cleanup disturbance, and disruption of subsistence practices. Subsistence harvest of marine resources would likely cease for some period of time. Does the distinction made by MMS matter? .042

Page V-65: Not adequately dealt with in the evaluation of cumulative effects on sociocultural systems is the issue of ongoing costs borne by the Borough and other local entities as a direct or indirect result of OCS leasing, exploration, and development. That analysis should include the budgetary effects on the Borough, community, and tribal governments of attempting to fully participate in OCS review and planning processes. That information should be a necessary component of your impact assessment, and would .043

serve as a means of identifying an appropriate level of impact assistance, which should accompany any continued OCS leasing.

Finally, as we observed in our hearing testimony, an assessment of the cumulative impacts of oil and gas activities on the North Slope is being conducted by a Committee of the National Research Council. Its report due out this year. MMS should acknowledge the importance of the Committee's work, and agree to put forth appropriate effort and funds to see that any recommendations offered in its report are acted upon. This EIS should be modified as appropriate to reflect the Committee's findings. .044

CONCLUSION

The primary purpose in preparing an Environmental Impact Statement is to assess the potential effects of a proposal on the physical, biological, and human environments. A key to the process is the development of alternatives to the proposal which differ enough from it to allow for a meaningful comparison of varying effects. It just makes good sense, and is good public policy, to use the document, and particularly the identification of alternatives, to highlight and address the most serious stakeholder concerns with the proposal. MMS has not done that. The proposal is to lease a large portion of the Beaufort Sea OCS Planning Area. Alternatives have been identified. Each would defer a subarea from leasing. They were developed with the apparent goal of providing options for the protection of sensitive resources and subsistence activities. Even without appropriate meaningful analysis, it is clear that the deferral areas offered are not sufficient to achieve the protections needed. A far more fundamental problem with the document and MMS' analysis is the meaningless development scenarios which are used in some poorly defined way to evaluate the effects of the proposal and the alternatives. Because projected developments are simply assumed to occur somewhere, but nowhere specific, within three large offshore zones, it is possible for MMS to avoid the central questions raised by the proposal. As the most directly affected community, it is reasonable for us to ask, what would be the effects if one or more developments and associated pipeline systems and support traffic occurred within a key subsistence area. That reasonable and surely understandable inquiry simply is not answered by this DEIS. The entire analysis should be reworked to address the fundamental questions which the Borough and others raised during scoping for this proposal. Thank you for considering the above comments, as well as the more technical comments that follow.

Sincerely,

George N. Ahmaogak, Sr.
Mayor

cc: John Goll, Director MMS Alaska Region
George Tagarook, Mayor Kaktovik
Eli Nukapigak, Mayor Nuiqsut
Edith Vorderstrasse, Mayor Barrow
Thomas Napageak, Chairman AEWC
Maggie Ahmaogak, Executive Director AEWC
Eugene Brower, President BWCA
Charles D.N. Brower, Director NSB Wildlife
Rex Okakok, Director NSB Planning
Dennis Roper, NSB Government Affairs
NSB Planning Commission
Brad Smith, NMFS Anchorage
Ted Rockwell, EPA Anchorage
Larry Bright, U.S. Fish and Wildlife Service Fairbanks
Glenn Gray, State of Alaska DGC
Senator Ted Stevens, Washington, D.C.
Senator Frank Murkowski, Washington, D.C.
Representative Don Young, Washington, D.C.
Senator Donny Olson
Representative Reggie Joule
Arnold Brower, Jr., President, ICAS
Jessica LeFevre, AEWC Counsel
Todd Sherwood, NSB Attorney
Tom Lohman, Wildlife

Technical Comments on the Draft Environmental Impact Statement for the Beaufort Sea Planning Area, Sales 185, 196, 202

Birds

Page III-43, III.B.5.a(2) Nesting Period:
Information should be added that Lesser Snow Geese also nest in the Ikpikpuk River Delta. The Ikpikpuk Colony has grown considerably in the past 5-10 years. As of 1998, the colony had grown to about 100 nesting pairs (Ritchie et al. 2000) and by 2002, the colony numbered more than 800 nesting pairs (R. Suydam, Pers. Comm.). The colony is mostly located in the western portion of the Ikpikpuk River Delta and occurs on low-lying islands and is thus vulnerable to flooding. .045

Page IV-81, IV.C.5.b(1)(a)1)c) Effects of collisions with structures:
First sentence in the first complete paragraph on page IV-81 states that "....most eiders are likely to see and avoid them [artificial island or drill rig] when visibility is good." There are no data to justify this statement and in fact there are data to suggest the opposite. The next sentence points out that birds have collided with the North Star structure during times with good visibility. The last part of the first sentence should be deleted so it does not contradict with the following sentence. .046

Page IV-81, IV.C.5.b(1)(a)1)d) Effects of discharges:
The third sentence states that "...discharges are not likely to cause significant effects either through direct contact with birds or by affecting prey availability..." This statement is made on the assumption that Spectacled Eiders are uniformly distributed across the Beaufort Sea and in low densities. There are few data on Spectacled Eider distribution in the Beaufort Sea. The assumption that Spectacled Eiders are uniformly distributed in low densities in the Beaufort Sea is contradicted by the eider's distribution in the Bering and Chukchi seas. Eiders have a restricted distribution in these areas and could easily be expected to have a restricted distribution in the Beaufort Sea. The paragraph should be changed to reflect the lack of information for the Beaufort Sea and the contradictory information for the Chukchi and Bering seas. .047

Page IV-83,IV.C.5.b(1)(b)5) Population Effects:
The last three sentences in the second paragraph in this section discuss the recovery of Spectacled Eiders. If the Spectacled Eider population is declining, "the rate of recovery from any oil spill or other mortality associated with oil and gas development" is NOT likely to be slowed, but the DECLINE INCREASED. For populations in decline, ANY added mortality will <u>increase the decline</u> not just slow recovery. For recovery to occur, the population must be increasing. If the population is increasing, then mortality from oil and gas activities will slow recovery. The premise that recovery will be slowed by mortality from oil and gas activities is simply not true; the decline will be exacerbated from additional mortality. Analyses about impacts from oil and gas activities on the Spectacled Eider population are therefore flawed and need to be redone. .048

Page IV-87,IV.C.5.c(1)(b)1) Effects of a Large Oil Spill:

This section discusses impacts to Steller's Eiders from an oil spill. The paragraph contains statements that are misleading or false. For example, the paragraph states that Steller's Eiders arrive at nesting areas via overland routes, thus few are likely to be vulnerable to oil in spring leads. There are no telemetry data on the route Steller's Eiders take to breeding areas. It is likely that the birds nesting near Barrow arrive from spring leads. There are no feasible overland routes for Steller's Eiders to take from wintering areas to nesting areas near Barrow. Thus, an oil in a spring lead near Barrow would likely impact and exacerbate the decline of Steller's Eiders. .049

Page IV-91,IV.C.6.a(1)(a)3) Effects of Collisions with Structures:
This section discusses impacts to marine and coastal birds due collisions with structures associated with oil and gas activities. The second to the last sentence in the second paragraph is misleading. The sentence, "The density of most species in the Beaufort area is relatively low, and mortality from collisions with the island also is likely to be low" is only true for birds resting on the Beaufort Sea. Migrating birds, especially King and Common eiders, move through the Beaufort Sea in incredible densities. As an example, Woodby and Divoky (1982) observed 360,000 eiders pass Point Barrow 360,000 in a 10-hour period with a peak passage of 113,000 in only half hour. Thus, migrating birds are at great risk to collision with structures constructed in the Beaufort. Collisions are of a concern because King and Common eider populations have declined markedly in the past 20 years (Suydam et al. 2000). If the declines are continuing, any added mortality to eiders from collisions will increase the decline. An increasing decline could ultimately lead to the listing of King and Common eiders under the Endangered Species Act. .050

Page IV-92,IV.C.6.a(2)(b)1) Effects of Disturbance from Oil-spill Cleanup:
The forth sentence states, "...staging and migrating flocks of most species generally are dispersed and thus wound not necessarily occur in the vicinity of the cleanup activity...and thus...few flocks are likely to be displaced...and expend energy stores for migration." This is a contradiction of statements made in the following section on Vulnerability of Birds to Oil Spills. Flocks of migrating birds can be large and losses due to cleanup activities or oil spills could be substantial. The EIS does not adequately deal with this issue and should be revised. .051

Page IV-93,IV.C.6.a(2)(b)2)b) Mortality from an oil spill:
This section primarily focuses on an oil spill/bird occurrence model that uses bird data from aerial surveys that occurred in July and August in the Beaufort Sea. The use of only these data is misleading as is pointed out in the assumptions of the model in the first paragraph in this section. Particularly of concern is the fact that large numbers of migrating birds were not accounted for in the model. As an example, only 19,842 King Eiders were accounted for in the surveys. Because King Eiders migrate across the Beaufort Sea twice a year, almost the entire population of King Eiders that migrate along the northwest coast of Alaska is vulnerable to an oil spill. A minimal estimate of King Eiders in this population is abut 300,000 birds, considerably more than ~20,000 stated in the DEIS. The third paragraph in this section attempts to point out this issue but does so poorly. An accurate assessment of the potential risks of an oil spill to birds migrating .052

across the Beaufort Sea is needed. The current assessment is a considerable underestimate of the potential risk of an oil spill to birds in the Beaufort Sea. .052

Pages IV-94 & -95, IV.C.6.a(2)(b)2)c) Population effects:
Analysis for this section assumes there is a constant carrying capacity for the Beaufort Sea. If an oil spill occurs and kills eiders or Long-tailed Ducks and these populations are already in decline, the added mortality from an oil spill will not slow recovery, but will exacerbate declines. See comments for Page IV-83, above. .053

The last paragraph in this section is misleading and contradictory to other comments made in the DEIS. Aerial surveys conducted by the USFWS indicate the population status for the bird species nesting on the North Slope of Alaska but not for the species migrating across the Beaufort Sea. For all of the species mentioned, many individuals from the populations nest in Canada and are not surveyed by the USFWS. Thus the analyses are flawed in that they do not account for the actual number of birds that use the Beaufort Sea. One example is King Eiders. Only about 10,000 King Eiders nest on the North Slope of Alaska while the remaining ~300,000 that use the Beaufort Sea migrate to Canada for nesting. .054

Page IV-95 Conclusions:
This section is inadequate for the same reasons described above. The data being used to estimate impacts to waterfowl are do not reflect an accurate assessment of the how many birds are at risk from these lease sales. The major failing is that the DEIS does not address the hundreds of thousands of birds, mostly eiders, that migrate across the Beaufort Sea twice a year between nesting areas in Canada and wintering areas in the Pacific Ocean or Bering Sea. This section should be modified with accurate assessment of the actual number of birds vulnerable to oil spills and other industrial activities, such as collisions with structures. .055

Beluga Whales

Page III-48, III.B.6.f. Beluga Whales:
The last three sentences of the first paragraph of this section are outdated. Twenty-three belugas from the eastern Chukchi Sea stock have been satellite tagged since 1998. Satellite tracking data show that Chukchi Sea belugas inhabit the Beaufort Sea, in addition to the eastern Beaufort Sea stock of belugas (1998 data reported in Suydam et al. 2001, other data, Robert Suydam, Pers. Comm.). Thus, Chukchi Sea belugas must be considered as part of the "Affected Environment" of the three lease sales within the Beaufort Sea. .056

Page IV-99,IV.C.7.a(1)(a) Effects of Noise and Disturbance from Routine Exploration Activities:
This section contains a misstatement: "Some beluga and gray whales might be diverted by helicopter noise up to 100 meters away (Richardson et al 1995)". This sentence implies that belugas more than 100 m away are not affected. This statement is not true based on Richardson et al (1995). They actually state that belugas were often disturbed by helicopter noise when the helicopter was operating at <250 m lateral distance and at .057

an altitude of <150 m. Thus the disturbance was much greater than what stated in DEIS. Furthermore, Richardson et al. (1995) did not even look at gray whales, but only belugas and bowheads. .057

Page IV-109,IV.C.7.a(2)(c)2) Effects of Large Oil Spill:
The third paragraph discusses effects to beluga whales. The paragraph only discusses contact with oil during spring migration off Barrow. This analysis is incomplete and lacking. There is no discussion about effects from an oil spill during the summer or fall when two stocks of belugas occur in the Beaufort Sea. This paragraph must be expanded considerably. .058

Bowhead Whales

Page III-36: The current best estimate of abundance estimate (N4/P4) for 2001 is 9,860 (SE = 1,222) with a 95% confidence interval of 7,700 to 12,600 (George *et al.*, 2002). .059

Page III-37: We are not aware of data indicating that smaller whales migrate first in the fall; however, this is true in spring. In autumn, it is very likely the opposite situation where the smaller size/age classes migrating last. .060

Page III-38: Second paragraph. It is stated that "While some factors may have dominating effects on site specific distributions...." It seems reasonable to mention seismic operations as one of these "factors" since they are know to significantly affect bowhead whale distribution during migration. .061

Page III-39: It should be mentioned in this discussion on feeding that the new USDOI, MMS bowhead whale feeding study has direct evidence of feeding off Cross Island. This information comes from examination of stomach contents of subsistence-harvested whales (Lowry and Sheffield, 2001). .062

Page III-40: Regarding the Richardson and Thomson (2002) quote, the Borough interprets the results of the feeding study as supporting the idea that bowhead whales feed opportunistically temporally and spatially throughout their range. Therefore, one should use caution in stating that a particular feeding area is more important than another, particularly across the large time scales that a bowhead whale lives. .063

Page III-40: The recently published paper by Hoekstra *et al.* 2001 is not included in the discussion of feeding areas. Hoekstra's work suggests that the Beaufort Sea is an important feeding area and that bowhead whales generally actually gain sufficient nutrition to change their carbon-isotope ratios between Kaktovik and Barrow. These data suggest the Beaufort Sea is an important feeding area. .064

Page III-40: Gestation and age at sexual maturity. Several papers were not cited that have relevance to gestation and age at sexual maturity in bowhead whales. Reese *et al.*, (2001) conducted a Bayesian analysis of fetus recoveries to estimate a gestation length of 13.9 months. They also speculate on geographical areas where bowhead whales give .065

birth (calving areas). This area likely extends from the Bering to the Beaufort Sea. The mean birth date was 24 March with a 90% predictive interval from 3 March to 13 April. .065

Page IV-54: As for other cetaceans, high levels of protection are requisite where nursery areas are known (Wells *et al.*, 1999). It seems reasonable to restrict seismic disturbances in the spring lead systems where mothers are calving and nursing their neonates. Effects from spring whale hunting activities are acute (short episodes) rather than chronic (constant stimulus). .066

Page IV-48: Seismic displacement: Seismic operations in the Beaufort Sea are a significant issue for two reasons: 1) interference with and displacement of bowheads from whale hunting areas, and 2) interference with and displacement of bowhead whales from known feeding grounds. Recent work by Weller *et al* (2002) on the Western Pacific stock of gray whales feeding near Sakhalin Island suggests that whales can be displaced from preferred feeding areas by seismic sound production. Weller's work was an "elegant" natural experiment in terms of study design in that it included pre-seismic, seismic, and post-seismic periods. Weller and colleagues gathered data on whale numbers and distribution before seismic exploration began and found most whales preferred feeding grounds about 35 km offshore. When seismic vessels were operating in the feeding grounds, the whales moved a considerable distance shoreward, and whale numbers significantly increased in their shore-based study area. After seismic work ceased, the whales again returned to the offshore feeding area. The International Whaling Commission Scientific Committee considers this a very serious problem for this critically endangered population. This is some of the first "direct" evidence of displacement of a baleen whale from a feeding area by industrial activity. Displacement near Sakhalin Island was on the order of 30 km, which is quite similar to measured displacements of bowhead whales during migration. Obviously, we have similar concerns for bowheads in Beaufort Sea feeding areas. The Borough considers the entire Beaufort Sea a feeding area based on new feeding evidence from Cross Island and existing data from Kaktovik and Barrow. .067

Subsistence Issues

Subsistence Deferral Areas

As the Borough has repeatedly stated, locations of strikes do not reflect the true extent of the search area used by bowhead whale hunters. When we provided whale harvest location data to MMS, there was an 'understanding' that these data would be used properly, whereby both "search areas" and "upstream quiet zones" from the harvest locations would be established. It is unfortunate to see that these strike locations were used to delineate a minimal hunting deferral area. .068

ExSum-2 Effects of Routine Permitted Activities

The DEIS found that no significant effects are anticipated from "routine permitted activities." The term "significant" is used far too loosely and what one organization deems not significant another would consider significant and unacceptable. For instance, it has been proven with a reasonable amount of scientific data, that along the Alaskan Beaufort Sea coast, bowhead whales typically feed in nearshore waters as they migrate .069

along the northern coast of Alaska in the fall (at a minimum during August to October). This has been directly observed, determined by examination of stomach contents (Lowry et al., 1993; MMS DOI Eastern Alaskan Beaufort Sea Feeding Study, *In Prep.*), concluded in chemical feeding ecology studies (i.e., contaminants, stable isotopes) by Hoekstra *et al.* 2002, and Willetto *et al.* 2002, and been expressed as local traditional knowledge (many comments received by the MMS). This known important feeding area of the Beaufort Sea coupled with the well-documented deflection of bowheads during active seismic exploration as conducted in this same feeding area indicates there is a likely significant impact on bowhead whales (reduced feeding, decreased fitness, etc.). This deflection also indicates there is very likely a significant impact on the bowhead whale hunters at Cross Island and Barrow. It is very unfortunate that this is not expressed as a significant impact in the Executive Summary; instead one finds "no significant effects" stated. It is clear that this "no significant effect" perspective was an *a priori* conclusion that this documents seeks to prove and support as opposed to an unbiased assessment of potential impacts. The activities associated with these Lease Sales should be deemed "significant" based on the supposed criteria used in this EIS as outlined in Section IV.A.1 and as considered under the Marine Mammal Protection Act (for marine mammals and hunters). .069

ExSum-3: The DEIS states that "The endangered bowhead whales may exhibit temporary avoidance behavior to seismic surveys, vessel and aircraft activities, drilling, and construction, but overall effects to bowheads from disturbance and noise would be temporary and non-lethal." This is clearly an unfounded statement, as the studies that documented deflection of migrating bowhead whales could not determine if (or at what distance and time) a recovery from the obvious deflection took place. Indicating that this is "temporary" conflicts with the data that indicated no recovery was evident, and was greater than the distance monitored beyond the seismic activity. Also, if activities are occurring over multiple years in the area then bowhead whales will be displaced in sequential years, and this is not "temporary." Ship strikes are certainly considered lethal, and the fact that ship traffic is devastating the North Atlantic Right Whale (NARW) population and that evidence of ship strikes in BCBS bowhead whales has been published the comment in the EIS is very much inaccurate (Kraus, 1990). Ships do kill large baleen whales (hull or bow strikes, lacerations via the propeller, entanglement, etc.). Thus the inclusion of "vessel" and "nonlethal" in the same comment is inaccurate and misleading. .070

ExSum-4: The DEIS states that "Some bowhead whales likely would experience temporary, non-lethal effects, if a large oil spill occurred. Terms like "some", "temporary", and "few" can be misleading. The Borough has long argued that the effects of oil contact on bowhead whales is grossly understated in the EIS. Whales surfacing in oil-contaminated water in ice-restricted (i.e. leads, polynya) situations could be devastation. The animals would likely inhale the highly toxic volatile components from the oil (depending on how old the spill is). In this scenario, many of the whales in the area could be killed immediately and as a result of chronic exposure to volatile oil components. It is understandable that fear of contamination and sensory detection (smell, taste) of hydrocarbons in hunted species would result in significant food avoidance. This is ongoing in Prince William Sound and has had a significant impact the nutritional and .071

cultural health of affected communities. It is unfortunate that this is not discussed in greater detail here, despite the issue having been raised repeatedly at various North Slope meetings. .071

Oil Spill Probabilities

The Borough has concerns about how the oils pill probabilities are estimated. We are interested in how confidence intervals for these probabilities might be calculated. A point estimate tells you very little about the probability of an event. We are interested in the upper 75% and 95% confidence intervals on the estimates and the statistical power of the estimates. .072

Right Whales and Industrial Activity

We can look to the bowhead whales' close cousins the North Atlantic Right Whale (NARW) to learn how these animals co-exist with industrial, shipping, and fishing activities (Kraus, 1990). The research conducted to date suggests that whales in this family do particularly poorly in areas with shipping activities (Kraus, 1990). Right whales are very slow swimmers and are poor at avoiding vessels – particularly calves and breeding groups whom are essentially unresponsive to vessel approaches (for obvious reasons!). Vessel strikes are considered the greatest source of mortality and largely explains their failure to recover despite over 80 years of protection from hunting. The bowhead population has increased during the same period (following the cessation of commercial whaling) despite a continued harvest by Eskimo subsistence hunters. .073

The right whale (Balaenidae) family lacks echolocation abilities are not adept at avoiding fishing nets and often become entangled (likely the 2nd most important source of mortality). Therefore, seismic array cables, buoys, and similar items if left at sea would seriously degrade that habitat. Based on the NARW experience, we can expect that increased offshore industrial activities will likely lead to direct mortality.

Effects of Exposure to Oil

Section IV, dealing with Environmental Consequences, understates the potential effects to marine resources of exposure to oil. All animals evaluated are susceptible to the toxic and irritating effects of petroleum due to contact, ingestion, and inhalation (aspiration) (Osweiller et al., 1995). The types and severity of lesions depend on the route of exposure, dose (the amount of oil) and type of "oil". The irritating effects of oil may injure eyes, lungs, and other organ systems reducing the animal's ability to oxygenate blood and to feed or capture prey (Jessup and Leighton, 1996). .074

Low viscosity hydrocarbons (30 to 35) are of higher toxicity (Rumack and Peterson, 1980) and a high aspiration (inadvertently taken into the lungs) risk. Certain volatile components of oil such as benzene, hexane, and toulene, are known to be highly toxic, and in cold environments may not evaporate or diffuse and may be at dangerous levels (Jessup and Leighton, 1996). If these volatiles enter the lung they can irritate a significant portion of the lung resulting in an acute chemical pneumonitis which is an irritation of the lung lining (Rumack and Peterson , 1980). Thus aspiration can lead to cyanosis (low oxygen in blood), tachycardia (fast heart rate), and hypopyrexia (low body temperature) (Rumack and Peterson, 1980); and possibly incordination, shivering, head shaking, and mental confusion can occur (Osweiller et al., 1995). Aspiration at the water/oil interface during inhalation would be a serious exposure scenario to consider for all marine mammals. Oil ingestion can result in stomach ulceration due to the irritant effect (Osweiller et al., 1995). Oral ingestion of petroleum hydrocarbons is very often associated with mucus membrane irritation, vomiting and central nervous system depression (Rumack and Peterson, 1980). Osweiller et al. (1995) state, "treatment of animals suffering from crude oil or kerosene poisoning is an exercise in frustration" since exposure often impacts many organ systems. .074

Exposure of skin to oil can cause an irritant dermatitis of the pustular (i.e. skin infection) and acneiform (i.e. acne) types (Weltfriend et al., 1996). Oil is also known to cause eye lesions (AMAP, 1997 p. 153). Eye damage (lymphoplastic conjunctivitis) due to crude oil exposure was observed in harbor seals following the Exxon Valdez spill (Spraker et al., 1994), while in ringed seals a severe conjunctivitis and corneal abrasions were seen after experimental exposure to Norman Wells crude oil (Geraci and Smith, 1976). Polar bears showed signs of skin irritation when experimentally oiled (Oritsland et al. 1981). Clearly, oil exposure can severely affect the eye, skin and mucosal lining of the digestive and respiratory tracts. .075

Spraker et al. (1994) indicates that severe neurological damage was occurring due to oil exposure in harbor seals exposed to the Exxon Valdez oil spill and was a likely a cause of death. Behaviorally the oiled seals were severely affected showing loss of visual acuity, dullness, and other central nervous system signs all of which may have been due to lesions seen in the hypothalamic tracts and other regions of the brain (Jessup and Leighton, 1996). .076

References

Arctic Monitoring and Assessment Program (AMAP). 1997. Petroleum Hydrocarbons In Arctic Pollution Issues: A State of the Arctic Environment Report. AMAP, Oslo, Norway

George, J.C., Zeh, J., Suydam, R. and Clark, C. 2002. Population size of the Bering-Chukchi-Beaufort Seas Stock of bowhead whales, Balaena mysticetus, based on the 2001 census off Point Barrow, Alaska. Paper SC/54/BRG5 presented to the International Whaling Commission Scientific Committee, June 2002, Shimonseki, Japan.

Geraci, J.R. and T.J. Smith. 1976. Direct and indirect effects of oil on the ringed seals of the Beaufort Sea. Journal of the Fisheries Research Board of Canada 33:1976-1985.

Jessup, D.A. and F.A. Leighton. 1996. Oil Pollution and Petroleum Toxicity to Wildlife In Noninfectious Diseases of Wildlife. Iowa Sate University Press, Ames Iowa, USA. p. 141-154.

Kraus, S.D. 1990. Rates and potential causes of mortality in North Atlantic right whales (*Eubalaena glacialis*). Marine Mammal Science 6(4):278-291.

Osweiller, G.D., T.L. Carson, W.B. Buck, and G.A.V. Gelder. Clinical and Diagnostic Veterinary Toxicology. 1985. Industry-Related Toxicants: Crude Oils, Fuel Oils, Kerosene. Kendall/Hunt Publishing Co. USA, p. 177-178

Reese, S., Calvin, J.A., George, J.C., and Tarpley, R.J. 2001. Estimation of fetal growth and gestation in bowhead whales. Journal of the American Statistical Association.

Ritchie, R.J., R.M. Burgess, and R.S. Suydam. 2000. Status and nesting distribution of Lesser Snow Geese (*Chen caerulescens caerulescens*) and Brant (*Branta bernicula nigricans*) on the western Arctic coastal plain, Alaska. Canadian Field-Naturalist 114:395-404.

Rumack, B.H. and R.G. Peterson. 1980. Clinical Toxicology In Casarett and Doull's Toxicology: The Basic Science of Poisons. Eds. Doull, Klaasen, and Amdur. Macmillan Publishing Co., Inc. New York, USA. p. 687-688.

Suydam, R.S., D.L. Dickson, J.B. Fadely, and L.T. Quakenbush. 2000. Population declines of King and Common Eiders of the Beaufort Sea. Condor 102:219-222.

Suydam, R.S., L.F. Lowry, K.J. Frost, G.M. O'Corry-Crowe, and D. Pikok Jr. 2001. Satellite tracking of eastern Chukchi Sea beluga whales in the Arctic Ocean. Arctic 54:237-243.

Weller, D. W., Ivashchenko, Y V., Tsidulko, G.A., Burdin, A.M., Brownell, R.L. 2002. Influence of seismic surveys on western gray whales off Sakhalin Island, Russia in 2001. Paper SC/54/BRG14 presented to the IWC Scientific Committee, June 2002, Shimonseki, Japan.

Wells, R.S., Boness, D.J., Rathbun, G.B. 1999. Behavior. *In*: J. E. Reynolds III, and S. A. Rommel, (eds). The Biology of Marine Mammals. Smithsonian Institution Press. 578 pp.

Woodby, D.A. and G.J. Divoky. 1982. Spring migration of eiders and other waterbirds at Point Barrow, Alaska. Arctic 35:403-410.

MMS Response to Comment Letter L-0035

L-0035.001

The MMS acknowledges that the North Slope Borough, in cooperation with the Alaska Eskimo Whaling Commission, provided the MMS with additional recommendations for deferring areas that were much larger than areas in deferral Alternatives III, IV, and V. However, as noted in Section I.C.2.b, the three larger EIS deferral alternatives suggested by the North Slope Borough would remove about half the opportunity for discovering and developing an economic oil field, with a large portion of the area being deferred offshore Prudhoe Bay where most of the existing oil and gas infrastructure exists. The deferrals as suggested by the Borough would remove much of the area in the Near and Midrange zones (see Map 4), where MMS projects most of the leasing and activities for Sales 186 and 195 would occur. As noted in Section I.C.2.b, the suggested scoping comments for the deferral alternatives and, for the most part, the comments to the draft EIS from the North Slope Borough and the Alaska Eskimo Whaling Commission, fail to acknowledge the positive effects and protection offered by the standard stipulations and mitigating measures that are assumed to be part of the Proposal. These stipulations, especially Stipulations 4 (Industry Site-Specific Bowhead Monitoring Program) and 5 (Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities), have proven to be effective in reducing and eliminating adverse effects on subsistence whaling. Proposed exploration and seismic activities have been modified or limited in scope to reduce conflicts with whaling and potential deflection of the bowhead whale migration. A study titled *Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow: Past and Present Comparison* is ongoing and will map geographic patterns of subsistence use near important North Slope communities. The MMS will use this comparative time-series information to assess cumulative sociocultural effects in the Beaufort Sea region. See also Section III.C.2 - Subsistence-Harvest Patterns for further discussion about subsistence harvest areas.

The MMS acknowledges that the North Slope Borough and the Alaska Eskimo Whaling Commission consistently have recommended the “No Lease Sale” alternatives and they have consistently stated their preference for no offshore oil and gas activity. As stated in Section I.C.2.b, the MMS analysis indicates that the levels of effects offered by the standard stipulations and ITL measures in combination with Alternatives III, IV, and V provide essentially the same level of protection offered by the much larger deferrals suggested by the North Slope Borough. However, the three large deferral options suggested by the Borough and the Alaska Eskimo Whaling Commission would eliminate a large portion of the economically recoverable resources and, therefore, they become essentially the same as the No Lease Sale Alternative, which is evaluated as Alternative II (see Section IV.B).

The MMS believes that the current alternatives, with the standard stipulations and ITL clauses, offer an effective range of options that meet NEPA requirements and the goals and objectives of the OCS Lands Act to offer Federal offshore oil and gas resources for lease and possible exploration and development in an environmentally safe manner.

L-0035.002

In the past, whalers’ names have been included as an aspect of traditional knowledge, and their inclusion was never a concern. Because including names has now become a concern, they will be deleted from Figures III.C-14 and III.C-15. Figure III.C-16 will be fixed to include the subsistence-harvest place names for Kaktovik, and a new Figure III.C-5, that maps Barrow’s bowhead whale strikes (that was inadvertently omitted in the draft EIS) has been added to the text.

L-0035.003

The MMS believes that the standard mitigation package (Stipulations and ITL clauses) that we have developed over the years offers adequate protections to the Inupiat communities on the North Slope. Stipulation 5 generally describes the timing and area used by Barrow hunters for fall subsistence whaling and recognizes that occasional use may extend to Cape Halkett. The MMS believes that Alternative III, the Barrow Subsistence Whaling Deferral as described and analyzed in this EIS, offers some additional protections related to potential oil and gas exploration. The blocks under this deferral alternative were identified during scoping. The MMS had already taken out in the current 2002-2007 5-year program areas to the west of this Barrow alternative, where most of the hunting typically occurs. The MMS believes that the consultation mechanisms in place required in Stipulation 5 help to reduce potential conflicts between subsistence hunters and whalers and potential oil and gas activities and help to reduce noise and disturbance conflicts from operations during specific periods during the subsistence-whale hunts. This stipulation evolved from the oil/whaler cooperative program from earlier Beaufort Sea sales, and the MMS has worked closely with the North Slope Borough, the Alaska Eskimo Whaling Commission, local affected communities, and whalers over time to further refine requirements. The MMS will continue this work for the Beaufort Sea lease sales under the 2002-2007 program.

From past leasing experience, very few blocks are actually leased in a given sale, and even fewer of these leased blocks ever have an exploration well drilled. Since 1979, seven OCS lease sales have been conducted in the Beaufort Sea; of these, 30 wells have been drilled in the Beaufort Sea. The Northstar Unit is the only project producing Federal oil and from only a few wells from an island in State waters.

See also Response L-0035.001 for additional information on how this alternative was developed.

L-0035.004

The MMS in no way intended to imply in the text (Section III.C.2.d(3)(a)) that whalers do not harvest in areas west of the community of Kaktovik.

See also Responses L-0021.009 and L-0035.001 regarding deferral of all waters offshore of the Arctic National Wildlife Refuge.

L-0035.005

The MMS agrees that Stipulation 5 identifies that Nuiqsut whalers may use an area extending east to Flaxman Island during their fall whaling activities. As indicated in our response to the comment, the MMS believes that the standard mitigation package offers adequate protection to the Village of Nuiqsut and its subsistence hunters and whalers. Alternative IV, the Nuiqsut Subsistence Whaling Deferral and the Stipulations 6a and 6b, Cross Island no permanent facilities, as described and analyzed in this EIS, offer some additional protections related to potential oil and gas exploration. However, our analysis did not find any differences in effects on the environment that we could describe quantitatively or qualitatively. The blocks being considered for deferral under Alternative IV were identified during scoping. The MMS believes that the consultation mechanisms in place required in Stipulation 5 can reduce potential conflicts between subsistence hunters and whalers and potential oil and gas activities and can reduce noise and disturbance conflicts from operations during specific periods during the subsistence-whale hunts. As you know, this stipulation evolved from the oil/whaler cooperative program from earlier Beaufort Sea sales. The MMS has worked closely with the North Slope Borough, the Alaska Eskimo Whaling Commission, locally affected communities, and whalers over time to further refine requirements and will continue to do so for Beaufort Sea lease sales proposed under the 2002-2007 program.

The MMS has corrected Figure III.C-14 to reflect the location of whale 73Nl harvested by the Nuiqsut community, which we inadvertently omitted. The deferral areas selected include the locations where most (although not all) of the whales were taken.

See also Response L-0035.001 for more detailed information on how this alternative was developed.

L-0035.006

We understand the North Slope Borough's concerns about any disruption of subsistence whaling and the Inupiat peoples' preference for focusing scenarios around subsistence resources and uses. Biological concerns (for example, threatened and endangered species) also are of primary concern to other parties. Designing a set of area-specific scenarios to satisfy every resource of concern is difficult, and analyzing multiple sets of scenarios would be extremely complicated. The development scenarios based on distance to infrastructure and water depth provide general models applicable to a wide variety of environmental, biological, and cultural impacts. We believe that the distance-depth model depicting expanding exploration and development activities is a valid reference point to analyze the variety of potential impacts from the three consecutive lease sales in the Beaufort Sea. It represents our best estimate of where activity is likely to occur first.

We also believe that the analytical approach we use for assessing cumulative effects (see Section V) is as rigorous as we can reasonably make it, given the information available about effects of past, present, and future activities on the North Slope and in the Beaufort Sea.

L-0035.007

We disagree with this comment. The MMS effects analysis is not faulty. We rely on established probabilistic methods to reach decisions under conditions of uncertainty. The Beaufort Sea contains numerous geologic features that could contain oil or gas. The chance of commercial success of any given prospect is low. We do not know which tracts will be leased, which will be explored, which will contain any oil or gas, and which would have large enough volumes to justify proceeding with development. With all of these unknowns, the MMS bases its analysis on the most likely events to occur from offering a lease area. For deferrals, we analyze the most likely effect of offering the program area minus the deferral area. Under the deferral conditions, we assume that industry is likely to redirect interest to the remaining, offered areas, if other drilling opportunities remain. The MMS uses knowledge of the geology and remaining opportunities to determine the most likely level of resources to result from the sale. Economic viability is a significant consideration when assessing deferral areas. The advantage of this probabilistic approach is that it allows MMS to quantify unknowns and update estimates as new information becomes available.

At the leasing stage, the EIS focuses on the overall picture. At this stage, the MMS is not in a position to know if or where leases will be bought; where or if exploration will occur; or, if exploration occurs, whether a commercial discovery will be made and developed. We have to create typical scenarios to show what may occur. The OCS Lands Act recognizes these three distinct stages of offshore oil and gas activities: leasing, exploration, and development/production. Leasing does not represent an irreversible or irretrievable commitment of natural resources. Additional, specific analyses will be conducted in the event of exploration or development activities. Since 1979, seven sales have been held in the Beaufort Sea OCS. As a result, 10,280 tracts have been offered, 692 tracts leased, 25 drilled, and only 1 field developed. A full developmental EIS was conducted on this one field prior to authorizing development. The purpose of this process of staged analysis is to permit greater specificity as uncertainty is reduced. Ample opportunity remains to assess impacts associated with a specific, proposed development.

The commenter asked why we indicate that we do not show a change in effects if a relatively small group of tracts were deferred. Our lease-sale analysis is structured to give the reader as accurate a picture as possible of effects that might occur. We know that we cannot necessarily assume effects are confined to the specific area where exploration or development occurs. If we defer a specific tract or set of tracts from leasing, that specific area does not become immune to possible effects. The one partial exception is the placement of a physical structure. Stipulation 5 applies equally for development; therefore, if a lessee made a discovery and planned to develop it, that stipulation would have to be followed.

Regarding sensitive areas, see Response L-0038.011.

L-0035.008

In Appendix E (Scoping Report), development of a single multiple-sale EIS, rather than an EIS for each of the three proposed lease sales, is listed as a major issue for the North Slope Borough. This fact has been brought forward to the Executive Summary.

L-0035.009

The MMS has reviewed the effects analysis of routine operations and found the analysis and conclusions to be accurate. These findings are consistent with the Northstar and Liberty NEPA analyses concerning routine activities and the activities to date at Northstar. Although the area being considered and offered in the three proposed sales is quite large, the number of leases estimated to be issued, the number of estimated exploration activities, and the number of estimated potential development activities is small. Our analysis of effects of routine activities for the proposed action with the standard stipulations and ITL clauses in place, and their impact on subsistence (including subsistence whaling), sociocultural effects, and environmental justice (see Sections IV.C.11, IV.C.12, and IV.C.15) found the potential effects to be well below the significance threshold. Stipulation 5 applies equally for development, so if a lessee made a discovery and planned to develop it, that stipulation would have to be followed.

L-0035.010

The MMS has reviewed the analysis and conclusions provided in the EIS, and they are accurate. They are based on the best available estimates of resources and the scenarios the MMS developed to reflect the information and knowledge we have about how those resources might be explored and developed, if they are leased. The MMS acknowledges that our leasing and NEPA review process moves along a continuum, from general to specific. The 5-year program is the most general, and the 5-year EIS evaluates the effects in general terms to cover large areas.

The next step is the lease-sale EIS that, through the use of scenarios, describes activities in general; therefore, the NEPA analysis is scenario driven and evaluates effects in relationship to the planning area. Specific locations are still unknown, but we provide additional information with the description of the three zones (Near, Midrange, and Far). We also indicate that more than half of the leasing and potential development would occur within the Near Zone. We also describe the technology and types of development that would occur in each zone. We do not know which resources will receive bids and, because the resources have not been drilled, we can only estimate the resources and ensuing activities in a general manner.

From past experience, we do estimate that only a few of the blocks offered in sales are ever leased and, since the downturn in the oil industry in the late 1980's, the number of companies participating in leasing, exploration, and development has declined. From experience, we estimate that only a few of the leased tracts are likely to be drilled (more than 1,600 leases have been issued on the Alaska OCS, which resulted in 84 exploration wells drilled on 73 tracts). Only one development (Northstar), which is a Federal and State unit, has resulted in production. A second potential development, Liberty, was withdrawn by BPXA after the Liberty final EIS was issued.

Exploration and development plans, if they are submitted, provide very specific information; therefore, the impact analysis that results likewise is specific. Facility sizes and types, pipeline routes, time schedules, etc. are provided. The analysis is focused and discusses places and specific times.

Neither the MMS nor the information noted above support the theory that if a lease sale is held, exploration and development activities will be occurring everywhere in the Beaufort Sea. We believe the rationale and analyses for our conclusions about the potential effects from routine activities are correct. Our re-evaluation of the analyses did not identify any flawed assumptions, analysis, or conclusions. The North Slope Borough's restatement of MMS's reasoning about cumulative effects essentially is correct. The cumulative effects of routine activities do not reach the significant threshold definition, and the contribution of each of the proposed leases sales is so small and the estimate of reasonably foreseeable future activities is so uncertain, that we can only reasonably assume that the contribution to cumulative effects of the proposal for one sale versus the next are about the same.

L-0035.011

We believe the two statements quoted are consistent and logical. The first statement is the bottom-line conclusion that the deferral alternatives would provide limited protection but that the effects essentially are the same. The "limited protection" is further elaborated in the next sentence. The North Slope Borough suggested that for purposes of analysis, the EIS should evaluate the effects of the deferral alternative by assuming development occurs from each deferral. The MMS does not know of any geologic reason to assume and predict with any certainty that a development would occur within those areas. In fact, we provide our best geologic assessment that there is a low probability that development would occur within the zones (see Table II.A-3). The MMS also did not "dramatize" the effects by placing all of the geologic resources as far away from the deferral area as possible, so there would be no effects. For the analysis of potential oil spills, the MMS did evaluate the effects of oil spills originating from each of the alternatives. Launch Areas LA2, LA12, and LA18 and Pipeline Segments P1, P2, and P7 were designed to help us evaluate the effects of Alternatives III, IV, and V off of Barrow, Nuiqsut, and Kaktovik, respectively (see Maps A-4a and A-4b). One of the tools used by the analysts in evaluating the effect of oil spills for the alternatives are the differences in the levels of contacts to resources by removing the launch area(s) and pipeline(s) segments and re-evaluating the effects (see Table A.2-2). Tables A.2-55 through A.2-72 provide combined probabilities and comparisons between the alternatives.

Our goal in assessing the effects of the Proposal and alternatives in the EIS is to give the reader and decisionmaker a realistic and reasonable assessment of potential effects based on the best available information. The concept of changing and moving resources to elevate or minimize impacts does not lead to good decisionmaking and only serves to cloud the issues. We believe our approach to analysis of the alternatives is the correct way to provide a realistic evaluation of potential effects to both the decisionmaker and the reader.

Stipulation 5 applies equally for development; therefore if a lessee made a discovery and planned to develop it, that stipulation would have to be followed.

L-0035.012

The MMS has no jurisdiction to require any aircraft flight restrictions. That is under the jurisdiction of the Federal Aviation Administration or it can be the requirement from the Endangered Species Act consultations or Marine Mammal Protection Act process.

L-0035.013

The word "meat" has been deleted from the text in response to this comment.

L-0035.014

The MMS analysts have correctly assumed that the number of trips indicated are round trips. One trip anywhere offshore would require the vehicle/vessel or aircraft to return. The effects to biological resources and subsistence users are evaluated as the effects from vehicles, aircraft, and support vesselsgoing from a base to a remote area and back. Therefore, the analysis of effects in Section IV does not require modification or further analysis.

L-0035.015

The MMS concurs with this assessment. As oil-spill-contingency plans are developed for exploration operations, distance from the spill-response infrastructure will be a concern. When industry submits a spill-contingency plan to the MMS, a key evaluation point will be accessed to sufficient spill-response assets necessary to conduct a timely response. We will ensure that response equipment and personnel are readily available to initiate spill-response activities and that additional equipment may be required to be staged to meet those needs. As activities move from exploration to development, spill-response support will continue to be a primary factor used in determining the sufficiency of the spill-response plans.

L-0035.016

The best recovery or removal rates for any system, mechanical or nonmechanical, occur when conditions are optimal.

L-0035.017

Estimates for future oil recovery are made for analytical purposes only. It is impossible to accurately predict the size and location of new commercial-size discoveries in an area such as the Beaufort Sea. Reviewing past exploration and development trends, it would appear that our oil-recovery estimates are overstated. However, projecting past data ignores the advances in exploration technology (3-dimensional seismic) and the remaining undiscovered oil potential. Only about 7% of the tracts offered were leased at some time in previous Beaufort OCS sales, and only 30 wells were drilled in an area covering nearly 10 million acres. Northstar is the second field located offshore. The first offshore field in the Beaufort was Endicott, which by State estimates originally contained 580 million barrels of oil. Fields in the size range of 150-460 million barrels of oil are possible throughout the Beaufort Sea. For purposes of analysis, we assume that smaller fields will be discovered and developed in the nearshore area, because this area has been more thoroughly explored. Although smaller fields such as Northstar could be discovered in remote areas, it is likely that commercial-size fields have to be considerably larger to be economic. This explains some of our rationale behind assuming different field sizes for the three development zones for purposes of environmental analysis.

L-0035.018

The MMS is aware that there is concern about potential effects of seismic noise on marine mammals. That is why the MMS and the National Marine Fisheries Service require that a site-specific monitoring program for seismic surveys be conducted in the Beaufort Sea and why the design of the monitoring program and the results from the monitoring are peer reviewed.

L-0035.019

The information in both sentences came from the same report and is based on the lack of statistically significant differences. The two sentences referenced on their own do appear to be somewhat conflicting. However, the third sentence in the fourth paragraph acknowledges that the lack of statistically significant differences in headings should be interpreted cautiously, because some changes in headings must have occurred, given the observed avoidance behavior.

L-0035.020

The basis for the statement is the report by Miller et al. (1999), which is discussed in the second paragraph. In that paragraph, Miller notes that seismic operations were moved to locations well west of Cross Island, the area where Nuiqsut-based whalers hunt for bowheads. This was done under the provisions of the Conflict Avoidance Agreements established between industry and the hunters in 1996-1998. No perceived interference between seismic operations and hunting was reported either in 1998 or in 1996-1997. As a result of mitigating measures implemented under the 1996-1998 Conflict Avoidance Agreements, the 1996-1998 seismic surveys did not adversely affect the accessibility of bowheads to subsistence whalers (Miller et al., 1999).

L-0035.021

The results of the studies are discussed in the chronological order that the studies were conducted. This seems like the most logical order of presentation. A complete discussion of the earlier studies can be found in Section IV.C.5.a(1)(a)1)b). To our knowledge, only the Ljungblad (1985) study has been criticized as being flawed. The limitations of that study also are discussed in Section IV.C.5.a(1)(a)1)b). The MMS disagrees with the statement that these studies are no longer accepted as comparably reliable as compared to more recent studies. It also should be noted that the National Marine Fisheries Service uses these references in their May 25, 2001, Beaufort Sea Biological Opinion. It also should be noted there were differences between the earlier studies and the later studies in terms of the water depths and distances from shore that the seismic surveys were conducted and in the seismic equipment and types of seismic programs conducted. There also may have been differences involving the whales' activity. There is no logical reason to exclude studies just because there are flaws or perceived flaws in the study, particularly if the limitations of the study are noted. If the criteria for citing studies were to cite only those studies with no flaws or limitations, the scientific database likely would be very limited.

L-0035.022

This is not a conclusion drawn by the MMS. The referenced text is citing the conclusion drawn by Geraci and St. Aubin after conducting their study and after critiquing the Braithwaite study.

L-0035.023

Thank you for the compliment. In several other places, the text concludes that if an unlikely large or very large spill occurred, a significant impact on subsistence could occur.

L-0035.024

The scenarios developed by the MMS in this EIS are intended to reflect realistic levels of potential development that may occur for OCS leasing. The analysts use the same exploration and development scenarios for the Proposal and the alternatives and, therefore, to focus on the evaluation of the differences among the alternatives. It would be misleading to assume significantly different levels of development with different technology and timing, because such assumptions would mask the real purpose of the analysis, which is to evaluate the differences between including and excluding a portion of the proposed sale area.

The statements about effects from Sales 186, 195, and 202 on bowhead whales come directly from the bowhead whale effects analyses in Sections IV.C.5.a(2)(c)4) through IV.C.5.a(2)(c)7).

See also Response L-0035.007.

L-0035.025

See Responses L-0035.007 and L-0035.024.

L-0035.026

The text in the conclusion in Section IV.C.12.a(4) - Effects on Sociocultural Systems has been changed to reflect this concern.

L-0035.027

Thank you for the compliment. The MMS does acknowledge that the lease-sale planning and scoping process alone can be a factor in the levels of stress and anxiety found in communities on the North Slope. We disagree that in and of themselves such stresses would represent a significant effect or an effect of the magnitude sufficient to cancel the lease sale. The MMS believes that aggregate onshore oil and gas development effects in addition to a variety of social changes, television, easy access to more urbanized communities, and other related influences have contributed much more to community stresses.

L-0035.028

The MMS fails to see the necessary linkage between onshore staging and offshore staging out of Barrow. If leasing reached the development stage, project-specific EIS's would evaluate such staging options. Although staging for the National Petroleum Reserve-Alaska is out of the scope for the Beaufort Sea multiple-sale EIS, the MMS does acknowledge that if such staging occurs, it could stimulate staging for potential offshore projects. As to the appropriateness of the Beaufort Sea zone approach used in this EIS, it is and continues to be the best analytical tool that MMS has found for multiple sales in the Beaufort Sea.

L-0035.029

The text has been changed to clarify that we are discussing environmental effects of an oil spill from a well blowout during operations in broken-ice or open-water conditions. If no drilling occurs during those periods, there can be no oil spills from blowouts due to drilling.

L-0035.030

The EIS analyzes both the chance of a spill contacting and the chance of a spill occurring and contacting from all launch areas and pipeline segments for large spills (greater than or equal to 1,000 barrels). Large spills are what the MMS believes to be the most likely spill sizes to occur, if a spill occurs at all, based on experience in the Gulf of Mexico and the Pacific Regions. It should be noted that the spill sizes analyzed in this EIS–1,500 and 4,600 barrels–are larger than any historical spills that have occurred on the Alaska North Slope from oil-field pipelines and facilities, with the exception of the Trans-Alaska Pipeline. The Alaska North Slope generally has spill rates lower than other production areas both offshore and onshore in the United States. For the period 1985-2000, the median facility spill greater than or equal to 500 barrels on the Alaskan North Slope is 663 barrels, and the average is 680 barrels. There is one pipeline spill in the data base. The volume of the pipeline spill was 510 barrels. The largest facility spill in the record is 925 barrels.

All five of the blowout events (greater than or equal to 1,000 barrels) in the OCS data base occurred between 1964 and 1970. Following the Santa Barbara blowout in 1969, amendments to the OCS Lands Act and implementing regulations significantly strengthened safety and pollution-prevention requirements for offshore activities. Well-control training, redundant pollution-prevention equipment, and subsurface safety devices are among the provisions that have been adopted in the regulatory program. The absence of an oil spill greater than or equal to 500 barrels from an exploration or development well blowout since 1970 reflects the success of a more stringent and rigorous regulatory program. Likewise, there have been no such blowout spills from all the North Slope drilling operations onshore and in State waters. Drilling procedures are comparable on the Alaska North Slope and in the Gulf of Mexico, and the data support each other.

Very large spills are analyzed in Section IV.I. The text has been modified to make it clear to the reader that the spill considered is from the nearshore areas (launch areas LA10 and LA12). The MMS uses these areas to analyze very large spills, because we are trying to ground the scenario in reality and not just pure conjecture. The technical challenge of working offshore far from facilities and pipelines of Prudhoe Bay adds high costs to all Beaufort development projects. Northstar came on line in November 2001 and took twice as long and costing twice as much as BPXA expected. BPXA's Liberty Project was shelved in May 2002 due to cost. These developments are nearshore in the area of onshore development. It would be purely conjecture for MMS to speculate that in development would occur outside the nearshore area for an extremely low probability event.

L-0035.031

The probability of an event occurring and contacting a resource also is part of the information used to decide a deferral.

L-0035.032

The draft EIS states that "128 bears could be exposed to oil." There is no way to predict whether any of these bears would actually be oiled or killed by the spill. Regarding the 60 or more bears recorded in the vicinity of Barrow in association with bowhead whale carcasses, this is a most unusual event. If an oil spill were to threaten the Barrow area when such a concentration of bears was occurring, the potential exposure of 60 or more bears easily could be avoided by removing the carcasses from the shoreline and either burning the carcasses to remove the attraction for the bears to the spill-vulnerable shoreline or moving the carcasses to another location where the bears would not be exposed to the spill. Such preventive measures would be very feasible in the vicinity of Barrow, where equipment and manpower are available.

L-0035.033

The contribution of Sale 186 to the cumulative effects is determined only after establishing the overall cumulative effects level that are part of the total past, present, and reasonably foreseeable future activities for each resource. The cumulative analysis consisting of overall effects, regional and local effects, and long-term and short-term effects are the basis for the cumulative analysis and are determined for each resource. The incremental contribution is only a small part of that analysis. The incremental contribution consists of only a paragraph for each resource. Short-term and local effects are determined and weighed more closely and are the most likely stage for potentially measurable additive and synergistic effects. These effects usually are not ongoing, and a resource-recovery factor has been applied where appropriate.

L-0035.034

See Response L-0035.038.

L-0035.035

Multiple exposures are more likely before any recovery. Whales could encounter mobile seismic vessels and stationary drilling structures in succession in addition to multiple oil slicks, particularly in broken-ice conditions.

Three operating production platforms offshore in an area as extensive as the Beaufort Sea or Beaufort Sea coastal waters do not constitute a succession of drilling structures and mobile seismic vessels that would or could produce an additive effect on migratory resources. Projections of activities for the proposed actions and into the reasonably foreseeable future do not suggest this multiple exposure is a realistic consideration at this time. Even when considering where initial development nearshore may be sited over the more than 400 miles of coastline, the proposed additional offshore platforms for the three sales poses too large an area to assume that multiple exposures resulting in measurable effects is likely to occur. Resources are considered lost in the case of a large oil spill; however, recovery of the resource is expected to occur over the 20-year life of the proposed projects. Multiple exposure to the same spill whether at sea, in the ice leads, or in broken ice are all counted as losses from the one spill, and the recovery of the population is considered subsequent to this event.

L-0035.036

Alternatives should make a difference in the cumulative case.

We in no way imply that whaling captains' feelings are anything but genuine. Our statement was meant only to indicate that one should not even attempt to try to draw small analytical distinctions in the cumulative analysis among sales and alternatives, whose effects were found in Section IV to be essentially the same, when the whole cumulative effects analysis, by its very nature, projects well into the uncertain future that we categorize as reasonably foreseeable.

The MMS had a choice to err on the side of taking either a restrictive or expansive view of the term "reasonably foreseeable." By choosing a more expansive view, we were able to add into the analysis more potential future activities; however, that implicitly means that the incremental contribution of the individual sales or alternatives is smaller.

These deferrals are not considered large enough to make a measurable difference in the cumulative effects for all the reasons given in Section V.C. The effectiveness of the deferral option is covered in the analysis of the proposed action and will be an important part of the decision process. Discussing these differences again in the cumulative context does not offer any new information and would be redundant.

L-0035.037

See Response L-0035.021.

Referencing text in a previous EIS is an acceptable and appropriate practice, considering that it is a public document. However, a change has been made in the text to also refer the reader to Section IV.C.5.a(1)(a)1)b of this EIS for additional discussion of the 1985 Ljungblad study and its limitations.

L-0035.038

There currently is not adequate evidence to suggest that a viable or heavily traveled northern route for commercial, military, scientific, and tourist vessels will be a reality in the next 10-15 years or the reasonably foreseeable future. There has been speculation that if a warming trend were to continue, a Northwest Passage or Northern Sea Route would be open for 2-3 months in summer and early fall (Brigham and Lawson, 2002). In the meantime, while this route is attractively shorter, many things need to be addressed; for example, insurance costs, double-hull requirements, unpredictability of polar weather, and sovereignty issues. As these issues are addressed, factors such as water pollution, noise, and disturbance will be addressed with appropriate mitigating measures. To date, the only commercial vessel that has successfully used the Northwest Passage was the specifically strengthened U.S. tanker, the *Manhattan* in 1969 with the aid of American and Canadian icebreakers.

L-0035.039

That is, 10-20 flights for Sale 186 compared to 450 flights in the cumulative analysis. Ten divided by 450 = 2%, and 20 divided by 450 = 4%.

L-0035.040

The word "prevent" has been replaced with the word "minimize" in response to this comment.

L-0035.041

The text has been changed to reflect the concerns about long-term noise effects to migrating whales from a drilling or production structure and the long-term concerns over subsistence-food safety after an oil spill.

We acknowledge the commenter's contention that "under comparable circumstances, any people, of any culture, would be hesitant to harvest traditionally consumed resources following a discharge of any toxic substance into the habitat of those resources." We are not implying such a concern is peculiar to the Inupiat. The statement is phrased the way it is, simply because the analysis focuses on the subsistence-harvest activities of the Inupiat.

L-0035.042

We acknowledge that within the context of the additive effects mentioned, the synergistic distinction does not seem particularly relevant. The text has been changed to reflect this concern.

L-0035.043

The NEPA offers the opportunity for public participation but does not require it. For any given entity that chooses to participate in a NEPA process, their costs are real to them. The cost of participation in a NEPA process is not an effect that NEPA specifies as a dimension that should be measured. Therefore we do not measure this cost in the text of the EIS.

L-0035.044

The MMS agrees that the National Resource Council's assessment of cumulative effects is an important effort. Accordingly, we have included *Cumulative Effects of Offshore and Onshore Oil and Gas Development on the Beaufort Sea Environment* as a proposed study in our profiles of studies proposed for FY 2004 (see FY 2003 *Annual Study Plan*, p. 197). These profiles are under review for potential inclusion in an FY 2004 environmental studies plan.

L-0035.045

Information on recent snow goose survey data has been added to Section III.B.5.a(2).

L-0035.046

While there may be little formal data to support the statement that "…eiders are likely to see and avoid obstructions when visibility is good," they are visually-oriented animals. We typically do not find large numbers of them colliding with islands, natural or artificial, or other obstructions in the Beaufort Sea, even though the flight trajectories of many must, at some time during the fairly lengthy open-water period, be directed at such obstructions until they veer away, gain altitude to pass over it, or come to a halt.

The commenter notes that this statement is contradicted by the following sentence that states eiders have collided with Northstar Island when there was good visibility. Good visibility meant that there was no fog on record but in the EIS text, this statement was qualified to indicate that the birds could have collided at night when visibility may not be good. Some clarifying revision of the statements has been added in Sections IV.C.5.b(1)(a)1c) and IV.C.6.a.(1)(a)3).

L-0035.047

The few aerial surveys carried out in the Beaufort Sea generally have found spectacled eiders as scattered flocks. No statement in the analysis implies that the eider distribution is uniform. In fact, spectacled eiders have been observed more often in Harrison Bay, for example, than in other areas, suggesting a nonuniform distribution. Also, it is not entirely clear why the eider's distribution necessarily would be restricted in the Beaufort as it is in the Chukchi and Bering seas, as noted by the commenter, when they are involved in different phases of the annual cycle in these areas (migration in the former, molting and wintering in the latter). We have added clarification to Section IV.C.5.b(1)(a)1)d) concerning there being little data on which to base assumptions about eider distribution.

L-0035.048

Statements concerning spectacled eider mortality and declining population status in Sections IV.C.5.b(1)(b)3), IV.C.5.b(1)(a)1)a), and IV.C.6.a(2)(b)2)c) have been clarified. Any mortality resulting from a spill is likely to be a one-time occurrence as compared to the relatively unknown but presumably constantly-acting factors that are causing this population to decline at a nonsignificant rate. Recovery from losses under these two types of circumstances may be quite dissimilar.

L-0035.049

This statement in Section IV.C.5.c(1)(b)2) was not meant to imply that Steller's eiders migrated long distances over land. It meant that because they had seldom been seen during migration counts they might, for example, move directly from the lead system often present in the northeastern Chukchi Sea to inland areas in the northwestern National Petroleum Reserve-Alaska rather than flying to leads north or east of Barrow before turning south to nesting areas. Little information exists that is specific to routes used by individual Steller's eiders nesting in northwest Alaska. This statement has been revised.

L-0035.050

Regarding collisions, the commenter says that the EIS suggests eider mortality from this factor would be low because of low duck density. In fact, this is not what is suggested. Rather, the EIS notes that collision of a flock of waterfowl with a structure could result in substantial mortality. The North Slope Borough states that density of most species is *relatively* low in the Beaufort Sea. This is true most of the time over most of the area. The one exception is during the migration periods, when migrating flocks are moving through the area. In this instance, substantial mortality could result if a collision occurred. The point made in the EIS is that very few structures (three or fewer as a result of these lease sales, unless the price of oil increases dramatically; Appendix F, Table F-3) will be constructed in the Beaufort Sea and, therefore, they will constitute a very low-density target. Thus, the probability of a flock colliding with one likely would be quite low unless, for example, structures were grouped in a small area or were coincidentally located along typical migration routes. Any such collision would result in substantial mortality but is not expected to occur frequently. To date, the largest number of ducks to strike the Northstar Island in one breeding season is 20 (not counting any that were not retrieved); this does not suggest that "incredibly large numbers" will routinely collide with such structures. However, revisions of this section clarify some of these statements. With regard to potential collisions, the MMS and the Fish and Wildlife Service are jointly coordinating the development of lighting systems for offshore structures under the terms of the Fish and Wildlife Service Biological Opinion for this project, which might reduce the likelihood of bird collisions with structures. The discussion of low density of birds concerns onshore density during the nesting and postnesting periods, when the commenter notes they are at low density, and the low probability of collisions with pipelines. Pertinent statements in Section IV.C.6.a(1)(a)3) have been revised to address this point.

L-0035.051

The North Slope Borough comment that eider populations still are declining, when recent eider aerial surveys indicate that king eiders at least are increasing at a nonsignificant rate. This would allow some recovery from minor mortality losses or maintenance of a stable population. Any statements noted as being contradictory with regard to bird densities or dispersion of flocks exposed to an oil spill, such as in Section IV.C.6.a(2)(b)1), has been revised for clarity. However, the statement regarding ducks at high density specifically refers to flocks of the extremely numerous long-tailed duck, which generally is present at much lower densities, and not to eiders, as indicated in the comment. Any disturbance from oil-spill-cleanup activity is not likely to result in "substantial losses."

L-0035.052

With regard to king eider population estimates, both the Point Barrow counts (373,000) and the estimates from aerial surveys (about 20,000) are cited. Until other data are obtained, these are the only available estimates with which to estimate potential mortality from an oil spill. In fact, only data that allow determination of waterbird densities is useful for making such mortality estimates, using the MMS oil-spill-model estimates of area covered by a spill. Prior to the migration period, it is reasonable to assume that offshore densities would dictate the number of individuals exposed to a spill, not the larger number passing during the migration period. Also, unless migrant sea ducks alight on the water during migration they are not particularly susceptible to oiling. In addition, a spill in a particular area during summer would not necessarily move far enough to substantially affect those birds moving offshore from nesting areas much farther to the west, but it could oil migrants from the east. For example, a spill in the Prudhoe Bay area probably would not affect a substantial proportion of birds that nest on the western coastal plain, but it would be expected to potentially affect those flying across the Beaufort from Canada and eastern Alaska.

The comment also notes that the discussion of potential factors that could elevate the losses from an oil spill, but for which data do not exist, cannot be incorporated into models attempting to estimate mortality. We do not understand what additional data has been used to support the comment that "the current assessment is a considerable underestimate of the potential risk of an oil spill to birds in the Beaufort Sea." The MMS certainly would be receptive to a clear explanation of the effect of confounding variables in making estimates of potential mortality.

L-0035.053

A constant carrying capacity was not assumed for this analysis of potential effects. In fact, sufficient information most likely does not exist to allow the calculation of carrying capacity for any bird species in the Beaufort Sea region. For further discussion of this topic, see Responses PH-Barrow.018 and L-0035.048.

L-0035.054

Statements concerning recovery of populations from losses in the referenced paragraph, Section IV.C.6.a(2)(b)2)c), have been revised. Estimates of population size for various species are discussed in Section III.B.5.

L-0035.055

The referenced Section IV.C.6.a(2)(b)2)c) on population effects discusses various factors that could result in a mortality from oil and gas development activities. Without additional pertinent data on vulnerability of populations to oil spills, for example, the assumption that an entire North American population is vulnerable is probably more speculative than the assumption that the approximate number of birds actually on the water during aerial surveys is closer to the vulnerable population segment.

L-0035.056

The text in Section III.B.6.f has been revised in response to this comment.

L-0035.057

Richardson et al. (1995) refer to gray and beluga whales being diverted by helicopter noise up to 100 meters away. The reviewer's comment about another Richardson et al. (1995) statement about helicopters operating at **less than** 250 meters lateral distance and at latitudes of **less than** 150 meters away is within about the same estimated range of potential cause and effect as the previous statement by Richardson et al. (1995). These apparent diversions (disturbances) were very brief in their duration (less than a few minutes), and there was no evidence that any serious harm occurred to the whales that had been temporarily diverted.

L-0035.058

In Section IV.C.7.a(2)(c)2), the EIS focuses on the worst type of spill scenario during the spring, when belugas are concentrated in the spring leads and when potentially the largest number of whales could be exposed to a potential spill that could contaminate the lead system. During the summer open-water season and during the fall when the belugas are present in the Beaufort Sea, their distribution is dispersed and far fewer whales are likely to be exposed to a potential spill. Thus, under the latter scenario, potential effects are likely to be far less than during the spring migration.

L-0035.059

The preliminary 2001 bowhead whale population estimate in Section III.B.4.a of the EIS has been updated.

L-0035.060

The reference for the statement in the text of the draft EIS is Moore and Reeves (1993). The quote from the text of that report is “Braham et al. (1984) reiterated the contention of Eskimo whalers that bowheads are segregated roughly by age class, with smaller whales preceding large adults and cow-calf pairs on the fall migration.” This statement has been added into the text in Section III.B.4.a.

L-0035.061

Section III.B.4.a has been revised to include prey concentrations, seismic activities, and localized vessel traffic as examples of factors that may affect bowhead whale distribution during migration.

L-0035.062

Information from the recent bowhead whale feeding study, including the chapter by Lowry and Sheffield (2002), has been included in the text in Section III.B.4.a.

L-0035.063

We agree with the comment and stated earlier in Section III that whales are likely to feed opportunistically where food is available as they migrate across the Alaskan Beaufort Sea. The comment does not appear to be in conflict with the quote from Richardson and Thomson. No change has been made in the text.

L-0035.064

Information from the study by Hoekstra et al. (2002) has been included in the text in Section III.B.4.a. The discrepancy between this study and the similar study by Lee and Schell (2002) has been noted in the text. Lee and Schell reanalyzed their samples and confirmed that the numbers referenced in the draft report were correct. The data in the Hoekstra et al. (2002) study were not reanalyzed.

L-0035.065

A discussion of Reese et al. (2001) has been included in the text in Section III.B.4.a.

L-0035.066

The MMS does not anticipate any exploration activities, including seismic surveys, in the spring lead system area during the bowhead whale spring migration as a result of OCS Lease Sale 186. This area is far removed from existing infrastructure, and industry interest in the area is likely to be limited. Available technology and cost of operations likely would preclude operating in the spring lead system during the ice-covered period, which would include the spring migration period. Finally, should industry acquire leases in the area and technology is developed allowing operations to take place during the spring migration, the National Marine Fisheries Service May 25, 2001, Biological Opinion for the Beaufort Sea requires the MMS to reinitiate Section 7 consultation under the Endangered Species Act before such operations could be approved and proceed.

L-0035.067

A discussion of the study on the effects of seismic noise on gray whales near Sakhalin Island by Weller et al. (2002) has not been included in the text on bowhead whales. A much more relevant and more rigorously designed study conducted by LGL and JASCO Research in 2001 on the effects of seismic noise on bowhead whales in the Canadian Beaufort Sea has been included in the text in Section IV.C.5.a. A marine seismic program was conducted in an area off the MacKenzie Delta, where bowhead whales were feeding. The marine seismic monitoring program was modeled after the rigorous, peer-reviewed marine seismic monitoring programs conducted in the Alaskan Beaufort Sea in recent years and was conducted by the same contractor. These similarities (same species, equivalent monitoring program, same contractor) provide excellent continuity between the Alaskan Beaufort Sea studies and the Canadian Beaufort Sea study.

L-0035.068

See Response L-0035.001.

L-0035.069

Regarding the effects on bowhead whales from routine permitted activities, the MMS maintains that the effects to the whales themselves are not likely to be significant. Some whales may exhibit temporary avoidance behavior to seismic surveys, vessel and aircraft activities, drilling, and construction, but the overall effects to these individual whales and the population in general are likely to be temporary and nonlethal. The MMS is unaware of any studies that document significant effects (reduced feeding, decreased fitness, etc.) to bowhead whales from temporary displacement.

Under more recent collaborative and cooperative protocol, Conflict Resolution Agreements between the Alaska Eskimo Whaling Commission and industry have prevented any conflicts between subsistence whaling and seismic data-gathering efforts.

L-0035.070

Reference to the avoidance behavior as temporary is appropriate, because there is no indication that the behavior is permanent. As stated, the monitoring did not determine how far west the deflection extended due to limited survey effort, limited numbers of sightings in some key areas, and individual variability in the distances at which bowheads react. Richardson and Lawson (1999) stated the offshore deflection in 1998 apparently persisted for at least 40-50 kilometers west of the area of seismic operations but may not have persisted as far to the west in 1996 and 1997.

Richardson and Lawson (1999) also noted that the sighting rate within 20 kilometers of the area of seismic surveys was similar to that at more than 20 kilometers within 12-24 hours after the survey ended. This 40- to 50-kilometer distance west of the seismic area likely represents about 24 hours or less of travel time for a migrating bowhead whale. (Inupiat whalers estimate about 7 days for whales to travel from Kaktovik to Point Barrow, which means whales travel an average of about 45-50 kilometers per day. The average swimming speed of migrating bowheads appears to be about 2.5-3 kilometers per hour, or from 60-72 kilometers per day.) The MMS believes that a 24-hour deflection falls into the category of temporary avoidance rather than permanent avoidance.

Activities occur over multiple years, and bowheads could be displaced in sequential years, but this still would be a temporary event. Also, unless individual bowheads could be tagged and tracked from year to year, it is not possible to know if bowheads displaced in one year are the same as those that were displaced the previous year.

Although ship strikes have been responsible for deaths of right whales, the MMS is not aware of any documented ship strikes on bowheads in the Beaufort Sea. The low number of observations of ship-strike injuries suggests that bowheads either do not often encounter vessels, they avoid interactions with vessels, or that interactions usually result in the animal's death. The bowhead whales' association with sea ice and the lack of any reports of death by ship strikes suggest that bowheads either do not often encounter vessels or they avoid interactions with them.

To accommodate the comment, the wording in the text has been changed from "would be" to "are likely to be."

L-0035.071

The effects of an oil spill on bowhead whales are unknown. However, the MMS has drawn some conclusions from studies that have looked at the effects of oil on other cetaceans. Engelhardt (1987) theorized that bowhead whales would be particularly vulnerable to effects from oil spills during their spring migration into arctic waters because of their use of ice edges and leads, where spilled oil tends to accumulate. Several other researchers (Geraci and St. Aubin, 1982; St. Aubin, Stinson, and Geraci, 1984) concluded that exposure to spilled oil is unlikely to have serious direct effects on baleen whales. Other studies (Loughlin, 1994; Dahlheim and Matkin, 1994; Dahlheim and Loughlin, 1990) either documented no effects to cetaceans from spilled oil, or the results of the studies were inconclusive. Geraci (1990) reviewed a number of studies on the physiologic and toxic effects of oil on whales and concluded there was no evidence that oil contamination had been responsible for the death of a cetacean. Nevertheless, the effects of oil exposure to the bowhead whale population are uncertain, speculative, and controversial.

Based on these studies, some whales likely would experience temporary, nonlethal effects as a result of oiling their skin, inhaling hydrocarbon vapors, ingesting oil-contaminated prey, fouling their baleen, and temporary displacement from some feeding areas. Some whales could die as a result of contact with spilled oil, particularly if there is prolonged exposure to freshly spilled oil, such as in a lead. The extent of the effects would depend on how many whales contacted oil, the duration of contact, and the age/degree of weathering of the spilled oil. The number of whales contacting spilled oil would depend on the location, size, timing, and duration of the spill and the whales' ability or inclination to avoid contact. If oil got into leads or ice-free areas frequented by migrating bowheads, a large portion of the population could be exposed to spilled oil. Under some circumstances, some whales could die as a result of contact with spilled oil. Prolonged exposure to freshly spilled oil could kill some whales, but the number likely would be small.

The cultural and nutritional effects on communities, based on the *Exxon Valdez* spill, are discussed in depth in Section IV.C.16 - Environmental Justice. In the effects analyses for Subsistence-Harvest Patterns, Sociocultural Systems, and Environmental Justice, effects from an oil spill on the nutrition and culture of local communities are considered to be significant.

L-0035.072

The oil-spill probabilities are estimated from several sets of information, all which have their own uncertainties. The oil-spill estimates primarily are a product of the oil-resource volume times the spill rate to determine a mean spill number. Spill occurrence has been modeled previously as a Poisson process (Smith et al., 1982; Lanfear and Amstutz, 1983; Anderson and LaBelle, 1990, 1994).

The 75% and 95% confidence limits are approximately 7% and 16% above and below the mean, respectively. These confidence limits include only variance in the arctic effects. The confidence limits do not consider the variance in the baseline data (Gulf of Mexico and Pacific OCS spill statistics) or in the production estimates. Inclusion of these variances would, in our opinion, significantly increase the above variance.

L-0035.073

Although shipping activities have been responsible for deaths of right whales on the east coast, the MMS is not aware of any documented ship strikes on bowheads in the Beaufort Sea. The low number of observations of ship-strike injuries suggests that bowheads either do not often encounter vessels, they avoid interactions with vessels, or that interactions usually result in the animal's death. The bowhead whales' association with sea ice, the relatively low number of industrial vessels in the Beaufort Sea, and the lack of any reports of death by ship-strikes suggest that bowheads either do not often encounter vessels or they avoid interactions with them.

The MMS is unaware of any loss of marine cables (streamers) or ocean-bottom cables from seismic operations on the Beaufort Sea OCS. In 1997, some ocean-bottom cables were lost from a seismic survey in State of Alaska waters in the Beaufort Sea. As the name implies, these are cables laid on the seafloor and later recovered after the seismic survey has been completed. These cables were buried during a major storm. The industry conducted recovery operations for about a week trying to recover the cables. Because the cables were buried in the seafloor by several feet of sediment, only some of the cables were recovered. Bowhead whales are not likely to become entangled in these buried cables.

The MMS believes that offshore industrial activities in the Beaufort Sea likely would not result in increased mortality to bowhead whales as a result of ship strikes or entanglement with seismic arrays, cables, etc.

L-0035.074

We believe the references already provided in the text in Section IV.C.5.a adequately describe the potential effects of oil on cetaceans. The references discussed in the comment do not appear to provide any relevant new information not already included in the EIS and, in many cases, do not pertain to cetaceans.

L-0035.075

The EIS recognizes these potential spill effects on marine mammals; see Section IV.C.7.a(2)(b)1)a) - Direct Effects of Oil on Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales).

L-0035.076

The findings of neurological damage in harbor seals heavily oiled by the *Exxon Valdez* spill reported by Spraker et al. (1994) are likely to have been the result of oil being inhaled or aspirated into the lungs, as discussed as a potential effect in Section IV.C.7.a(2)(b)1)a) - Direct Effects of Oil on Marine Mammals (Pinnipeds, Polar Bears, and Beluga and Gray Whales). Oil that is inhaled into the lungs is quickly transported to the brain and other vital organs of the seal's body. If a large amount of toxic oil vapors are inhaled by heavily oiled seals, death is likely to occur.

L-0036

9/25/02

MR JOHN GOLL, REGIONAL DIRECTOR
ALASKA OCS REGION
MINERALS MANAGEMENT SERVICE
949 E. 36TH AVE ROOM 308
ANCHORAGE, AK 99508-4363

ANY PLAN TO DRILL FOR OIL WITHIN THE ARCTIC AREA IS TOTALLY NUTS !
HOW GREEDY AND REALLY STUPID !!!

THE NUMEROUS REASONS 'NOT TO' ARE WELL KNOWN AND SHOULD BE TAKEN SERIOUSLY.
DON'T CREATE A PLANET DISASTER.

RECEIVED
OCT 1 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

SINCERELY
JOHN E. VAN SYOC SR.

MMS Response to Comment Letter L-0036

No response necessary

United States Department of the Interior

L-0037

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska 99503-6199

RECEIVED
OCT 2 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

IN REPLY REFER TO:

AFES/FHC/FFWFO

SEP 30 2002

Memorandum

To: Regional Director - Minerals Management Service

From: Regional Director - Region 7

Subject: Comments on Draft Environmental Impact Statement Beaufort Sea Lease Sales 186, 195, 202

The U.S. Fish and Wildlife Service has reviewed the referenced Draft Environmental Impact Statement prepared by the Minerals Management Service for three oil and gas lease sales planned for the Beaufort Sea Outer Continental Shelf Planning Area. While we recognize that these comments are late, we are providing them for your consideration as you prepare the Final EIS for these lease sales. Under separate cover, the Service has forwarded you a draft Biological Opinion on Lease Sale 186 regarding the potential impacts on Steller's and spectacled eiders, both listed under the Endangered Species Act.

The Service understands the speculative nature of predicting locations, timing, and levels of exploration and development that may occur as a result of the proposed lease sales and the difficulties this presents when trying to analyze potential direct, indirect and cumulative impacts. We hope that the attached comments help MMS in its decision making regarding the proposed action. In our general comments we offer information on some important fish and wildlife species and areas that MMS should be aware of as it weighs its decision. Similarly, we have provided some more specific comments and additional scientific information that may be useful to the MMS in preparing the Final EIS.

We appreciate the opportunity to comment on the Draft EIS for Beaufort Sea OCS Oil and Gas Lease Sales 186, 195 and 202. If you have questions regarding these comments, please contact Jim Zelenak, Fairbanks Fish and Wildlife Field Office, at (907) 456-0354. Questions specific to polar bears may be addressed to Scott Schliebe, Marine Mammals Management, at (907) 786-3812, and those specific to migratory birds may be addressed to Russ Oates at (907) 786-3560.

Attachment

U.S. Fish and Wildlife Service Comments on the Draft Environmental Impact Statement prepared by the Minerals Management Service for Beaufort Sea Outer Continental Shelf Planning Area Lease Sales 186, 195 and 202

General Comments

Arctic National Wildlife Refuge

The Arctic National Wildlife Refuge (Refuge) encompasses a principally undisturbed Arctic ecosystem unique among Alaska's conservation system units. It provides important habitat for the Porcupine caribou herd, polar bears, snow geese, musk oxen and many other species. The Beaufort Sea Outer Continental Shelf (OCS) Planning Area includes tracts offshore of the Refuge that are proposed for leasing under Lease Sales 186, 195 and 202. Potential impacts to migratory birds, mammals, water, and other resources of the Refuge would be of significant concern to the Service. The offshore and nearshore marine waters adjacent to the Refuge provide habitats that are important to polar bears, caribou (insect relief), migratory birds, and bowhead whales.

Teshekpuk Lake

The Teshekpuk Lake area is known internationally for its outstanding wildlife values. The area contains a complex of wetland habitats that supports some of the largest concentrations of molting geese in North America; a variety of other waterfowl, including threatened spectacled eiders; and tens of thousands of breeding and staging shorebirds.

Molting, non-breeding or failed-breeding black brant that concentrate in the vicinity of Teshekpuk Lake often represent 20 to 30 percent of the continental population. Recent monitoring indicates that Harrison Bay, offshore of Teshekpuk Lake, supports concentrations of spectacled eiders and king eiders as well as high densities of scoters and red-throated and yellow-billed loons (Fischer et al. 2002). Offshore surveys conducted between Harrison Bay and Brownlow Point in 1999-2000 found the highest concentrations of king eiders in offshore waters (>10m depth) near Cape Halkett, to the northeast of Teshekpuk Lake (Fischer et al. 2002). A more expansive survey in 2001 between Barrow and Demarcation Point provided a direct measure of abundance and density of marine birds in waters offshore of Teshekpuk Lake (Fischer 2001). This survey showed high concentrations of king eiders in Harrison Bay and in offshore waters to the west of Harrison Bay, directly offshore of Teshekpuk Lake. More than 81 percent of the king eiders observed in this area occurred >10 km offshore. Moreover, satellite telemetry data indicate that offshore waters in Harrison Bay are an important stopover area in the migration corridors for post-breeding king eiders and other sea ducks (Dickson et al. 2000). Results of these surveys confirm the importance of nearshore and offshore waters adjacent to Teshekpuk Lake to molting and migrating waterfowl.

Migratory Birds

Breeding and molting waterfowl are sensitive to disturbance and may be particularly vulnerable to impacts of oil and gas development including oil spills, human activity (especially extensive boat, barge and low-level aircraft activity) and changes in the abundance and/or distribution of predators (Noel et al. 1999, Johnson 2000, Sovada et al. 2001). Breeding, staging and migrating shorebirds and landbirds are also likely sensitive to these types of disturbance. Migrating waterfowl are also susceptible to collisions with offshore structures; 22 common eiders, 8 long-tailed ducks and 5 king eiders died after colliding with the Northstar and Endicott offshore structures during the fall of 2001 (USFWS unpublished data).

Barrier islands and lagoons of the central Beaufort Sea provide important waterfowl breeding and molting habitats. Long-tailed ducks are the most abundant molting waterfowl in Beaufort Sea barrier island-lagoon systems (Noel et al. 1999); they occur in high densities throughout the lagoon system between Oliktok Point and Brownlow Point, with particularly high concentrations in the eastern portion from the Stockton Islands to Brownlow Point (Fischer et al. 2002, Noel et al. 2001). Aerial surveys indicate possible long-term downward trends in numbers of long-tailed ducks breeding on the Arctic Coastal Plain (Fischer et al. 2002, Mallek 2002) and molting in central Beaufort Sea barrier island-lagoon habitats (Noel et al. 2001).

Most common eiders that breed in Arctic Alaska nest on barrier islands (USFWS 1999, Johnson 2000), with a large proportion occurring from Flaxman Island west to Thetis Island. High densities of breeding common eiders occur in the Return Island group, just west of Prudhoe Bay (Dau and Anderson 2002) and among the Stockton Islands (Fischer et al. 2002). Long-term migration counts at Point Barrow indicate declines in populations of Beaufort Sea common and king eiders (Suydam et al. 2000).

Aerial surveys of lagoons and offshore areas between Harrison Bay and Brownlow Point in 1999-2000 found the highest densities of long-tailed ducks in near-shore habitats near Brownlow Point on the western border of the Refuge (Fischer et al. 2002). This area provides important molting habitat for long-tailed ducks. Numbers of molting long-tailed ducks in this region declined significantly between 1990 and 2000 (Fischer et al. 2002). This area may be particularly sensitive to impacts from human disturbance and development.

Given the importance of barrier islands, lagoons and offshore habitats to breeding, molting and migrating waterfowl, and the declining trends of some species dependent on these areas, the Service wants to highlight the importance of these areas as Lease Sales 186, 195 and 202 are being considered. We emphasize the need to acquire additional information regarding these habitats and the species utilizing them. The Service looks forward to working closely with MMS to delineate further studies that would provide the information needed to effectively conserve these resources.

Polar Bears

The Beaufort Sea OCS Lease Sale Area is within the range of the southern Beaufort Sea polar bear population; polar bears travel, feed, and den within the sale area. Offshore oil and gas exploration, development and production may affect polar bears. The most significant aspect of offshore activities is the potential for discharge of crude oil in the environment and its consequences to polar bears. The following comments summarizing recent research on polar bears are provided as an update to ongoing or new polar bear studies that may be useful for MMS in planning Lease Sales 186, 195 and 202.

The U.S. Fish and Wildlife Service, in cooperation with BP Exploration and LGL Limited, conducted aerial surveys in 2000 and 2001 along the coast and barrier islands of the Beaufort Sea between Harrison Bay (Atigaru Point) and Barter Island (Jago Spit). The purpose of the surveys was to document the distribution and abundance of polar bears during the fall open water period. Documenting the number, sex, and age of polar bears provides information useful for assessing the effects of various on-and off-shore exploration and production activities on polar bears, and it allows for implementing better strategies related to human activities in polar bear habitat. Preliminary results indicate that at least half of the bears observed in nearshore areas are family groups consisting of females with cubs of the year and females with 1-2 year old cubs (yearlings). The numbers of polar bears present along nearshore habitats varied by survey and by year. The majority of bears were observed on barrier islands with high numbers of bears present near Barter and Cross Islands. An interim report (Kalxdorff et al. 2002) is available, and additional surveys are planned for 2002. Final reports summarizing results for 2000-2002 and any future surveys will also be prepared. A ground-based study sponsored by the MMS on the demography and behavior of polar bears at Cross and Barter Islands is also currently underway and will continue through 2004, with interim and final reports to be prepared as data become available.

Simac et al. (2001) tested the use of forward-looking infrared (FLIR) technology to detect maternal polar bear dens in northern Alaska. The FLIR is a thermal imaging system with a sensor that can be mounted on the nose or belly of fixed wing aircraft or helicopters. The sensor is connected to a high-resolution monitor and a digital video recorder inside the aircraft that indicates the presence of a polar bear (or other warm objects) as a white or glowing spot (hot spot) on a relatively dark background. Polar bears suspected to be pregnant were captured and radio-collared in 1999-2001. Once females had entered their dens for the winter, aerial surveys were conducted at various altitudes, temperatures and weather conditions. The study showed that detection of maternal dens by FLIR is highly dependent on environmental conditions, especially ambient moisture levels (e.g., fog, mist or wind blown or falling snow) and sunlight. The greatest success in detecting dens occurred when viewing terrestrial habitat during early morning hours when air moisture was minimal. Under the right conditions, FLIR may be a useful tool in identifying maternal dens that may be affected by oil and gas operations.

Last spring, LGL Limited and U.S. Geological Survey (USGS)/Biological Resources Division conducted a test to determine the ability of trained dogs to locate polar bear dens. The tentative results of this study show promise in using dogs to confirm the presence or absence of polar bear dens. This technique, combined with the results of FLIR overflights, may be useful in locating dens prior to oil and gas exploration and development activities.

The USGS, Alaska Science Center has been studying the effect of changing sea ice patterns on polar bear foraging habitat. Through the use of National Ice Center data, weekly ice charts available as ARC INFO polygon coverages are overlain with polar bear satellite location data. Ice data include percent concentration, ice form and ice thickness. Preliminary analysis indicates that polar bears do not use habitat in proportion to availability; rather, a preference for the use of thin first-year ice appears to exist. Analysis techniques are being further refined, and results will be available in the next few years. This information may be useful to help minimize potential impacts to polar bears in offshore areas where oil and gas exploration and development are planned.

Amstrup et al. (2001) and Durner et al. (2001) modeled the impacts of a hypothetical oil spill from BP Exploration's Liberty Oil Production Island and sub-sea pipeline into Beaufort Sea waters. Impacts were modeled by overlaying hypothetical oil spill trajectories with grids that represent polar bear distribution during the open water period (September) and mixed ice period (October). The Draft EIS cites Amstrup et al. (2000) as the source for the estimate of the number of bears likely to be contaminated. If the Draft EIS used either Amstrup et al. (2001) or Durner et al. (2001) as the source of the estimates, the Final EIS should note that those analyses were based on spills of specific duration occurring at a specific location at a specific time of year. Impacts from spills occurring elsewhere, at other times of the years, or for greater duration would likely yield different results. A thorough assessment of oil spill modeling, probabilities and potential effects on polar bears is beyond the scope of this review and is not provided at this time. However, the Service will continue to evaluate oil spill information and seek input from others with respect to the development of incidental take regulations for polar bears in the Beaufort Sea. .001

Specific Comments

Page ExSum-4, paragraph 3: Estimates of king eider mortality resulting from an oil spill do not take into account turn-over rates of migration. If a spill occurred during a period when king eiders are migrating, the impact of spilled oil will be cumulative as eiders move through the area until all oil is removed from the spill area. Dickson et al. (2000) showed that post-breeding king eiders migrate through the proposed lease area up to 38 km offshore, frequently staging on the surface to rest. Consequently, the Draft EIS should reflect that mortality should be referred to as a minimum estimate, and acknowledge that actual levels of mortality are unknown. .002

Page ExSum-5, Cumulative Effects: Here, and elsewhere in the Draft EIS (Table A.1-2, Volume III, Appendices), the authors state that migratory birds are in the region only 3-5 months of the year, further reducing the likelihood that they would be impacted by an oil spill. This assessment is dependent upon the assumption that if an oil spill occurred during the spring, fall, or winter months, all spilled oil would be removed from the region prior to the arrival of .003

migratory birds. The Draft EIS correctly points out that some (possibly most) spilled oil will not be recovered due to limitations of available technology (Robertson and DeCola 2000). Due to the limitations of oil containment and recovery in broken ice conditions, the fact that migratory birds are only in the region 3-5 months of the year is less relevant. If oil is not removed from the environment, an oil spill in winter may still contact migratory birds when they return from wintering grounds. The Final EIS should acknowledge that oil spills that occur at any time during a given year could impact migratory birds and other wildlife. .003

Page ExSum-5, Cumulative Effects: Cumulative impact analysis is difficult even when dealing with a clearly defined development. The Service recognizes the difficulties of analyzing cumulative effects when dealing with the limitless possibilities of a lease sale. Because it is so difficult to predict the industry's response to the Lease Sale, MMS could consider as part of its cumulative effects analysis providing a discussion that covers the range of impacts that could be expected based on past, current and future offshore developments from a low to a high response to the sale. .004

The Draft EIS estimates that Lease Sale 186 would contribute 9 percent of offshore cumulative effects. This estimate seems low given that the sale assumes three offshore developments (2 near-zone and 1 mid-zone), and the only other currently operating facilities that could be considered offshore are West Dock, Endicott and Northstar. Therefore, developments anticipated to result from the first sale would represent 50 percent (3 of 6) of offshore developments, and contribution to cumulative effects would likely be at least proportionate. Even if Liberty, McCovey and possibly Point Thomson are included in the analysis, Sale 186 developments would represent 33 percent (3 of 9) of offshore developments, and contribution to cumulative effects would still be considerably higher than the 9 percent presented in the Draft EIS.

Page ExSum-5, paragraph 2: The parenthetical list of key resources at the bottom of this paragraph should include threatened eiders. .005

Page ExSum-7, paragraph 1: The Draft EIS states that Stipulations 1 and 5 have been modified from those adopted in Lease Sale 170, but the nature of the changes or the reasons for them are not presented here or in section II.II. The Final EIS should specify these changes and the reasons for them. .006

Page III-42, paragraph 3: Shallow and deep waters are defined differently throughout the Draft EIS. In the summary of Service surveys, "deeper waters" should be consistently defined as >10m depth. .007

Page III-42, paragraph 3: The citation "Fischer 2002" should be Fischer 2001. Correct this in other locations throughout the document including Biblio-16. .008

Page III-42, paragraph 4: The section does not discuss Steller's eider use of Beaufort Sea. Three Steller's eiders were observed in the nearshore waters of Smith Bay during Service surveys in July 2001 (Fischer 2001). This information can also be incorporated into IV-87. .009

Page III-43, paragraph 3: The Final EIS should indicate that common eiders have been documented nesting along the mainland coast near Point Thomson (in addition to the islands). Also, indicate that a variety of shorebirds nest on tundra portions of the offshore barrier islands including dunlins, semipalmated sandpipers, American golden-plovers; other likely nesters include semipalmated plovers, pectoral sandpipers, red-necked and red phalaropes; nesting landbirds include redpolls, Lapland longspurs, and snow buntings (unpublished data from fieldwork conducted by USGS in 1999-2002). .010

Pages III-43 and 44, Section III.B.5.a(3): The Final EIS should expand the section on shorebird use of shorelines of the Beaufort Sea based on current information. This should include that: 1) in early June and middle June, pre-breeding adults of a few species, such as sanderlings, Baird's sandpipers, and semipalmated plovers, occur in early-opening gravel and mud areas on some beaches and at pools near lagoons; 2) from late June through early July, a movement of non-breeding and post-breeding adults of several species occurs, with flocks and individuals using habitats at edges of small coastal lagoons and nearby brackish pools; 3) late July and early August, adults relieved of parental duties flock in littoral (i.e., shoreline areas) areas prior to migration; and 4) August and September, juvenile semipalmated sandpipers and red phalaropes feed along inner lagoon margins in preparation for migration. Indeed, shoreline use by red phalaropes is extensive, and numbers exceeding 500 per kilometer of gravel beach have been reported on the Barrow Spit. Disruption of postbreeding adults and juveniles may hamper their ability to put on critical energy reserves needed to migrate (Conners 1976). High numbers of red phalaropes have been observed in the Simpson Lagoon area by USGS personnel (unpublished data, 1999-2002). .011

Page III-44 and 45, III.B.5.b: Indicate that sandpipers and phalaropes use littoral areas in addition to wet-tundra habitat during pre- and post-breeding. .012

Page III-47: The document indicates that the southern Beaufort Sea polar bear population has increased over the past 20-30 years at 2 percent per year and is believed to be increasing slightly or stabilizing near its carrying capacity. The most recent Stock Assessment for Southern Beaufort Sea bears concluded that recent analyses confirm that this stock experienced growth during the late 1970s and 1980s, then stabilized and experienced little or no growth during the 1990s (Amstrup et al. 2001). The change in population trend from a state of growth to one of stability is an important distinction that has implications for assessing potential population effects and recovery rates. This change in trend and an analysis of its impact on population dynamics and potential recovery rates should be presented in the Final EIS. .013

Page IV-80, paragraph 3: The authors state that recovery of spectacled eiders from disturbance losses will be slow while the population is in declining status. Because the status of the North .014

Slope-breeding population is unclear, it should be stated that the population could be expected to recover slowly from disturbance-related losses if it is increasing or perhaps stable. However, if the population is in decline, it will not recover from disturbance-related losses. .014

Page IV-81, paragraph 4: In discussing the effects of discharges on spectacled eiders, the authors state, "...there likely is sufficient time between sales for the population to recover from the minor effects that may result from each sale." As stated above, this would be true for an increasing and perhaps for a stable population. However, the Final EIS should acknowledge that if the population is declining, it will not recover between sales even if the losses are "minor." .015

Page IV-82, paragraph 1: The Draft EIS states that birds experiencing moderate to heavy oil contact are unlikely to survive. This implies that lightly oiled birds would be expected to survive. However, in cold water habitats even light oil contact will likely result in mortality. The authors should consult the published literature and clarify in the Final EIS. (Same comment for page IV-87, paragraph 6 and page IV-92, paragraph 3.) .016

Page IV-83, paragraph 2: The Draft EIS states "Regardless of the factors...complete recovery of the Arctic Coastal Plain spectacled eider population from even small losses in the proposed sale area may be slow...." Again, slow recovery could reasonably be expected of a growing and possibly of a stable population, but if the population is in decline, then even slow recovery is not likely. In view of the cumulative, non-compensatory nature of mortality in low productivity Arctic breeders (Goudie et al.1994), caution should be exercised to be conservative and not further expose the population to loss. The Draft EIS correctly states (page IV-83, paragraph 3) that recovery from substantial mortality is not likely to occur while the population is declining. .017

Page IV-84, Effectiveness of Mitigation Measures: The mitigation measures identified and discussed in the EIS are reasonable and a good starting point, but we caution that these measures may need to be expanded as we learn more about a number of wildlife/development issues in the Beaufort Sea. These issues include the potential for bird collisions with offshore facilities and the importance of specific offshore areas to molting and staging. Research currently underway at the Northstar facility and existing literature (e.g., Weir 1976) should provide further direction regarding bird collisions and potential mitigation measures. However, mitigation measures are still being investigated at Northstar and more research may be needed to determine appropriate facility construction requirements in the Beaufort Sea. In addition, we are not aware of information that suggests Cross Island may be no more or less susceptible to bird collisions than other sites within the planning area. .018

Page IV-90, paragraph 2: For clarity, the authors should specify that the eiders breeding on barrier islands are common eiders. .019

Page IV-90, paragraph 2: Referring to aircraft disturbance, the Draft EIS correctly points out that eider nesting colonies and long-tailed duck molting concentrations are "particularly susceptible." We also suggest that you consult (Johnson 1984, 1985; Johnson et al. 1987) for additional .020

research on long-tailed ducks and common eiders within the planning area. Brant and snow geese, two species highly sensitive to aircraft disturbance, also use islands and coastal habitats within the planning area (Johnson and Troy 1987) and potential impacts on their nesting and molting (Derksen et al. 1992) could occur. .020

Page IV-90, paragraph 5-6: In discussing disturbance from boat-traffic, the Draft EIS states "...no significant overall effect is likely to result from these minor adverse effects...." We want to point out that (Thiel et al. 1992) documented that molting seaducks are very vulnerable to boat disturbance. Additional published literature is likely available on this topic and could be included in the Final EIS. .021

Page IV-99: The discussion of effects of noise and disturbance from routine exploration activities and support for production facilities should include the potential for disturbance to denning polar bears (e.g., winter seismic exploration, exploratory drilling, etc.). .022

Page IV-107, paragraph 4: The Draft EIS states that polar bears would be most vulnerable to oil spill contamination along the ice-flaw zone north of Point Barrow east to Demarcation Bay. This is a very broad area that bisects the entire lease sale area. This section of the Draft EIS also states that the loss of 20-30 bears would be replaced by recruitment "within 1 year up to more than one generation (7-10 years)." Elsewhere in the document, recovery of a wider range and smaller numbers of bears is forecasted to occur within 1 year: (5-30 polar bears, page IV-138; 6-10 polar bears, page V-47), and recovery from the loss of up to 128 polar bears due to a very large oil spill (180,000 bbl) is estimated at 1 to 2 generations (up to 15 years, page IV-217). Any references or rationale to support the predicted recovery times would be useful. A clear explanation of how the numbers of impacted polar bears were derived would also be useful. It should be noted that recovery "in-kind" cannot occur within 1 year, although recovery to former population size may be possible for a population experiencing growth (however, as noted above, the most recent assessment of this population indicates it is stable, not growing). .023

Page IV-139, IV.C.11.b(2)(b)5: We suggest that the statement "common eiders [as an example] are not likely to suffer high mortality as a result of an oil spill, because they are not abundant in most of the proposed sale area...." is incorrect. Rather, the vast majority of the Pacific wintering population of common eiders moves through the Beaufort Sea in spring and fall. Significant proportions of this population could be susceptible to oil spills. In addition, the locally breeding common eiders, that nest on barrier islands during June through August, raise their young in lagoons during August and September when open water would spread and expose animals to any oil spill. Given that the combined population of U.S. and Canadian breeding common eider appears to be declining and that recruitment into the Alaskan population during the past 3 years has been close to zero (see Lanctot et al. 2001; USGS, unpubl. data), this species, as well as other sea duck species, is vulnerable to a spill. .024

Page IV-199, IV.G.6: In this paragraph, the authors suggest that alternate habitat areas for critical activities of marine and coastal birds are available. Given the lack of information on .025

habitat quality along the coast, this conclusion may be unfounded and additional information is needed to support this statement. .025

Page V-44, paragraph 5: The section on effects of noise and disturbance on polar bears indicates that current information on the distribution of den locations near oil facilities does not show that bears were permanently displaced from denning habitat. It would be very helpful if a reference were provided to support this statement. .026

Page V-45, paragraph 2: Although the Service 1-mile buffer for polar bear dens theoretically applies to all occupied dens, known den locations determined from telemetry or FLIR data represent only a small fraction of dens occupied in a given year and the majority remain unknown. Bears that occupy dens of unknown location are not effectively protected by the 1-mile buffer, and they may be disturbed by oil and gas exploration and development activities. .027

Literature Cited

Amstrup, S.C., T.L. McDonald, and I. Stirling. 2001. Polar bears in the Beaufort Sea: A 30-year mark-recapture case history. Journal of Agricultural, Biological, and Environmental Statistics, Vol. 6(2): 221-234.

Conners, P.G. 1976. Shorebird dependence on Arctic littoral habitats. Environmental Assessment of the Alaskan Continental Shelf Vol. 2. Marine Birds.

Dau, C.P. and P.D. Anderson. 2002. Aerial population survey of common eiders and other waterbirds in the nearshore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 25-29 June, 2002. U.S. Fish and Wildlife Service, Anchorage, Alaska.

Derksen, D.V., K.S. Bollinger, D.Esler, K.C. Jensen, E.J. Taylor, M.W. Miller and M.W. Weller. 1992. Effects of aircraft on behavior and ecology of molting black brant near Teshekpuk Lake, Alaska. Final Report to BLM and MMS. U.S. Fish and Wildlife Service. 227pp.

Dickson, D.L., R.S. Suydam and G. Balogh. 2000. Tracking the movement of king eiders from nesting grounds at Prudhoe Bay, Alaska to their molting and wintering areas using satellite telemetry. 1999/2000 Unpublished Progress Report, Canadian Wildlife Service, Edmonton, Alberta.

Durner, G.M., S.C. Amstrup, and T.L. McDonald. 2001. Estimating the impacts of oil spills on polar bears. Arctic Research of the United States 14:33-37.

Fischer, J.B. 2001. Beaufort shelf offshore survey, July 23-26, 2001. Unpublished trip report. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska.

Fischer, J.B., T.J. Tiplady, and W.W. Larned. 2002. Monitoring Beaufort Sea waterfowl and marine birds, aerial survey component. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska. OCS study, MMS 2002-002.

Goudie, R.I., S. Brault, B. Conant, A.V. Kondratyev, M.R. Petersen and K. Vermeet. 1994. The status of sea ducks in the North Pacific Rim: towards their conservation and management. Trans.N. Am. Wildl. Nat. Res. Conf. 59:27-49.

Johnson, S.R. 2000. Pacific eider. Pages 259-275 *in* Truett, J.C. and S.R. Johnson, eds., The natural history of an arctic oil field: development and the biota. Academic Press, San Diego, California.

Johnson, S.R. 1985. Adaptations of the long-tailed duck (*Clangula hyemalis* L.) during the period of molt in Arctic Alaska. Proc. Int. Ornithol. Cong. 18:530-540.

Johnson, S.R. 1984. Habitat use and behavior of nesting common eiders and molting oldsquaws at Thetis Island, Alaska during a period of industrial activity. Unpubl. Rept., LGL Alaska Research Associates for Sohio Petroleum Co., Anchorage, Alaska.

Johnson, S.R. and D.M. Troy 1987. The status of lesser snow geese in the Sagavanirktok River Delta area, Alaska: A 7-year summary report. Unpublished report sponsored by BP Exploration (Alaska) Inc., Anchorage.

Johnson, S.R., D.R. Herter and M.S.W. Bradstreet. 1987. Habitat use and reproductive success of Pacific Eiders *Somateria mollissima v-nigra* during a period of industrial activity. Biol. Conser. 41:77-90.

Kalxdorff, S., S. Schliebe, T. Evans, and K. Proffitt. 2002. Aerial surveys of polar bears along the coast and barrier islands of the Beaufort Sea, Alaska, September-October 2001. U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, Alaska. 27pp.

Lanctot, R.B., J. Reed, D. Lacroix, P. Flint, J.C. Franson, T. Hollmén, M.D. Howell and J.B. Grand. 2001. Monitoring Beaufort Sea waterfowl and marine birds, 2001 Annual Progress Report. Report for Minerals Management Service by U. S. Geological Survey, Anchorage, Alaska. 70pp.

Mallek, E.J. 2002. Aerial breeding pair surveys of the Arctic Coastal Plain of Alaska - 2001. Unpublished Report, U.S. Fish and Wildlife Service, Migratory Bird Management, Fairbanks, Alaska.

Noel, L.E., S.R. Johnson, and R. Rodrigues. 2001. Aerial surveys of molting waterfowl in the barrier island-lagoon systems between Spy Island and Brownlow Point, Alaska, 2000. Report for BP Exploration (Alaska) Inc. by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

Noel, L.E., S.R. Johnson, and P.F. Wainwright. 1999. Aerial surveys of molting waterfowl in the barrier island-lagoon systems between Spy Island and Brownlow Point, Alaska, 1999. Report for BP Exploration (Alaska) Inc. by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

Robertson, T.L. and E. DeCola. 2000. Joint Agency Evaluation of the Spring and Fall 2000 North Slope Broken Ice Exercises. 47pp.

Simac, K., S.C. Amstrup, G. Weston-York, T. McDonald, G. Durner, and A. Fischbach. 2001. Forward looking infrared (FLIR): a new method for detecting maternal polar bear dens. Presented at the 14th Biennial Conference on the Biology of Marine Mammals, Vancouver, Canada, November 28-December 3, 2001.

Sovoda, M.A., R.M. Anthony, and B.D.J. Batt. 2001. Predation on waterfowl in arctic tundra and prairie breeding areas: a review. Wildlife Society Bulletin 29:6-15.

Suydam, R.S., D.L. Dickson, J.B. Fadely, and L.T. Quakenbush. 2000. Population declines of king and commom eiders of the Beaufort Sea. Condor 102:219-222.

Thiel, M., G. Nehls, S. Brager and J. Meissner. 1992. The impact of boating on the distribution of seals and moulting ducks in the Wadden Sea of Schleswig-Holstein. Netherlands Institute for Sea Research, Pub. Ser. No. 20 (1992): 221-233.

U.S. Fish and Wildlife Service. 1999. Population status and trends of sea ducks in Alaska. U.S. Fish and Wildlife Service Report, Migratory Bird Management, Anchorage, Alaska.

Weir, R.D. 1976. Annotated bibliography of bird kills at man-made obstacles: A Review of State of the Art and Solutions. Environ. Manage. Ser., Can. Wildl. Ser., Ontario. 85pp.

MMS Response to Comment Letter L-0037

L-0037.001

The draft EIS did not use Amstrup et al. (2001) or Durner et al. (2001) as a source for estimates of the number of polar bears effects by a potential oil spill.

See also Response PH-Anchorage.028.

L-0037.002

The potential influence of turnover rates during, for example, king eider migration, is discussed in Section IV.C.6.a(2)(b)2)b). Dickson, Suydam, and Balogh (2000) are cited in Section III.B.5.a. Minor revisions of mortality-level statements clarify the severity implied by such statements in the Executive Summary, Large Oil Spill, third paragraph. However, some substantial mortality estimates cited are not likely to be minimum estimates.

L-0037.003

The possibility that all oil from a spill may not be cleaned up and, thus, might contact birds in the year(s) following a spill, is discussed in Section IV.C.6.a(2)(b)2)a). The potential for cumulative effects has been added to the Executive Summary, Cumulative Effects.

L-0037.004

Sale 186 should contribute more than 9% to the offshore cumulative effects, based on the number of currently operating facilities.

The MMS has selected overall production as a more realistic indicator of potential disturbance from operations and oil spills using the number of oil spills and oil-spill rates based on volume of oil produced. While the most likely number of spills for Sale 186 is zero, a contribution factor from the proposed lease sale based on the fractional increase in the estimated mean number of spills can be determined (Table V-12). The overall production volume also gives a good indication of disturbance and habitat effects from past, present, and reasonably foreseeable future activities (Table V-7b). In would be inappropriate to treat all platforms as equal, because we know some are high producers that are more likely to have an accident and there also are more activities associated with the high production. This would result in low production platforms being overweighed in their respective perturbation contribution. Also, the contribution of three platforms from the proposed multiple-sale scenario would be significantly less when past activities are factored in, as required by NEPA, because most of the activities on the Beaufort Sea offshore environment have failed or resulted in no commercial discoveries.

L-0037.005

Eiders have been included as a resource of concern that warrants continued close attention.

L-0037.006

Reference is made to page II-9 of the draft EIS under the heading II.H - Mitigating Measures, second paragraph. Some of the stipulations included in this analysis as assumed mitigating measures from past OCS oil and gas lease sales in the Beaufort Sea have been slightly reworded to bring them up to date with current information and situations (i.e., Protection of Biological Resources). Other changes were simply editorial (Conflict Avoidance Mechanisms to Protect Subsistence and Other Subsistence-Harvest Activities). Similarly, the third paragraph explains minor changes to the ITL clauses.

L-0037.007

A revision has been made to Section III.B.4.a(2)(b) that qualifies that deeper waters are greater than 10 meters in depth.

L-0037.008

Fischer (2002) has been replaced with Fischer (2001) in Sections III.B.4.a(2)(b), IV.C.6.a, and the Bibliography.

L-0037.009

The Steller's eider sightings information has been added to Sections III.B.4.a(2)(c), IV.C.5.c(1)(a)1)a), and IV.C.5.c(1)(b)2).

L-0037.010

The information on bird use of the barrier islands, supplied by the Fish and Wildlife Service, has been added to Section III.B.5.a(2).

L-0037.011

The shorebird habitat use and timing information supplied b y the Fish and Wildlife Service has been added to Section III.B.5.a(3).

L-0037.012

The habitat information supplied by the Fish and Wildlife Service has been added to Section III.B.5.b.

L-0037.013

The suggested change in the polar bear population trend from increasing at 2% to stable or slightly increasing in the stock assessment conflicts with statements made by Amstrup, McDonald, and Stirling (2001) about the size of the southern Beaufort Sea population of polar bears. The latter investigators suggest that this population number is "over 2,500 bears—many more than previously hypothesized." This information suggests that the southern polar bear population is larger than previously thought and, therefore, is more likely to sustain a one-time loss from a potential oil spill than previously thought.

L-0037.014

See Response L-0037.015.

L-0037.015

The comment regarding recovery of declining populations is discussed in PH-Barrow.018. Revisions dealing with this topic have been made in Sections IV.C.6.a(2)(b)2)c), IV.C.5.b(1)(a)1)a), and IV.C.5.b(1)(b)3).

L-0037.016

Appropriate revisions dealing with the severity of effects for oiled birds have been made in Sections IV.C.5.b(1)(b)2)b), IV.C.5.c(1)(b)2), and IV.C.6.a(2)(b)2).

L-0037.017

See Response L-0037.015.

L-0037.018

Terms and Conditions in the recently issued Biological Opinion for the Beaufort Sea Planning Area (October 22, 2002) requires that the Fish and Wildlife Service and the MMS cooperatively develop a lighting protocol to facilitate birds avoiding drilling structures. This effort will take place at Northstar Island.

The commenter is correct in assuming no information indicates that birds approaching Cross Island are no more or less susceptible to collision than elsewhere.

L-0037.019

The eider discussed at this point has been specified as common eider, Section IV.C.6.a(1)(a)1).

L-0037.020

A brant and snow goose discussion and long-tailed duck and common eider references have been added to Section IV.C.6.a(1)(a)1) concerning potential effects of aircraft disturbance.

L-0037.021

Additional documentation has been added to the discussion of vessel-traffic effects in Section IV.C.6.a(1)(a)1); however, MMS does not consider that the overall effect is likely to be sufficiently substantial to satisfy the definition of “significant” in this document.

L-0037.022

The text in Section IV.C.7.a(1)(b) - Effects of Seismic Activities has been revised in response to this comment.

L-0037.023

The estimate of 5-30 bears is based on the number of polar bears observed at whale carcasses, which is based on aerial survey data (see Sections IV.C and IV.A(2)(b)2) on specific effects of a large [1,500- or 4,000-barrel] oil spill). The more likely loss of 6-10 bears is based on the high density of 1 bear per 25 square kilometers times the area swept by a 1,500-barrel or 4,000-barrel spill (see the referenced section). The potential loss of up to 128 bears is based on the density of 1 bear per 25 square kilometers times the area swept by the 180,000-barrel spill, assuming all bears in the vicinity die (see Section IV.I.2.g). The MMS is concerned with the welfare of the polar bear population. “In-kind” replacement of individual bears of a certain age and sex should not be an issue in the conservation of polar bears.

See also Response L-0037.022**.**

L-0037.024

The common eider has been deleted from the discussion in Sections IV.C.11.b(2)(b)5) and IV.C.6.a(2)(b)2)c) as an example of a species that might not experience substantial losses from an oil spill because of numbers present or distribution. Clarifying revisions concerning population recovery have been incorporated in this discussion.

L-0037.025

Section IV.G.6 on the irreversible and irretrievable commitment of bird resources has been revised for greater specificity. However, it should be noted that there is little indication that nesting, staging, or foraging habitats for any species on the Arctic Coastal Plain is at carrying capacity.

L-0037.026

The MMS is not aware of any published information that shows that the locations of polar bear have been affected by oil facilities. Therefore, we assume in the absence of data that there is no effect. If the Fish and Wildlife Service has data to support a hypothesis that denning has been affected by oil facilities, we would appreciate receiving it and we will incorporate it in our NEPA analysis in the future.

L-0037.027

Although unknown den locations are not effectively protected by the 1-mile buffer, the chance that numbers of unknown denning polar bears would be disturbed during the winter season is very unlikely. Den locations vary greatly both on- and offshore, and they are widely dispersed both on and offshore.

L-0038

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

RECEIVED
OCT 8 - 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Reply To
Attn Of: ECO-088

OCT - 3 2002

02-044-MMS

Paul L. Lowry
Minerals Management Service
949 East 36th Ave., Rm. 308
Anchorage, AK 99508-4302

Dear Mr. Lowry:

The Environmental Protection Agency (EPA) has reviewed the draft Environmental Impact Statement (EIS) for the *Beaufort Sea Planning Area for Oil and Gas Lease Sales 186, 195, and 202* in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. The draft EIS assesses impacts associated with the proposed action (sales of 1,877 lease blocks in the Beaufort Sea Planning Area in years 2003, 2005 and 2007), the no-action alternative, and four deferral alternatives.

The EPA has rated the draft EIS, EO-2 (Environmental Objections-Insufficient Information). Enclosed is a copy of the rating system used to conduct our review. EPA has objections to the proposal since it did not include the deferral lease blocks that were associated with the four deferral alternatives (Alternatives III - VI). EPA also believes that portions of the analyses addressing impacts to whale hunting and environmental justice need to be strengthened. Additionally, EPA has concerns about the potential impacts of oil spills, noise disturbance, and the presence of vessels and structures on declining populations of listed eiders and the significance thresholds.

Subsistence Whaling

.001

Each of the alternatives III through VI mitigate potential impacts to subsistence whaling by setting aside areas that protect subsistence whale areas. These deferral areas are not part of MMS' proposed action. EPA strongly recommends that the proposed action be revised to include all deferral areas contained in Alternatives III-VI. Without inclusion of these deferral areas, EPA believes that the proposed action will have high and disproportionate impacts on some or all of the Inupiat communities because of the impacts on their subsistence lifestyle.

.002

Specifically, four of the five action alternatives defer areas from oil and gas leasing to enable subsistence whaling activities to continue and are referred to in the EIS as the deferral alternatives. Each of the four deferral alternatives protects the whaling area or a portion of the whaling area of only one of three Inupiat communities. This arrangement forces a decision maker to choose protecting the environmental resources critical for one community's subsistence needs while allowing significant adverse impacts to the subsistence needs of two other communities. The only other alternative left to the decision maker is to select the proposed

Printed on Recycled Paper

action which does not provide protection to subsistence whaling for any of the communities. The absence of an alternative which would protect whaling areas for all three communities appears inconsistent with 40 CFR 1502.14, which requires that the EIS rigorously explore and objectively evaluate all reasonable alternatives. The proposed action should be revised to protect environmental resources adequately enough to ensure the continuation of subsistence whaling activities by all Inupiat communities. .002

The EIS should describe on what basis these alternatives were developed. It is not evident from reviewing the draft EIS whether deferral alternatives are based upon traditional knowledge provided by the subsistence whaling community and how the alternatives address their concerns. While Appendix E of the draft EIS contains scoping comments that Inupiat and non-Inupiat parties raised concerning the potentially significant impacts of action alternative to subsistence whaling, it appears that: 1) neither the mitigation measures nor the alternatives in the draft EIS adequately address the concerns expressed by these parties; 2) those impacted have not had meaningful participation developing information supporting the decisions that will impact them; and 3) that Environmental Justice requirements have not been adequately addressed. The EIS should explain how the information provided by the subsistence whaling community was used in the development of the alternatives and how the impacts for the preferred alternative would consequentially affect them. .003

The draft EIS appears to use only information on past whale strikes to define withdrawal areas for protecting subsistence whaling. This approach does not consider other important areas that are of critical importance for successful whale hunts, namely whale migration routes and the staging areas for whalers. Unless impacts to these areas are considered as well, it is not possible to evaluate the indirect impacts on subsistence hunters. For example, the draft EIS states that both scientific and traditional knowledge support the belief that noise and disturbance cause bowhead whales to take evasive actions. Changes in the migratory routes of whales from their historic patterns would likely affect subsistence whalers' access to whales and their success rate. These impacts, and other impacts to areas and resources important to a subsistence way of life, should be analyzed. Based on this analysis, it appears appropriate to expand protection areas (deferred leasing blocks) for subsistence whaling to include migratory routes and staging areas. .004

The analysis of the effects from a potential oil spill should be more rigorous and additional measures to prevent an oil spill should be put in place. The draft EIS states that in three oil spill cleanup drills, the industry has not proven its ability to adequately clean up spilled oil with mechanical equipment in relatively calm environmental conditions in ice-infested waters. This finding and the low success rate of oil spill clean up near shore and in other ice conditions highlights the need to take all available precautions to prevent oil spills. The draft EIS does not prescribe additional needed measures to prevent oil spills and instead accepts the 8-10% chance of an oil spill as insignificant without containing analyses that demonstrates that such a risk is acceptable for the various resources at risk. The EIS should contain additional measures for preventing oil spills or support with analysis conclusions that an 8-10% chance of an oil spill is insignificant, especially for animals hunted for subsistence, subsistence hunters and consumers, and threatened, endangered, and sensitive species. As part of this analysis, the EIS .005 .006 .007

should use scientific and traditional knowledge to describe the health effects and the effects on .007
the perceived palatability of eating contaminated foods. Finally, the EIS should "analyze and
evaluate... the equity of the distribution of benefits and risks..." of oil and gas exploration and .008
development to the potentially impacted "minority and low-income populations and
communities" consistent with Environmental Compliance Memorandum No. ECM95-3, dated
May 30, 1995.

The EIS should describe the methodology for identifying Barrow, Nuiqsut, and Kaktovik
as the only subsistence communities potentially affected by action alternatives. In particular, the .009
EIS should describe the 31% of the population of the North Slope Borough not located in
Barrow, Nuiqsut, and Kaktovik in its Environmental Justice analysis. Without this explanation
and analysis it is unclear how an evaluation of the equity of the distribution of benefits and risk
could be conducted. Also, to mitigate the environmental impacts of the leasing, and avoid the
risk of creating disproportionately high and adverse impacts, the EIS should also contain
assurances that the behavior and abundance of animals hunted for subsistence purposes .010
elsewhere (i.e., Point Hope and Wainwright) are not significantly affected by proposed activities
in the project area.

Finally, the EIS largely bases analyses of cumulative effects on past, present, and
predicted future oil and gas activities in the project area rather than around affected resources. .011
The draft EIS concludes that there are limited cumulative effects because oil and gas activities
take place in a small percentage of the project area and that existing low oil and gas prices
suggest a slow rate of exploration and development in the foreseeable future. This conclusion
does not consider how important location is to the type and extent of resource effects. For
affected resources, especially subsistence resources and their users, the EIS should disclose the
range of potential cumulative effects from exploration and development activities occurring in
sensitive versus insensitive areas. Such an exercise appears appropriate because multiple leases
tend to be developed around successful finds and single pipelines and could potentially be
congregated in a sensitive area. This analyses also appears necessary to fully disclose the
multiple and cumulative impacts on subsistence populations and the resources upon which they
rely consistent with NEPA 1508.2(c), CEQ's EJ Guidance under NEPA, and Environmental
Compliance Memorandum No. ECM95-3 (May 30, 1995).

Threatened Eiders

The EIS states that proposed construction activities may disturb declining populations of
threatened spectacled and Steller's eiders resulting in reduced fitness or reproduction of young.
In addition, migrating threatened eiders may be vulnerable to mortality from collision with .012
offshore structures resulting from the proposed lease sales. Section 7(a)(1) of the Endangered
Species Act (ESA) requires all federal agencies to conserve (i.e., protect and restore) listed
species. Since action alternatives would appear to worsen the condition of eiders rather than
conserving them, the EIS should include enough alternatives and mitigation measures to
demonstrate, through analysis, that sufficient mitigation measures exist to conserve listed eiders.

Significance Thresholds

EPA is concerned about the lack of information describing the basis for the significance criteria used in the EIS on page IV-4 of the EIS. For example, the significance criteria for biological resources is a decline in abundance and or change for three or more generations (except for polar bears). The EIS should explain the basis for selecting three generations for all biological resources (except polar bears) without taking into consideration the biological differences among species (e.g., reproductive rate). Similarly, the EIS does not describe what information was used to determine that a 2-5 year period of disturbance in a socio-cultural system was significant. The EIS should include the basis for its significance criteria for both biological and social resources. The latter is important because activities to extract natural resources, like the one proposed, are subject to boom and bust cycles. We are concerned that people that have relied upon subsistence might curtail or abandon these activities during boom periods and be left without the skills or knowledge to resume them when jobs associated with oil and gas exploration and development are no longer available. .013

The staff contact for this review is Chris Gebhardt. Mr. Gebhardt can be reached at (206) 553-0253. Thank you for the opportunity to comment.

Sincerely,

for Elbert Moore, Director
Office of Ecosystems and Communities

Enclosure

cc: Rex Okakok, Sr., North Slope Borough, Barrow
Steve Lewis, USFWS, Fairbanks
Harry Bader, ADNR-DLM, Fairbanks
Al Ott, ADF&G, Fairbanks
Brad Smith, NMFS, Anchorage
Tom Lohman, North Slope Borough, Anchorage

U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements Definitions and Follow-Up Action*

Environmental Impact of the Action

LO - - Lack of Objections

The Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC - - Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO - - Environmental Objections

The EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU - - Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 - - Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 - - Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonaby available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 - - Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Impacting the Environment. Februa

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL	# of pages ▶ 1
To Paul Lowry	From C. Gebhardt
Dept./Agency MMS	Phone # (206) 553-0253
Fax # (907) 271-6507	Fax # (206) 553-6984
NSN 7540-01-317-7368 5099-101	GENERAL SERVICES ADMINISTRATION

MMS Response to Comment Letter L-0038

L-0038.001

Before responding to the point we label as L-0038.001, the MMS needs to address the second paragraph of the letter. The Environmental Protection Agency rated this EIS as EO-2 rating (Environmental Objections – Insufficient Information). Several incorrect assumptions are presented in the letter based on what appears to be only a cursory reading of the draft EIS.

The most significant incorrect assumption is in the second paragraph of the letter, that deferral Alternatives III through VI are not mutually exclusive. The text of the draft EIS clearly indicates in several places (for example, see the last paragraph of Section II) that any one or all these alternatives could be chosen by the Secretary. Implicit in these EPA comments is an assumption that they are mutually exclusive and, thus, the Environmental Protection Agency makes the recommendation that the Proposal be modified by adopting these deferrals. Adopting their recommendation would result in an EIS with only a Proposal (with the adopted deferrals as part of it) and a no-action alternative–hardly an adequate set of alternatives for any EIS.

The Environmental Protection Agency also apparently does not understand the value and protective nature of MMS's standard stipulations and ITL clauses. The standard stipulations, especially Stipulations 4 (Industry Site-Specific Bowhead Monitoring Program) and 5 (Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities) have proven to be effective in reducing and eliminating adverse effects on subsistence whaling. Proposed exploration and seismic activities have been modified or limited in scope to reduce conflicts with whaling and potential deflection of the bowhead whale migration. As stated in Section I.C.2.b, the MMS analysis indicates that the levels of effects offered by the standard stipulations and ITL clauses provide essentially the same level of protection offered by deferral Alternatives III, IV, and V.

The description and baseline data for Environmental Justice is found in Section III.C.6. The analysis of effects of the proposed action to Environmental Justice is found in Sections IV.C.16, which includes information about demographics for race and income and information about the reliance of the communities to subsistence foods and activities. Additional information about subsistence is found also in Section IV.C.11, and effects to the sociocultural systems are provided in Section IV.C.12. Section IV.C.16.d provides an analysis of how our standard stipulations and ITL clauses provide mitigation from OCS activities to the Native community. This analysis is consistent with the Department of the Interior and Council on Environmental Quality guidance for the executive order and meets the Agency's requirements to fully analyze the effects under the executive order. Furthermore, the MMS believes the analysis presented in this EIS is consistent with the Environmental Protection Agency guidance they provided as a cooperating agency for the Liberty EIS.

The MMS believes the current alternatives, with the standard stipulations and ITL clauses, offer an effective range of alternatives that also meets the goals and objectives of the OCS Lands Act to offer Federal offshore oil and gas resources for lease and possible exploration and development in an environmentally safe manner.

The MMS has found that under routine actions, disproportionate impacts on Inupiat communities would not occur; however, in the unlikely event of a large oil spill, disproportionately high adverse effects could occur. Such unlikely events are not expected and, thus, the MMS does not expect disproportionately high adverse effects to occur to the Inupiat community lifestyle.

L-0038.002

As mentioned in Response L-0038.001, the Environmental Protection Agency apparently misunderstands the structure of the alternatives of this EIS. They indicate that all the deferral alternatives (Alternatives III through V) should be melded into Alternative I, the proposed action, because a decisionmaker would be forced to chose only one alternative. That is incorrect, and a closer reading of the EIS is warranted. The action alternatives are not mutually exclusive. As the text indicates in several places, a decisionmaker could choose any or all of Alternatives I, II, IV, and IV or Alternative II, the No Lease Sale Alternative.

The Environmental Protection Agency then goes on to draw another inaccurate conclusion that the Proposal does not provide protection to subsistence whaling for any of the North Slope communities. The MMS has worked with the Inupiat communities for more than 20 years to develop stipulations and ITL clauses that protect subsistence whaling for all the North Slope villages. The MMS strongly disagrees with the Environmental Protection Agency's implication that these have no value. The Environmental Protection Agency would have been well served to take the time to ask the Mayor of the North Slope Borough and the Executive Director of the Alaska Eskimo Whaling Commission whether the entire suite of stipulations and ITL clauses should be dropped as valueless before preparing their comments of October 3, 2002.

The MMS believes that the Proposal provides adequate subsistence-whaling protection for the three communities. Alternatives III, IV, and V would provide a small additional increment of protection for the respective villages. However, the increment is so small that we cannot differentiate their estimated incremental effects, given the uncertainty inherent in estimating future exploration and development activities let alone the environmental effects of such activities. Hence, we feel strongly that this EIS is completely consistent with 40 CFR 1502.14.

L-0038.003

The text does indeed indicate the basis for the development of alternatives. See Sections I.C.2, II, II.A, II.D, II.E, II.F, and Appendix E. See also Response L-0038.001. The Environmental Justice protocol followed for the Beaufort Sea multiple-sale EIS was modeled closely after the protocol agreed to by the Environmental Protection Agency for the Liberty Project EIS, which was developed between the Environmental Protection Agency and the at meetings in Seattle in October 2001. The MMS added substantially to the already extensive Environmental Justice sections in the Liberty EIS, on which the Environmental Protection Agency signed off. This EIS has parallel mitigating measures as standard stipulations and ITL clauses, and the text is very similar in content to the analysis in the Liberty Final EIS. The MMS also conducted a very similar public participation process for this EIS. Our Environmental Justice Analysis is fully consistent with the Executive Order and the accompanying Council on Environmental Quality guidance. We urge the Environmental Protection Agency to read the detailed discussions in Sections III.C.6, IV.C.16, IV.I.2.p, and V.C.16.

L-0038.004

Concerning the development of alternatives, please see Sections I, II.A, II.D, II.E, II.F, and Appendix E of this EIS. Effects analyses done in Section IV.C.5 for subsistence whaling, in Section IV.C.11 for Subsistence Harvest-Patterns, and in Section IV.C.16 for Environmental Justice do consider the effects of noise and disturbance on bowhead whales. Conclusions for these sections dissolve the commenter's claims that these impacts were not considered or analyzed.

L-0038.005

The analysis of effects from potential oil spills in this EIS is extremely rigorous. It is described in detail in Sections IV.C, IV.I and V.C. However, if the Environmental Protection Agency's staff finds the analysis too detailed given their time constraints in reading the EIS, we would be pleased to make a verbal presentation at our office or at their Region 10 offices, describing the spill-statistical methods, spill-trajectory modeling, and assessment of effects analysis we perform for each EIS, including this one. The commenter uses a key word: "prevention." That is our main defense against oil spills. While our preventive measures also are spelled out in detail in the EIS, we would be pleased to also cover this topic in a meeting. Finally, the Environmental Protection Agency provides no specific recommendation on how the analysis should be made more rigorous or what additional measures they recommend. If they have such recommendations, we would be pleased to consider them.

The drills conducted during 1999 and 2000 indicated that estimated operational limits for one series of oil-spill-cleanup tactics were more constrained than previously thought. These trials established more reasonable maximum operational limits for the R-19A barge-based spill-response tactic. Industry has a large amount of equipment and numerous other tactics that could be employed in a spill-response situation to address environmental conditions. We suggest review of these tactics in the several oil-spill-contingency plans that apply to the Beaufort Sea. Through the pollution-prevention programs, safety systems, and spill-response programs, sufficient precautions are in place to protect the environment.

L-0038.006

The question the commenter asks is one of value and judgment. The MMS makes clear our value judgments and acknowledges that other stakeholders may not reach the same value judgments (Section IV.A.4.a(1)). The MMS believes that through the pollution-prevention programs, safety systems, and spill-response programs, sufficient precautions are in place to protect the environment. And, regardless of the spill probability, the EIS evaluates the effects of an unlikely large oil spill on the resources.

L-0038.007

See response L-0038.001. The effects analyses done in Section IV.C.11, for Subsistence Harvest-Patterns, Section IV.C.12 for Sociocultural Systems, and Sections IV.C.16 and V.C.16 for Environmental Justice do consider potential health and tainting effects on subsistence foods.

We have now incorporated by reference in Section III.C.6 - Environmental Justice, the Environmental Justice Effects Section IV.C.16 - Summary of Human Health Effects, from the Cook Inlet Planning Area Oil and Gas Lease Sales 191 and 199 Draft Environmental Impact Statement (USDOI, MMS, Alaska OCS Region, 2002) that considers more extensively the potential health and tainting effects on subsistence foods. This additional information includes recent information provided by the Alaska Native Health Board and others on the risk of contaminants in subsistence foods.

L-0038.008

The Environmental Justice analysis fits the protocol of the Executive Order, and is fully consistent with Department of the Interior, Council on Environmental Quality, and Environmental Protection Agency guidance in addition to the Environmental Justice approach developed by the MMS with the Environmental Protection Agency for the Liberty Project in October 2001.

See Response L-0038.003.

L-0038.009

The approach we used for this EIS essentially is identical to the approach we developed with the Environmental Protection Agency Region 10 in Seattle in October 2001 for the Liberty Project EIS. The MMS directs the reviewer to Section IV.C.16, where the methodology for the analysis is outlined. As we noted in the Liberty EIS and Section IV.C.16, the North Slope Borough is, by latest census counts, 70% Inupiat Native. By definition, the population is a defined ethnic minority and any adverse effects experienced by this minority population would be in a disproportionate manner.

Under the Environmental Justice executive order, the primary impacts of concern that may occur from the proposed action to the minority population are those activities that could affect subsistence resources. We determined the affected community as the three Beaufort Sea coastal villages. The other villages the commenter mentioned are so far from the location of potential effects that they cannot be expected to experience significant effects.

L-0038.010

The MMS directs the reviewer to Section IV.I - Low-Probability, Very Large Oil Spill; and to Section V - Cumulative Effects; and particularly to the effects analyses for subsistence-harvest patterns, sociocultural systems, and environmental justice, in addition to the analyses discussing bowhead whales, fish, seals, and caribou within these large sections. These sections analyze effects on resources and communities outside the immediate lease-sale area.

L-0038.011

We refer the Environmental Protection Agency reviewer to the introductory sections of Section V - Cumulative Effects of the EIS. The analysis does consider a range of potential effects on resources in sensitive areas and is compliant with Council on Environmental Quality and Department of the Interior guidance on Environmental Justice. The document also meets the analysis requirements of NEPA and is consistent with the language and structure of Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. We direct the reviewer to the MMS Offshore Program website at http://www.mms.gov/envd-bea/12898/guidance.htm, which discusses the MMS's approach to satisfying the mandate of Executive Order 12898 and the use of and compliance with the Department's 1995 Environmental Compliance Memorandum No. ECM95-3, and the 1998 Council on Environmental Quality Guidance. Additionally, the environmental justice analysis for this EIS was developed along the same guidelines negotiated in October 2001 with the Environmental Protection Agency for the Liberty Project EIS. The EIS has identified sensitive areas with respect to subsistence activities and with respect to the migratory corridors of marine mammals, birds, and terrestrial mammals. The transitory nature of these resources can put them in temporary conflict with exploration and development activities, as proposed in the scenario of proposed activities. We have attempted to determine zones of influence from activities and overlapping zones of influence for the cumulative-effects analysis, and we rely primarily on the subsistence-hunting areas as to what may be called sensitive areas. For the most part, we have attempted to capture in our cumulative analysis all of the North Slope, both onshore and offshore.

L-0038.012

This EIS serves as the biological assessment document for Section 7 consultation under the Endangered Species Act. See Appendix C for the Biological Opinion from the Fish and Wildlife Service pertaining to the spectacled and Steller's eiders. Little evidence exists that activities associated with oil and gas development actually cause decreased fitness or productivity in threatened eider populations. In fact, substantial information from the Prudhoe Bay area shows that the presence of structures and the occurrence of routine oil-field activities have little effect in altering routine eider activities during the breeding season. The Environmental Protection Agency makes a good point regarding mitigation of potential threats to eiders. The recently finalized Fish and Wildlife Service Biological Opinion specifically addresses the problem of potential collision with offshore structures and requires a cooperative effort between the Fish and Wildlife Service and the MMS to develop a lighting protocol that could warn birds to avoid flying into the object in their path but also to not attract birds to it. See the information provided about Stipulation 8 in Sections I.C.3.a(2) and II.H.2.d and the analysis to Steller's and spectacled eiders in Sections IV.C.5.b and IV.C.5.c.

L-0038.013

This document is the eighth lease-sale EIS prepared in the Beaufort Sea. Two development EIS's in the Beaufort Sea (Northstar and Liberty) have been prepared. When we started preparing this document, we looked at the definitions and standards used in these previous EIS's. The definitions used in this EIS are the outcome of that review, which includes the best professional judgment of our senior staff biologists and sociologists. Furthermore, they are essentially the same standard used in the Liberty EIS, for which the Environmental Protection Agency was a cooperating agency and on which they signed off.

The definitions carried forward reflect the information and comments we have received in the past. While the MMS continues to receive comments about the appropriateness of the definitions we use for determining significance, we have not received specific suggestions for change. The current definitions for significance are still the best standards we have available. If we receive suggestions for a better definition with supporting information that provides us with a better standard and that is demonstrated to be more appropriate, and that can be applied to all threatened and endangered species, we will adopt the new standard.

As stated previously, the definition for significance for sociocultural effects is identical to the one used in the Liberty EIS. The significance definition in this EIS is based on our review and evaluation of past standards used in our previous NEPA analyses. Those documents have undergone public review and comment and, in many cases, withstood legal challenges. The Environmental Protection Agency questions the 2-5 year definition portion of the sociocultural definition, but they do not suggest an alternative definition or standard. There may be arguments that the timeframes in the definition are too short or too long; however, no one has provided the MMS with a better definition supported by scientific data and good rationale that has withstood our evaluation and/or the public review and comment process.

Subsistence skills and techniques are developed by hunters over their lifetime. The traditional knowledge used in hunting and gathering is passed down from generation to generation. While it is possible that some hunters may choose not to participate in hunting for a few years (well within the 2-5 year period in our definition), it is very unlikely that the all subsistence hunters in a community would lose those skills. In fact, during 1977, no subsistence bowhead whaling occurred and very limited hunting occurred in the years that followed; however, by the 1990's those activities had resumed, and the whaling crews have been very successful in taking their allotted quota. Furthermore, the typical boom-and-bust cycle associated with natural development may not be that applicable to the current oil and gas industry here in Alaska. The development of Prudhoe Bay (the boom) which is now declining has not led to the total bust, but it has resulted in an industry that currently is maintaining and starting to increase production and jobs over time. The late 1980's and early 1990's may have been the bust cycle for Prudhoe Bay, when the price of oil dropped and many oil and gas companies either left the business or went elsewhere for work. However, during that time period, whaling and subsistence harvesting of foods in the communities continued. A boom-and-bust cycle is very unlikely to result from the type of projects and the levels of resource development projected (460 million barrels of oil) for each of the three sales in this EIS. In fact, the current level of activities onshore and offshore in Alaska is likely to help create jobs and employment to maintain at least current levels.

1014 Black Oak Drive
Medford, OR 97504
Sept. 10, 2002

RECEIVED
SEP 13 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

L-0039

Dear Mr. Gol

I have serious concerns about the oil lease sales proposed for the Beaufort Sea area. Leasing offshore from the Arctic National Wildlife Refuge is a particularly egregious betrayal of the public trust given the clear rejection, by both the U.S. Congress and the American people, of oil exploration and development in the Arctic National Wildlife Refuge. The potential for severe harm to that ecosystem is as great whether the drilling happens on land or a few miles offshore. Oil leasing in that area should be permanently removed from consideration.

.001 The Beaufort Sea is home to polar bears, walrus, seals, and migratory birds (including threatened eiders), and the endangered bowhead whale. Global climate change is already putting pressure on some of these animals because the pack ice is less reliably thick and long-lasting as formerly. Adding the near-certainty of petroleum leaks and large oil spills and these population could be devastated. A spill around Teshekpuk Lake durin the Pacific black brants' molting season or fouling the water off the Refuge during bowhead migration east of Barrow could cause irreparable harm to these species. The risks are too great.

.002 Major spills - it is senseless to assume they wont happen - have already damaged Alaskan waters. They cannot be cleaned up adequately and the oil and its effects linger for decades. Some of the detrimental effects on living organisms

.002 may be permanent in terms of genetic damage. There is still oil, fresh and undiminished as when it went into Prince William Sound a decade ago, just beneath the rocks and gravels of that coastline. Trying to clean up a spill in breaking pack ice is expected to be so difficult that even the 10-15% cleanup achieved on spills in less severe climates is unlikely to happen around the Beaufort sites. Those leases should not be allowed to go forward, given the nature and magnitude of the risks.

.003 Historically, the Minerals Management Service has wisely seen fit to avoid leasing tracts off the Arctic National Wildlife Refuge and Teshekpuk Lake due to the extremely sensitive nature of the areas, the high environmental risks inherent in the development of these areas and public opposition to leasing in these areas. They should, for these reasons, be permanently deleted from current and future lease sales.

The United States cannot drill its way to energy sufficiency or security. The amount of oil gained from offshore or refuge drilling in the Arctic (as well as other sensitive areas of the country) is simply not worth the danger of permanent environmental damage there. It is especially troubling that this is still an issue when nothing whatever has been done to require improved vehicle efficiency or invest strongly in alternative energy sources - wind, solar and fuel cells in particular. Continuing to hold our environment hostage to a fossil-fuel mindset has to stop. A refusal to allow exploration and drilling in the Beaufort Sea would set an excellent example.

Sincerely, Carol Ampel

MMS Response to Comment Letter L-0039

L-0039.001

With regard to the potential effects of global climate change on migratory birds, including threatened eiders, we could speculate that such change that results in the pack ice becoming less reliably thick and long lasting may represent a positive result for these birds in the Arctic. This could be the case, because at the conclusion of their spring migration to the Beaufort Sea they rely on the presence of open water to provide foraging areas where they can obtain food to replace fat reserves used up during migration, and to build up reserves for the breeding season, especially the production of eggs. This probably would be true for waterfowl species but may not be for some species such as the black guillemot (nonmigratory) that appear to use ice-edge habitat. Although the commenter probably is correct in stating that petroleum “leaks” (if this means small spills of a few barrels or less) are nearly certain to occur, the near certainty of a large oil spill is grossly overstated, given the 8-10% probability of such a spill occurring (pipeline plus platform) that is determined by the MMS oil-spill model. Thus, it is not likely, for most birds at least, that these two factors would act together to devastate their populations. With regard to potential effects of a spill in the Teshekpuk Lake area where brant molt in large numbers, we consider the probability as extremely small of such an event resulting from Beaufort Sea offshore lease activity, given its separation from the marine environment where such a spill might occur. A spill in coastal areas near the Arctic National Wildlife Refuge could affect local waterbirds and those migrating from farther east in addition to a small number of bowhead whales. However, as noted above, the chance of spill occurrence is quite small, and the period of vulnerability of these species to the initial presence of a spill is quite short, basically only during the migration period; therefore, effects are not likely to be significant in most instances. In most cases, the populations in or passing through this area that could experience oil-spill mortality are stable or increasing, and losses would be replaced.

L-0039.002

The EIS describes the probable effects in the unlikely event of a large oil spill (Section IV.A.4 and a very large oil spill (Section IV.I), and describes the decade-long persistence of spilled oil in Prince William Sound (Section IV.C.2.a(3)(b).)The assumed spill sizes in the Beaufort EIS are much smaller than the massive *Exxon Valdez* oil spill in Prince William Sound, because the use of tankers in the Beaufort Sea is not considered feasible.

L-0039.003

See Response L-0021.009.

L-0040

RECEIVED
SEP 6 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

169 Wildflower Drive
Plymouth Meeting, PA 19462
September 2, 2002

Mr. John Goll
Regional Director
Alaska OCS Region, Minerals Management Service
949 E 36th Ave., Rm 308
Anchorage, AK 99508-4363

Dear Sir,

While this letter is being mailed from Pennsylvania, it would be an error to assume that I have little knowledge firsthand of the area off the coast of Northeast Alaska. I have personally been on the Beaufort Sea from Demarcation Bay to Kaktovik, and have talked with persons who have traversed even wider portions of the northern coastline.

I remember a number of years ago attending a scientific presentation concerning attempts to clean up an oil spill from a wrecked tanker off the coast of Southern Argentina. While that spill had been ten years earlier, little could be done due to the cold, winds, and wave conditions. Standing on a spit in the ocean off the coast of northern Alaska, I can only imagine the horrors of trying to clean up an oil spill as the waves crashed on shore, and that was without any strong winds.

As I have discussed with others and experienced the many differences in short distances in ocean conditions, I find it abhorrent to think that Minerals Management Service has prepared a single plan that considers the entire coastline from the Canadian border to Barrow as a single area. That is a lot of coastline, and considering some of it abuts the Arctic National Wildlife Refuge, and portions adjacent to the environmentally sensitive Teshekpuk Lake area the lack of any consideration of the special circumstances of these two regions is appalling. .001

The Beaufort Sea lease sale 170 set the precedent for deferring leasing off shore of sensitive areas due to lack of information on the cumulative effects of exploration. The lack of information still continues.

We are a party to International treaties to protect the polar bear. Since denning areas on land are not uniformly distributed across the northern portion of Alaska, how can an EIS consider the entire region as a single piece? And as recently reported, the thinning ice off Barrow is having a potential serious impact on polar bears. Climate change and the effects on wildlife and the cumulative effects of oil exploration must be a part of the equation, yet this equation cannot be applied in a broad swatch across such a large area of coastline and adjacent ocean area. .002

MMS is planning to have three lease sales, but only one EIS. Yet, this covers approximately ten .003

million acres. If there is one lease, then one EIS; two leases, two EIS's, etc. so that there are sequential EIS hearings just as there are proposed sequential leasings. This is how one gets an informed public and a full discussion of the issues involved. .003

I would be very interested in finding out how an oil spill clean up would be accomplished in such a severe climate. I suspect I already know the answer. Having one EIS cover such a large area is not the way to obtain proper answers to important questions.

As I approached a spit off the coast of northern Alaska, I noted that water was splashing higher than the height of the spit. As I stood on the ocean, the waves were only about three feet high with no wind. Recently, friends were on that same spit, and the winds were at gale force. An oil control boom would be of little value in conditions like that. However, the impact of an oil spill could be massive. Bird nests were on the spit, and a relatively fresh track of a polar bear when I was there. On an adjacent spit, several jellyfish had been washed up.

Tracks in the gravel indicated large tree trunks had been pushed over the spit, likely due to ice movement during break up. The shoreline is a very environmentally fragile area. If trees can be pushed over the spit, oil spills would have no difficulty breaching the spits and winding up on shore.

No, I must object to the idea of a single EIS covering such a large area of coastline, in regions that vary greatly in both topography, ocean bottoms, and wildlife potential.

Sincerely yours,

Robert Franz

MMS Response to Comment Letter L-0040

L-0040.001

See Response L-0002.016.

Although OCS areas are offshore of the National Petroleum Reserve-Alaska and the Arctic National Wildlife Refuge (both onshore Federal lands), there are approximately 3 miles of State waters between the shoreline and OCS jurisdiction. Oil-spill trajectories of spills in OCS waters are taken into consideration when modeling analysis of impacts to shoreline entities. The EIS analysis shows that impact probabilities will be minimal, if at all, to both the Petroleum Reserve and the Refuge.

L-0040.002

The EIS recognizes that polar bear denning areas are not uniformly distributed across the northern portion of Alaska, and that denning is more concentrated on the Arctic National Wildlife Refuge (see Section III.B.6.e - Polar Bears). The EIS recognizes the importance and sensitivity of the refuge and proposes deferral Alternatives V and VI that would defer leasing offshore of most of the refuge. Climate change-global warming would have catastrophic effects on polar bears and ice seals, if the polar pack ice continues to diminish over the next several years. It is very uncertain whether this warming trend will continue and, thus, this potential cumulative effect cannot be predicted in the EIS. If climate warming continues and the polar ice cap continues to disappear, the consequence and contribution of the Proposal to global warming would be insignificant.

L-0040.003

See Response L-0001.005.

VII.E Public Hearings and MMS Responses to Hearing Comments

The following are the transcripts from the Public Hearings in Nuiqsut, Kaktovik, Anchorage, and Barrow. Please note that two pages of transcripts are on a single printed page. The page number of the transcript is in the upper left-hand corner. After each hearing, the MMS responses to hearing comments are provided.

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERALS MANAGEMENT SERVICE

OFFICIAL TRANSCRIPT -- PUBLIC HEARING

DRAFT ENVIRONMENTAL IMPACT STATEMENT
BEAUFORT SEA MULTIPLE SALE PROPOSED OIL AND GAS LEASE SALES
(SALES 186, 195, AND 202)

Nuiqsut, Alaska
Kisik Community Center
Wednesday, July 24, 2002
7:00 p.m.

00001

MMS PUBLIC MEETING

July 24, 2002

Nuiqsut, Alaska

00002

P R O C E E D I N G S

MR. NUKAPIGAK: In Native.

MS. L. AHVAKANA: In Native.

MR. NUKAPIGAK: In Native.

MR. STANG: Emily, can you give us a quick synopsis of what was said briefly.

INTERPRETER: Of what he was saying?

MR. STANG: Yes.

INTERPRETER: Okay. What Eli was saying was the introduction to what, where you came from and where you had specific instructions to go ahead and do with this lease/sale, if it's possible, and he mentioned that some of you came from Washington, D.C. and some of them from in other areas, BIA, BLM. So, he was introducing about where the lease/sale is going to be from Barrow to the border of Kaktovik to Canadian side. And then he asked Lucy Ahvankana to have an invocation.....

MR. STANG: Right.

INTERPRETER: .....and that's what she did.

MR. STANG: Okay. Thank you.

INTERPRETER: Yeah. That's what it was.

MR. STANG: Okay. Thank you. Well, good evening. I'm glad you came this evening. My name is, as Eli said, is Paul Stang with the Minerals Management Service of Department of Interior.

00003

INTERPRETER: In Native.

MR. STANG: We are here this evening to get your testimony and your statements and your expressions about the Beaufort Sea multi-sale EIS, or Environmental Impact Statement.

INTERPRETER: In Native.

MR. STANG: Thank you. We had a couple of copies, maybe about six or so copies on the desk there. This is the executive summary of that EIS. There is a light blue one that is translated into Inupiat. There were some copies of that and I believe some were sent out to villages -- were sent up to the village, but we've run out of copies in the back. I have one more here you're welcome to have. And also up there -- I don't know if we'll run out of these or not but -- we ran out of these? Yeah. This is a copy of the five-year program. If you want copies of these things, you can come up to us after the meeting and we'll mail them to you, but there were some sent to the village, so I guess Eli would be one who could check on that for you to figure out where those extra copies are. We also have the thick document, which George has here, which is three volumes, which is the full EIS, and that's what we're going to -- the focus of our discussion will be tonight. Ah, Eli has just brought some more out there.

00004

But first before we proceed, I'd like to introduce the members of Minerals Management Service who are here tonight. On my left is George Valiulis, who is in the EIS or the Environmental Impact office in our headquarters in Washington, D.C. area. On my right is Renee Orr, who is the chief of the Leasing Branch in Headquarters. And we also have Nathan, who is -- Hile -- who is doing our translation, and Albert Barros, right here, who is our community liaison, and Angela Mazzulo who helped you figure out what those maps were all about.

INTERPRETER: In Native

MR. STANG: Valiulis.

INTERPRETER: Valiolucas?

MR. STANG: Valiulis.

INTERPRETER: Valiulis.

MR. STANG: Good.

INTERPRETER: Okay. In Native.

MR. STANG: Angela Mazzulo.

INTERPRETER: Oh Angela. In Native.

MR. STANG: And Albert Barros.

INTERPRETER: Did I miss him? Albert Barros, you want to raise your hand? In Native.

MR. STANG: Thank you. What I'd like to do before anyone testifies is just to give you a little information about the lease/sale and the EIS, just a little

00005

bit. Not long.

INTERPRETER: In Native

MR. STANG: Good. The area that we're talking about, as Eli pointed out, is on the map in pink color. And if there's not a map there, there's a map here. In the pink color. And that area is the candidate area for leasing, and it extends from about three miles from shore out to 60 miles, nautical miles, from shore. And it is from 25 feet depth of water to 200 feet depth of water, generally speaking, and it is about 9.9 million acres. And it goes from the Canadian border on the east to Barrow on the west.

INTERPRETER: What was that, 25 feet, the depth?

MR. STANG: From 25 to 200 feet depth.

INTERPRETER: Okay.

MR. STANG: About 9.9 million acres.

INTERPRETER: In Native

MR. STANG: Thanks. Now we're doing the EIS a little differently this time. We have three sales that the Secretary of Interior scheduled in this document that was approved in June, and we are preparing one Environmental Impact Statement to cover those three sales. The first sale is in 2003. The second sale is in 2005. The third sale is in 2007. These are proposed sales.

00006

INTERPRETER: In Native.

MR. STANG: Thank you. After we complete the final version of this draft environmental impact statement, then we will hold the sale in September or so of 2003, and the decision will be made to hold the sale or to cancel the sale and to pick one alternative or the other. We'll talk about more of that in a minute. But, after that, before we hold the next sale, we'll do an environmental assessment and make a decision whether we need to a supplement to the EIS.

INTERPRETER: In Native.

MR. STANG: When we get any comments from you tonight, and last night we met with the members of the Tribe, and we got comments from them and we will meet on Friday night in the village of Kaktovik and then we have to come back on August 1st to meet with the village of Barrow. Any comments we get from you here tonight verbally, or these other meetings or in writing, we will consider in preparation of the final Environmental Impact Statement, and we will also consider them in light of the executive order on environmental justice.

INTERPRETER: In Native.

MR. STANG: Good. Thanks. When you send in your comments, or when you speak here, if you think this is a good idea for us to translate this executive summary into

00007

Inupiat, please let us know, as I think it's the first time we've done that, and if that's a benefit, we need to know and then we could do it at future EIS'. Along with these meetings, the public meetings, like this one, as I said, we're meeting with the tribes, and that's on a government-to-government basis.

INTERPRETER: In Native.

MR. STANG: Since 1979, we have held seven sales in the Beaufort Sea and we have issued 690 leases, and of those 54 are still active.

INTERPRETER: In Native.

MR. STANG: The lessees, the people who were awarded those leases, the oil companies, drilled 30 exploratory wells, but as of today, the only oil that's being produced from the Federal waters comes from Northstar, because some of the bottom locations of the wells are in Federal waters, even though the island of Northstar is in State waters.

INTERPRETER: In Native.

MR. STANG: The only other thing I want to say about your comments, and that is, you can give your comments verbally tonight, you can write them to us, and we have these sheets in the back. If you'd like to use these or any letter, the address is right on here. The end date for comments, we must receive comments by the 20th of

00008

September.

INTERPRETER: In Native.

MR. STANG: We are obviously making a transcript of this -- of everything you say, so we're having a record of that and will use that in our analysis, but the important thing is, when you come up to sit down at the table next to Emily, please state your name into the microphone so that when Nathan does the transcript, he'll know who was doing the speaking. So, with that, we can at this point -- I'd like to keep this informal so if you have questions of us, we'd be pleased to answer those, but our basic purpose is to come here and listen to what you have to say. So if anybody has any questions they'd like to ask, do so. Otherwise, I'd like to know who would like to testify first.

INTERPRETER: In Native.

MR. STANG: So who would like to testify first?

MR. LONG: I'll go first.

MR. STANG: Please, could you come on up Frank?

MR. LONG: I'm Frank Long, Jr., I'm member of Native Village of Nuiqsut and the vice-president. I'm also a member of the North Slope Borough Assembly and a member of the Alaska NANA Commission. My testimony tonight

00009

will be in regards of the lease/sale, which I will oppose. Due to the fact that we are the only people in the world that has culture and tradition. In the Lower 48, it's a big problem. They don't have culture. They don't have tradition, but they got stock market. When that stock market falls, I know a lot of you hurt. When you put something like this in front of me, it hurts. It hurts the heart. What if a drastic spill happen? Worse than Exxon did with 11,000,000 gallons. It will -- it's already affecting our seals, our fish our walrus. It may even have affect on the whale, which we subsist on yearly.

Other countries have the harder time on subsisting whales or any marine mammal. We have to go through IWC, which is, as far as I'm concerned, a foreign entity who tells me what the hell to do and I don't like that. We don't go to a different country from Alaska and tell them what to do, how to hunt, what to eat, where you should sleep, and why you should wake up.

I'm really heavy on this right now because I don't have a job. It indicates in there that there will be 600 jobs, but will a Native get any of those jobs. As of today, Natives have the hardest time of employing, when you can see a lot of employment all along. And this has been happening for years. We started very small in 1969 when we were inducted to the industry. I went in as a roust

00010

about. Came out a floor hand of a drilling rig, a chain thrower. And now today they're so automated that they hardly need anyone, even to make a connection on the drilling rig. When a drill pipe busts, it gets stuck in the bottom of the hole. You have to fish it out and it takes days to fish one little pipe, sometimes a week. Maybe they have a spill that will take longer.

If, today, Northstar has a drastic spill or accident, or nature decides to move it a little, what will the government do to help us? Are they going to give us some of this 1.5 billion dollars?

Thank you.

MR. STANG: Thank you. Frank. Would you like to translate?

INTERPRETER: In Native.

MR. STANG: Good. Thank you. Would anyone else like to testify now, please. Eli?

MR. NUKAPIGAK: Hello, good evening. My name is Eli Nukapigak from Nuiqsut, also representing city and North Slope Borough. I am preparing a (In Native) lease/sale for 2007. As the mayor and a council member for the community of Nuiqsut, we are honored to officially comment on behalf of the city office of Nuiqsut and the community. This common letter is in response to the five-year OCS leasing program that is currently in nomination of

00011

notice of intent to prepare an EIS and call for information.

The area of Alaska shore of what we would like to concentrate our input on and especially the area of Alaska's northernmost shoreline and offshore region, the Chukchi Sea and the Beaufort Sea. In contest, these waters have sentimental value to the marine mammal and the human environment coexistence continuously. Throughout, the shoreline of the Beaufort Sea is the human environment of Alaska Native and non-Native Alaskans who depend on the very subsistence resources flourishing in this region. The coexistence of the human environment and the marine mammal environment is maintained with our utter most care. The Native Alaskan population on the shoreline region of the Beaufort Sea share a common responsibility to share subsistence between the two environments.

As a result, our people exist with great pride in their ability to effectively manage the marine mammal and wildlife resources for generations to come. The Beaufort Sea and Chukchi Sea support plenty of activity in terms of subsistence hunting and fishing. The Native people who traverse the open sea and ice pack have a precious knowledge of an ever changing climate in the offshore area. Having that knowledge, the people know when it's safe to hunt and how best to travel the environment

00012

for a successful hunt. Just to know law and rule other aspects of renewed knowledge our people have followed for generations laws and rules which are observed and honored among Inuit environment.

Today, the indigenous population maintain these laws and rules in order to sustain the cleanliness of the waters. The providence of these natural habitat and the wildlife it supports and the human environment who are dependent on the providence of the water. The climate is predominantly cold and icy throughout the Beaufort Sea ad Chukchi Sea and for a period of time the sea ice gave way to very strong ocean water current. The Inuit people knew the power of this expanse and when it moved, it moved without any regard to anyone or anything. Whether it's natural shoreline or the man-made installation, be assured that the movement will damage and destroy when it contracts. It is everything that placing unnatural material into the sea does not hold very well, too well, when the ice is on the move unpredictably.

The people who live their lives from that expanse are the testament of this and we advise you to take this into account when considering oil and gas prospects of these shores. During the long winter months on the Arctic Slope, wildlife is still present and surviving the elements. The Inuit People of Alaska, Arctic Slope,

00013

customarily face each winter and summer on hunt in accordance with the ever changing elements. And traditional knowledge and rule obtained by our ancestors as the short summer of Alaskan Arctic Slope Inuit subsistence hunting.

Having to take advantage of this time and year across the region of the Beaufort Sea. Summer in this region is sufficiently for wildlife, whether they are land-faring mammal or seafaring mammal or water fowl. The ecosystem of the summer Arctic climate supplement the different species of animals with dietary needs, particularly, for each species. The Inuit people of Arctic Alaska take every opportunity to have -- to fill their winter cache during the short summer months as winter approach. The Inuit people work lengthily to ensure that their caches are full enough to last them most of the winter. In the Arctic summer climate, wildlife is further offshore than inland of the Beaufort Sea and Chukchi Sea. Wildlife such as waterfowl, caribou, polar bear, brown bear, moose, musk ox, reindeer, ground squirrel, fox, seal, walrus, wolverine, wolf, beluga whale, (In Native) fish of various choice, crab, clam, shrimp, bow head whale, and a number of other species of wildlife. The Inuit people of Alaska and the whole upper circle farther of Canada, Greenland and Russia depend on all the animals.

00014

The animals in their habitat provide foot to sustain life during the long cold winter season. Coexistence of the marine and non-marine mammal in the human environment in everything is vital to eat. And as we depend on them, they depend on the care that we provide for them and their habitat. It is our opinion, Inuit Eskimo, to ensure the plenteous environment for mankind and for wildlife. A clean, natural manner of maintaining the environment is the Inuit Eskimo uttermost approach. The clean and natural manner is the only way the Inupiat people believe is effective. This kind of environment has proven to be sure process in which all living beings benefit without unnatural cost of this kind of conduct.

Marine mammals of the Beaufort Sea and Chukchi Sea are especially important. Not only in their own habitat, but also to the Inuit Eskimo population for as long as it can be recalled. The Inuit Eskimos have hunted for whales, seals, polar bear and fish, walruses, other organic creatures since the people first journeyed over the land bridge of the Beaufort Sea. Our marine mammals in their habitat are vital to the folk of the Inuit. The Northern Inuit of Alaska especially esteem the bow head whale. The bow head whale, with its size, when it's harvest right for the community the food necessary to sustain the people traditional diet and nourishment.

00015

The arrival ice break up in the Beaufort Sea and Chukchi Sea, the Inuit ready themselves and all their traditional hunting tools for the harvest of the mighty creatures. The careful work to prepare for endurance is a combination of community corporation and our selfish desire to move forward for the health of the community. Our knowledge of oil and gas industry settlement in these waters will undoubtedly disrupt the percent of the cycle of each environment mentioned here.

Even though this other shares most of the -- most on subsistence ecology. based on our traditional knowledge, we encourage you to continue listening to the Inuit people who exist here and keep this account. This environment of the far north, during the EIS, on the proposed lease/sale. As evident, we are not in favor of lease/sale proposed for Beaufort Sea proposed 2002-2007. Permitting oil and gas efforts in these waters would only cause intense friction between the entity and the residents of Arctic Alaska.

Thank you.

MR. STANG: Thank you Eli.

INTERPRETER: In Native.

MR. STANG: Thank you Emily. Thank you very much and I appreciate your providing that testimony, Eli. Who else would like to testify now? Please. And if

00016

you would state your name please?

MS. HELMS: Hi. My name is Sarah Helms. Is this on?

MR. STANG: Yes. It turns out that's only being heard by Nathan, so.....

MS. HELMS: Oh okay. My name is.....

MR. STANG: .....you'll have to either speak up or use the microphone, whichever you prefer.

MS. HELMS: Okay. My name is Sarah Helms. My maiden name is Taliak and I'm originally from here and I work for Nanook, Incorporated, a subsidiary of Kuulpik Corporation. I wanted to bring up a training program, you know, that could be some good opportunities for the communities. If you're going to have a bunch of jobs, you can have the communities go through some training so where they can actually be part of working for your company. Look into something like that because most of the communities, they don't have too much training -- go for just laborers. You could have people go as technicians or any kind of other long-term job. I think that would be something really good to look into.

I do human resource for Nanook, Incorporated and I try to find qualified people from the villages and it's kind of hard when they don't have the proper training and it's pretty frustrating when you're

00017

trying to get people to work. I think that would be a good connection with the communities. We could work very closely with the village corporations or the North Slope.

That's all. Thanks.

MR. STANG: Thank you. I would like to mention and I think it was about two years ago, roughly, that BP was here in Nuiqsut talking about the Liberty Project, which has temporarily been put on hold. But they committed to -- and I don't know the status of this at the moment, but they committed to a $3,000,000 training program for North Slope residents. So it might be prudent for you to contact BP and ask them how the program's going and how you can get a little help here. That was a very clear commitment on their part publicly.

INTERPRETER: In Native.

MR. STANG: Thank you, Emily. Who else would like to testify please? Please. Thank you, Joseph.

MR. AKPIK: Good evening people of Nuiqsut. My name is Joseph Akpik and I want to welcome Paul Stang and your committee and George. Welcome to Alaska. Renee, also your staff here. I wanted to thank you on stressing and addressing the Environmental Justice Executive Order 12898 as ordered by President Clinton during his early era. But anyway, I would like to thank you again for addressing that. What I would like to see is to follow-up on that

00018

environmental justice in relating to this Beaufort Sea for this proposed lease/sale. How are we going to follow-up on that environmental justice, is one of my questions I would like to see before the evening is over. What does it mean, environmental justice?

And I do believe if we can follow-up that then I would be pretty much agreeable with this proposed sale, but right now I would strongly oppose any offshore exploration due to the fact that the majority of our people, I do believe, are opposed to the sale. I would like to stress.

I wish to thank you again.

MR. STANG: Okay. Thank you.

UNIDENTIFIED MALE: In Native.

MR. STANG: Joseph, before you go, I will try to give you a partial answer to your question, if you'd like. Would you like that at this point?

MR. AKPIK: Yes, I would like to be addressed to the public here with the interpretation. I'm glad that Emily Wilson is here to interpret on some of these vital issues that we need to hear before the evening is over, especially to that environmental justice.

Thank you.

MR. STANG: Okay. In a nutshell, there's kind of two parts to the environmental justice issue. The

00019

first part is, is the project going to effect a minority or low income population in some disproportionate way? That's the question. And the other part is, will these be high adverse effects. So there's kind of two questions. I think that we have agreed that if there are effects here that Nuiqsut would be a minority and/or low income population. I think the minority population. The Inupiats are a minority population in the United States.

MR. AKPIK: Exactly.

MR. STANG: So, I think that, if you have, there's kind of two parts to this. George is our resident expert in headquarters, so he's going to correct me or add to what I say. Then the next question -- so you have a kind of yes to one of those. The next question then, is the effect high and adverse? At this point, we don't think that's the case as we see it in the Environmental Impact Statement.

Now, I'll tell you the reason for that. We have certain scenarios that we use when we do an environmental impact statement about what affects might occur. No one really knows until any development proceeds, so you do the best educated estimate that you can make. Let me stop right there for a minute to have Emily give that piece and then I'll give you the second part of what I'm going to say.

00020

INTERPRETER: I'll do my best. In Native.

MR. STANG: Okay. Thank you.

So, what we had was the question, do we have disproportionate affects on a minority or low income population and I said I believe that that's the case. The next question is, would those disproportionate affects be high and adverse. I don't think that's the case and I'll tell you the rationale behind it. We see basically two kinds of affects from offshore oil and gas. These are affects from what we call permitted activities. For instance, in the case of exploration, it's the drilling of an exploration hole. In the case of development, it's the building of an island and the drilling of the wells and laying of pipeline to shore. Those are permitted activities.

The company asks for a permit and the Federal government, if it passes all the rules, gives a permit. Same with the North Slope Borough. They issue a permit. We don't believe those affects in themselves are high and adverse. Now, question about an oil spill. If we expected an oil spill to occur, then I would think then we have an issue that we really need to deal with on environmental justice. But when we look at it, the best information that we have available and that we have presented in the EIS, is that we think that the probability

00021

of a large oil spill, now, I'm not talking about a small spill, but a large oil spill, the probability of that occurring is fairly small. And, therefore, we've talked with our lawyers about this particular provision of environmental justice, and we think that it doesn't meet the requirement of high adverse. That is, we don't expect that to occur.

Now, personally, and this is not Department of Interior speaking or MMS, but myself, personally if there were a spill then we would have to re-look, in my mind, at this provision. Let me ask George what, if anything he'd like to add to that.

MR. VALIULIS: Environmental justice, although it has been around since 1994, has really become prominent in the last few years. Likewise, in our environmental impact statement, especially in this one, you would find that we treat that quite prominently. The purpose of the Environmental Impact Statement is to provide information to people and ultimately to the decision-maker, so that person can make a proper decision. And what that executive order says is, when you provide that information, you have to specifically address environmental justice. Environmental justice, simplistically, says everyone has to be treated fairly and especially the minority and low income folks. So, we have done our job in making the

00022

analysis. Paul has indicated what our findings are in the draft EIS.

I think that's all I have to say so far.

MR. STANG: Okay. Let's let Emily.....

MR. AKPIK: Thank you very much, Mr. George, Joseph again. I do believe I want to stress strongly on this a little bit further that environmental justice orders tends to identify subsistence consumption.

(In Native)

If you can correct me on that, George. It says that executive order identifies subsistence consumption.

MR. VALIULIS: Right. That's the key here.

MR. AKPIK: Whatever we eat is something going to poison it?

(In Native)

That's all I have, thank you very much

MR. STANG: Thank you, Joseph. Can you.....

INTERPRETER: I think he.....

MR. STANG: Did he.....

INTERPRETER: .....explained that in Inupiat.

MR. STANG: He explained that.....

INTERPRETER: Yeah.

00023

MR. STANG: He explained what we said?

INTERPRETER: Yeah.

MR. STANG: Okay, good. Thank you.

INTERPRETER: Except for George's comments.

MR. STANG: Do you want to add those?

INTERPRETER: Yeah. Let me add them.

(In Native)

MR. STANG: Thank you. Thank you very much. Ruth would you please address us?

MS. NUKAPIGAK: Yeah

MR. STANG: Thank you.

MS. NUKAPIGAK: In Native.

MR. STANG: Thank you, Ruth. Emily if you could, for the record, give her first and last name.

INTERPRETER: Summary, yeah. My name is Ruth Nukapigak and I would -- this has been talked over several times before. The ones that have come here several times before and how many times the oil companies have come here to talk to us about this similar thing. The Inupiat people subsist on wildlife animals and oil and gas is all over here and they have had lease/sale before and where does the money go and where do they spend it? She had a question.

The ocean has plenty of wildlife that we subsist on. Several years ago, even before our time, our

00024

people survived on animals and wildlife and they help each other and this is how they survived within the environment. There was no oil and gas. There was nobody to bother them or anything like that. No lease/sale. When it comes to lease/sale she watched T.V. and watch everything. She is very curious about what they're going to do on how the oil spill was that had been done in waters. It killed all the wildlife and she has seen this on T.V. and the oil spills has happened in the ocean and that all of these has happened ad she had watched them on T.V. Now she knows that the drill rig is coming to Cross Island with Thomas Nukapigak, he's traveling with them and supposed to be planning to go to Cross Island for this.

They're waiting for that. Seal Oil Island [sic], they had visited several years ago and Seal Island is so far away from the land. There were several of them that went there. She looked at the pipes that were put onto go to the depth of the sea and to the gravel down below. It was about 30 feet deep where they were excavating gravel from down below. And then the water and onto the land at the bottom of the sea they were extracting small gravel they had seen. It's very small. She wondered how, you know, when you are excavating some gravel it spreads all over, the gravel does. It spreads everywhere. Maybe that's why there was so small proportion of it that

00025

came up. And then she knows that the gravel spreads a lot when you are disrupting it from the bottom of the sea.

And then there was ice that was cracked after they had done that. Then Nuiqsut experienced not many fish that time. For the summer they didn't come in very much and there was very small fishes that went through. She thinks about how they worked on this. Seal Island is small and they put a barrier off the -- to keep off the ice pressure ridges and they put steel over that so that it wouldn't hurt the island and it would block the ice pressures that were crumbling up. They said they were sure that was going to happen.

How is that effecting the hunting. How does it effect the Inupiat people? It would have to have an impact on the hunt -- the animals that they hunt. They survive on seal oil and with no jobs Inupiat people can survive on wildlife. However, when you try to buy something from the store it's very expensive and the person who is managing -- the manager or who is heading that, eats very good from the store and their food is very inexpensive. Here we have to get a lot of expensive food brought in and it's very, very hard. It's kind of a hardship buying the food from the store.

In lease/sale who is going to keep the money and where did it go? Do the Alaskans have it? The

00026

different wildlife will change by lease/sale. They will have to put pipes in and she mentioned again the T.V. and killing off the animals and different kinds. The pipelines are visible here at Nuiqsut. Several years ago they had no experience with any pipelines but nowadays it's surrounding Nuiqsut. She has one concern. She has a concern of the two rivers when the fish did not come in. It was the Sisco fish that they didn't catch very much of and that kind of lacked fish for the winter.

When the seismic people do seismic in the area and the environment, they spread wires all over looking for oil, indication of where it would be. Sometimes they have to pull all of these wires up to get to their rooms where they were staying and that's how bad it was.

And then she wants to mention the caribous were killed off so many of them. How did they -- who killed them? How did they die? Nobody knows about this. And then she had seen the one caribou that curled up and died. What happened to that? How did it die? We do not have the luxuries of eating in the good place, nor can we afford them. Oil and gas is surrounding us but, however, the Inupiat have been patient and they're waiting and sometimes they don't say anything. We value the jobs, but we value more of the wildlife animals that we subsist on.

00027

I welcome all of you for coming to Nuiqsut. I want to talk right, however, things are changing within our lives. I am opposed to the lease/sale if it's going to disrupt our Inupiat way of life.

MR. STANG: Thank you, Emily. Ruth, I think -- is Ruth still here?

INTERPRETER: Yeah.

MR. STANG: Oh, there you are. I'm sorry. I can answer one of your questions about the money and where does it go. The money that comes from these lease/sales, that we collect from the oil companies, for the, what we call up front payment and if there is subsequent royalties and there are rentals, that money goes into the general treasury of the United States, and that then can be appropriated as the Congress sees fit. If a tract is between three and six miles from shore, then 27 percent of those receipts go to the State of Alaska, but as I understand it, at this time, the State does not pass through any of that 27 percent to the communities of the North Slope, but uses it into their general receipts in the state. So, that's, at least, what happens to the money that comes to the Interior Department from the oil companies.

INTERPRETER: What did you mention about three miles?

00028

MR. STANG: Any tract that's between, I'll show you. Any tract that's from this line, which is the jurisdiction between State and Federal. State is on this side, Federal waters are on that side. From that line out three additional miles. So it's that band, the first three miles of Federal waters. Any receipts that we get from tracts in that area, 27 percent of that goes to the State. But beyond that, so somewhere out here, all of that money goes to the Federal government.

INTERPRETER: In Native.

MR. STANG: Thank you, Ruth. Anyone else would like to testify at this point please?

INTERPRETER: Sarah.

MR. STANG: Oh, Sarah. Sitting right there in front of me.

INTERPRETER: Yeah.

SARAH: My name is Sarah Kunaknana. In Native.

INTERPRETER: My name is Sarah Kunaknana. I would like to comment and I have made this comment before and she thinks about these things. At the ocean, the current is very strong and she has said this before. It will destroy anything when it starts going and it starts moving, it can destroy anything because the winds and currents are now in control when it does that. Damage to

00029

some people, some animals, some -- it doesn't have any -- it can damage anything that is in the way or something. The environment. It damages the environment and wildlife and seeing dead seals after the wind storms and stuff like that. They have seen seals that were beached to the shore and she has seen this several times at Cross Island and Flaxman Island is also where they had lived. Inneslaw [sic] Island and we hunted in this area with parents. The parents that they had, they prepared food, the meat that we hunted and they make the seal and make pokes into them and preserve the meat this way, with oil in it.

And only the boats come in only in the summertime. The Inupiat hunt in land, at sea, and animals and then they trade the furs when the boats come in summertime and this is when they get some of their grubs and stuff like that. They had this in the -- they had experienced this about two times doing some trading. Father bought a boat one time with a small engine and then their food was plentiful then and then they were able to come up with food for the winter.

Herding the reindeer for furs and meat was preserved. During that time there was hardly and herds of reindeer, but they do come around. They dry the seal skin, they do it the hard way and then they make it into ropes and then they use it for clothing and the seals have holes

00030

but they're not very big. They make nets and they put it in the water and they catch seals this way. This way they save some bullets for the guns. They didn't have to purchase any bullets for when they are trapping or when they are fishing this way with nets.

The meat is shared with the community and whoever is in need and they use some of it for trading. The first thing they do is feed the poor because there is no way -- they might be poor because they were unable to go or they might be sick or something and then they just don't look at poor people. They share what they have. In spring time the Arctic chars are very plentiful then. And this is how they -- they have fish for those and they hang these fish for drying after cleaning them and store them in ice cellars. They're very easy to store. They store them in the ice cellars. This is how they prepare for the winters.

And inland they do hunting but by trapping. It's almost the same thing. They take care of everything that they have caught by hunting. Her testimony is a little bit different, but they are having a hard time at present. No jobs and no meals to eat at the table. This is very hard when the children are involved and they're hungry. She is involved with children from eight years on up and up to 17 years of age. They take them out camping and then they try to continue with traditional -- how they

00031

can prepare. They teach them how to fish and how to take care of them or any other animals they get. They teach them how to cut it and how to preserve it. Where she was in the tent was with girls. They have curfew at midnight. They encourage them to speak Inupiat and how to take care of the fish. At first they had a hard time but now they learn a little bit and much better towards the end. But this past year has been very hard. She has heard that the children were hungry. Without jobs it is hard to try to feed the children at present. She's trying to -- it's a little bit different from what she had, but this is what she has come up with. They survived by dog team several years ago and they didn't have to try to fix up the snow machine or anything like that. They don't have to buy anything. They just feed the dogs and then they use them for manpower in this way.

MR. STANG: Good. Thank you very much, Sarah. I appreciate your testimony. Yes sir?

MR. KASAK: Yeah, my name is David Kasak, Sr. They going to work on that drilling site on the ocean.

In Native.

INTERPRETER: His name is David Kasak, Sr. He has worked in a drill site, I mean on the drill site and you guys are going to work on the drilling site on the

00032

ocean. He has worked for ARCO at Prudhoe Bay and the caribou at that time were coming in and the truckers had to stop to make them go on their way. On one of these routes, one of the caribou had rabid and it became -- there was nothing they could do but only the one that can kill that was a policeman with guns. So this happened on land and one of the caribou had contacted the rabid disease and stuff like that. So, this was at the time when he was working at least that they were there and now he says that there won't be anybody down there to look out for these kind of things when there's a drill site going on the ocean.

He said that's all he has to say.

MR. STANG: Thank you, David. Thank you very much. Anyone else would like to present some testimony or viewpoints? Geoff?

MR. CARROLL: My name is Geoff Carroll. I work for the Alaska Department for Fish and Game, but these are just kind of my own comments. I didn't show up here with a good organized presentation I just happened to be in town for other reasons and came to listen in to the meeting.

In past years I did attend a fair number of these MMS meetings in relation to offshore development and kind of my duties have changed and I work more with land

00033

mammals now and I haven't been attending them regularly. But it sounds like things haven't changed dramatically since the past years. I kind of hear the testimony that people are very much afraid of oil spills and the impact that that's going to have on marine mammals and their way of life and for that reason they are quite opposed to offshore development.

It's stated in the summary that -- it almost discounts the chances of an oil spill. Chances of an oil spill, because of current technology and everything, are quite slight, but I don't know, we all still have vivid memories in our minds of the Exxon Valdez oil spill and what havoc that reaped and it's just a good illustration that even though the chances are very slight of an oil spill, it can very well happen. Just common sense tells us that even though for any exploration or development project, the chances of an oil spill are very slight when you start having more and more and more of these, which seems to be the direction we're going, we see more development every year and more proposals for development, that you start adding these up and eventually it adds up to the point that at some point there is going to be an oil spill out here.

I think it's quite clear to just about everybody that there is really no method for cleaning up an

00034

oil spill in the Arctic at this time. Even under good conditions, or relatively good conditions in Prince William Sound it took a long time to clean that up and start the recovery from that. In the Arctic, I don't think there is any evidence that there would be any reasonable chance to clean that up at all. So I feel that until there is a good method of cleaning up an oil spill in the Arctic, or until you can say that there's absolutely no chance for a spill that the leasing and the following exploration and development should not occur.

I know people have been saying this for many years at almost every meeting I've attended, the great majority of people get up and say that they don't want to have the leases continue, but for economic reasons and other things, they always do. So I assume that will be the same situation here that this lease will go ahead. If it does occur, I'd recommend that the Barrow, Nuiqsut, Kaktovik, and the eastern deferrals be incorporated to protect important hunting and feeding areas for bow head whales.

As I said, I'm not much of a whale biologist anymore, but I do spend a lot of time working with caribou and I'd just like to disagree with one statement that I saw in the summary concerning caribou, about the effects on caribou. Basically it said that

00035

possibly small numbers of terrestrial animals could be affected by offshore development. Like, last week, we had some very warm weather and it was just about the entire Central Arctic Caribou Herd and the Teshekpuk Caribou Herd moved up to the coast, as they do during warm weather for insect relief. I mean, many of them almost become marine mammals. They're out there wading up to their chests in water to get away from the bugs and they are just literally lining the beaches. Certain circumstances, if there was a big oil spill and it did end up along the beaches, I think that there's a possibility that it could have a considerable affect on a lot of caribou. I think that's understated in the summary.

That's about all I have to say for now. Thank you.

MR. STANG: Thank you, Jeff. Thank you very much. I appreciate your coming.

INTERPRETER: In Native.

MR. STANG: Thanks again, Jeff. Does anyone else have something they'd like to say at this point?

(No audible responses)

MR. STANG: While you're thinking about that, let me mention something that came up last night, and came up here a couple of times today. And that is concern

00036

about the Arctic Sisco. I had asked, Keith Coles who heads our science group in Anchorage to give me a little update on what's going on with Arctic Sisco, so what I'd like to do is read that to you because it's in partial answer to what Bernice is was asking about last night. We understand clearly that the Nuiqsut villagers are concerned that ice roads affecting salinity, drilling mud spilled underground during construction of alpine pipeline could be entering the river or other activities that have effects on the abundance of Arctic Sisco. Very low returns of fish the past five years have accentuated these concerns. Other factors that could affect Arctic Sisco populations include, but are not limited to, factors effecting recruitment at the McKenzie River, changes in the channel of the Colville River, and hence the distribution of fish available for subsistence use, fishing practices and harvest, and possibly the cumulative affects of offshore and on shore related development.

In light of that, and our understanding and we're hearing from the villagers concerns about the Arctic Sisco, we have had a study proposed, and it's been ranked very highly by our office. The study's entitled "Analysis of Variation in Abundance of Arctic Sisco in the Colville River". We expect that to be funded for FY03. We don't have a final decision yet, but we're pretty well expecting

00037

that to get funds. The first phase of that will include meetings with individuals, meetings of individuals in traditional and scientific knowledge about this species to help further design the topics. In the first phase we'll be talking with the Inupiat community about this issue to help define it more closely. We expect that that could start -- the fiscal '03 starts October first, so we would be working in shortly thereafter on that.

There is also another study that is ranked fairly highly and that's "Locating Overwintering Fish Habitat in the Colville River and Beaufort Sea". Finally, our region's fisheries oceanographer has been participating in the North Slope Borough sponsored Arctic Sisco working group and will continue working and coordinating the North Slope Borough on this issue. So, I just wanted to let you know that we heard what people have been saying here about Arctic Sisco for some time, and I think we're going to translate that into some studies that we hope will be useful in trying to assess the nature of the problem with Arctic Sisco.

INTERPRETER: Where is that?

MR. STANG: I have it here. I'll give it to you. Just a second.

INTERPRETER: Thank you. In Native.

MR. STANG: Thank you, Emily. So, Eli, if

00038

you could pass that on to Bernice that information and also apologize for me that, she was correct. We are in the field now studying and she observed that we weren't. But we hope to be in next fiscal year.

INTERPRETER: In Native.

MR. STANG: Thank you, Emily.

INTERPRETER: Uh-huh.

MR. STANG: Anyone else have any testimony that they would like to give or questions or any issues you'd like to raise?

(No audible responses)

MR. STANG: Well, hearing none, I want to thank you all for coming, and I want to thank you, Emily for doing such a wonderful job in your testimony. We certainly appreciate it. It was a very valuable service you provided tonight. We want to thank you.

INTERPRETER: You're welcome.

MR. STANG: Thank you, Mr. Mayor for arranging the meeting and setting everything up for us. We appreciate that. Thank you so much.

(Off record)

(END OF PROCEEDINGS)

C E R T I F I C A T E

UNITED STATES OF AMERICA)
)ss.
STATE OF ALASKA)

I, Joseph P. Kolasinski, Notary Public in and for the state of Alaska, and reporter for Computer Matrix Court Reporters, LLC, do hereby certify:

THAT the foregoing Mineral Management Service Hearing was electronically recorded by Nathan Hile on the 24th day of July 2002, at Nuiqsut, Alaska;

That this hearing was recorded electronically and thereafter transcribed under my direction and reduced to print;

That the foregoing is a full, complete, and true record of said testimony.

I further certify that I am not a relative, nor employee, nor attorney, nor of counsel of any of the parties to the foregoing matter, nor in any way interested in the outcome of the matter therein named.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal this 26th day of August 2002.

____

Joseph P. Kolasinski
Notary Public in and for Alaska
My Commission Expires: 4/17/04

MMS Responses to Nuiqsut Public Hearing Comments

PH-Nuiqsut.001a

The EIS assesses the effects of large oil spills in Section IV.C and the effects of very large oil spills in Section IV.I. However, the use of tankers is not proposed for the Beaufort Sea lease area, and the EIS does not assess the effects of a massive tanker spill such as the *Exxon Valdez* spill.

PH-Nuiqsut.001b

The 600 jobs (Table IV.C-2) are forecast during development. Table IV.C-2 indicates that these 600 workers will reside in Southcentral Alaska and Fairbanks. The numbers of forecast workers from Sale 186 who reside in the North Slope Borough are in the first three rows of Table IV.C-2. The text in Section IV.C.10 in the next to last paragraph under subsection "b" addresses the question of the number of Native residents of the North Slope Borough who might obtain work as a result of the lease sales proposed in this EIS. Mr. Long explains his personal work history in the oil industry, which we have summarized in Section III.C.1.b (4) - North Slope Oil-Industry Employment of North Slope Borough Resident Natives.

PH-Nuiqsut.001c

The government addresses compensation through two methods. Under the Oil Pollution Act of 1990, all operators in the offshore, whether in State or Federal waters, are required to get insurance policies, post financial bonds, or otherwise demonstrate that they have sufficient assets available to mount a spill-response effort and then pay for cleanup of the oil and restoration of the environment. The MMS is the Federal Agency designated to ensure that these Oil Spill Financial Responsibility documents are in place before allowing offshore drilling activities to proceed. Should a spill occur, these financial assets are made available to the U.S. Coast Guard should the responsible party decide not to take action.

The second method of paying for oil-spill-response activities and compensating people for damages caused by an oil spill is the Oil Spill Liability Trust Fund. The Fund was established under the Oil Pollution Act of 1990 to cover costs that responsible parties were unable to pay, or to pay for response efforts when the spiller cannot be identified. The fund was created through a nickel-a-barrel tax on crude oil production in the US. The fund is managed by the U.S. Coast Guard and is immediately available in the event of a spill. The fund is maintained at $1 billion dollars and should the fund be entirely expended in an incident, Congress can take action to add additional funds to continue spill cleanup and environmental restoration.

Once a spill occurs and if the responsible party is not responsive in paying claims for compensation for damage to equipment, property, and loss of income or subsistence hunting/gathering opportunities, the Coast Guard is then authorized to make payments to people and organizations that can demonstrate a loss. The National Pollution Fund Center (operated by the Coast Guard) will assist people in preparing and filing claims for compensation for damages.

PH-Nuiqsut.002

The MMS acknowledges the commenter's detailed knowledge of the region and of regional subsistence resources and practices and the dependence on these resources by the people of Nuiqsut. See also Response PH-Katovik.049. The MMS respects and incorporates the traditional knowledge of the Inupiat into its planning process. See Response L-0006.005 for a more detailed discussion of traditional knowledge. The MMS believes that it can effectively mitigate oil and gas activities in the waters off Nuiqsut. For a more in-depth discussion of mitigation, see Responses L-0001.009, L-0002.008, L-0002.011, L-0002.014, L-0034.019, L-0034.023, L-0034.024, and L-0034.026.

Section III.A.4 discusses sea ice and what the impacts are when it moves.

PH-Nuiqsut.003

Ms. Helms makes important points about job training, which we have added to Section III.C.1.b(4) - North Slope Oil-Industry Employment of North Slope Borough Resident Natives.

PH-Nuiqsut.004a

For a definition of Environmental Justice and a discussion of mitigation that is proposed to address Environmental Justice concerns, see Section IV.C.16. See also Responses L-0034.019, L-0034.023, and L-0034.024.

PH-Nuiqsut.004b

See Response PH-Anchorage.042.

PH-Nuiqsut.005a

Section III.C.1 Economy explains the history of collection of or rents, bonuses, royalties, escrow funds, and settlement payments collected by the Federal Government from OCS leases. Most funds to the Federal Government and the State of Alaska go to the Treasury and General Fund, respectively, and are not allocated to specific programs.

PH-Nuiqsut.005b

The equipment for spill responses is described in EIS Section IV.A.6. The equipment includes skimmers, containment booms, and collection pumps. The section also describes the ongoing research on spill responses.

PH-Nuiqsut.005c

The effects of pipeline dredging are assessed briefly in EIS Section IV.C.1.a(2) and are assessed in detail in the Liberty EIS (USDOI, MMS, Alaska OCS Region, 2002), which is referenced in this EIS. The Liberty EIS conclusion was that coarse sediment would settle to the seafloor very near the trench, but that a plume of fine suspended sediment would drift several miles. There is no known direct correlation between gravel settlement and the abundance of fish in an area.

PH-Nuiqsut.005d

This EIS assesses the potential effects on subsistence harvest. We recognize that some households on the North Slope have higher cash incomes than others. For an analysis of these issues, see Section IV.C.11 - Subsistence-Harvest Patterns and IV.C.16 - Environmental Justice, respectively. We answer the question regarding lease-sale money in Response PH-Nuiqsut.005a. In the Cumulative Effects section, we analyze the spread of the oil pipeline system on the North Slope, especially as it nears Nuiqsut (see Section V.C.11 - Subsistence-Harvest Patterns).

PH-Nuiqsut.005e

To the best of our knowledge, pipelines have no measurable effect on fish populations other than during the construction phase. During construction, fishes generally avoid the immediate area where pipeline construction is occurring but quickly reenter the area following that period.

PH-Nuiqsut.005f

Ocean-bottom cables would disturb seafloor organisms, as discussed in EIS Section IV.C.2.a(2). The section explains also that ice keels disturb the seafloor.

PH-Nuiqsut.005g

Most of the caribou herds on the North Slope have been increasing in recent years except for the Porcupine Caribou Herd on the Arctic National Wildlife Refuge. This herd has been on the decline in recent years due to adverse weather conditions and low calf survival. The MMS is not aware of any oil-industry pollution or activity that has or would cause the direct mortality of caribou. Individual caribou may die from diseases that are part of the natural environment. It is possible that some caribou could ingest soil or plants that were contaminated at old drilling-mud and -cutting reserve pits on the North Slope oil fields, although there is no evidence to support this suggestion.

PH-Nuiqsut.006

The MMS appreciates the commenter’s vast knowledge of currents, winds, marine mammals, and the long history of regional subsistence practices. We agree that the winds and currents can be strong at times in the Beaufort Sea. Recent measurements in Stefansson Sound have recorded currents greater than 100 centimeters per second. We also appreciate the problems that sometimes arise when subsistence food is not available during certain seasons. We also acknowledge that jobs are scarce in the smaller North Slope communities. Although the MMS, as a Federal

Agency, cannot require local hire, we do encourage the oil industry to vigorously pursue it. It is our understanding that the Alpine Project has provided some new local employment.

PH-Nuiqsut.007

Rabies is a natural disease that is common in arctic foxes and in wolves. Oil workers are instructed to stay away from these animals and to not feed them. The same would be true for diseased caribou. This concern is not likely to be a problem out in the ocean except for potential encounters with polar bears. Oil workers are instructed to avoid encounters with polar bears. The oil industry requires oil workers to follow specific guidelines when working in polar bear habitats. These measures are expected to prevent any adverse encounters between oil workers and polar bears and other wildlife in the Arctic.

PH-Nuiqsut.008a

See Section IV.A.4 - Oil Spills regarding the chance of an oil spill occurring. The commenter is correct that as more development occurs, the chance of a spill occurring increases. The cumulative case in Section V looks at the issue of increasing development and analyzes future development and the impacts of oil spills.

PH-Nuiqsut.008b

See Response PH-Barrow.004.

The MMS has considered the environmental effects of an oil spill and has factored this into the deferral options offered for the Secretary of Interior's lease-sale decision process. The various deferral options are discussed in Sections II.D through II.G.

PH-Nuiqsut.008d

The large spill assumed in the EIS is either 1,500 barrels or 4,000 barrels. Such a spill is not likely to oil hundreds or more caribou, even if they are concentrated along the coast (the caribou are more likely to be on land rather than in the water). Much of the oil from the assumed spill could oil shorelines where caribou are not present. Caribou and other ungulates that frequent coastal areas are not known to be particularly vulnerable to oil spills. Only animals that swim offshore in open water are likely to be come oiled enough to be adversely affected by the spill. Caribou generally wade in the water along the coast and do not swim offshore. If the caribou move out on the shorefast ice (as they are known to do the spring-early summer), they are not likely to be come oiled. Spill-cleanup activities could include hazing to keep the caribou from entering oiled waters. Even if some caribou are oiled, there is no direct evidence that mortality would occur. There was no evidence that the *Exxon Valdez* oil spill that extensively oiled beaches in Prince William Sound had any effect on the Sitka black-tailed deer that frequent the coastal beaches during the time of the spill.

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERALS MANAGEMENT SERVICE

OFFICIAL TRANSCRIPT -- PUBLIC HEARING

DRAFT ENVIRONMENTAL IMPACT STATEMENT
BEAUFORT SEA MULTIPLE SALE PROPOSED OIL AND GAS LEASE SALES
(SALES 186, 195, AND 202)

Kaktovik, Alaska
Quargi Community Center
Friday, July 26, 2002
7:00 p.m.

00001

MMS PUBLIC MEETING

July 26, 2002

Kaktovik, Alaska

00002

P R O C E E D I N G S

(On record)

MR. STANG: Maybe this is a good time to start. First I'd like to thank you all for coming. We don't need to translate I trust, and if you do need translation, Suzie's here to help when, and if you do. The purpose here is to have a meeting to discuss and to hear your testimony on a lease/sale EIS, Environmental Impact Statement, Draft Environmental Impact Statement for three lease/sales. One schedule for 2003, one scheduled for 2005, and one scheduled for 2007. We are from the Minerals Management Service in Anchorage and in Herndon, Virginia, which is our Minerals Management Service headquarters. My name is Paul Stang, S-T-A-N-G. I'm the regional supervisor for leasing and environment here in Alaska. On my left is George Valiulis, who is the key person in headquarters for the environmental impact issues and statements and assessments for Alaska. On my right is the head of the leasing division in headquarters. Why don't you say a few words, Renee, and then we'll introduce the other people.

MS. ORR: Okay. I'd just like to say what an honor and pleasure it is for me to be here tonight to actually hear from you what your questions and concerns are about the proposal. It's quite a different thing to be able to actually hear from you all personally and see

00003

Kaktovik, rather than sitting at my desk in Washington, D.C. and reading about it in documents like that, so I'm very pleased to be here tonight.

MR. STANG: We also have, in back, who greeted you coming in, Albert Barros, who is our community liaison and Angela Mazzulo, who is in the budget shop in headquarters and she wanted to get some idea about what goes on here in Alaska. Nathan Hile is our court reporter and he's going to be transcribing everything that you say -- everything that is said here tonight. As I said, the purpose is to get your comments on this Draft Environmental Impact Statement. Now what you have in your hands is either an English or an Inupiat version of the executive summary of that Environmental Impact Statement. We sent a bunch of those up. Did they arrive here Lon?

MR. SONSALLA: Yes, (indiscernible)

MR. STANG: Okay. The environmental.....

MR. SONSALLA: (Indiscernible)

MR. STANG: Good. And we have it both in hard copy, which is a document here. George has a copy right here. Three volumes. And they're also there on CD. If you have a CD you need to have internet access or you need Adobe Acrobat in order to pull it up on the CD. The area that we're talking about I can show you on the map and Agnela gave you a brief description of it. It's that pink

00004

area on the map on the right there on the wall. That extends from three miles offshore to about 60 miles offshore. Of course, the first three miles of ocean water is State waters, and so Federal waters start from three miles and go on out. The depth range from about 25 feet to 200 feet and we're talking about an area that's about 9.9 million acres. It goes from the Canadian border on the east to Barrow on the west.

And then on the left map, there's an outline that shows the same area as the pink area, but we also have four candidates for deferral. What we mean by deferral is these are alternatives that are in the EIS that could be selected by the Secretary of Interior where leasing would not occur. So she has those for her consideration so she could propose leasing the whole pink area. Have no leasing at all or she could lease like the whole area except for one of those areas. So, if you take, let's say the green area right off Kaktovik, she could say well, I'll propose leasing in the whole pink area except for the green area. Okay? If you follow what I'm saying. Those are candidates for her consideration.

The three on the left, the one related to Barrow, the one related to Nuiqsut, and the one related to Kaktovik are there for whaling deferral. The one on the east is there because some people have indicated that

00005

that's a bow head whale feeding area. So those are what we call deferral options.

One of the things that we are trying to do here is to consider your comments, and we consider them both in and of themselves, and consider them in light of the executive order on environmental justice, so we consider it in both those ways. The information we gather will be shared with the State of Alaska and other Federal agencies. We also have had a series of government to government meetings up here on the North Slope concerning leasing, and we will continue to have those. To date, we have held seven lease/sale in the Beaufort Sea starting in 1979, and in total in those sales we leased 690 blocks. Those are basically three mile by three mile areas. A number of those have expired. The primary term has expired and those leases have been relinquished. There are still 54 that are active. So while there's been a lot of leasing, that many tracts leased, there hasn't been a lot of activity that has occurred.

To date, only 30 exploration wells have been drilled. We have, so far, only produced oil from the Northstar facility. Northstar, as you may know, is right just shy of three miles from land. Most of the wells being drilled from Northstar are from State waters. There are a few of the wells, the bottom hole location of those wells

00006

are in Federal waters. That's to date the only Federal oil that is being produced.

You might recall we came here and talked about the Liberty Project. Well, in January we had finished the Environmental Impact Statement and were about ready to issue it and BP decided that they had to re-think that project, so they said let's hold up for the time being. And then in June they formally withdrew their proposal. But they have indicated to us that they intend to resubmit a new configuration for the Liberty Project sometime within the next year. Now, of course, I guess we hear them, but we're not sure what we're going to get until we get it. When we get it then we'll look at it and see what goes from there. That's a possible thing on the horizon.

The only other thing that is active at the moment, is called the McCovey Prospect. Phillips and ANTANA, which is the new name for Alberta Energy is, this winter, planning to do an exploration at the McCovey Prospect which is a little northwest, maybe about six miles northwest of Cross Island. They will see whether they find any oil or they don't. The timing on the first sale is scheduled for about September of 2003. We will, this fall, produce a -- or I guess it's in February, will produce a Final Environmental Impact Statement, and then there will

00007

ultimately be a decision by the Secretary and the sale will occur a little more than a year from now.

The EIS will cover all three sales. But before we start the process for the sale in 2005, we're going to do a check to make sure that that document is still up to date. So, we'll do what we call an Environmental Assessment and that we'll make that publicly available. And then we'll decide then if we need to do a supplemental Environmental Impact Statement or whether this one will serve as adequate for the 2005 sale. We'll do the same thing again for the 2007 sale. We'll do also a consistency determination with the State, of course in consideration there of the North Slope Borough's Land Use Plan for Coastal Zone, Coastal Zone Plan. We have to do a consistency determination to say that the sale is consistent with that and demonstrate that for all three of these sales. Part of the reason to do one Environmental Impact Statement for three sales is because those are expensive to produce. They cost about $1,000,000 to produce this document. That's the government producing it. The one for Northstar cost $7,000,000 to produce. We understand the one for the TAPS pipeline renewal that they're talking about now, that one costs $6,000,000 to produce. They're expensive things and to a large degree things don't change that rapidly. So it doesn't make sense

00008

for us to do three of these things where one would be hardly different than the next, unless we find that we need to do a supplemental. Then we would do a supplemental. So that's the story behind it.

The decision, as I said, is made by the secretary of the Department of Interior, Secretary Norton. She's the decision-maker for these sales. But the person to your right here -- to my right, has a little to say about it and we, in our office have a little to say about it too. We write a recommendation to the Secretary and then that's taken by Renee Orr's office and they modify it or shape it or add their own viewpoint and send a decision memo, which they prepare then for the Secretary to make a decision.

We want to indicate that the sign-in sheets are a public record and can be released under the freedom of information. So that information that you have on there could be released to the public. If that gives you a problem, we could strike your address, but we still need to keep the names of the people who appeared here. That's a kind of for your information piece of information.

These proceedings here will be transcribed, and that transcript will be available upon request, but the comments that you make in there will be responded to in the Final Environmental Impact Statement. So, that's kind of

00009

the background that we wanted to present to you briefly.

At this point, we can do one of two things, because I'd like to keep this as informal as possible. If you have questions that you want to ask about what we're doing or why we're doing it or anything like that, feel free. If you have testimony you want to give, we ask you to sit up here at the table and make sure you state your full name first for the record so Nathan will know and whoever does the typing will actually know who did the speaking. So, let's keep it that way. If somebody would like to testify first, jump right up. If you have questions, let me know.

SUSAN: I have a question on that Liberty?

MR. STANG: Susan, yes.

SUSAN: BP was going to and they decided not to go through with it. What make them want to.....

MR. STANG: Hold off?

MS. S. AKOOTCHOOK: .....no, what made them want to reopen it again?

MR. STANG: Okay. Well, they didn't decide not to do it. They decided that it was -- the configuration and the approach they were using, according to them was too expensive. The cost that they projected would be higher than they felt reasonable given their assessment of how much oil was there. Part of that, I

00010

think, was based on their experience with Northstar. Northstar cost -- the construction and initial operating cost of Northstar turned out to be much higher than they anticipated. And I think that BP, as a corporation, in London looked at this project and they said, your projected costs are too high. So, what they are doing is they're looking at this project again to see if there's a way that it can be produced more economically. We've heard various ideas about what they may do, but I think the best thing to do is wait until they actually submit a plan for development and production and then you know what they're actually proposing, or if they ever do submit a plan for development and production. We don't know. I mean, they -- from all we can tell, there's 140,000,000 barrels of oil sitting there and they just need to find a way that they can produce it economically. As you know, costs up here are very high compared to the Lower 48 for instance, and so they have to make sure that it's an economic prospect.

SUSAN: (Indiscernible) Are they going to make a barge ship or something to go out to the ocean here?

MR. STANG: Yes. Yes.

SUSAN: (Indiscernible)

MR. STANG: Here's the deal. They were -- this SDC is the name, Steel Drilling Cason, I think is the correct interpretation. It's basically a vessel that can

00011

be sunk, that's basically how, and stuck onto the bottom. That's where it was over near Nome, sitting there kind of in storage in the ocean. A week and one half or so ago, they fueled it up and made sure it was in operating condition and blew the ballast and floated it and they're steaming around. I don't know exactly where it is at the moment, but apparently it's somewhere past Barrow but I'm not sure how far. It probably depends basically on the ice, as to what the ice conditions are so they can get it the McCovey site. Then what they'll do is they'll just drop it right down on the sea floor. Just flood the ballast tanks and it will submerge right on the sea floor. They will start preliminary work on it but wait until winter and it's locked in before they do their exploration. They'll be locked in the ice.

MS. ORR: Nathan's saying if we want the questions on the transcript they need to come to the microphone.

MR. STANG: Okay. Right. We can do one of two things. Let me see how long the cords are. Well we can't really. We'll need any questions -- unfortunately we have to have them on the microphone in order to record them. So if you have a question, you've got to go to the microphone, otherwise it'll be missed. I think in your two questions we can figure out what they were by the answers

00012

I gave, but for subsequent questions we ought to come to the microphone.

Okay. So any other questions or who would like to provide some testimony? Please, Marilyn.

MS. TRAYNOR: My name is Merylin Traynor and I have two or three questions. Could you show us where the 54 existing leases are? Are those leases that are near Kaktovik that are now existing and how they relate to looking at a map?

MR. STANG: Let me see. We've got two maps here. Let's see if we've got ones that have existing leases. I'm afraid we don't. Is there one in the EIS, George, do you think? We can show you generally where they are on this map here. George will look and see if he can find one.

MS. TRAYNOR: Also, it would be interesting to see the one you're talking about, McCovey right, where it relates to Liberty.

MR. STANG: McCovey is there. Liberty is here. Northstar is there. Now on this map, it's kind of a small map. That map is kind of a small map, but basically that is the general area where the leases are. There are a couple of leases off the National Petroleum Reserve, but I don't know if there are any leases east of the Canning. I don't think there are leases east of the Canning.

00013

MS. TRAYNOR: Well what I see on this map here, it only goes to this side of the Stains River, Flaxman Island, so it doesn't even come over here. So there are no existing leases off of Kaktovik then?
MR. STANG: See, those aren't leases, those are prospects.
MS. TRAYNOR: Oh, okay. Those are.....
MR. STANG: Or as they call them new discoveries or fields, or whatever have you. But, we're trying to find a chart that shows you the exiting leases. The difficulty is on these graphics for existing leases is that they change frequently because these leases get relinquished along the way, either at the end of the lease term or if the company decides they just don't want to pursue it any more. They're paying a rental on those leases and they.....
MS. TRAYNOR: So how long are these leases?
MR. STANG: The leases are 10, aren't they here? We use 10 year leases basically in Alaska. Some leases elsewhere are five or eight years.
MS. TRAYNOR: I guess what I'm asking is outside of this pink and green zone of Barter Island is there any existing leases out there?
MR. STANG: No. No. Just in the area where you see what we call these, well, just what the title

00014

says, "Fields, New Discoveries, Proposed Activities", the leases are in there with one exception which I think is about six tracts that are out there off NPR-A that they haven't done anything about. One thing that -- just so you understand. Since 1979, there has been leasing all around Alaska. There has been leasing in the Chukchi, in Prince William Sound. There's been leasing in a whole bunch of places way out in Naverin. Way out 300 miles from shore. But, none of those leases resulted in any development. Some were drilled. They drilled some holes out there, but they didn't find enough oil or gas to produce. They found a whole load of gas in Chukchi, but it's not economic around Prudhoe Bay, so, therefore, it's not going to be economic in Chukchi.
MS. TRAYNOR: Okay. I guess I had one question of drilling, sound pollution on mammals.
MR. STANG: Sound from drilling?
MS. TRAYNOR: We have new questions down in the Gulf of Mexico about maybe sounds that they're producing down there and proof that it's damaged and killed some of the sea mammals.
MR. STANG: Correct. One of the activities in the Gulf of Mexico that has produced mortality is when, at the end of the life of a platform, they were using explosive charges to blow the legs of the platform clear

00015

and they were killing a lot of animals due to the pressure wave in the immediate vicinity. So they made an assessment of that. So there was mortality from that. The main issues that we've had here in Alaskan waters with respect to noise has related to seismic exploration. We have had whole series of ongoing studies. What's interesting, of course, is the Inupiat whalers were saying, we can tell you what happens when the sound comes. We can see what happens to the whales and that there's a deflection that the whales in the migratory path seismic noise goes off, they deflect out away and, of course, that's been a big concern.

Our initial science indicated that the deflection wasn't particularly -- the whales didn't deflect that far. The whalers were saying yes it does. In fact, what's happened as more and more data -- we've gathered more and more data and we've listened a little more carefully, is I think we're closer to agreement about the nature of that deflection. With respect to drilling noise and noise related to operations, we literally don't have any facility on the outer continental shelf yet. As I said, we have Northstar, which is right on the edge of State waters just close to Federal waters. We are doing a series of measurements to try to assess the amount of sound and the effects of sound on species from the Northstar operations. This is for development drilling.

00016

Now, what we've done for Northstar is that there is a window when drilling will not be taking place and it's during the migration. So in a sense, we don't have much data on the effects of drilling on the whales because we haven't been drilling when the whales are there. The Annaninna Project, which basically is a project on monitoring, not only sound but the quality of the water and other aspects is a project that we initiated as a first priority of our science program based on information that we got here in Nuiqsut and Kaktovik and Barrow. People were saying we need you to monitor what's going on in the water before you build any of these islands and before you have any production. So, if there's a problem, we'll have a baseline from which to measure the problem that occurred. We've had that program ongoing from early in the beginning of Northstar and well before Liberty was scheduled to go. Now we have a lot of data on the Liberty area but we don't have a Liberty project yet. So, we're doing our best to keep track of the effects of these projects and what effects they may have. Then we can use that information to make any modifications that are appropriate to how drilling is done or how production is done.

MS. TRAYNOR: With all the wells that have been drilled in the Gulf of Mexico and off the Pacific Coast, do you have data on all the sounds and does the

00017

temperature of the water -- I don't know how it effects the sound.

MR. STANG: It does. Sound propagates in the ocean and it propagates differently at different temperatures. In fact, if you have a thermoclimb, which is one temperature here and another temperature there, the sound basically bounces off of that, doesn't go up through that thermoclimb. Yes, there's a lot of data in the Gulf of Mexico and some in the Pacific about the affects, but they may relate and give us a first approximation, but we have a different situation here. We have shallower water. We have ice over the top of it. We have a bottom that may be different for the most part here than there. We have water temperature that's much colder. So, all of those things affect the environment.

MS. TRAYNOR: So we must know what colder water does to sound. Does it make it higher or lower? What does ice do? Does it hold it down in the water?

MR. STANG: One of the things that ice does because of the very ragged underside of the ice -- the underside of the ice is quite uneven and the top, a lot of the ice is quite uneven, too. That's a baffle. That tends to baffle the sound to some degree. The temperature, and I can't remember my physics that well as to the speed, but I think it's a relatively minor affect on the speed of

00018

sound through water, whether it's cold water or hot. It's not a major affect. There's some change but not enough. But the key is that we don't have data from the Gulf of Mexico that indicates that we have an alarming problem that we have to deal with. But it's what happens here in the Arctic. We get a first approximation from what happens elsewhere, but what we really need to know is what happens here in the Arctic.

MS. TRAYNOR: We have seals out here, I assume, all winter and they're under the ice and on top of the ice and you saw them today so.....

MR. STANG: Right. Exactly. But remember again, so far we haven't had any, except Northstar -- this is out three miles from shore and it's going to be a big difference if you're in the very shallow water versus if you're out that far. But it's something we're very much attuned to and will remain attuned to. We do have a fairly decent science effort. Our whole purpose of that is to identify problems which we get here. We take information and questions like that and questions that we have ourselves back to our science group and we say, look, what are the most important key issues we need to work on. Let's devote the immediate funds to that and then we have a priority system. We have a whole series of issues like, for instance, Nuiqsut had been quite concerned about the

00019

Arctic Sisco and they haven't been catching much in the last four years. So we are directing one of our studies in 2003 to that very issue. So we try to, and that's what I said on the Annaninna Project, the monitoring project, is one in which we have refocused our priorities to look at monitoring those specific sites where we expect, well in the case of Northstar and where we thought Liberty was going to go.

MR. VALIULIS: Can I add to that?

MR. STANG: Sure. Please.

MR. VALIULIS: This is George Valiolis. In this document, we treat noise as a very important element. I don't remember and I can't tell you exactly what our findings were, but I do know that they're in this document. I can tell you that it did not reach the level of concern that it would be a significant impact in the view of our analysis. But, again, we have a large section devoted to answering some of the things that you mentioned.

MS. TRAYNOR: Thank you.

MR. STANG: Thank you, Merylin. Suzie.

MS. S. AKOOTCHOOK: Good evening. My name is Suzie from right here. Just listening to Merylin's questions and your answers on noise and acoustics or noises down underwater. I was very fortunate to work with North Slope Borough when they were counting the whales and

00020

observing the whales. They had an acoustic crew and I was very fortunate to be on the acoustic crew. I can tell you that the noise from the ice, you can hear it. We had radios going all the way from 25 feet, 75 feet, 50 feet, to 100 feet, 150 feet from the ice. That's how deep we had those.....

MR. STANG: Hydrophones.

MS. S. AKOOTCHOOK: Yeah. When people are walking over the ice, 100 feet below you can hear them walking on the ice. The whales are very sensitive to noise. There was an airplane, a small airplane. I don't know if it was 160, 175 or 189 plane but anyway, I'm not sure how high it was flying, but I could hear that, the sound of the airplane in the water.

MR. STANG: Through the hydrophones 100 feet down.

MS. S. AKOOTCHOOK: Yes, I could do that, and all that is recorded.

MR. STANG: Yes.

MS. S. AKOOTCHOOK: How closely have you guys worked with North Slope Borough on getting the information about that? You guys are talking about your guys own crew, right?

MR. STANG: Right.

MS. S. AKOOTCHOOK: How much information

00021

have you gotten from the North Slope?

MR. STANG: I can't answer you specifically on the amount of information we've gotten from the North Slope, but I can tell you this. The scientists for the North Slope Borough and our scientists are in daily, or not daily, but frequent communication. The fisheries people talk to the fisheries people. The oceanographers talk to the oceanographers. The acoustic people talk to the acoustic people at the staff level. We also, when we have our studies planned as to what should be studied. That's the question. What should we be studying? We request that information from the North Slope Borough, in particular, as well as a variety of other sources. We send out these requests. What's the most important thing to be studying?

They tell us and we factor those in. We then do our priorities. Then we send out that list of our priorities. When you know the way it's going to work you're going to fund the first, second, third, fourth, fifth maybe with the amount of funds you get until you don't have anymore funds. You got to stop and then try again next year. We send that list out to them so we have a constant communication on what data we have and what data we need. We share data. We share data with them, they share data with us. So we work closely with them. It's a very important element.

00022

MS. S. AKOOTCHOOK: So you're talking about the constituency on offshore. You guys are working with North Slope Borough right, on the costal planning, Coastal Plan management?

MR. STANG: Yes. That's correct.

MS. S. AKOOTCHOOK: Also on the deferral. You guys were talking like if one area is -- when you said there's -- I know we had our deferral, right? Lon, was this in the State waters or was that off the State waters?

MR. SONSALLA: The last time there was a deferral, I think it was within 50 miles of (indiscernible) a 50 mile radius. That's what we have.

MS. S. AKOOTCHOOK: And it's still in effect to this day, right?

MR. SONSALLA: I don't know. I think it's lapses (indiscernible).

MS. S. AKOOTCHOOK: So we'll have to testify about what areas we want deferred?

MR. STANG: That's a very legitimate area to testify on. It certainly is.

MS. S. AKOOTCHOOK: I would like to testify then. Our area from Demarkation Point all the way to -- well actually, as far as we can travel that we have a deferral -- a request for a deferral in our area, as the whaling captains, when they go out whaling in falltime

00023

depending on what the ice condition is. We don't know how the ice condition is until when the month comes. Cold weather is out there, 12 miles, 15 miles. What miles is it the most last year? Was it 14 miles out or was it 15 miles out?

MR. SONSALLA: Twenty-two or 23 miles.

MS. S. AKOOTCHOOK: Twenty-two or 23 miles up they were last year, last fall. So our whaling crew goes quite a ways out to go and get their whales. I will continue to request that there be a deferral in our area because that's a feeding area for the whales and it's been on record for many years.

MR. STANG: Okay.

MS. S. AKOOTCHOOK: We live off the ocean. We've got people that are out there that are fishing right now. We've got people out there going after seals or oruuks (ph) because we need to harvest.

MR. STANG: Seals and oruuk?

MS. S. AKOOTCHOOK: Yeah. Harvest for winter and also harvest for the whaling season so that the whaling crew can have food out there when they're out there all day. They take off like sometimes six in the morning and they're out there until it gets almost dark. So it's what, like, about 12 hours or almost that many hours out there in the ocean. And they need, you know -- I prefer to

00024

have our area deferred. I request that. Because we live off -- they get real serious in their whaling. I know you don't see much of them here, but those of us that care are here prefer to continue to see it be deferred in our area as far as 50 miles out like it was. And if there should be anything in writing. I believe so. I believe that the entities here can get together to agree on what areas they want deferred, like the city, KRC and Tribal government.

MR. STANG: Okay. Speaking of that, there's something I didn't mention, and I should have. That is that September 20th, is the last day for written comments to be received by the Minerals Management Service. On the table over there is this sheet of paper, which basically converts into a mailer if you want. It has an address on it. It has a place for your return address and a place for a stamp and a place on the inside to write what you want. So a simple way to submit a comment in writing is just to take this, fill it in, fold it in half and tape it and put it in the mail. That's the simple way. Any way you want to write it is fine. As I said, this testimony here is taken as testimony and comments on the document. So what you just said is recorded verbatim and also understood as a specific comment.

MS. S. AKOOTCHOOK: Another question on that deferral, that deferral that the city had at one time.

00025

Is that still active or do we have to re-do it?

MR. STANG: Right. The way a -- let me tell you in a nutshell the way that system works. This document is the five-year plan for 2002 to 2007. It was approved at the very end of June by the Secretary herself. She had sent out three preliminary versions of this over the last 18 months or so for comment. So this is her approved five-year program. This is the one that has those three sales that I mentioned, the three sales here in the Beaufort in it. The way the law is written, Suzie, is that for each five-year period, the Secretary is to look at the entire Outer Continental Shelf, and make an assessment of one area relative to the next on a whole bunch of criteria. So, in a sense, she is supposed to start with a clean slate when we're talking not about what people have said in the past, but when we're talking about what areas to be included. So she looks at those and makes her judgement. Obviously, any Secretary who is worth her or his salt would consider what people have said in the past. I think Gail Norton has done that.

Literally though, she is obliged to start afresh. Then the pink area is the area that she chose to be considered for leasing. Then when we started structuring these three sales, after she did her thing, we started structuring these three sales, we considered and we

00026

added consideration of these four candidate deferral areas. Basically, the three on the left there, the one by Barrow, the one by Nuiqsut, and the green one by Kaktovik, were based on the actual whaler strike data, where strikes were made. That was the basis for that. So in a sense, yes, you start afresh for each five-year program.

MS. S. AKOOTCHOOK: Okay. Thanks.

MR. STANG: Sure. George and Renee chime in and Albert and Angela if you have anything to add or whatever, please, please just jump right in.

MR. THOMPSON: Yeah, my name is Robert Thompson.

MR. STANG: Yes.

MR. THOMPSON: I have a question. Has the ability to clean up an oil spill in broken ice conditions ever been demonstrated adequately to the government or to anybody?

MR. STANG: That's a good question. There is capability of dealing with oil in broken ice. There are a variety of ways to deal with it. The one that they've been working on, and it's partly because of the way the state's laws are written and the way they're interpreted, is they are looking at mechanical clean up. Clearly, they had some difficulties in their tests for mechanical clean up in broken ice. Another way to deal with oil in broken

00027

ice is by burning. That is a viable way and has been tested and we are, in fact, continuing to pursue efforts in that testing. The MMS itself and through contract. The jury hasn't concluded on what and how best to do everything. That's an ongoing process. But, I'll acknowledge that some of the tests they ran on mechanical clean up of oil in broken ice were less than optimal, that's for sure.

MR. THOMPSON: So would it be fair to say that the government has never demonstrated the ability to clean up?

MR. STANG: I would say if you are speaking mechanically, for mechanical clean up, that's probably correct. For burning, I think that's probably a different story. You probably have -- and there's some conditions that are needed in order to do burning of oil. You need a certain thickness of oil and you have to get access to it. So there are situations that you can't assure you're going to be able to burn your broken ice under any conditions. You have to be able to get access to it and it has to be thick enough to ignite.

MR. THOMPSON: Has it ever been demonstrated that the burning is possible?

MR. STANG: Yes. I wouldn't say that we're done with our investigations, but we do know and we have

00028

been working with the Norwegians and we've been working with some others who, as you may know in the United States, we may not put oil in the water in order to do a test. We can't do that. That's not allowed. But the Canadians can do it and the folks from Norway can do it. So we've been relying and working with them on these tests of burning oil and we've funded and helped participate with those and we're continuing to do so.

MR. THOMPSON: Okay. What percentage of the oil is being able to be burned.

MR. STANG: I can't answer that specific question, but I can get you documentation if I have your address. We can give you the best information we have on what success rate, what were some of the conditions, what were some of the problems they ran into, what were some of the successes?

MR. THOMPSON: The reason I ask this, I believe in the Exxon Valdez oil spill, more than 80 percent of the oil was never ever recovered.

MR. STANG: Correct.

MR. THOMPSON: Most of it isn't at the surface, It goes throughout the water level where it would not be accessible to be burned.

MR. STANG: Yes. Clearly, any oil that gets into the water column, burning obviously is not a

00029
choice. Burning typically has got to occur very early in a spill. For two reasons. One, the oil is thicker and two, it has more of the volatile components that make it susceptible to burning. The longer it goes, the more of it is mixed into the water column and the more of the volatile components evaporate and you're left with the ones that aren't as volatile and hence, not as subject to burning. So, you're right.
MR. THOMPSON: Does this Environmental Impact Statement reflect the latest findings of the Clean Water Act in regards to how toxic the oil is on environments? Specifically on fish?
MR. STANG: I'm going to have to defer to George on that because I read parts, but I don't remember literally what we've got there.
MR. VALIULIS: It's considered in two parts. It's considered under water quality and then it's considered under the organisms that are affected, primarily fish has been the concern, fish eggs and that sort of thing. It reflects the latest knowledge that we have on the topic.
MR. THOMPSON: Were any of these tests on how toxic the oil is done in cold water conditions, Arctic conditions?
MR. VALIOLIS: I'd have to look at the

00030
section.
MR. STANG: I'm fairly certain we have in our science studies program a fair amount of data on the toxicity of oil to fish, but again, if you'd like me to get a specific answer to that question I'll do so and mail it to you.
MR. THOMPSON: Yeah, I would like an answer on that.
MR. STANG: Okay. So, we want success in burning in broken ice.
MR. THOMPSON: Or clean up of any type.
MR. STANG: Okay. Well, okay. Let's say.....
MR. THOMPSON: Mechanical or burning.
MR. STANG: .....mechanical and burning. I don't know that we've done others, but those tow. And then you want the toxicity of fish in cold water.
MR. THOMPSON: Toxicity of the oil in cold water.
MR. STANG: Toxicity of the oil on fish.
MR. THOMPSON: Or wildlife.
MR. STANG: Any wildlife.
MR. THOMPSON: Because I understand it takes a lot longer to break down in cold water. It may not break down at all.

00031

MR. STANG: I know one thing. There's a lot of data on toxicity of oil on wildlife in general just because of all the research that happened on Exxon Valdez. There's a load of it there. That's cold water too. Now, if you're talking about Arctic water, are you differentiating between Exxon Valdez data from Prince William Sound and Arctic?

MR. THOMPSON: Yes.

MR. STANG: You're looking at Arctic specifically?

MR. THOMPSON: Yeah like 28 degree water or how ever cold it is here.

MR. STANG: Right. Arctic water. Okay. All right. We will -- did you have a chance to put your address down?

MR. THOMPSON: Yes.

MR. STANG: We'll make sure you get that information?

MR. THOMPSON: Does this Environmental Impact Statement reflect any impacts outside of the lease area?

MR. STANG: Well.....

MR. THOMPSON: And if not, why not?

MR. STANG: .....yes and no. The majority, and George fill in here, the majority of the focus is in

00032

the specific area that we're talking about. The primary focus is what's happening here in the lease area. We do, however, when we address cumulative effects, we look at the species that are affected by -- potentially affected by development that would occur in the pink area. But we look at, also, what other affects they would receive in the rest of their migratory path. So, for instance, if we're talking about birds that could be affected here, birds migrate down to South America, so we look at along their migratory route to see what affects there could be on those. We also look to see if any of the affects, whether it be from the actual development itself or from the potential of spilled oil would have beyond the borders of that pink area. But I can give you a general statement that, by and large, we don't see much affect that proceeds out of, let's call it the pink area, of oil or of noise or of sediments or whatever have you. The reason being, is by the time oil would transport itself that far, it would be so dissolved and diluted in the ocean water that you probably couldn't perceive affects let's say around from the northwest of Alaska or east over into Canada. They would be so diminished that you wouldn't be able to measure any difference between that and the natural phenomena that occur.

MR. THOMPSON: Well, has there been studies

00033

to verify that?

MR. STANG: I think our analysts look at those specific issues and they make their best judgement based on the data that they've got available. After you get to certain dilution -- you know, we have studies that indicate you can't differentiate any effect. It's kind of like the same concept with the EPA where EPA sets water quality standards and they say if the parts per million fall below an area that we presume it's safe because we can't find any health affects based on that.

MR. THOMPSON: So then you would say that the studies have been done in cold water to verify what you're saying?

MR. STANG: To some degree. There's no absolute.....

MR. THOMPSON: Either the studies have been done or they haven't.

MR. STANG: Well there have been some studies done.....

MR. THOMPSON: In cold water?

MR. STANG: Huh?

MR. THOMPSON: In cold water, ice conditions? I mean Arctic conditions?

MR. STANG: There have been studies done in cold water in Arctic conditions on the -- well, let me be

00034

careful here. One of the difficulties we've got is that we have laboratory tests in cold water, but one problem is, one of the benefits, as well as an issue here, is we don't have a lot of data on spills in the Beaufort Sea because we haven't had spills in the Beaufort Sea. You've got to have an oil spill in order to measure its affects. So, we haven't had spills of any substance in the Beaufort Sea from offshore oil that we have been able to measure. Until you -- in a sense you don't want to ever have that, but until you do, you can't measure everything that you would need to answer the question as definitively as you would like.

We can use foreign studies and laboratory studies to make judgements as to how dilute an affect where you would see an affect and where you wouldn't see an affect depending on the pollutant.

MR. THOMPSON: Have any studies been done to determine the affects that this additional amount of oil that's anticipated will have on the existing pipeline and have you incorporated any of this data with the pipeline renewal permit?

MR. STANG: Your last question I don't know the answer to, but we can certainly find out. The real key here is the pipeline is well below its capacity. It's pumping, I think, at about half the rate that it was at its

00035

peak. Any of the discoveries that we anticipate from any of these three sales, individually or collectively, is not sufficient to over extend the capacity of that pipeline. In fact, it's almost the other way.

MR. THOMPSON: My understanding is there is a known reserve of about 30 years from this existing pipeline and additional permitting will cover that life span, so if this area is to develop at a later time, have you taken that into consideration?

MR. STANG: It's a kind of yes, but, answer. My understanding is that they are producing oil at a rate that's about half the rate that they used to produce here on the North Slope. Yes, there is, and I don't know if it's 30 years or how many years worth of oil that they will be producing, but it's the rate of production. The rate of production has dropped precipitously in Alaska -- in the North Slope in recent years. So while they still could be pumping for 30 years, the rate keeps dropping down. So any oil that would be produced related to this sale, that we envision and obviously you never know until you find it, would not in any sense of the word exceed the capacity of the pipeline.

MR. VALIULIS: If I could also interject. Your questions, to a degree, are on what we call cumulative impact. This activity along with others. We've made a

00036

best estimate of what we think other activities or future activities are going to be and we have a scenario for that and we've -- doing cumulative the proper way, we've considered what the actions here would be to that and then come up with a total. Plus we also evaluate what contribution this present project would have to the overall in that. In doing that, we also go beyond the bounds of the lease area. We're looking at the oil being transported down and even being tankered out. So I think our cumulative section is pretty thorough and, although I can't tell you off the top of my head some of the answers, I can tell you that it's in this document.

MR. STANG: That was George Valiulis speaking.

MR. THOMPSON: Okay. I'm concerned about the clean up costs. Who would be responsible for that?

MR. STANG: Good question. The cost of clean up falls on the companies. It's their obligation and responsibility to clean up. There was an act passed by the Congress in 1990 regarding oil spill liability. Companies can be under that act, required to have bonds up to $150,000,000 for this very issue of who is responsible for the clean up. The way, and I'm going to give you an approximation of the way the system works, and either Renee or George can fill in if I miscategorized. The way the

00037

system works is that the Coast Guard is the on-scene commander. They are the ones who are in charge of making sure that that clean up is done in the optimal way. So, you don't say, okay, before we clean up BP or Phillips, cough up the money to spend. The government steps in immediately, takes over and runs the operation and incurs whatever costs are necessary. Those costs then are passed to the company to clean up and the bonding, this up to $150,000,000 bonding, is to ensure that these guys don't claim bankruptcy and bail out on us. All right? So, there is the responsibility under the law. There are penalties under the law if they attempt to avoid these costs. I think the OPA, Oil Pollution Act, I'm not sure if I got the exact name correct of 1990, is a pretty tough piece of legislation. We have a whole group in our headquarters office whose responsibility it is to make sure that that is operating correctly with our permitees and licensees. That's the obligation for the financial obligation.

The Coast Guard has training exercises for oil spill contingency. Each company has to have an Oil Spill Contingency Plan and then there's some broad overall Oil Spill Contingency Plans. Then there are these drills. You were referring to the clean up in broken ice. That was one of the drills that they undertake to test the capabilities and obviously they didn't meet the

00038

expectations that we would have liked to have seen on that. But I remember attending a meeting in Barrow where a bunch of folks from the North Slope and the Coast Guard and our people and the companies all got together to meet, to help assure the maximum and most efficient clean up scenario.

Furthermore, companies have equipment stationed at various places and, of course it depends to some degree on where the action is, where the activity is as to where that would be stationed.

MR. THOMPSON: Okay. Before these lease/sale are put out for bid, I understand there's supposed to be a need for the development. How do you have the need for development if you have known reserves for Prudhoe Bay?

MR. STANG: Okay. The Secretary of Interior in developing a five-year program is looking at that program from the prospective of the nation as a whole. So what the Secretary is doing is looking at what are the needs of the nation as a whole and where are the prospects for oil and gas around the nation. Now, as you may know, the Congress has set aside certain areas of the Outer Continental Shelf by a device called an annual moratoria, which they've placed on a bunch of areas where the Congress has kind of intervened relative to what the Outer Continental Shelf Act says. They have taken off the whole

00039

East Coast and they've taken off the whole West Coast for new leasing, as well as the eastern Gulf of Mexico. So, they've removed a good portion of the Outer Continental Shelf through their acts of Congress.

Yet, the Secretary has still to meet the mandate of finding and producing oil in an environmentally sound manner. So it's a judgement that she makes about what's the need for the nation as a whole. Now, obviously if you're in the central and western Gulf of Mexico, or if you're in Alaska, you're in the area where this production is occurring, and to a small degree in Southern California. While on one hand you say there's a 30-year supply of oil in tracts -- already discovered oil that will take 30 years to produce out. That's a diminishing rate and she sees the need for additional exploration and development to find sources to replenish those as they diminish.

MR. THOMPSON: Okay. Have there been studies on ocean currents and to determine where exactly this oil will go if it gets away?

MR. STANG: There certainly have. This is one area I have a little familiarity with and we have expended a lot of resources on those assessments. We have a modeling group in Herndon who are specifically devoting their careers to modeling where oil would go based on the best information we have on currents. So one, we do have

00040

information on currents, some of which we generated, some of which we get from the National Oceanic and Atmospheric Administration. Some of which are picked up from satellite. We do know how the currents flow pretty well and it depends on the season. We know that there are a lot of shifts in those currents. They have statistical models that are very rigorous models that take a lot of computer horsepower to run to project where oil spills would flow, how they would flow and where they would hit shore and how they would hit shore, and what would happen to the oil as it degrades over time. Those models are fairly sophisticated. The summary of the results of that does appear in the EIS.

MR. THOMPSON: And does it, the EIS reflect ability to clean up outside of the immediate area in the under ice conditions?

MR. STANG: The clean up under ice and on ice is viewed, generally speaking, to be pretty good as long as that spill occurs sometime from the early formation of the ice to, and I'm guessing now, about a month before break-up. Basically what they can do is mine the ice. Just literally mine the ice to get the oil because it gets encapsulated. If there was a spill let's say in November or December, the ice would form underneath it. The oil would be encapsulated. That oil we understand does not

00041

change in composition. You made note of that earlier. Because of the cold water there is no degradation. Well, because it's locked in the ice there's even less degradation. As long as you can mine that ice before break-up, you're in good shape. However, if a spill occurred under ice just before break-up and you weren't able to mine it, then it would release into the water as break-up occurred in the slow fashion. That would be a more complicated clean up issue.

MR. THOMPSON: How large of an area would people be able to mine?

MR. STANG: It depends on how many bucks and how many pieces of equipment you have, I would imagine.

MR. THOMPSON: I mean, if the oil happened to go 100 miles?

MR. STANG: Obviously, if it would have to go 100 miles it would take a lot of equipment to mine it. One of the advantages of the underside of ice is it really tends to trap oil because of its uneven nature. If the ice were perfectly flat, the oil would flow great distances, but the underside of ice is pretty porous and jagged and therefore, it would tend to, in itself, arrest the flow of that oil. So I doubt it would go a couple hundred miles.

MR. THOMPSON: In areas of open leads in the winter time and new formed ice in open leads it could

00042

go a long distance.

MR. STANG: In leads it probably would. I agree.

MR. THOMPSON: So there's no studies to determine how far it might go in those conditions?

MR. STANG: I have to look at -- I know they model not only in open water, but they do model in ice and in spring break-up. Whether or not they have an element of the model that deals with spring leads, I don't know. But we can find out. I'd be pleased to find that out for you too if you'd like.

MR. VALIULIS: If I could add to perhaps this discussion. This is George Valiulis. The oil spill aspect -- the large oil spill aspect is the number one concern in addition to the noise affect on whale migration. The Environmental Impact Statement almost goes ad-nauseam in trying to reflect that. We do it two ways. We assume conservatively if there was no ability to clean up the oil spill. We analyze it that way then we superimpose what the effectiveness of the oil spill clean up would be to the degree we can, so that's something else that's being done. So, we are doing that.

As far as the spill under ice and so forth, we consider that too. That's the 180-day spill and the idea is, yeah, it would go so far it would probably be

00043

trapped and we'd probably have to drill through the ice to suck it out and so forth. Those are some thoughts on that.

MR. THOMPSON: Okay. Does this Environmental Impact Statement reflect changes in the environment due to global warming and will you incorporate the studies that the government is now funding into Arctic global warming.

MR. STANG: George will take a crack at that.

MR. VALIULIS: We look at global warming very carefully especially at the five-year environmental impact statement, because that's an overall concern. Global warming is a large geography type of concern over a great amount of time. That's the point at which we look at it. We, in this document, go back to the five-year program EIS and indicate our thoughts, our best knowledge on global warming. I don't think we're addressing global warming within specifically to the lease period we're talking about for these actions, but on broad.....

MR. THOMPSON: If the government funded studies do, in fact, prove there is global warming, will you incorporate findings that the government is.....

MR. VALIULIS: We have been incorporating. Our air quality people, especially a person in Washington who sits next to me. That's his job. We incorporate and

00044

update for all our OCS program areas.

MR. STANG: I'd like to add to what George said a little bit. The reason for doing it at the five-year program stage rather than the individual lease/sale stage, is because global warming is a long-term trend issue that affects not just the Beaufort, but the world. The globe obviously. We felt issues such as that would be more appropriately dealt with at the five-year program stage than at the individual lease/sale stage. Not that the individual lease/sales aren't -- that's not a relevant issue for that, but in a sense it's more relevant to cover it at the programmatic stage where the Secretary has in front of her the overall decisions for the program. The global warming, to the degree we understand it, is related to the burning of emissions rather than, for instance, the leasing and exploration and development of oil on the North Slope. It's related primarily to burning of hydrocarbons. Most of that doesn't occur on the North Slope. Most of that occurs down below.

MR. THOMPSON: Yeah. What I'm talking about is lessening the depth of the ice and the possible change in ocean currents.

MR. STANG: Our science group -- I've got a science group in Anchorage that are looking at changes in the environment here in Alaska and trying to make

00045

assessment of it. Now, one of the challenges is to understand exactly what changes relate to global change, global warming, and what changes are natural variations. Whether we -- we don't know everything there is to know about the cause and nature of global change. We do know it's happening but we don't know all the answers to exactly why it's happening.

MR. THOMPSON: Okay. Is the clean up equipment going to be in place before the activity is permitted? I mean adequate clean up equipment, not just this ConEx you have down here at the airport. I mean enough to clean up whatever happens.

MR. STANG: The -- let's take -- we've got three phases. We have the leasing stage, the exploration stage and the development/production stage. Basically, at the leasing stage we talk about the need for clean up but companies aren't doing anything yet. They're just acquiring leases at the leasing stage. At the exploration stage where, generally speaking, I think there's general agreement that the risk of a severe accident is relatively low compared to exploration/production stage. So there is oil spill contingency plans needed for the exploration phase, but typically the big concern is development and production, for instance Northstar. So Northstar has to have a specific contingency plan to show how and what oil

00046

they would clean up. That has to meet, because it's in State waters, the State requirements. The State says you need to clean up so much of that oil in so many days and so on and you have to show us in a contingency plan how that would be done. So if we had -- if the Liberty Project went ahead or if we sold a lease here of McCovey goes ahead. Those are in Federal waters. They have to have the same thing. They have to have a contingency.....

MR. THOMPSON: On site and not.....

MR. STANG: On site.

MR. THOMPSON: .....civilian equipment halfway across the state?

MR. STANG: That's right. That's right. We're talking about this project right here, you show us how you clean up oil associated with this project on the island from the pipeline to shore. And then, once you get to shore and you're hooked into the network, then that's part of a broader contingency plan for the pipeline system and if there's a spill in the pipeline system on shore.

MR. THOMPSON: Are these studies that you mentioned that will be ongoing, are they funded by the United States government or are they funded by the oil companies?

MR. STANG: Both. We have a budget that's, I think, in the ballpark now in Anchorage of about three to

00047

five million bucks a year for scientific studies. We have a group in Herndon, Virginia that has money to do technological issues such as, we had a big issue on the type of pipeline to use for Liberty. Should it be single wall, should it be double wall, that sort of thing. In addition -- and those studies as I mentioned earlier, are all driven by our best assessment with the advice of the North Slope Borough, with the advice of our Outer Continental Shelf Scientific Committee, may of whom are from the Alaska area, scientific experts in their field, independent of MMS, independent of the government. Their best advise as to what the priority should be on those studies. And finally, the companies, when they submit their exploration and development plans, they often include with that plans they have for certain studies that they'll do. In addition, as a condition of permits, the Corps of Engineers, the Fish ad Wildlife Service, National Marine Fisheries Service, and our office can require other studies of them that they need to fund. For instance, in Liberty the Corps of Engineers required -- it was about a $500,000 study on sediment plumes that would occur from dredging and from laying the pipeline and how that sediment would flow, in which direction and when. So it's both Sederal money and in State waters, State money. Less State money than Federal generally, and then private companies have to pay

00048

a variety of studies themselves.

MR. THOMPSON: I've got a question about the deferral area?

MR. STANG: Yes.

MR. THOMPSON: Is there any assurance that no pipelines will traverse these areas?

MR. STANG: The deferral is related strictly to leasing. That is, at this stage tracts -- let's say as a hypothetical, the Secretary decided to pick one of the alternatives. Let's just say hypothetically the Secretary decided to pick the Kaktovik green deferral and say I won't have leasing there. Her decision is literally about no leasing of that area. In itself, that kind of removes, from this lease/sale anyway, the great likelihood that there would be any pipelines or anything traversing the area because you go from the green area to shore. You don't go out to sea. Typically any infrastructure would want to get to shore as quickly as they can and then traverse over to Pump Station 1 on shore, typically.

But the technical answer to your question is no. The deferral doesn't remove the possibility of transiting that area with a pipeline, for instance. But by removing those from leasing, the probability of having any -- you'd literally have to have a tract out beyond it. It would literally have to be a tremendous find to justify and

00049

then you'd have to prove to the Secretary that that's the best route to come right through that, over through that tract to get to shore. So the answer to your question is no, but from a practical viewpoint I don't think you could anticipate significant activity in the area.

MR. THOMPSON: So now if you have the oil lease/sale outside the deferral area, is there any possibility that they would consider oil pipeline under the ocean to access the existing Trans-Alaska Pipeline?

MR. STANG: To bury the pipeline?

MR. THOMPSON: Under the water.

MR. STANG: Yeah. Yeah. In fact, the pipeline from Northstar to shore is buried six to eight feet under the sediments. The pipeline that was proposed for Liberty was buried a similar depth. I, in fact, saw the burying of the pipeline from Northstar to shore. What we had included in the Northstar pipeline. There were actually two pipes strapped together because they were going to take gas from the Badami to go out to the Northstar Isle to fire up all the equipment. And then the other one was the oil pipeline flowing to shore. In addition to that, there's a tube about this big in diameter, which is the LIOS tube. What that LIOS tube is a tube that can sense the presence of hydrocarbons at the molecular level. So if there were a small leak in the

00050

pipeline, this LIOS tube would be able to detect it down to a third of the barrel. But, I think their capability is even more. They say a third of a barrel, but I think they can detect even less oil coming out. That check is run every 24 hours through the life of the project. It's a pretty sophisticated device. It's a German device that's been used under rivers and under land in Germany. Allbeit, we haven't run it this distance in the ocean, but the engineers tell us that technically they don't see much difference. Furthermore, it's calibrated every 24 hours to make sure it's working.

The proof of the pudding on the Northstar pipeline is that they have zincs on the pipeline to prevent rust from occurring on the pipeline and so when they do this LIOS tube testing, every 40 feet, which is the length of the pipeline, they're seeing the off gassing of the zincs being generated. The hydrogen from the zincs is off gassing and they're picking it up on this tube every 40 feet. They see this when they have the read-outs on this thing. So they know that think is at least working that way. But BP is being very conservative about that LIOS tube and they're not saying we have definite proof this works at this time. I think they will ultimately, but they're being very conservative on how they make their statements.

00051

MR. THOMPSON: Just one more question. The State of Alaska is on record being in favor of a natural gas pipeline along the existing pipeline. If these oil lease/sales go into effect, would that allow the gas producing companies to circumvent the wishes of Alaska and go down through the gas pipeline into Canada?

MR. STANG: To that the -- they call it the over the top route? Is that what you mean? To go along the Beaufort Sea over into Canada?

MR. THOMPSON: Yeah. Could the leases allow the gas producing companies to do that?

MR. STANG: No. These lease only allow companies to develop and produce hydrocarbons and bring them to market. It doesn't give them access to transport a pipeline along the shore. That's a separate permit that would have to be achieved. A right of way. Now we would be involved in that. Our office would be involved in that right of way if they wanted to go through the Outer Continental Shelf in Federal waters over to Canada. We would certainly be involved in it, but this lease doesn't give them right to transport other hydrocarbons. It only gives them the right to develop and produce hydrocarbons from this particular lease.

MR. THOMPSON: The transportation would be a separate hearing and separate lease?

00052

MR. STANG: The transportation of the hydrocarbons from the particular lease would not be, but the transportation of other hydrocarbons across the Outer Continental Shelf would be. Now, I don't think it's realistic to expect that they would discover so much gas on a particular lease that they would then transport that to Canada. Because we already have 30 years of gas reinjected sitting there in Prudhoe Bay that no one has to drill for it. It's there. All you have to do is produce it. All you need is a pipeline and down it will go for 30 years. So, you've already got a lot of the natural gas sitting there. But these -- what we're doing here has nothing to do with the ability to transport or decide where the pipeline would go.

MR. THOMPSON: Okay. Well that's all the questions I have for now. Thank you.

MR. STANG: Thank you, Robert. Your questions were very appropriate. Yes, Albert.

MR. BARROS: This is Albert Barros.

MR. STANG: You'll need to come over here, if you wouldn't mind.

MR. BARROS: This is Albert Barros. Just two quick notes for Robert. About two or three weeks ago, Alaska Clean Seas did conduct a spill drill with some of their equipment on Prudhoe Bay and the results I got from

00053

Christy Bolt, one of our oil spill specialists, said that it was encouraging from what they had the last time they did it where it really didn't work in the broken ice. I think it was either Johnny or Gordon Brower that was at the drill and he was impressed with the equipment. So that is more encouraging. We haven't got the results of that officially yet from Christy, but we hopefully will be getting the report.

Also in regards to global warming, the Alaska Intertribal Council is convening a meeting on August 18 through 20 in Anchorage where they will be talking about the Native perspective and signs that they've been getting on global warming, especially here in Alaska. That's just for your information.

MR. STANG: Thank you Albert. Lon?

MR. SONSALLA: My name is Lon Sonsalla and I don't think I have too many questions but I'd like to make a few comments. Basically they are just reinforcing what has already been said tonight. I also don't believe that we have seen any real demonstration of oil spill clean up capacity in ice infested waters. Also the one that we keep referring to because it's the one that's already in place is Northstar. I believe that's in a more protected area than a lot of these newer proposed leases that are being offered or proposed at this time. And so that gives

00054

me concern that they would be in an area, possibly, that wouldn't be as protected as where Northstar is at from the ocean and the ice movements.

Also, as Suzie said, the noise had been demonstrated fairly thoroughly that it disturbs the migration patterns of the bow head whales, as well as the other mammals that we rely upon. To me it seems really silly to even be discussing possibilities of leases off of the coast of the Arctic National Wildlife Refuge because there is no way to make a landfall. I mean, these are things that we've said before over and over again, so I just would like to reiterate them for this time.

So at this point, I would recommend that we have a deferral for the Kaktovik subsistence whale deferral number five, and also number six, which is the eastern deferral, which has been demonstrated to be a primary whale feeding area. I don't even think that takes in enough consideration like I said that the whole area off the shore of ANWR should be deferral area. That's staying within the confines of what is proposed here.

To get off a little bit on a tangent. While I was looking through this, and I've commented on this before in the past, that, and you've mentioned it tonight that in the Lower 48 there is a moratorium on the new leasing on the East Coast, as well as the West Coast.

00055

Because of that, I'm assuming that the folks that live in those areas do not have to contribute their comments. It seems like we're always on the defensive here. This is something that happens over and over that these are proposed and we say no, we don't want them and then once again, there's another proposed lease/sale and we've all done individual lease/sales and I'm not sure if this five-year plan would preclude individual lease/sale commentaries or if this is a one time.

MR. STANG: Well, let me jump, if I could, Lon, on that. Paul Stang here. This program was approved in late June by the Secretary, developed by Renee's office and approved in late June. It specifically includes the three sales we're talking about. The sale in 2003, 2005, and 2007 showing that pink area. That's the starting place for the individual lease/sale. You start with the pink area and then you raise issues just like we're raising here today about these three sales. So that's how it works.

MR. SONSALLA: The way we've done it in the past is there was a five-year proposal.....

MR. STANG: Right.

MR. SONSALLA: .....and then each lease/sale would come up and we'd also comment on each lease/sale.....

MR. STANG: And that's.....

00056

MR. SONSALLA: .....it would be the same way?

MR. STANG: And that's what we're doing right now.

MR. SONSALLA: Okay.

MR. STANG: But instead of commenting for an EIS for each lease/sale, we have an EIS for all three lease/sales. Just like we had an EIS for this whole program.

MR. SONSALLA: Okay. That makes it a little bit easier. So anyway, what I would like to propose, besides saying that we should have a deferral, is that we should have a moratorium as same as the East Coast and the West Coast. We're not interested in offshore leasing here off the coast of ANWR, especially if ANWR is not developed and there's no possibility of making landfall, it just seems like a waste of time for us. And yet, as you can see, we're still willing to come here and comment and, as glad as we are to see you Paul and Albert once again, well you know we've become acquaintances over time.

MR. STANG: Right.

MR. SONSALLA: It does have an impact. This is a beautiful evening tonight and we're willing to give up some of our time to come here and make the comments

00057

that we've done in the past. So a moratorium would mean that we wouldn't have to keep doing this, at least not as long as the moratorium was in effect. So, like I say, it does have an impact. One thing that we keep asking for and there hasn't really been a reply, but I'll bring it up again. We need an impact office to help us deal with these outside forces. It would be, and I'm asking that it would be a federally funded office located locally here that people could come in contact with and give their thoughts and feelings. Not everybody is here as you can see. I think a central gathering place, as well as a type of spokesperson for the rest of the folks who aren't here. So once again I'd like to ask that would be considered that we have some type of impact office to help us deal with these impacts that we seem to be constantly incurring.

MR. STANG: Understand.

MR. SONSALLA: So that's all I have.

MR. STANG: Thank you for your testimony. I appreciate that and we appreciate your coming to the hearing. Merylin.

MS. TRAYNOR: Hi. This is Merylin Traynor again. I had some questions Robert brought up as he was talking. You were talking that the Coast Guard is the commander on site for the spill. Is that what you said?

MR. STANG: I believe there is an on-site

00058

commander who is up here on the North Slope. I believe I am correct. I can't guarantee it but I certainly can find out rather quickly and let you know if you'd like.

MS. TRAYNOR: Okay. Yeah, I've never heard of a Coast Guard person around Kaktovik.

MR. STANG: Oh, okay. You're talking about Kaktovik.

MS. TRAYNOR: Well, the North Slope.

MR. STANG: Okay.

MS. TRAYNOR: Yeah. You talked about Barrow but I -- west of Barrow or east of Barrow.

MR. STANG: Okay. Is there an on-scene Coast Guard commander in charge of clean up? I'll check it and let you know.

MS. TRAYNOR: And with the new offices being set up, the Coast Guard is being pulled into the homeland security, what happens if the Coast Guard at that point? That's a question they're asking in Congress.

MR. STANG: That's a question a lot of people are asking. You're right.

MS. TRAYNOR: Well what are we going to do for the next year or two where people are trying to figure out their jobs who are now sitting with.....

MR. VALIULIS: I can add to that question. George Valiulis. There will be an on-scene coordinator.

00059

I am not 100 percent sure that will be the Coast Guard, but we know that would occur. We can check where the Coast Guard comes in, but.....

MS. TRAYNOR: And how long will it take for that person to get here.

MR. VALIULIS: Immediately. That person becomes -- no, that person becomes -- somebody has to take charge of a spill immediately. There are protocols and all that worked out and it will become more obvious if a project develops. But this is not just for here, it's for everywhere. Some cases it's the Coast Guard. Some cases it could be EPA. It may even be us. But the reason for having an on-scene coordinator in charge is to get to it real quickly and organize things. So.....

MS. TRAYNOR: Knowing weather and conditions, I can see a possible delay.

MR. VALIULIS: Yes. I participated in such drills and it's very structured.

MS. TRAYNOR: Okay. I want to -- Lon said it, but I also want to say that I don't see a pipeline coming on shore in ANWR under the current conditions that ANWR is under. So, they shouldn't be drilling anywhere north of ANWR, because I don't know where you're going to get your pipeline on the land until you get over to the Canning River there.

00060

I also have a question on the pollution of the air around the oil fields of Prudhoe Bay. I understand that it's some of the -- some very high pollution just from drilling oil over there. But -- and I'm not a scientist so I don't.....

MR. VALIULIS: The studies that we have done, and it's one of the requirements we have and EPA has to approve the permits for that. We know that the action we propose would be from these leases, based on what we know so far and the scenarios that we've adopted would not be significantly detrimental.

MS. TRAYNOR: What is the actual pollution from the oil if, say, a well were to be developed? What's the pollution factors there?

MR. VALIULIS: I'm not an air quality specialist and I do know that we cover this in the Environmental Impact Statement but I can tell you that it's a very limited affect.

MR. STANG: In fact, just reading while I've been up on this trip, the air quality for Cook Inlet, in that document -- and I'm presuming it's just as precise in this -- is they're quite specific about the amount of pollutants they would expect and what affect there would be on air quality. I think -- in fact, it's fairly easy to find in here. Did you get a copy of this baby?

00061

MS. TRAYNOR: The big one?

MR. STANG: Yeah.

MS. TRAYNOR: No.

MR. STANG: You've got some copies here, Lon, I think. Okay. I mean, we can show you exactly where it is if you'd like to see. Probably the easiest thing to read is the one for the proposal itself because the alternatives are only slight variations from that. The air quality section in the proposal itself in section four will be pretty informative to you and help you answer that question.

That question with respect to development that would occur on the Outer Continental Shelf. Not as informative about the situation of pollutants in Prudhoe Bay.

MS. TRAYNOR: I understand that the situation of the air quality in Prudhoe Bay suffers greatly from just bringing oil out of the ground. I don't know that that's a fact because, strictly somebody said that.

MR. STANG: I don't know the answer.

MS. TRAYNOR: Okay.

MR. VALIULIS: I do know it's covered in the Environmental Impact Statement.

MR. STANG: Yeah. But how extensively for Prudhoe Bay, I'm not sure. Certainly it's covered fairly

00062

extensively for our proposals.

MR. VALIULIS: This is George Valiulis. We're not guessing at this. We've modeled this and we have the information. There are very strict requirements. Now when you're dealing with an area as large as this, obviously you can't be as precise as when you have a particular development. Then it gets -- the criteria and such that have to be applied are much more strict. But given the whole area and our assumptions of how much may be developed, I can say that we don't see a problem.

MR. STANG: A good way to see that for a specific development is for us to look at the Liberty Final Environmental Impact Statement, which would talk about air quality associated with some specific project to get you some feeling about that.

MS. TRAYNOR: Oh, okay, a single project. Okay. Thank you.

MR. STANG: Thank you. Isaac.

MR. AKOOTCHOOK: My name is Isaac Akootchook, raised here in Kaktovik. I've been here 80 years and I've look at the -- having many times this hearing, a hearing in our land and we talk about oil development in the Beaufort Sea. Many times we opposing. I'm always saying we oppose it. The oil development in our area, oceans is our living. We're fishing and seal and all

00063

already we testimony about all those things already. But this is still happening. Same old things that coming back to us and play more -- something else to give you more testimony, but -- I have a lot of big books as to how many boxes is coming in to us. I've not really read it because I don't know how to read much about it. But big things arrive and I just set them up in my floor and that's it. But one of the things is we're always saying that, is still there, we oppose oil development in the ocean because our life, living, we pass it on to our generations and generations.

And one of the things I'd questions, always is make it answer. It happened to the pipeline oil spill drill, whatever, did Kaktoviks people have a benefit from that? Happen to use the money for all his life? I don't know. I don't think you will have answer that. I don't think we will get any benefit. Happen to our yards, in the oceans spill. That's how -- I'm always listening to that because we are government, we pay the taxes, you know. Anything -- there's always a government doing it, we pay. Everything -- the income, you konw, all of that income through taxes. Same thing with the North Slope government.

We'd like to know sometime if you come back maybe you get answer for that because it's not going to stop. We're going to oppose [sic] the oceans and the

00064

inland and we always favor to ANWR and make plans, we always favor about it, but not in the ocean.

That's all I have to say. Thank you very much.

MR. STANG: Thank you, Isaac. Anyone else would like to provide some testimony? Good. Thank you. Lilly.

MS. L. AKOOTCHOOK: Lillian Akootchook. I'd like to say that ocean is our garden. Just like you white people. You have your garden in springtime, plant it and harvest. We depend on baby seal, seal, whale and fish and if there's ever a spill that's going to be the end of it, you know. And it's going to be a big mess. So I'm against that ocean drill, you know, but otherwise that's our livelihood in relation to our generation.

Thank you.

MR. STANG: Thank you, Lilly. Anyone else? Yes, Merylin.

MS. TRAYNOR: While I was sitting and listened to Isaac and I realized how many years, you know, they've dealt with this and dealt with this, and I've had the luck to get to fly along the coast a little bit this year and to see that ice move and to see that ocean move, I know what can happen out there if an oil spill should occur. I've seen it over the last three weeks with storms

00065

and it just changes constantly. It would be devastating if we had a spill. Exxon Valdez was bad. It would be very bad here. It would affect Canada depending on the weather conditions. The weather conditions change just constantly. We need to really think about what we're doing if we're going to drill in this ocean.

MR. STANG: Thank you, Merylin. Anyone else who would like to make a statement or ask a question?

(No audible responses)

MR. STANG: Well, I want to -- would you like to make another.....

UNIDENTIFIED VOICE: No.

MR. STANG: Okay. I would like to thank you all for coming. I really appreciate your coming. It certainly is a gorgeous evening to be inside and, as Merylin said, you better enjoy it while you can because the weather can change very quickly. But I want to thank you for spending your time and for coming and giving us your thoughts and your inner feelings. I really appreciate that.

We've made a record. We've taken notes to talk about it as soon as we get back to the office what you've said and we have a transcript that Nathan will have word for word. So, thank you very much.

What we would like to do is leave these

00066

maps if you'd like, with you and we have some extra copies which I have back at the hotel. I can leave you with those, too, or I can take them back and we'll leave these extra documents. I think you may have the final Liberty EIS still here, copies of that. If you'd like one, Merilyn, and we have copies of this document.

(Off record)

(On record)

MR. STANG: If I could. This was the first time that we translated the executive summary into Inupiat and we would like to know if this is a good idea for us to do this. Generally speaking, if you could kind of give me your views from the audience.

UNIDENTIFIED FEMALE: Well, I take it home and (indiscernible) trying to read this. An Inupiat reader. (Indiscernible)

MR. STANG: Okay. So I take that as a yes. You like the idea and that we should do this in subsequent documents. Is that correct?

MS. S. AKOOTCHOOK: Yeah. And then send them to the school, Inupiat.

MR. STANG: And send them to the school?

MS. S. AKOOTCHOOK: Yeah (indiscernible)

MR. STANG: Okay. Good. Here or where?

MS. S. AKOOTCHOOK: (Indiscernible)

00067

MR. STANG: Well, maybe what we ought to do is have Albert make -- well, leave those for sure and leave the one I've got here -- but maybe what we ought to do for the final, we ought to look to see how many we should deliver to the North Slope because I think, you know -- on these things, once you go through the cost of translation and the cost of printing the first batch, the subsequent copies are pretty cheap. So, that might be a really good idea for the schools. Good idea, Suzie. We'll look forward to doing that.

UNIDENTIFIED FEMALE: Who was the translator?

UNIDENTIFIED FEMALE #2: Mabel Hobson.

UNIDENTIFIED FEMALE: Mabel Hobson.

MR. STANG: Yes. Yes. Good. Again, thank you all for coming very much. We appreciate it. We always love to come to Kaktovik and visit your beautiful village.

MS. ORR: Especially when the weather is like this.

(Off record)

(END OF PROCEEDINGS)

00068

C E R T I F I C A T E

UNITED STATES OF AMERICA)
)ss.
STATE OF ALASKA)

I, Joseph P. Kolasinski, Notary Public in and for the state of Alaska, and reporter for Computer Matrix Court Reporters, LLC, do hereby certify:

THAT the foregoing Mineral Management Service Hearing was electronically recorded by Nathan Hile on the 29th day of July 2002, at Kaktovik, Alaska;

That this hearing was recorded electronically and thereafter transcribed under my direction and reduced to print;

That the foregoing is a full, complete, and true record of said testimony.

I further certify that I am not a relative, nor employee, nor attorney, nor of counsel of any of the parties to the foregoing matter, nor in any way interested in the outcome of the matter therein named.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal this 26th day of August 2002.

Joseph P. Kolasinski
Notary Public in and for Alaska
My Commission Expires: 4/17/04

MMS Responses to Kaktovik Public Hearing Comments

PH-Kaktovik.001

BPXA notified the MMS on March 5, 2002, that they were re-evaluating the development plan for the Liberty Project. The re-evaluation contains a number of development scenarios. The scenarios range from moving the proposed development island to the construction of a drilling island with three-phase flow back to existing infrastructure.

PH-Kaktovik.002

The transcript is unclear as to whether a question is being asked about the Liberty Project or the McCovey Project, and part of the question is indiscernible. Rather than try to guess what was being asked, we have decided not to respond.

PH-Kaktovik.003

This response is in addition to the answer provided during the public hearing. Seismic noise and its effects on endangered species also is an issue in the Gulf of Mexico. Some species of whales may be affected and possibly injured by the seismic noise. The MMS is working closely with the NMFS to find ways to mitigate this problem. In Alaska, the MMS and seismic companies work closely with the NMFS to ensure no animals are injured. The NMFS issues an Incidental Harassment Authorization to operators of oil and gas activities in the Beaufort Sea. One of the requirements is that all seismic surveys and drilling activities during the fall bowhead whale migration must conduct a monitoring program to determine the level of sound and any changes in the behavior of the whale. This information is provided to the NMFS and is discussed in a peer-review forum consisting of representatives from the NMFS, the Alaska Eskimo Whaling Commission, the North Slope Borough, the MMS, and industry.

PH-Kaktovik.004

Sound is transmitted efficiently through water. Hydrophones often detect underwater sounds created by ships and other human activities many kilometers away, far beyond the distances where human activities are detectable by senses other than hearing. Sound transmission from noise-producing sources is affected by a variety of factors, including water depth, salinity, temperature, sound frequencies, ice cover, bottom type, and bottom contour. In general terms, sound travels farther in deep water than it does in shallow water. Sound transmission in shallow water is highly variable, because it is strongly influenced by the acoustic properties of the bottom material, bottom roughness, surface conditions, and ice cover. Smooth, annual ice cover may enhance sound propagation as compared to open-water conditions. However, as ice cracks and roughness increases, sound transmission generally becomes poorer than in open water of equivalent depth. At this point, the roughness of the under-ice surface becomes more significant in influencing sound-transmission loss than bottom properties. Temperature and salinity also can have a significant effect on sound propagation. In general, sound travels more slowly in freshwater than in oceanic water, and sound travels more slowly in cold water than in warm water.

PH-Kaktovik.005

See Response PH-Kaktovik.004.

PH-Kaktovik.006

The EIS describes the species of seals and their habitats that occur in the Beaufort Sea Planning Area (see Sections III.B.6a, Ill.B.6b, and III.B.6c).

PH-Kaktovik.007

Under the right conditions, ice cover can enhance sound propagation through the water. See Response PH-Kaktovik.004.

PH-Kaktovik.008

To avoid potential disturbance to whales, the NMFS has long determined that airplanes should maintain at least a 1,000-foot altitude above sea level. Special permits are required to fly lower than that. We fully support the 1,000-

foot guideline for all fixed-wing aircraft. Our Bowhead Whale Aerial Survey Project plane normally surveys at a 1,500-foot altitude.

PH-Kaktovik.009

Deferral areas are considered on a sale-by-sale basis. For each OCS sale, deferral areas are designed to address specific concerns existing at the time of the Proposal. An area considered for deferral or actually deferred in a previous sale will not automatically be carried over to the next proposed sale. These decisions are based on information that is current at the time these deferral areas are designed.

PH-Kaktovik.010

Our office has proposed that the area around Kaktovik be considered for deferral as Alternative V - Kaktovik Subsistence Whaling Deferral. The reasons for Alternative V are described in the EIS in Section II.F. This subsistence area is shown on Map 2- -Beaufort Sea Multiple-Sale Deferral Options. The extent to which feeding by bowhead whales takes place in the eastern Alaskan Beaufort Sea is summarized in this EIS in Section III.B.4.a(1), based on more detailed scientific findings and whaler testimony in the report *Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information* (OCS Study, MMS 2002-012).

PH-Kaktovik.011

See Response PH-Kaktovik.009.

PH-Kaktovik.012

See Response PH-Barrow.004.

PH-Kaktovik.013

See Response PH-Barrow.004.

PH-Kaktovik.014

In situ burning of oil has been demonstrated both in open-water conditions off the Canadian east coast and in broken-ice conditions in a containment basin on the North Slope. In 1993, an offshore burn experiment was conducted off the coast of Newfoundland, Canada to evaluate aquatic toxicity from in situ burning of oil. The results of these experiments are published in *Aquatic Toxicity from In-situ Oil Burning: Newfoundland, NOBE Offshore Burn Experiment*. These experiments focused more on the effects of in situ burning on the aquatic environment and did not address the overall efficiency of the burn itself. During the early 1980's in Prudhoe Bay, in situ burning tests in broken ice were conducted. Efficiencies realized in these experiments ranged from 55-85% removal of oil from the water's surface. The results from those tests are contained in *Oil Spill Response in the Arctic: An Assessment of Containment, Recovery, and Disposal Techniques.* Additional laboratory tests have realized burning efficiencies in excess of 95% oil removal.

The MMS funded additional in situ burning tests in October 2002 in Prudhoe Bay. A series of burns will be conducted in the Alaska Clean Seas wave tank to better understand in situ burning in freezeup/slush-ice conditions.

PH-Kaktovik.015

See Response PH-Kaktovik.014.

PH-Kaktovik.016

The answer provided by Mr. Stang is correct.

PH-Kaktovik.017

The previous Beaufort Sea lease-sale EIS was published in 1998; the current EIS contains several references to studies that have been published since then. For example, the section on toxicity of oil to lower trophic-level organisms (Section IV.C.2.a(3)) is based partly on studies that were published by Gibson during 2000 and by Shirley and Duesterloh during 2002. The section is based also on spill-recovery information in the current web site for the *Exxon Valdez* Oil Spill Trustee Council (www.oilspill.state.ak.us/facts/lingeringoil.html). Further, the section on toxicity of oil to fishes (Section IV.C.3.a(2)) is based partly on studies that were published by Marty et al. during 1999, by Pearson et al. during 1999, and by Rice et al. during 2001. This EIS does reflect recent information on the toxicity of oil.

PH-Kaktovik.018

The toxicity studies were conducted in cold water. The studies by Rice et al. were conducted at the Auke Bay laboratory near Juneau, Alaska. The studies by Shirley and Duesterloh were conducted at the Juneau Center of the University of Alaska. The studies for the *Exxon Valdez* Oil Spill Trustee Council were conducted in water from Prince William Sound. The studies on the toxicity of diesel oil to kelp (Section IV.C.2.a(3)(b)(1)) were conducted in the Antarctic.

PH-Kaktovik.019

The toxicity of hydrocarbons on fish in cold water has been studied for many years, and there is a wealth of information on that subject. Most of these studies were not funded by the MMS.

PH-Kaktovik.020

See Response PH-Barrow.004.

PH-Kaktovik.021

See Response PH-Kaktovik.019.

PH-Kaktovik.022

The EIS recognizes that spilled oil can take a long time to break down in the cold temperatures of the Arctic (see Section IV.C.9 - Effects on Vegetation and Wetlands). The effects of oil toxicity on wildlife is discussed in Section IV.C on lower trophic-level organisms, fishes, essential fish habitat, endangered species, marine and coastal birds, marine mammals, and terrestrial mammals. However, to put the concern about crude oil-spill effects on wildlife and on the arctic environment into perspective, the public should recognize that natural crude oil seeps occur along the arctic coast of Alaska. The largest known seep occurs at Cape Simpson east of Barrow; there also are oil seeps just east of Kaktovik. This means that wildlife and the environment are exposed naturally to some crude oil and its toxicity. The main concern regarding oil spills should be the exposure of wildlife to a large volume of oil at one time. The effects of a large spill are analyzed in Section IV.C.9.a(2).

PH-Kaktovik.023

Because of the seasonality and migratory behavior of most arctic species, it is necessary to consider potential effects outside the proposed sale area. This is true for both marine and terrestrial species of concern. The treatment of this important concept is in the cumulative analysis of each resource category under transportation effects. Our emphasis has been on potential spills from potential onshore pipelines and from tankering of oil to Far East and West Coast markets. Tankering out of Valdez has received the greatest emphasis, and we have estimated six spills to occur, four in port and two at sea (Section V.C). Taken over the 20-year life of this proposed activity, these events are not seen as additive to the same population, and differences in time and space allow for recovery of the population prior to an additional exposure.

PH-Kaktovik.024

The analyses in the EIS are based on multiple oil-weathering studies, including dispersion and dilution, under arctic conditions in the laboratory and directly in the Arctic Ocean. Several of these studies were conducted by the MMS Alaska OCS Region or by international consortiums including the MMS. Field experiments have been conducted the U.S. and Canadian Beaufort seas, Baffin Bay, and in the Norwegian Arctic. Some of the reports and publications that have been taken into account by MMS analysts in writing this EIS are cited here and have been added to the bibliography: Adams, Scott, and Snow (1975);.Arctec Canada (1983); Boehm et al. (1983); Buist and Bjerkelund (1986); Buist and Dickins (1988); Buist, Joyce, and Dickins (1987); Buist, Pistruzak, and Dickins (1981); Buist et al. (1989); Comfort and Purves (1982); Cox and Schultz (1981); Cox et al. (1981); Dawe et al. (1981); D.F. Dickins Associates Ltd. (1992); Dickins, Buist, and Pistruzak (1981); Humphrey et al. (1987); Kovacs et al. (1981); Martin (1979, 1981); Martin, Kauffman, and Welander (1978); Payne (1987); Payne et al. (1984, 1987, 1989, 1991); Payne, McNabb, and Clayton (1991); Reed et al. (2000); Rosenegger (1975); Sayed and Løset (1993a,b); Stringer and Weller (1980); Sydnes et al. (1985); and Tebeau, Meehan, and Myers (1982).

PH-Kaktovik.025

No studies have been done or are planned to determine the effects this additional amount of oil would have on the existing pipeline system. The optimistic estimate of 460 million barrels of oil from each of the three sales does not constitute volumes that would translate into any meaningful information. The pipeline, with a capacity of 1.7 million barrels per day, presently is running at below capacity at 1.38 barrels/day and readily can accommodate any additional inputs, especially that of the magnitude of the proposed lease sales (Conally, 2002, pers. commun.). The volume transported has been dropping for several years and recent estimates from BP state that a new Alpine or Northstar discovery is needed each year to maintain the present volume of oil transport. Trans-Alaska Pipeline System pipeline spills have been included in the analysis of cumulative effects (see Table V-12).

PH-Kaktovik.026

By our informal definition, the foreseeable future is over the next 2-3 decades. Beyond that, speculation about the timing and size of possible discoveries is beyond any accurate estimation. It would be misleading to discuss the possible impacts beyond the foreseeable future. Reserve estimates will change as new discoveries are made and brought into production. If no additional discoveries are made on the North Slope or Beaufort Sea, oil production from northern Alaska will be nearing the end of life in 30 years. However, if new oil discoveries are made, the pipeline corridor and facilities could be refurbished to handle production for decades more.

PH-Kaktovik.027

The company responsible for the oil spill is responsible for funding the cleanup. The MMS requires that operators post bonds or other methods of insurance demonstrating that there are funds available to cover spill-response and -cleanup costs. In addition to these funds, following the *Exxon-Valdez* spill, Congress created the Oil Spill Liability Trust Fund to cover response costs in the event the responsible party is unable to completely fund the cleanup or if the responsible party cannot be identified. The Fund is managed by the U.S. Coast Guard. The Fund was created through a nickel-a-barrel tax on crude oil produced, and the Fund stands at $1 billion. In the event these funds should be exhausted, Congress can allocate other Federal dollars to ensure spill-response efforts continue.

PH-Kaktovik.028

The petroleum industry has billions of dollars invested in North Slope infrastructure and intends to use it as long as it is feasible. However, most of the North Slope oil fields are past their production peak and are facing depletion and abandonment in the next 20-30 years. Since 1977, the Trans Alaska Pipeline System pipeline has carried between 20% and 25% of total U.S. oil production to a growing economy. Maintaining this transportation system is a key element in our domestic energy strategy. New discoveries and development in northern Alaska are necessary to support the continued operation of North Slope infrastructure and the pipeline. This is important to the U.S. and vital to the Alaska economy.

PH-Kaktovik.029

Considerable effort has been made by the MMS to acquire observation data on ocean circulation in the area considered in this EIS. Information about these studies can be found in the Environmental Studies Program Information System, which makes all completed Environmental Studies Program reports available online as full electronic "pdf" documents, including images and graphics. Technical summaries of more than 700 MMS-sponsored environmental research projects in addition to full "pdf" documents of more than 2,000 research reports are available for online, full-text search. The information is grouped geographically to help locate the most useful documents. Their efforts to obtain circulation data have been quite successful. The most recent study was a circulation study (Weingartner and Okkonen, 2001) for the Stefansson Sound, as recommended by the National Research Council in 1994. In addition to the MMS's own funded science, we use data that have been certified by investigators available from several Federal archives (for example, the National Oceanographic Data Center). Data also are available from researchers in their published results in addition to data reports. Due to the scientific interest in the causes and impacts of global warming in the Arctic, several oceanographic research studies have been conducted in the late 1990's and early 2000's (for example, Pickart (2001)).

PH-Kaktovik.030

The EIS does not evaluate the ability to clean up spilled oil. The EIS evaluates impacts to the environment when no cleanup actions are conducted. The ability to track, access, and clean up oil spills is evaluated during the course of the oil-spill-contingency plan review and approval process.

PH-Kaktovik.031

If encapsulated oil traveled 100 miles or more from the spill site, mining may not be the best response method. Ice mining is most appropriate for areas in close proximity to the spill source, where heavy concentrations of oil would be present. As oil begins to freeze into the ice, the responsible party would position tracking buoys with the oil so that it could be followed as the ice shifted. The best methods of oil removal in areas significantly distant from the Prudhoe Bay infrastructure would be to collect the oil with a skimmer or conduct an in situ burn as the oil surfaces through the brine channels in the spring. Alaska Clean Seas has a number of response tactics to collect or burn the oil in these conditions.

PH-Kaktovik.032

The MMS conducts an oil-spill-trajectory analysis as part of the EIS analysis. Part of this oil-spill-trajectory analysis examines the paths of thousands of hypothetical oil spills from hundreds of locations and tracks them for as long as a year. These spills are tracked in both open water and in ice. Depending on the winds and the currents, some of these hypothetical oil-spill paths can move quite far from the location where they were launched. A small percentage (1-8%) of the trajectories launched in winter can move as far as 300-400 miles over a year (360 days, Appendix A, Table A.2-54.). Summer trajectories move as far, but a lower percentage of trajectories travel that far.

PH-Kaktovik.033

See Response L-0026.015. Mr. Stang's comment p 44-45 sufficiently reinforces Mr. Thompson's statement on line 20-22.

PH-Kaktovik.034

The Oil Pollution Act of 1990 requires that industry have sufficient equipment available to respond to a worst-case discharge. As the agency responsible for enforcing these regulations, the MMS ensures that any offshore operations have sufficient equipment onsite to initiate a response until the rest of the oil-spill-response equipment can arrive. As operations move farther away from the Prudhoe Bay complex, additional equipment most likely would be staged across the North Slope to ensure that assets are available for a timely response. As potential spill quantities increase, so do the requirements for response equipment and personnel.

PH-Kaktovik.035

Mr. Stang's comment on pages 46-47 sufficiently responds to Mr. Thompon's question on page 46, line 20.

PH-Kaktovik.036

Mr. Stang's response on pages 48 and 49 to Mr. Thompson's question about assurance that no pipelines will traverse the deferral areas (page 48, line 5) essentially is correct. Any oil produced from the Federal OCS in the Beaufort Sea would be transported to shore via undersea pipeline and through the Trans-Alaska Pipeline System. However, this assumes leases in areas not deferred, and that if an exploration well were drilled and a discovery made, a developmental environmental assessment would be prepared, as mandated by the OCS Lands Act. This assessment would be based on specific detailed data submitted by the lessee in its development and production plan. This plan and environmental assessment (or EIS) would analyze potential effects, would consider pipeline or transportation alternative routes, and the public will have an opportunity to comment on the analysis prior to the decision.

PH-Kaktovik.037

Mr. Stang's comment on page 49 sufficiently responds to Mr. Thompon's question on page 49, lines 6-9. Also see Response PH-Kaktovik.036.

PH-Kaktovik.038

Mr. Stang's comment on page 51 sufficiently responds to Mr. Thompon's question on page 51, lines 1-6.

PH-Kaktovik.039

Mr. Stang's comment on page 52 sufficiently responds to Mr. Thompon's question on page 51, lines 24 and 25.

PH-Kaktovik.040

See Response PH-Kaktovik.012.

PH-Kaktovik.041

The commenter is correct in that present law prohibits any landfall or facilities on the coastal plain of the Arctic National Wildlife Refuge. Also, regarding noise disturbance to the bowhead, see Response PH-Kaktovik.003.

Regarding the commenter's recommendations regarding the Kaktovik subsistence whaling deferral and the Eastern deferral (deferrals V and VI), see Section I.C.2.b(3), areas offshore of the Arctic National Wildlife Refuge. Although no prohibition on offshore leasing is included in the Arctic National Wildlife Refuge statutes, its Comprehensive Management Plan restricts the use of the Refuge for infrastructure to support any offshore development. Any OCS activity (including pipelines to shore) would not be approved without thorough technical and environmental reviews and would have to meet the requirements of the Marine Mammal Protection Act, the Endangered Species Act, and several other Federal and State laws that help to protect the natural resources of the area and environment.

PH-Kaktovik.042

The opportunity to comment on various stages of the Proposal will continue throughout the process for each of the three sales proposed in this EIS. The next opportunity to comment on Sale 186 will be when we publish a proposed Notice of Sale and the final EIS for the three proposed sales. At the time we publish a proposed Notice of Sale we will also send a Consistency Determination to the State of Alaska. This document will address coastal zone consistency issues. The North Slope Borough will have an opportunity to review and comment on all of these documents. For each of the remaining two sales, Sale 195 and Sale 202, we will prepare additional environmental documents, proposed Notices of Sale, and Consistency Determinations. Each of these steps will provide the opportunity to comment on each of those sales individually.

PH-Kaktovik.043

See Response L-0034.027 and Section I.C.1.e(1).

PH-Kaktovik.044

In the event of a large spill, the Unified Command would be activated to oversee oil-spill-response activities. In the Beaufort Sea offshore, the Unified Command is comprised of representatives from the company that spilled the oil, the U.S. Coast Guard, the State of Alaska, and the North Slope Borough. If a large spill occurs, the Responsible Party is the On-Scene Commander, who is responsible for ensuring that sufficient spill-response equipment and personnel are available to effectively clean up the oil. The Responsible Party will work with the other parties of the Unified Command to ensure that critical response elements are addressed, such as protecting environmentally sensitive areas, implementing an in situ burn, protecting archeological resources, collecting oiled wildlife, etc. The Coast Guard On-Scene Coordinator would take over the spill response only if he determines that the Responsible Party is not adequately managing the spill response or does not have sufficient assets available to respond.

Were a large spill to occur, the members of the Unified Command would be onsite within hours of notification. The spill-response effort does not wait for the Coast Guard or any of the other Government agencies to be onsite. Each of the operators has an Incident Management Team present on the North Slope at all times, and this team sets in motion their contingency plans to ensure a spill response is organized immediately. Industry conducts annual, full-scale spill-response exercises called Mutual Aid Drills, which bring together the entire Unified Command; supporting industry; and Federal, State, and local government agency personnel to practice large-scale spill response. These drills help to ensure that an effective spill-response effort is initiated without delay and a minimum of confusion.

PH-Kaktovik.045

See Response PH-Katovik.041.

PH-Kaktovik.046

Please see Table III.A-5 for ambient air quality standards for the program area and Table III.A-6 for measured air pollutants at Prudhoe Bay.

The air pollutants measured at Prudhoe Bay (Table III.A-6) represent the air pollution that was occurring from a very large complex including many wells in Prudhoe Bay, Kuparuk, and several smaller nearby fields. The pollution expected from "a well" would be vastly smaller.

PH-Kaktovik.047

See Response PH-Kaktovik.046. Also, see Section III.C.1.m(2)(b) of the Liberty final EIS (USDOI, MMS, Alaska OCS Region, 2002), which is a fairly detailed discussion of the analysis of air quality impacts for that proposed project. Tables III.D-1 and III.D-2 from the Liberty final EIS present the most relevant data from the site-specific air-quality modeling analysis that BPXA performed.

PH-Kaktovik.048

The MMS acknowledges the commenter's opposition to offshore oil exploration and development in the Beaufort Sea. We also acknowledge that there is an inequitable distribution of development benefits and risks on Inupiat communities on the North Slope and particularly to the bowhead whaling subsistence hunt. At the same time, the MMS has a mandate to develop oil resources offshore Alaska. In an effort to bring these two opposing views to a place of compromise, the MMS has endeavored to improve its dialogue with Native stakeholders on the North Slope. The MMS has supported impact-assistance legislation. See Section I.C.1.e(1) and Response L-0034.027. The MMS has funded long-term studies and surveys of the bowhead whale, recently awarded a study to examine Native residents' perspectives on effects from offshore oil activity on bowhead whaling and social traditions and, with the urging of the North Slope Borough, has developed conflict resolution processes to increase stakeholder involvement in MMS decisionmaking.

While these efforts do not solve the larger problems of an ongoing threat to Inupiat traditions from increasing development in the region and the powerful influences of modernity, such as cable television, the internet, and an increasing dependence on a wage-based economy, they do provide processes for a dialogue where compromise has often successfully been achieved. For a discussion of benefits derived from MMS lease sales, see Responses L-0034.020 and L-0034.027.

PH-Kaktovik.049

The MMS acknowledges Inupiat dependence on the ocean for their food, the seriousness of food tainting in case of an oil spill, and the potential for an unwarranted community avoidance of subsistence foods. This is discussed using *Exxon Valdez* spill research in Section V.C.12 - Cumulative Effects on Sociocultural Systems. In the Environmental Justice analysis, we concluded that a spill would produce disproportionate, high adverse effects because of potential effects to subsistence resources and harvest and concerns over food palatability and tainting.

Regarding oil spill cleanup, see Response PH-Barrow.004.

Since the *Exxon-Valdez* oil spill, new legislation in the form of the Oil Pollution Act of 1990 has mandated that industry and the government significantly increase and improve their oil-spill-response capabilities. Oil-spill-contingency plans are routinely exercised by both industry and the government to ensure that response activities are initiated immediately following a release to limit the impacts of a spill on the environment.

PH-Kaktovik.050

The impacts of a very large spill are analyzed in Section IV.I. The MMS acknowledges that a very large spill would be of grave concern; however, these types of very large spills are rare. This analysis of where hypothetical oil spills can travel considers the climatological "weather" that occurs on the Alaska North Slope in the Arctic. The MMS acknowledges that large spills in the U.S. Beaufort Sea sometimes can move into the Canadian Beaufort Sea. The results of the oil-spill-trajectory analysis bear out this fact.

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERALS MANAGEMENT SERVICE

OFFICIAL TRANSCRIPT -- PUBLIC HEARING

DRAFT ENVIRONMENTAL IMPACT STATEMENT
BEAUFORT SEA MULTIPLE SALE PROPOSED OIL AND GAS LEASE SALES
(SALES 186, 195, AND 202)

Anchorage, Alaska
Minerals Management Service
3rd Floor Conference Room
Tuesday, July 30, 2002
4:00 p.m.

00001

MMS PUBLIC MEETING

July 30, 2002

Anchorage, Alaska

00002

P R O C E E D I N G S

(Anchorage, Alaska - 7/30/02)

MR. STANG: A couple more people have signed up, but haven't arrived, but that's okay. My name is Paul Stang, I'm the regional supervisor for Leasing Environment here in the Alaska region of Minerals Management Service. The purpose of our meeting today is a public hearing on the -- what we call the multiple sale EIS for three lease sales in the Beaufort Sea that are proposed for the years 2003, 2005, and 2007. Our team here also consists of Fred King on my right, who's head of our Environmental Assessment Section, and Paul Lowrey on my left, also in the Environmental Assessment Section, who's the lead o the preparation of this EIS. And we have with us Salena Hile who's doing the recording, and she'll make a transcript of this. We also have with us some members of our staff in the back, as well as our regional director, John Gull.

MR. KING: And there's Angela.

MR. STANG: And Angela Mazzullo here who's with the budget shop in -- with our budget folks in our headquarters in Hernon, Virginia, so if you're in need of money, see Angela, and we'll see what she's made out of here.

We're just starting. Come on in and grab

00003

a seat.

UNIDENTIFIED VOICE: Thank you.

MR. STANG: We're here to get your comments on this document, this environmental impact statement, and we also -- I would like to keep the meeting a little informal, so if you have questions that you would like to ask, or you need some clarification or whatever have you, please feel free, and I'll do my best to answer them. If we can't -- or Fred or Paul, and if we can't answer them, we will then take them down in writing and get back to you.

Just so you know, and I pointed out the map here on the left, the area we're talking about extends from about three miles from shore, which is the beginning of state waters, and the division between state and federal waters, beginning of federal waters basically out to six nautical miles in depth. And we are ranging out to 60 nautical miles. And the depth ranges from about 25 to 200 feet. It's about 9.9. million acres, and it goes from the Canadian border on the east to Barrow on the west.

The basic reason we're preparing a multiple sale EIS instead of an EIS for each of the three sales is that we're -- the proposal that we have, which was formulated by the Secretary of Interior in her five-

00004

year program which was just approved this past June at the -- actually just at the end of June, proposes that basically the same area be offered in all three sales, and to do three EIS's that essentially repeat themselves doesn't seem prudent, nor is it seem -- envisioned by NEPA, so what we're going to do is this multiple sale EIS, we'll hold the first sale, assuming it's -- that the sale is held, and then between the first and the second sale what we'll do is do an environmental assessment to determine if we need to do a supplemental EIS. And we'll do the same thing between the second and third sales. We will do a consistency determination for each of the three sales. By the way, on those environmental assessment, we will ask for public input.

This is one of a series of public hearings we've been having. We met last week in Nuiqsut and Kaktovik, and had originally scheduled a meeting for Barrow, but due to bad weather that was canceled, and we'll be meeting in Barrow on Thursday, the first of August.

We have held seven sales in the Beaufort Sea starting in 1979, and we've issued 690 leases, and 54 of those are still active. The lease area extends basically from three to 12 miles offshore or off the barrier islands, and we drilled 30 exploratory wells.

00005

But to date the only production has come from the Liberty project.

MR. KING: No, Northstar.

MR. LOWREY: Northstar.

MR. STANG: Excuse me, the Northstar project. Indeed that's a dream if it's the Liberty project. The Northstar project is in state waters and has a few downhole locations in federal waters, and that's how that production's occurring.

Speaking of the Liberty project, the Liberty project was -- the environmental impact statement was essentially finished when BP notified us that they were putting that project on hold to rethink it based on its location and economics, and they have since withdrawn their development and production plan, and they may within a year or so some in with a modified plan.

These comments that we get here at this public hearing and the other public hearings will be used by the Secretary of Interior in making her decision on the proposed sale, on each of these three proposed sales.

When we -- when you testify, if you would lease state your name before you testify, and the place to be testifying will be right here. And if someone else has a comment to add in the process, we need to get the microphone in front of you, because otherwise it won't be

00006

in the transcript.

I think that's a brief introduction that I wanted to give. Anything else that we're missing here as far as you two are concerned?

MR. KING: I don't think so.

MR. STANG: And is there -- yes?

MR. KING: Do we have a time limit?

MR. STANG: I'm not going to set a time limit for people giving testimony at this point, but if you go on much more than 15 minutes or so, I may take the privilege of setting a time limit, so we'll see how we go on that. Does anyone, before we start, have any questions or points they would like to make in general, that's of general interest to people? Okay. Well, I think Jeremy was the first one in, if you'd like to start. Again, state your name and organization if you would, and speak clearly into that, and you're on.

MR. MILLEN: Okay. My name is Jeremy Millen, I represent the Alaska region office of the Ocean Conservancy. And -- set to go? All right.

UNIDENTIFIED VOICE: Ready to go.

MR. MILLEN: First and foremost, thanks for the opportunity to comment to comment on the OCS oil and gas leasing program for the Beaufort Planning Area Draft Environmental Impact Statement.

00007

Alaska's Beaufort Sea OCS waters host endangered species, productive marine life and vibrant coastal communities. These proposed lease sales threaten these sensitive marine, coastal, and social environments, including the Arctic National Wildlife Refuge and areas near Teshekpuk Lake.

Secretary Norton's proposed leasing program is a major federal action requiring the preparation of an EIS, as mandated by the National Environmental Policy Act. NEPA's purpose is to promote efforts which will prevent or eliminate damage to the environment, to inform the public of environmental consequences, and to help public officials take actions that protect, restore, and enhance the environment. To be sufficient under the law, and EIS must address the direct and -- the direct, indirect and cumulative impacts of the project and its alternatives.

The Beaufort Sea DEIS fails to satisfy the above-listed requirements of NEPA. The proposed oil and gas lease sales endanger the fragile marine environment off the coast of northern Alaska. Productive marine ecosystems, marine mammals, sea birds, and coastal communities are all at risk from potential blowouts and pipeline oil spills. Additionally, marine life is threatened by toxic sediments and cuttings disposed at

00008

sea during exploratory drilling, noise pollution generated by vessel traffic, drilling, platform work, and seismic testing, and the laying of miles of pipelines in or on the sea floor. Even small amounts of oil can negatively affect marine life. Oil pollution increases susceptibility to diseases in fish, inhibits phytoplankton productivity, and interferes with reproduction, development, growth and behavior of many species.

And in -- the inclusion of all of the Beaufort lease sale area prominently ignores the ability to respond to an soil spill in ice conditions. Fierce climatic conditions, high winds and seas, seas ice, and cold temperatures challenge offshore technologies and spill cleanup far beyond present capabilities. Recent oil spill drills both by oil companies and contractors have confirmed their inability to in effect -- to effectively respond to a spill in broken ice and open water conditions that prevail for most of the year in the Beaufort Sea. The Exxon Valdez oil spill of 1989 taught Alaskans and the world harsh lessons about the ability to clean up a significant oil spill. Scientific studies of the Exxon Valdez oil spill show long-lasting and significant damage to fish, wildlife and subsistence.

Apart from large spills, smaller

00009

persistent spills can have a dramatic impact to the marine environment. For example, based on current sub-sea buried pipeline technology, persistent leaks of up to 100 barrels a day could go unnoticed, particularly if under the ice where sheening wouldn't be noticed.

The DEIS asserts that this offshore drilling is necessary to satisfy U.S. energy demands and to reduce reliance on oil imports. However, MMS fails to mention that the U.S. only has three percent of the global oil reserves, therefore the U.S. will never drill its way to energy security and independence, even if every last drop of oil is drilled from federal waters off the coast of Alaska.

Oil development off the coast of the ANWR poses risks to the Porcupine caribou herd, bowhead shales, fish, polar bears, and migratory birds using the refuge coastline, lagoons, and barrier islands. Offshore exploration and development would cause pollution, aircraft and vessel noise and related industrial activity, and oil spills degrading the refuge, even if there were no construction of infrastructure within its boundaries. I the future, there would be intense pressure to construct sprawling onshore airports, pipelines, roads, docks and other support facilities in the refuge. In light of these threats to our national

00010

treasure, MMS should do more than what is indicated by the eastern deferral, which only provides a thin margin of protection and assumes oil could be cleaned up before it travels a mere 20 miles into the Arctic Refuge from the Beaufort planning area.

Internationally significant brant molting areas are located along the Beaufort Sea coast in the Teshekpuk Lake areas of the National Petroleum Reserve. This area is sensitive to aircraft and other disturbances caused by industrial activities and infrastructure, as well as oil spills. We strongly support the exclusion of tracts in the spring bowhead lead zone around Barrow, but because of the above-listed concerns, we also urge the MMS to pursue a no sale alternative for the entire Beaufort Sea planning area.

In conclusion, Alaska's Beaufort Sea is too productive, sensi -- and sensitive to threaten with OCS oil, gas and development. Alaska is the only state in the nation where large portions of coastal residents depend on marine resources for subsistence. The fierce climatic conditions, high winds and seas, sea ice and cold temperatures challenge offshore technologies far beyond their present capabilities. These conditions make ecosystems more vulnerable and less resilient to disturbance and perturbations. Because of the

00011

inhospitable climate, challenging spill response and extreme productivity/ sensitivity of the marine ecosystems off Alaska, this is the last place in the world OCS exploration and development should be allowed. If moratoria are in place along the remainder of the U.S. coastline, except for the Gulf of Mexico, then logic would dictate that at the very least Alaska should be similarly exempted from leasing. Alaska shoulders more risk than any other state in the U.S., and the Beaufort sale areas constitute some of the riskiest acreage for proposing lease -- for proposed leasing. This is both unacceptable and dangerous to Alaska's unique environment. Please don't place our environment at such risk and add these -- and add this lease sale areas to the moratoria that is appropriate.

I want to thank you for your opportunity to comment, and these comments supplement prior letters and testimony we have submitted on the five-year program on three Beaufort Sea sales, and during the five-year program DEIS public hearing. Thank you very much.

MR. STANG: Okay. Thank you, Jeremy. Who would like to testify next? Please, Jim.

MR. SYKES: Thank you, Mr. Stang, members of the MMS. My name is Jim Sykes, S-Y-K-E-S, P.O. Box 696, Palmer, Alaska. I'm one of the founders of Oil

00012

Watch Alaska, which is a group that watches for our resources and oil companies and bureaucracies to make sure Alaskans are getting a fair share in whatever decisions are made. In the interest of full disclosure, I'm also a candidate for U.S. Senate, and so I've testified here before. Whether I get elected or not, I'll continue to follow these very important issues.

I'm speaking today in support of no action, no sale, which I believe is alternative number 2. I think there are compelling reasons not to go forward with this lease sale, or any of the three for that matter. Moratoria have been declared in most other offshore areas on the coast of the United States, and for good reasons. I find it incredible, and in fact reprehensible that there is a proposed sale for the Beaufort Sea. This is some of the most sensitive, most risky coast land that could possibly be considered for oil development, and if it's not good for California, if it's not good for Florida, it shouldn't be good for Alaska. It also is offshore from the Arctic National Wildlife Refuge, which is the only intact ecosystem in the Arctic under the jurisdiction of the United States.

It has already been proven that oil cannot be recovered from cold, icy water, and that's one of the questions I have for you. If you've come up with

00013

any proof that it can, I'd like to know about it. It cannot be cleaned up, and for this reason it's a great risk. The Inupiat people's that are dependent on subsistence resources all across the North Slope are at risk, and it's a risk we don't have to take. We ought to learn from our past. If you will recall, and I think it's been about 20 years now, leases were let by both the state and federal governments in Bristol Bay. It's a world renowned fishing area. The leases were bid, they were let, and what ended up happening was that the state and federal government ended up buying them back, because it was evident that even a small risk was not worth taking for the resources in Bristol Bay. And I think that we should save the taxpayers of this country, save the Inupiat people the fear of losing their cultural resources, and Alaskans of losing a very important part, and simply not to do the sales, because I don't -- I think that we'll end up buying them back if you do the sales, and I don't think that's necessary to do.

I've been following the leasing for quite a long time, and it's very clear to me that it's driven by industry. They simply want control over an oil supply, and they don't really care if they start offshore or onshore, and unfortunately they view this as a wedge between the two indigenous peoples, the Gwichen and the

00014

Inupiat of the North Slope, and we have to ask why? Why is this going forward? The oil is not needed. Whether you use federal estimates, state estimates or industry estimates, that little yellow area there in the middle of the map between the Canning and Colville Rivers has 30 to 40 years worth of oil, that we intend to help supply our nation's energy needs with. And as was pointed out by the previous speaker, we cannot drill our way out of the energy problem. The only thing that we can do is shift to alternative fuels, and we actually have an opportunity here -- the only way that we can achieve that energy security is by using natural gas is the most obvious choice for bridging fuel, developing renewal resources including hydrogen, which Alaska has the greatest potential for.

The figure that was not spoken of, the United States uses 25 percent of the world's daily oil production, and yet we have less than three percent left. If you think about that for just a couple of seconds, if we were to drill all of the oil available within the borders of the United States, it would only hasten the day where we would have no oil, and therefore be much more dependent, in fact completely dependent on foreign oil in the future. So it's a lose/lose situation.

I would like to also mention the fact

00015

that there is no way to get oil offshore of the Arctic Refuge to the current distribution system unless you keep offshore pipelines or allow pipelines within the refuge, which is currently not allowed, and I hope never is allowed. So unless we can start transporting oil through the air like we do telephone signals, I think that's a real bad deal, and there's no proven technology for the ice pad drilling that has been proposed. There's no proven technology to deal with a spill, and it's simply not worth the risk.

I would like to say a word about natural gas. There's 60 trillion cubic feet estimated on the North Slope. All we need to do is get a pipeline to tidewater to help the energy-starved West Coast which was never previously a market for liquified natural gas. The U.S. would have control of the supply, there would be no opportunity for the Canadians to stuff their gas into a Trans Alaska Highway line, and there would be no opportunity for the Canadians to strip the gas liquids, which they've threatened to do if we run a line through Canada. Of that 60 trillion feet, only 7 trillion feet is within the Arctic Refuge or offshore from the Arctic Refuge, so the gas resources, which is the next step in energy policy I hope in this country, are not even a factor in these areas. It's almost nothing.

00016

The lease to me looks like perhaps Washington Bureaucrats are hoping that a relatively small number of Inupiat people who are dependent on subsistence hunting and other Alaskans will be easy to steamroll by the industry. That's the problem with this lease sale proposal, that's the problem with our lack of national energy policy, which is now controlled by the oil industry. We have to get it out of the control of the oil industry, and here's a real good place to stop and say, look, all you want is control over a supply of oil. There's plenty of other oil, and we've already got plenty of oil in Alaska to help our nation's energy needs. This is one area that we're not going to lease in. And that's where I'm coming from on it, because I know -- I fully understand, I have sympathy for the Minerals Management Service, because as these moratoria occur across the United States for very good reasons, the Minerals Management Service has less to do. Well, I think that you should concentrate on some other minerals, or concentrate on some renewable energy, because it looks like an excuse to keep this bureaucracy in motion that probably doesn't have any reason to exist. And this is the last area of the United States that should be considered for oil development. It's not needed, and if it's not good for the coast of California or coastal

00017

Florida because of environmental concerns or the risks there, it should be less good here, and there's just simply no excuse for it.

So I do have those two questions if somebody would like to address them. Is there actually any proof that the proposed ice islands that some of the offshore developments have proposed will actually work? Is there documentation to this? And is there any documentation that exits that demonstrates that oil can be cleaned up in ice-filled waters?

MR. STANG: Well, on the first question, to my knowledge right now, there isn't a proposal for an ice island in front of the Minerals Management Service. John?

MR. GULL: John Gull, the regional director with MMS. There have been a number of ice islands that have been used off the Beaufort Sea and in Canadian.....

MR. STANG: Maybe you take that to the.....

MR. GULL: Pardon me. And in Canadian waters, so we could have you talk to some of our engineers.....

MR. SYKES: Okay.

MR. GULL: .....at some time. And with

00018

regard to cleanup within -- primarily the problem is more in the ice -- broken ice conditions, and there are methods that can be used in addition to mechanical cleanup, such as in situ burning, also allowing the oil to be encapsulated into the ice. Other countries have done things like this. You'll never get absolutely everything cleaned up, of course, and there was a test done two weeks ago where within the broken ice during the springtime where they maneuvered the smaller vessels, and they were able to maneuver and be used, the mop ropes system. That seemed to work well. Again, they were able to maneuver. Again, it's -- nothing is perfect, but there are tactics that can be -- that, you know, can be used in response. And again we could talk about that more also.

MR. SYKES: Okay. Well, I would simply suggest to you that this DEIS talks about mitigating circumstances and effects for routine permit and activities, and I think it's not a question of whether oil will be spilled. I think it's only a question of when. And when you weigh the risks of development against possible mitigation of what could happen, it's simply not worth taking the risk. Thank you.

MR. STANG: Thank you, Jim. Who would like to testify next?

00019

MR. WIENHOLD: I would.

MR. STANG: Okay, Bob.

MR. WIENHOLD: My name is Bob Wienhold, W-I-E-N-H-O-L-D. I'm testifying as a private citizen. I'm a retired fishery biologist.

I haven't had a chance to go through this in depth. I think as usual, there's too much verbiage in these documents. Some of these pages I think could very well become paragraphs without loss of any, shall se say, thread along the way.

I note that in one of the documents you have all of the reference points on the beach marked quite well, maybe to the point where it's cluttered, but on this map you do not. For instance, it would be -- it would make things -- make the reader understand a little bit more. You're talking about the Colville River, why not put the Colville River on this map? Let's have an Urtok (ph) River, why not put it on the map? The same thing with the Canning River. That will be only three reference points you have to put in there. It wouldn't cost you a nickel's worth of nothing to do it. Do it.

Okay. The last -- as I said, I haven't really had a chance to go through this thing in detail, but I think if you were to increase and improve your graphics, you could cut down on cutting down trees to

00020

publish these things. In other words, they don't have to be this big.

Last. Camden Bay. I think Camden is within the lease sale area, but it's on state land. And that's not marked on here at all. Nor is Flaxman Island, the abandoned DEW Line site. Camden Bay has a beached LST, landing ship tank, from World War II. It's been there since 1965 or '66 when they were building the DEW Line sites along the Arctic coast. They were using this particular LST as a floating warehouse for construction purposes. They were towing it up the beach toward Kaktovik, which at that time was called Barter Island I think. It's a good idea to put down some of the Anglicized names as well as the native names for these things. It wouldn't hurt a bit. Anyway, the tow line broke, the LST went up on the beach in Camden Beach. If I'm correct, that particular LST has petroleum products in it yet. If I am correct, it's still there. Now, you can say, okay, that ain't my department, because we're the federal MMS, but oil that goes -- it's in state waters, of course, on the beach. Oil that goes onshore can also go offshore into federal waters. I would ask that perhaps the oil industry or someone determine or ascertain the status of that LST. I know it has not been salvaged. I don't think it's salvageable. but it would

00021

be a good idea I think to determine what happened to it and where it is.

Conversely -- or also, a number of other -- by the way, I started working up there in January 1969 when Prudhoe Bay consisted of ATCO trailers full of disgruntled Texan drillers that wanted to get the hell out of there. But anyway -- and I also flew this particular area. We lost a couple of biologists up there in August of 1969. I went up on the search, and I flew everything from Atigrew Point down Demarcation Point in a Cessna 180 on floats, out to the edge of the ice pack, back and back, back and back, looking for these people. We never found a trace of them. So I know a little bit about the area. Or did know a little bit about the area.

The other thing I think would be handy perhaps on this map would be for you to put the boundaries of the present development on here, just, you know, even dotted lines or block diagrams or something like that, so the general public knows what you are talking about. These things are paid for by the general public. They should be understandable by the general public. And if you can't get them down to where the general public can understand them, then you probably ought to go to another type of format I think.

00022

That's all I have to say. If you have any questions, I'll try and answer them. I've not -- like I say, I haven't had a chance -- I just picked this thing up about a half hour ago, so this is pretty much extemporaneous. But I want to reiterate that LST needs to be looked into.

MR. STANG: Okay. Thank you very much, Bob.

MR. WIENHOLD: Thank you.

MR. STANG: Appreciate your testimony.

MR. KING: Was that a Navy.....

MR. WIENHOLD: It's a landing ship tank. It's ocean-going, shallow draft vessel that was used in our invasions in World War II. As I said, it's an ocean-going vessel. It's a big one. And I'll bet you dollars to donuts that there's oil aboard that thing yet as well as other things. See, and it's very difficult for people to get on board, because there's a -- you've got to climb to really get up on that thing.

MR. KING: So it's military in origin?

MR. WIENHOLD: It's military in origin, that's right, and it was -- I've seen photographs of it. I've flown over it, I've seen it. I know it was there when I flew over it in '69 and '70, and there were photographs of it taken in 1966, I think, and I think

00023

that there's probably of a photograph of it in the MMS library some place if you want to go back and take a look through it. But it's against the beach in Camden Bay, and ice may have broken it up, but there still should be traces of it. I know it was -- I'm reasonably sure that it was not salvages. Reasonably sure. Okay. That's all I have. Thank you.

MR. STANG: Thank you.

MR. KING: It's probably a historic site by now.

MR. STANG: Yeah.

MR. KING: Thanks, Bob.

MR. STANG: Pam, would you like to testify next?

MS. MILLER: Sure. Well, my name is Pamela A. Miller. I'm with Arctic Connections.

Secretary Norton's proposal to have three lease sales in the Beaufort Sea and five others off Alaska's coast for the next five years is a return to the massive sales with millions and millions of acres off Alaska as was first launched in the 1980 by Interior Secretary James Watt. These proposed leasing plans sharply contrast with the leasing moratoria that were rightly imposed elsewhere in the nature off sensitive coastlines due to citizens pressure.

00024

For over 25 years the local citizens of Alaska have opposed offshore drilling in these areas now at stake. These three lease sales in the Beaufort Sea stretch from the Canadian border nearly to Barrow. At about 10 million acres apiece, this is ten times the size of the last lease sale held in this region. Secretary Norton is further short-circuiting the public review with one impact statement covering all three lease sales. One public hearing on a beautiful summer's day in Anchorage for three lease sales. There are no maps in the EIS, in the main body of it, nor in the executive summary that's a special stand-alone document, where you can see the size of the past lease sales, nor even the current proposed alternatives. The three proposed lease sales as I said are 10 times as big as the last one.

Public relations experts say something like you have to hear it eight times before you really hear it. Well, this is the eighth MMS has tried to do a lease sale in the Beaufort Sea. Perhaps now listen and hear what the public has had to say all these times. Perhaps now we can have a moratorium on new lease sales off Alaska.

When people hear about the Arctic Ocean, they think it's flat like the water in an ice cube tray that freezes. They think the ocean bottom is empty sand,

00025

but hear the coast the Beaufort Sea is an estuary. It's like Chesapeake Bay. It's like Puget Sound. It's even like Prince William Sound. The waters are very different than what people think they're like. This is a very rich zone. It's called Arctic Ring of Life. That was the name given to it by a polar bear biologist from Russia. It's a bountiful zone with endangered whales, the bowheads and beluga whales that migrate through there, millions of migratory birds that come from many continents. And it supports the local Inupiat residents as it has for thousands of years with the bowhead whales, the fish, and the other subsistence resources.

In the last week or so I visited this area again. I stood along the coast off Kaktovik. I saw the huge ice bergs. I saw flocks of migratory birds. I even saw polar bear tracks. I turned around at that point.

Unlike the last Beaufort Sea sale, which was considerably smaller, Secretary Norton plans on leasing the area of the coast of the Arctic Wildlife Refuge, as well as the Teshekpuk Lake area of the National Petroleum Reserve. This is a roll-back of incremental steps that the Interior Department had taken where they had done some leasing deferrals or deletions. At this point, Secretary Norton is ignoring the public

00026

request that the area off the coast of the Refuge, the Teshekpuk Lake Special Area, and the spring bowhead whale migration path in the lead zone be deleted from these sales. This specific request was made by seven Alaskan and national environmental organizations representing local Alaskans along the coast as well as millions of Americans, as well as the City of Kaktovik and the North Slope Borough requested that the entire area off the coast of the Arctic Refuge be deleted. Yet this deletion or deferral was not one of the alternatives. It would be far more preferable as an alternative than any of the deferrals you have proposed.

What's been proposed are small teeny-weeny, meaningless and confusing deferrals. Whether inadvertent or intentionally deceptive, these options would not achieve their named goal. They're called things like the Kaktovik subsistence well deferral, the Barrow subsistence well deferral. It looks to me like somebody took a little GIS program and drew a line around some points on a map and came up with some little squares. They have nothing to do with avoiding the resources that subsistence depends on. The bowhead whale feeding grounds located off the shore of the Arctic Refuge, the whale fall migration corridor along the entire coast, the spring whale migration route, nor the

00027

area where oil spills or noise from exploration and production would occur and could harm the whales habitat and the migration route.

I also note that in the sale 170 final impact statement there was what was called the Kaktovik deferral. This was a different beast than what is shown in this new document. It went from 35 miles west of Kaktovik, and then all the way to Canada. The new so-called Kaktovik subsistence well deferral goes from about Kaktovik east for 30 miles and then it stops. So if you chose that alternative, it would stop and you could lease east of there. It doesn't make any sense.

I'll talk about two other topics. The first is with respect to the Arctic Refuge, there are tremendous potential impacts not only from the chance of an oil spill hitting the beach, but also from the potential that there would be onshore infrastructure to support offshore activities. While this is not currently allowed under the conservation plan that is governing the refuge, and the Arctic Refuge is rightly closed to oil and gas development and exploration, there would be pressure in the future if this area is leased and developed, to put pipelines to shore. If not, then you're going to run up to 100-mile long subsea pipeline to reach areas that are proposed for leasing. That just

00028

doesn't make sense. We don't have a record, and at the time of the last lease sale, 170, a precedent was set of not leasing off the coast of the Arctic Refuge. At that time the Interior Department cited among many reasons the lack of information on cumulative impacts to the resources of the refuge, the lack of emergency response plans for oil spills, and the risky new technology of subsea pipelines. We don't have a track record for these subsea pipelines. Only one exists, Northstar. It just started operating. It's too soon to tell what the true risk is.

I was out there on a series of three or four spill drills that showed industry's inability to contain and clean up an oil spill in Arctic waters during most of the year. Like I was just up in Kaktovik in July, the ice is to the shore. That's the part of the year when oil spills couldn't be cleaned up. These four field tests were very revealing. In one of them, popcorn couldn't be picked up. In one of them, the barge couldn't get out of -- away from the beach. In one of them, the ice had frozen in, the drill hadn't been done soon enough, and so you couldn't put anything in there.

I'm sorry that the public wasn't invited to observe this most recent drill that may have occurred, but when I saw these little rope mops dumped into the

00029

Beaufort Sea, I took a picture of them. I showed a friend of mine the pictures. She said, those look like little dental floss. That's about what it's like putting these rope mops into a major spill in the Beaufort Sea. Imagine some real dental floss out there. That's the nature of what you're going to clean up. And not dental floss in the sense of being a preventative tool, but just this skinny strand of rope mop.

Also, this concept of oil being encapsulated into the ice, how are you ever going to catch it? The shipwreck of the Karluk, a research vessel, occurred in August 12th, 1913. It was abandoned by the great explorer Stephanson on a pretty cowardly move. It was in Camden Bay near Flaxman Island. Over the next five months it drifted hundreds of miles to the west in the pack ice until it sank north of the Wrangell Island, Russia on January 10th, 1914. That's where oil could go. There's polar bears denning in Wrangell Island. That's where oil could go. But the oil spill trajectory studies for the open water season use in supporting this environmental impact statement only look at a 30-day period for the open-way season. August is open-water season. We don't have a clue where that oil is going to go, how it's going to hit the bowhead whale migration and so on.

00030

The impact statement downplays the number of polar bears that could be oiled in an Arctic spill. The modeling done for the Northstar and Liberty development projects estimated that up to 78, 108, 61 polar bears could be oiled. 108 polar bears. Maybe it's not a high chance, but there is a chance, and that's what the biologist's modeling showed could be oiled from an oil spill from a production platform in the Beaufort Sea. But this environmental impact statement says that an estimated 50 to 30 bears could be harmed. So it's not even listening to the science that might be out there.

I'll mention one other thing about the fuzzy math. The chance of an oil spill. I looked up the Interior Department's final impact statement for the five-year plan published just in April. And it assumed that there would be one large platform spill and one large pipeline spill due to OCS activity from these Beaufort Sea sales, and they calculated the chance of a spill greater than or equal to 21,000 gallons being 81 to 94 percent chance. What do we read now? Well, up to 10 percent chance. Just since April, the Minerals Management Service has changed its tune. What's this based on? There's a new study, it's in press, it hasn't been reviewed. But we looked back at the Northstar field, the Army Corps of Engineers projected 24 percent

00031

chance of a major spill just from that one project alone. And in fact the last lease sale environmental impact statement projected a 46 to 70 percent.

You could say, oh, this is a bunch of numbers. But where's the credibility in a change by the same agency from April to August? At any rate, we know that accidents do happen, they will happen, and that if a spill does occur, it would be devastating.

In conclusion, alternative 2 is the only alternative you've proposed that addresses my concerns about oil spill risks and the impacts to the Arctic National Wildlife Refuge and the coast of the Teshekpuk Lake Special Area. Areas that were deferred or deleted from past Beaufort Sea sales, including the area north of the of the coast of the Arctic National Wildlife Refuge and the National Petroleum Reserve, as well as the spring lead system should be permanently removed from the lease sales.

Finally, there should be a full environmental impact statement process complete with hearings for each lease sale that is had, that is held. Thank you for this opportunity to comment.

MR. STANG: Thank you, Pam. Would anyone else like to comment?

MS. MILLER: I do have testimony to read

00032

from Sylvia Ward, but if there's somebody else in between, that might be a nice break.

MR. STANG: I think maybe you're on, Pam.

MS. MILLER: Okay. Deb Moore from the Northern Alaska Environmental Center requested that I read her testimony into the record. So if that's fine, I'll go ahead do it.

MR. STANG: Sure.

MS. MILLER: This is the testimony of Deb Moore, Arctic Coordinator, Northern Alaska Environmental Center.

Good evening and thank you for this opportunity to comment on the draft environmental impact statement for the three Beaufort Sea lease sales. My name is Deb Moore and I am the Arctic Coordinator for the Northern Alaska Environmental Center. The Northern Center is the Nation's most northerly, broad-spectrum environmental advocacy organization, based in Fairbanks. Our mission is to conserve Alaska's stunning natural resources, by advocating management and stewardship policies that promote sustainable, responsible practices.

The Northern Center opposes leasing the Beaufort Sea, particularly off the shore of the Arctic National Wildlife Refuge or Teshekpuk Lake in the National Petroleum Reserve of Alaska. Our reasons for

00033

this opposition are many. The potential impacts from oil spill risks are too great to risk in these sensitive wilderness and wildlife ares. Previous Beaufort Sea lease sales have deferred or deleted the areas off the Arctic Refuge and Teshekpuk Lake from leasing due to this high risk, thereby setting a precedent that we believe should be continued; and the United States should be focusing on ways to decrease our dependence on oil, not encouraging that dependence by developing in frontier areas.

The Beaufort Sea is home to polar bear, walrus, seal, migratory birds, including the Pacific black brant, threatened spectacled and Steller's eiders and the endangered bowhead whale. Oil spills in this harsh ice-dominated environment would have a severe impact on many of these species, particularly on the bowhead whales during migration east of Barrow and offshore the Arctic National Wildlife Refuge, and on black brant during molting along the coast in the Teshekpuk Lake area of the NPRA. Considering the industry's proven lack of ability to read -- to clean up oil spills in the Beaufort Sea during most of the year, as well as the maximum of 10 to 15 percent of spilled oil that is ever, quote, cleaned up even in these much less severe climates, the risks to these species and sensitive

00034

areas are too great to allow new lease sales to go forward.

The Minerals Management Service has developed a recent history of not leasing or of deferring the sale of lease tracts off the coats of the Arctic National Wildlife Refuge and the Teshekpuk Lake area of the NPR-A. It is our understanding that these deferrals have occurred due to the sensitive nature of the areas, the high environmental risks associated with development of these areas, and the overwhelming public opposition to these leases. For these reasons, we request that these areas not only be deferred, but permanently deleted from the current and future sales.

While the Northern Center agrees that the United States should decrease its reliance on oil it imports, we believe that domestic offshore drilling is not the correct way to accomplish this. The U.S. has only three percent of global oil reserves while accounting for 25 percent of the world's oil consumption. Therefore, the U.S. will never drill its way to energy security and independence, even if every last drop of oil is drilled from federal waters off the coast of Alaska. In fact, the expansion of development into frontier areas such as the Beaufort Sea encourages this dependence. Instead, to decrease our reliance on all oil, not just

00035

imported oil, the United States should halt offshore leasing and focus its efforts on improving energy conservation and energy efficiency and shifting toward the use of more alternative, renewable energies.

Finally, we would like to make two comments about public process. The Northern Center is disappointed that the Minerals Management Service chose not to hold a hearing in the Fairbanks area. As the second largest community in Alaska, it is very likely that numerous individuals would have been interested in attending and commenting at such a hearing. However, by excluding Fairbanks, you have excluded these people, many of whom cannot take the time to travel to Anchorage or find another person to speak for them as I have. We encourage you not to overlook Fairbanks in the future.

In addition, we are concerned with MMS' efforts to lump three lease sales into one environmental impact statement process covering approximately 10 million acres. As these three sales are expected to be held sequentially, not simultaneously, so there should be three full public EIS processes held sequentially. In this way, each EIS will reflect the most current knowledge, experience and technology at the time, not reflect outdated information, as may be the case when using this current EIS process for a lease sale not set

00036

to begin for five years. In addition, by holding separate EIS's sequentially, the public will be a more active and informed part of the process, focusing their attention of each individually and basing their comments on the immediate situation for each sales.

Once again, thank you for the opportunity to comment.

MR. STANG: Thank you for reading that, Pam. Appreciate that. Anyone else that would like to testify at this point? Or make any observations? Okay. Well, what we're going to do is we're going to be here until 7:00, but unless someone else comes in or someone gets inspired to say something else, then we'll just be rather quiet here in the room.

MR. GULL: Just go off the record until somebody else comes.

MR. STANG: We can do that.

(Off record)

(On record)

MR. STANG: We're ready to roll.

MS. APP: Great. My name is Jenna App, and I'm with Trustees for Alaska. First I guess I'd like to say that, of course, we will be submitting written comments, and so these are just sort of the brief initial comments that I have from reading through the draft

00037

environmental impact statement.

As you know, these proposed sales extend from Barrow to the Canadian border, from approximately three to 60 miles, nautical miles, and water depth from 26 feet to 200 feet. And the area consists of 1,877 whole and partial leasing blocks, or about 9.8 million acres, an area very unprecedented in terms of actually proceeding with the OCS lease sale in the Beaufort Sea. It's nearly six times the size of the proposed 1998 sale 170 which was to encompass 1.7 million acres, and although the -- I guess it was the 2000 proposed sale 176 encompassed approximately 9.9 million acres, it was deferred by Secretary Babbitt for lack of available information.

Trustees for Alaska opposes the proposed lease sales due to the irretrievable adverse impacts oil and gas development on marine mammals, fish, coastal birds, and other wildlife. Our opposition is also due to the fact that direct and cumulative effects of exploration, development and production will result in permanent harm to the Arctic in general, and the unique wildlife and wilderness values of the Arctic National Wildlife Refuge and Teshekpuk Lake Special Area in particular.

We therefore have -- we therefore

00038

recommend that MMS select alternative 2, the no action alternative. I'm sure you're all not surprised with that, and we have several particular concerns.

First, the protected areas and species are likely to be impacted by the three separate sales. Although the areas proposed -- although the areas proposed to be part of sales 186, 195, and 2020 are all offshore, the lease sale will have unacceptable impacts on onshore protected areas. Transportation of oil from the sale areas would presumably involve some combination of subsea pipelines, tankering, or onshore pipelines. Each of these alternatives would have permanent adverse effects on valuable onshore areas, such as the Teshekpuk Lake Special Area and the Arctic National Wildlife Refuge.

The area around Teshekpuk Lake, inside the NPR-A has been designated a special area. A special area is one that is identified by the Secretary of Interior as having significant subsistence recreational, fish and wildlife or historical and scenic value, and, therefore, warranting maximum protection of such values to the extent consistent with the requirements of the Act for the exploration of the Reserve.

The Teshekpuk Lake area has extraordinary wildlife. It is the home of the Teshekpuk Lake caribou

00039

herd, and this herd calves on the land around the lake and provides subsistence food for the North Slope villagers. There are large numbers of waterfowl, including more than 20 percent of the world's black brant population, which molt along the shores of the lake and east of Teshekpuk. Spectacled and Steller's eiders, both listed under the federal Endangered Species Act, also use this area.

This area remains off limits to oil and gas leasing, and support for oil and gas activities from development outside of the area under recent decision by the Secretary of Interior. The former Secretary of Interior, Secretary Babbitt.

The three sales are also offshore of the entire expanse of the Arctic National Wildlife Refuge's northern boundary.

The coastal plane of the Refuge provides important insect-relief habitat for tens of thousands of caribou from the Porcupine caribou herd. Other wildlife species found in great abundance include musk ox and grizzly bears, wolves and Arctic foxes. Wolverine, marmot, voles, lemmings, weasels and dozens of other mammal special joint in the tapestry of wildlife that make the coastal plain of the Refuge the highly valued wildlife preserve on the continent.

00040

Oil from the lease sales would presumably reach the Trans-Alaska Pipeline System, or TAPS, by either subsea pipelines, tankers, and/or other onshore pipeline infrastructure. If oil transportation by hundred-mile-long subsea pipelines is unacceptably dangerous, and if tankering is unacceptable under the local government's Coastal Zone Management Programs, then that puts tremendous pressure to transport oil in pipelines across the Arctic National Wildlife Refuge and the Teshekpuk Lake Special Area. This would result in long-term habitat loss and disturbance to calving and post-calving habitats of the Porcupine and Teshekpuk Lake caribou herds, migratory bird nesting, molting, staging habitats, and prime polar bear denning areas. Such infrastructure would not only be compatible -- would not be compatible with the purposes of the Arctic National Wildlife Refuge. If MMS considers leasing off the Refuge, then it must provide adequate analysis for the potential effects of such onshore pipelines and other support infrastructure in order to comply with NEPA's requirement to analyze all reasonably foreseeable actions resulting from the sales.

Permanent deletion of the sale area would best protect the full spectrum of the Refuge and special area ecosystems from the direct, indirect, and cumulative

00041

effects of outer continental shelf development. It would also reduce certain impacts to the sensitive marine ecosystems in this region by feeding -- used by feeding and migrating bowhead whales, denning and feeding polar bears and other marine mammals, migratory birds, and wildlife and their habitat -- and other wildlife and their habitats.

Because there is no legal or environmentally and technically acceptable means of transporting oil from the lease sale areas to off -- off the coast of these protected areas, we do not believe that it is in the public interest for these sales to go forward, particularly offshore of the Teshekpuk Lake Special Area and the Arctic National Wildlife Refuge.

Second, there are unacceptable problems associated with oil transportation, oil spills, and oil spill clean up.

As you know, no roads or docking connecting to areas outside of the planning area of NPR-A are allowed, without exception. Further, no pipelines are permitted with the Teshekpuk Lake -- within the Teshekpuk Lake Special Area. The same is true of the coastal plain of the Arctic National Wildlife Refuge.

Consequently, to move oil from the western edge of the proposed lease sale, a subsea

00042

pipeline or other transportation method would have to run parallel to shore for nearly 160 miles before it would reach existing onshore infrastructure. On the eastern edge of the proposed sale, an 80-mile subsea pipeline or other method will be necessary. This does not take into consideration the distance the pipeline would need to span in order to reach shore. This alone could be 60 miles or more.

And as you know, the Northstar Project was the first offshore development project in America's Arctic that relies solely on a subsea pipeline to transport the oil to market. It is located approximately six miles offshore of the existing oil field development on the North Slope.

And in the final EIS for the Northstar Project, the Corps specifically said that the challenges for oil spill response were significant, and that given the -- given present oil spill response technology, broken ice, unstable ice, rough seas or high wind conditions could hamper the ability or prevent any cleanup response for over 50 percent of the year. As far as I know, there has been no consideration of different technologies that are available now that have not been yet available at Northstar, so we still face the same restrictions in oil spill cleanup.

00043

Additionally, when MMS and the Corps were selecting -- were helping to select the route for the Northstar pipeline, the agencies made a strong argument for the shortest pipeline possible, because the shortest pipeline possible, the one directly to shore, would probably or potentially have the smallest risk in terms of spill, whereas the Fish and Wildlife Service preferred a longer pipeline that would go outside the barrier islands.

What we're talking about here is an extremely long potential for a pipeline, 150 miles or so, and MMS and the Corps both recognize that a long pipeline is a risky pipeline. So even the relatively short pipelines are fraught with risk, but as I've said, that risk is multiplied many times over for a 100-mile long pipeline. This level of spill risk combined with the inability to clean up spills is unacceptable. And as MMS found in combination with DEC during the 1999 and 2000 oil spill response drills for Northstar, that response technology isn't in place yet. And until it is, we should not be leasing those land -- those offshore areas.

Third, sale 170 and 176 precedent should stand.

In the spring of 1998, the Interior Department deferred lease sale 170 tracts offshore of the

00044

Refuge. And in January of 2001, the Interior Department again deferred the sale out of a concern about the lack of knowledge of potential impacts. These deferrals established an important precedent on several fronts. First, they recognized that offshore from the Arctic Refuge is the last place where untested oil transportation technologies, such as subsea bed pipelines, especially long ones, should be deployed. Secondly, they confirm the inherent difficulties associated with oil sill response in Arctic conditions. Third and most importantly, they acknowledge the need to safeguard the full range of intact ecosystems of the Arctic Refuge, including its lagoons, barrier islands, river mouths and shorelines. In the year and a half or so since the sale 176 deferral, these concerns have not be addressed.

Fourth, the cumulative effects of sale 176 are -- or not 176, 1 -- I get all the numbers confused, 186, 195 and 202 are significant.

These cumulative effects -- the cumulative effects analysis for the three sales must consider the impacts from all the state and federal activities in the Beaufort Sea. Offshore oil development is progressing at an ever-increasing rate with little analysis of the possible cumulative effects of such

00045

development. The State Beaufort Sea areawide lease sales, the Northstar and possibly someday the Liberty project, the McCovey project, the proposed Armstrong Resources exploration projects in Harrison Bay, and now the three proposed lease sales reflect just a small sample of the aggressive future offshore development in the Beaufort Sea. So far no one project has meaningfully examined the cumulative effects, the impacts of offshore development. And this trend has continued in this draft environmental impact statement. This failure can't help but result in an under-assessment of significant environmental impacts, including cumulative air, noise and water pollution associated with normal operations and infrastructure requirements as well as catastrophic oil spills. A cumulative impacts analysis for the sales must include the incremental expansion of oil field roads and pipelines,onshore processing facilities, increased potential tanker traffic out of Valdez, and increased offshore supply vessels, including boats, fixed-wing planes and helicopters, and other development associated with oil and gas leasing in this area.

Further, we encourage that MMS supply information regarding human health risks associated with the sales. Given the high rate of consumption of fish and wildlife by North Slope communities potentially

00046

affected by the sale, MMS must identify the risks of this consumption and communicate those risks to the public, in conjunction with the existing and future risks of impacts from other offshore development.

Yet another environmental justice issue is implicated in the proposed sales, is the consideration of cumulative effects of the sale on several caribou herds. Onshore support for offshore sales may well threaten the herds' ability to thrive, especially given the insect relief necessary in the barrier islands offshore of the Arctic Refuge. This would in term harm subsistence livelihoods of many Alaska Natives and Canadian Nations -- First Nations people.

I addition to the direct cumulative effects from offshore development and offshore pipelines, like threats to subsistence-based cultures, there will be indirect effects related to offshore development, including global warming. As you know, and as you've probably read in the paper, Anchorage Daily News and the New York Times lately, Alaska is warming at a rate three to five times higher and faster than the global average, resulting in melting permafrost and glaciers, and changes in the thickness and the extent of sea ice. Additional fossil fuel extraction will only serve to increase this greenhouse effect.

00047

The impacts on the ice edge environment are already documented, with thinning ice and warmer temperatures, which create particularly dangerous conditions for whaling crews, as well as threats to Arctic -- as well as threats to the Arctic environment in general.

MMS just consider the impacts of climate change on the Arctic marine ecosystem in a cumulative assessment of the impacts of the OCS lease sales. By perpetuating the industry's access to the frontier areas in Arctic OCS, the MMS permits unnecessary destruction of a unique and fragile environment, as well as the cultures that dependent on healthy marine and coastal ecosystems for their survival.

Fifth, the sales may be inconsistent with potentially applicable laws.

There are several potential conflicts between the lease sales and state and federal law. A lease sale of such enormity, 9.8 million acres, may well be inconsistent with Alaska's Coastal Management Plan, applicable district plans, and the broader goals of the Coastal Zone Management Act.

Additionally, these sales will affect several threatened or endangered species, and will undoubtedly raise concerns under the Endangered Species

00048

Act. The sale's size, the presence of endangered species and threatened species, the recognized inability to clean up spills, the State's proximi -- and the sale's proximity to protected areas, and the potential use of extremely long subsea bed pipelines may all serve to invoke a wide range of relevant laws including, but not limited to, the Outer Continental Shelf Lands Act, the National Environmental Policy Act, and the Oil Pollution -- and the Oil Spill Prevention Act of -- Pollution Act of 1990. Additionally MMS makes the rather dubious claim that one EIS is preferable under NEPA regulations. However, impacts associated with the first sale must be fully assessed prior to later sales in an EIS document, or an EIS-type document.

So, in conclusion, the oil industry does not have the technology to respond safely and develop safely the offshore oil resources in the Beaufort Sea.

We urge you to cancel these three sales because of the high risk associated with the high risk associated with the offshore development to bowhead whales, polar bears, threatened and endangered species, ringed seals, migratory birds, fish, sensitive habitat, and the people of the North Slope who depend on these resources for survival. Should MMS decide to proceed with these sales, we would urge MMS to delete the entire

00049

area off the coast of the Arctic National Wildlife Refuge from being considered for these lease sale processes in this five-year plan in order to safeguard the full range of intact ecosystems of the Arctic Refuge, including its lagoons, barrier islands, river mouths, and shorelines from inevitable industrial intrusions.
And I thank you all for the opportunity to comment.
MR. STANG: Good. Thank you.
MS. APP: Thanks.
MS. APP: You can turn it off.
(Off record)
(On record)
MS. OBERMEYER: .....Obermeyer, and I, of course, looked over the little ad that was in the newspaper, I have it here.....
UNIDENTIFIED VOICE: Actually that's.....
MS. OBERMEYER: .....and what the -- or did I leave it there. Yeah. Do you know how much these ads cost these days?
MR. STANG: Uh-huh. (Affirmative)
MS. OBERMEYER: Just these little ads. I mean, I don't, but I find this newspaper just unbelievable, because, of course, I am running for office and you wouldn't even know it. My opponent gets hard

00050

news stories almost every other day, with colored pictures, and my name hasn't even been printed in the newspaper. I think it was in the Ear once. And as Judge Karen Hunt said to me, Theresa, you've got to get out of the Ear and onto the hard news stories. But, I don't know, I mean, it's as if there isn't even a race.
And, you know, what I'd like to talk about just momentarily is, and I think I've said, I would like to take your documents and read them over, but I just think you people are the experts on what's going on in the Beaufort Sea. I don't even go to the Beaufort Sea. I've never been there. And so is this the document?
MR. KING: Part of it.
MR. STANG: That's -- here, this is the.....
MS. OBERMEYER: Is this the main one?
MR. STANG: .....this is the whole document.
MS. OBERMEYER: Oh, sure.
MR. STANG: That's the main section, yes.
MR. KING: There's three volumes to the document.
MS. OBERMEYER: Is this -- this is the main one?

00051

MR. STANG: That's the main section.

MS. OBERMEYER: Okay. Well, I'd like to look that over when I have time, but I just consider you people are the experts about all this.

What I'd like to talk about briefly is nepotism, and I'd like to talk about our Congressional Delegation. Now, of course, what we've tried to do is we have tried to put a smattering of documents, of what has gone on for about a 25-year period on a website. It is tobermeyer, O-B-E-R-M-E-Y-E-R, dot-info, I-N-F-O. That's a domain. And what we -- but we could never be complete. This has been going on for -- well, it's really been going on for almost 25 years. It started when I sued the University of Alaska, and it's all very long. I'd like you to understand that, but I'm not sure if you can, because as I say, you'd have to look at like how the files interrelate.

But if I could get back just briefly to nepotism, I'd like to talk about each one of the three members of our Congressional Delegation, and how they have each gotten their family members in influential positions, and my theme here is I live in a place where we have term limits, recalls and run-offs of our neighbors, the school board and the assembly. And U.S. Senators are in office for life. We have never even met

00052

them. They have both put their own children in the state legislature, and I would start with Lisa Murkowski who never even has had an opponent. I guess she does have an opponent this time, and the name is Nancy Dahlstrom, D-A-H-L-S-T-R-O-M, whom I don't know, but I support her unequivocally. And then -- but you see, my point would be, it's very educational to have an opponent in a political campaign. Then you remember who you're really working for. Lisa only is working for her father. And just to mention, when Lisa did run in 1998, and I go to church with Terry Martin. I remember how he wired that seat for Lisa. And then there was another man, his name was Rick Helms who runs a traffic school that had put his name in. And I called him and he hung up on me. That's how much competition Lisa Murkowski had. So now Lisa is running for her third term, and, of course, we know that her father is running for governor, and I am positive, and let's see how the whole thing goes, that blood is thicker is water, and I just -- I know that -- and I put if on my website that Frank Murkowski got a veto override through the state legislature on January 16th, that he gets to appoint his successor to the U.S. Senate within five days of him being sworn in.

And then I really started thinking about all this, because then there's also this man that's 77

00053

years old, that's the 34-year incumbent who put his son in the state senate. Now, just to mention, and I'm not sure if you people even follow all this, there's another Stevens named Gary Stevens that's from Kodiak. He's not related to those people.

And, of course, I don't know how it will go, because if Frank Murkowski should get elected, it could be possible that they would both put their children in the U.S. Senate. I don't know what they're going to do. I have no idea. I only know my theme is, not only nepotism, but the blood is thicker than water.

Then let's go on to Don Young, because I have just recently learned that his son-in-law is running against Terry Crawford. His son-in-law's name is Art Nelson.

But before I finish all this, I also wanted to mention that I learned only in May of 2002 that Frank Murkowski's middle name is Hughes, H-U-G-H-E-S, and then the whole thing really became very clear to me, because, of course, John Hughes is Hughes Thorsness, the law firm, and Mary Hughes has been Municipal Attorney from 1994 until 2000, and so, of course, she was appointed by Rick Mystrom, but really Rick Mystrom worked for her instead of the other way around, because she was John Hughes' daughter. She is Frank Murkowski's cousin.

00054

And I've learned all this, and it's just scary, because also know, and, you know, just in looking at my website, it will become clear to you what I'm really talking about, that the governor of Alaska has so much power that one law firm are the attorneys for the Pension Investment Board, the Public Employees Retirement System, the Teachers Retirement System, the Alaska Housing & Finance Corporation, the Alaska Industrial Development & Export Authority, and then Eric Wohlforth is the former chair and the current vice chair of the Alaska Permanent Fund Board. They only have $25 billion. And it was in the newspaper on Sunday that he was reappointed. I mean, that's so ridiculous. I don't know how -- I don't know what to say. They don't have terms of office. All of a sudden these people evaporate and they put somebody else on. There are four attorneys on it. There's Bruce Botelho, who's Attorney General, and Bruce isn't elected. He is only investing in Exxon as he uses his position on the Permanent Fund Board. And I have these signatures on my website, I hope you'll check their signatures. Then we have Eric Wohlforth, Clark Gruening, and then we have Wilson Condon, who is Commissioner of Revenue for the state, and past Attorney General I believe. I think Wilson has been. I mean, he has probably, what would you say, 700 employees working

00055

for him? This is Wilson. I don't know how many, but, you know, those are all public employees, so they're all trying to get their retirement from Eric. It's scary, when you really sort, start sorting all this out.

But if you would allow me to must briefly mention the Hughes family, and what I've learned, but I have run for mayor of Anchorage in 2000, and I ran for school board in 2002. Now, in 2000, and I have this on my website, it says manipulation of mayoral election 2000-slash-AIDEA, Alaska Industrial Development and Export Authority. And what I know, just to laugh with you, because it's scary, it's so funny, see, Wilson Hughes chairs AIDEA, and he is not related to the Hugheses. Wilson Hughes works for GCI. He's a vice president of GCI. I'm not sure if you know these people. We live in such a small town though, you might. And I have kidded Wilson, I said, Wilson, if you don't like what I've got on my website, just pull the plug, because I have my website through GCI.

But anyway, I know that when I went to the AIDEA meeting on April 26th, 2000, I watched Andy Eaker (ph) who is Mary Hughes' husband, he owns all the Alaska Clubs, get a refinance of his Alaska Clubs for $13,300,000, and then, you know, I really reflectively said -- just to mention, I have always been around

00056

politics. I don't even think of myself as a politician, but I got 1.9 percent of the vote, not -- I'm absolutely positive I couldn't have gotten that few votes. I'm not necessarily saying I would have won, but I made a joke out of it, because I'm Irish. And I said, couldn't Andy and Mary have had enough brains to give me 20 percent? Well, guess what I got in the school board election? I mean, it's -- and of course, then going on to the school board election, I was required to run against to licensed attorneys, and my husband still isn't licensed. Now, I consider that demented. I know that Jeff Friedman was going to run, and then when I filed, John Steiner filed. And John, of course, is working as one of the almost 500 of 2266 state -- you know, attorneys that are licensed in our state. We live in a state that has about 2266 attorneys. We have more oil development than the State of Texas, and they have 64,000 attorneys. Now, can we start figuring this out? I think you people are very bright, and you probably figured all this out. I don't know.

I only know what I've learned, and I'm going to read over what you've learned and I truly wish you well, but, you see, I know we didn't even have the last two Municipal elections were not fair, and it's all these things.

00057

If you would allow me to just go over what I've given you. I gave you a press release when I filed for the U.S. Senate that's date June 3rd, 2002, and then I gave you on the same letterhead what I wrote as a press release after I got out of jail when I ran six years ago. And at the time we had filed -- I had the Federal Public Defenders as my attorneys, and we filed lengthy briefs. We did not get anywhere in any of that. It was just dropped and dissolved, so my husband and I filed a civil suit, and that also was dropped and didn't go anywhere. You see, we've tried to do these things for many, many years.

Then just briefly I'd mention the other documents, and that is that I have sent to the 60-member legislature. We've been doing this now since about 1992. We mail lengthy documents. We do not even get a response. And this -- these are just, let's see, a total of three public opinion messages. One is my husband's and the date is almost cut off. From February 16th, 1998. You know, we just said that since there is absolutely no level of accountability, we thought the legislature would simply license my husband, and, of course, not only has he not been licensed, but I have been prosecuted now for 12 years. And then Tony Knowles and AIDEA have paid out $37 million when I've run for

00058

office. I mean, really sort this out yourselves. I would really like for you to understand it. I consider you very bright people. I'm trying just for us as neighbors to know what I really believe is true, and that I can prove.

And, you know, reflectively in terms of the Hughes family and the thing that is so appalling, they're supposed to be attorneys? And I absolutely am positive that about six weeks before I have actually been knocked out cold, waking up in a pool of blood and having to have seven stitches in the back of my head. That was on February 20th, 1998, when I was invited to the Hilton Hotel by the general manager. I was warned that that was going to happen by John Thorsness, who is one -- is the son of the partner David Thorsness, who is now deceased. I was warned. I mean, all these things really have -- fit together now that I know that Frank Murkowski is really related to these people. It's unbelievable. They commit criminal acts in the name of American law. And so just to finish up here, because I didn't want to take your time, because you're tired, and, oh, my gosh, it's after 7:00. You know, we live in the only state in the United States that does not have a law school. I am positive that is why all of this could have happened. And so all I can do is is explain it to you, hope that we

00059

all speak English. I don't know. I mean, you know, I'd like you to just look at this yourself, and sort it out.

Of course, I have given issues about fair elections to the U.S. Attorney, Tim Burgess. He does not follow up with me. He's my neighbor. He used to be my chil -- my daughter's basketball coach. We live in such a small town.

And so I'd really like for you to read this over and look at it, and understand it, and then I would be glad to field questions. You're probably tired and want to go. And would you forgive me for coming late? I should have come earlier, and I wanted to, but I just didn't get over here until right now. So I'm sorry to -- I hope I'm not keeping you.

Did anyone have a question about anything I've said?

MR. STANG: Maybe after we go off the record. I just had something to ask about the school board, but.....

MS. OBERMEYER: Oh, sure.

MR. STANG: .....maybe separate.

MS. OBERMEYER: Would you want to go off the record?

MR. STANG: Are you done?

MS. OBERMEYER: Yes, of course. Unless

00060

you have -- any of you have a question. I'd be glad to field questions.

MR. STANG: Okay.

MS. OBERMEYER: And thank you to Mrs. Hile for tape recording.

(END OF PROCEEDINGS)

C E R T I F I C A T E

UNITED STATES OF AMERICA)
)ss.
STATE OF ALASKA)

I, Joseph P. Kolasinski, Notary Public in and for the state of Alaska, and reporter for Computer Matrix Court Reporters, LLC, do hereby certify:

THAT the foregoing Mineral Management Service Hearing was electronically recorded by Salena Hile on the 30th day of July 2002, at Anchorage, Alaska;

That this hearing was recorded electronically and thereafter transcribed under my direction and reduced to print;

That the foregoing is a full, complete, and true record of said testimony.

I further certify that I am not a relative, nor employee, nor attorney, nor of counsel of any of the parties to the foregoing matter, nor in any way interested in the outcome of the matter therein named.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal this 29th day of August 2002.

____

Joseph P. Kolasinski
Notary Public in and for Alaska
My Commission Expires: 4/17/04

MMS Responses to Anchorage Public Hearing Comments

PH-Anchorage.001

The MMS notes your preference in alternative choice. In this final EIS, the MMS presents the various options for this lease sale (Section II) and gives our rationale (Sections IV and V) for and recommendation (Section II.I – Agency-Preferred Alternative) to the Secretary of the Interior for her decision regarding this lease sale under consideration.

PH-Anchorage.002

See Responses L-0001.002 and L-0001.003.

PH-Anchorage.003

See Response L-0007.001.

PH-Anchorage.004

See Response PH-Barrow.004.

PH-Anchorage.005

The OCS leasing program in Alaska has been in place since the mid-1970's. Twenty OCS lease sales have been conducted in Alaska; seven of them have been in the Beaufort Sea. Eighty-three exploration wells have been drilled; 30 of them in the Beaufort Sea, and the Northstar Unit is producing from several wells. These activities have been extensively studied, and no evidence of significant impacts to the resources of the region has been discovered. Cooperation of the local residents has been an important component of these activities and will continue to have a significant role in the process.

The North Aleutian Basin leases were relinquished by the lessees as part of the settlement agreement in a lawsuit brought by lessees. Following lease issuance, U.S. congressional appropriations included yearly moratoriums that provided that no funds were to be expended by the Department of the Interior for leasing or the approval or permitting of any drilling or other exploration activities on lands within the North Aleutian Basin Planning Area. Lessees sued the Government to buy back the leases. In 1995, the MMS announced a settlement to a portion of the lawsuit. As part of the settlement agreement, companies relinquished all of the leases issued in Sale 92.

PH-Anchorage.006

The OCS Lands Act of 1953 (43 U.S.C. 1331 et seq.), as amended states that the OCS is "…a vital national resource reserve held by the Federal government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs…." The 1978 amendments to the Act (43 U.S.C. 1801 et seq.) states the purposes of the Act include establishing "…policies and procedures for managing the oil and natural gas resources of the Outer Continental Shelf which are intended to result in expedited exploration and development of the Outer Continental Shelf in order to achieve national economic and energy policy goals, assure national security, reduce dependence on foreign sources, and maintain a favorable balance of payments in world trade…." The Act also requires that these efforts must include "…the enforcement of safety, environmental, and conservation laws and regulations," and cooperation with "…relevant departments and agencies of the Federal Government and of the affected States." The MMS is carrying forward the provisions of the 5-year program approved by the Secretary and the Congress in June 2002 and in accordance with the mandate of the OCS Lands Act.

PH-Anchorage.007

See Responses L-0001.002 and L-0001.003.

PH-Anchorage.008

Pipelines have many advantages over other types of oil-transportation systems such as tankers, trucks, and rail. For that reason, pipelines continue to be the preferred method for transporting oil.

Many ice islands have been used successfully for exploration drilling over the last 30 years. Ice islands have the unique advantage that they melt in the spring, leaving little evidence that they were ever there.

PH-Anchorage.009

No one knows with reasonable certainty how much oil or gas exists in undiscovered fields on the North Slope or, for that matter, anywhere else. Resource estimates change constantly when new information becomes available. In their 1995 assessment, the U.S. Geological Survey estimated that 63.5 trillion cubic feet of undiscovered gas was recoverable in all of northern Alaska. In a 2002 assessment, they reported that 61.4 trillion cubic feet of undiscovered gas was recoverable in the National Petroleum Reserve-Alaska alone (less than half of northern Alaska). Over the last 2 decades, published gas resource estimates for the Arctic National Wildlife Refuge have ranged from 3.5-31 trillion cubic feet. To state that there is "only 7 trillion feet" in the Refuge ignores that uncertainty surrounding resource estimations. However, it is widely known that more than 30 trillion cubic feet of gas is recoverable in and around existing oil fields on the North Slope. This potential reserve base has been known for 2 decades but, for economic reasons, it has not been developed. It will take tens of billions of dollars to build the infrastructure to move this stranded gas to market, and more gas reserves will be needed to support this costly project. Areas of high potential, along proven trends in northern Alaska and the Beaufort Sea represent the best, untested lands in the United States under Federal jurisdiction. As such, all high potential areas are considered important to meet future domestic energy needs.

PH-Anchorage.010

See Responses L-0001.002 and L-0001.003.

PH-Anchorage.011

The MMS has been involved in the assessment of ice-island technology for many years. The MMS Technology Assessment and Research Branch maintains an internet site where information on ice mechanics, including ice islands, can be downloaded. The internet site address is http://www.mms.gov/tarprojectcategories/ice.htm.

PH-Anchorage.012

There are reports on oil-spill-response capabilities in broken-ice conditions. In 1983, an oil-industry taskforce (Amoco, Exxon, Shell, and SOHIO) prepared a study entitled *Oil Spill Response in the Arctic: An assessment of Containment, Recovery and Disposal Techniques*. This report covered oil-spill response for mechanical and in situ burning methods in broken-ice conditions.

The MMS has conducted research with the MORICE skimmer, designed specifically for broken-ice response; sponsored research on the effectiveness of in situ burning in broken ice; and currently is participating in research to better define the limits for burning oil in freezeup conditions. In 2000, the MMS was one of the sponsors for the Oil and Ice Workshop conducted in Anchorage, Alaska that brought together cold-water-response experts from around the world to discuss methods of recovering oil in ice-infested waters.

Environment Canada, the Canadian branch of government responsible for environmental oversight, also has conducted extensive research in oil recovery methods in broken-ice conditions.

PH-Anchorage.013

Thank you for your comment.

PH-Anchorage.014

The maps in question (Executive Summary maps) were reviewed and reference point consistency (i.e., add major river names to maps) was checked and added for clarity.

PH-Anchorage.015

After contacting the U.S. Coast Guard Marine Safety Office, the MMS learned that the vessel in question, LST 642, was beached 50 yards off the east shoreline near Demarcation Point in Demarcation Bay, not Camden Bay, and has been there for about 40 years. The U.S. Army Corps of Engineers contacted the Coast Guard Marine Safety Office in April 2000 regarding the LST, because residents of Kaktovik had asked the Corps to remove the vessel as part of their Formerly Used Defense Site (FUDS) Environmental Restoration Program. The Corps' FUDS Program did not cover remediation of ships, but they wanted to address the local concern about potential contamination from fuel aboard the vessel.

Coast Guard Marine Safety Office information revealed that the ship was used to transport materials for DEW Line station construction in the late 1950's and early 1960's before a storm beached the vessel, and it was abandoned. One account has the vessel being purchased by an oil company that moved it to Barter Island. Many Kaktovik residents remember climbing on the vessel in the 1950's. Apparently, it was anchored at Barter Island for many years, and some local residents believed that fuel and other items were taken off the ship at that time. The vessel then seems to have been sold to Canadians who decided to tow it from Barter Island to the MacKenzie River Delta; however, while en route, the vessel encountered a heavy storm and the towline to the LST was cut and it was lost and considered a "ghost ship" until it was found ashore at Demarcation Bay. The Fish and Wildlife Service believes this occurred before the original Arctic National Wildlife Range was established in 1960. On one of their slides of the vessel is written "This vessel was not abandoned. It was beached under authority of its owners." Years later, when the Corps began its DEW Line cleanup efforts, local people first mentioned the vessel. The Corps believed that the best way to dispose of the LST was to blow it up. Local residents protested, asserting that the vessel was a historic site. More recently, local residents have come to consider the vessel a safety hazard, and the Corps has said it has no responsibility for the hulk.

The BLM made a flyover of the vessel in the late 1960's. In 1989, the Fish and Wildlife Service took some photos during an overflight of the vessel, believing at the time that it was a Liberty ship. The Corps boarded the vessel in 1993 or 1994 and noted that the decks were "greasy" in places. In 1999, the Corps did an overflight of the vessel and reported the vessel was within 50 yards of the shore and in fairly good shape. No sheen was sighted. More recently, personnel from the Coast Guard Marine Safety Office made an overflight of the vessel and reported that it had either been broken up by ice or sunk into the beach and buried. During the course of their inquiries, the Coast Guard contacted an expert on LSTs, Commander Melcher (U.S. Navy, Retired), who revealed that these vessels did not carry much fuel and that most was carried in port and starboard day tanks of up to 2,000 gallons each. These tanks would not have lasted the 40 years that the vessel has been on the beach and, as mentioned, probably were emptied while the LST was anchored at Barter Island. No sheens or spills have been reported over the years the vessel has been ashore.

PH-Anchorage.016

Map 16 was added to the EIS. It shows all the leases that have been issued, which includes current active leases. Figure III.A.1 provides a graphic that shows the developments, both onshore and offshore.

PH-Anchorage.017

See Response PH-Anchorage.015.

PH-Anchorage.018

The Secretary of the Interior under the OCS Lands Act proposes a 5-year program at regular intervals. At this stage, the entire OCS is a clean slate and recommendations are proposed for various OCS leases sales around the Nation. The 5-Year Oil and Gas Leasing Program includes an EIS, with public review and comment at this stage. Each new Administration makes their recommendations, and the political process does influence the outcome. Although past lease-sale history within a given region is taken into consideration, the 5-year program that emerges may or may not reflect past thinking and boundaries.

PH-Anchorage.019

Please see Responses PH-Anchorage.014, PH-Anchorage.018, and L-0003.007.

PH-Anchorage.020

A primary objective of the OCS Lands Act is to make lands available for oil and gas leasing in an environmentally acceptable manner, taking into consideration protection of the marine, coastal, and human environments. The MMS must write the EIS based on many uncertainties, including whether or not any given area will be leased, explored, and then possibly developed and produced. These uncertainties are complicated by uncertain environmental effects. We consider that the proposed mitigating measures will provide a significant level of protection to the environment while allowing some level of exploration and development to proceed.

Also see Response L-0005.007.

PH-Anchorage.021

These deferral areas were designed in response to comments received during the scoping process for this EIS. Particular attention was given to the areas where successful subsistence hunting has occurred in the past.

PH-Anchorage.022

See Responses PH-Anchorage.021 and PH-Kaktovik.009.

PH-Anchorage.023

Congress has not restricted oil and gas exploration or development offshore of the Arctic National Wildlife Refuge.

Pipelines have many advantages over other types of oil-transportation systems, such as tankers, trucks, and railways. For that reason, pipelines continue to be the preferred method for transporting oil.

PH-Anchorage.024

The MMS has participated in the equipment and tactic demonstrations conducted by industry in the Beaufort Sea during 1999, 2000, and 2002, in conditions ranging from open water, spring broken ice, and fall freezeup. The equipment, tactics, and personnel are capable of responding to an oil spill in all of these environments. The oil-spill-response demonstrations conducted to date have identified individual tactic limitations and have led to the addition of new tactics to improve effectiveness in broken-ice conditions. In an actual response situation, industry would be able to use every tool at their disposal and would not be limited to a single skimming configuration; they would mix and match tactics to most efficiently access oil in the environment.

The MMS believes that industry will be able to conduct a credible spill response regardless of the time of year. Industry has an extensive spill-response toolbox that includes mechanical response, in situ burning, and tracking capabilities. Research to improve oil-spill response is being actively pursued by both industry and MMS to add new tools and increase effectiveness of existing methods and equipment.

PH-Anchorage.025

Were oil to be spilled during the onset of solid-ice conditions, the responsible party would release a number of tracking buoys and markers that would move with the ice. The buoys would be tracked, and the current position of the contaminated ice would be maintained. Once ice conditions would permit personnel and the use of heavy equipment, recovery efforts would begin.

PH-Anchorage.026

See Responses L-0025.011 and PH-Anchorage.027.

PH-Anchorage.027

The hypothetical oil-spill trajectories can run for more than the open-water or ice season if they freeze into the ice. The trajectories age while they are in the water and/or on or in the ice. For each day that the hypothetical spill is in the water, the spill ages—up to a total of 360 days. The text has been clarified to state that trajectories that start in open water and freeze into ice are followed up to a total of 360 days. The MMS has statistical information based on thousands upon thousands of trajectories followed through as long as 360 days. There are 735 spill points, each with 2,700 trajectories (1,984,500 trajectories) and 13 pipeline segments, each with 100 points and 27 trajectories (35,100 trajectories). These trajectory data provide statistical information on where an oil spill goes, how long it takes to get there, and what resources have a chance of being contacted.

PH-Anchorage.028

The EIS does not ignore the "polar bear/oil spill" models. The Liberty EIS model is cited in this EIS. Both the Northstar and Liberty models assume a larger spill–5,600 barrels–than the one assumed for this EIS (1,500 or 4,600 barrels). Thus, the estimate of polar bears killed would be larger. These models do not factor in ice coverage at the time the spills are assumed to occur (late September-October) when much of the Beaufort Sea can be iced over. Under those conditions, polar bears likely would not be exposed to the oil. These models have not been subject to peer review for publication and do not represent accepted science. The analysis of the results of the models runs suggests that polar bear densities used in the models are overestimates of the number of bears in the area, and that the model may be counting the same bears over again to come up with the 78, 108, and 61 dead bears. The models represent a type of "worst case" where all the bears that maybe at the same location as the assumed spill will die, even though no direct contact with the oil occurs.

PH-Anchorage.029

The chance of an oil spill occurring has changed over time due to input from stakeholders. The draft EIS for the BPXA Northstar Development Project included oil-spill probabilities to aid in analyzing the potential effects from oil spills. Questions on how these probabilities were generated, and what they mean to the local environment in regard to impact assessment, were raised during the review of the draft EIS (June 1998). A white paper on the probability of a Northstar oil spill was written (USDOI, MMS, 1998), which addressed the uncertainty in estimating probabilities, the rationale for selecting the spill size used in the oil-spill probabilities, the primary sources of an oil spill for the proposed project, several methods and data used to compute spill probabilities, North Slope oil-spill data, and measures that have been adopted in the Northstar design and operation to significantly reduce the chance of spills. The paper ended with overall conclusions regarding the safety of the offshore portion of the Northstar Project and the likelihood of a significant oil spill reaching the water. Several probabilities were described in the Northstar final EIS, including the 24% mentioned by the commenter.

Because there was concern regarding spill rates in the Northstar draft EIS, the MMS collated and analyzed all available spill data. In July 1999, the MMS released a request for proposals on *Estimation of Oil Spill Risk from Alaska North Slope, Trans-Alaska Pipeline and Arctic Canada Oil*. That study was completed in April 2000. This study looked at spill rates in an arctic environment by the same companies that were operating in that environment. The Liberty Project included all available information about historical spill rates, including Alaska North Slope spill rates for facilities and pipelines.

These Alaska North Slope rates were used in the 5-year EIS. If we look at the individual numbers in the 5-year and other EIS's, it will be clearer to the commenter. See Table 4.1.e - The Proposed Action (Alternative I) Oil Spill Assumptions in the Five-Year EIS (USDOI, MMS, 2002a). In the 5-year EIS, the resource ranges from 1.02-1.71 billion barrels of oil for the Beaufort Sea. In Table 4.1.e, the 81-94% chance of one or more spills greater than or equal to 500 barrels is for facilities, pipelines, and tankers. The tanker spill is listed in the Gulf of Alaska column. If we look only at facilities and pipelines, the chance of one or more spill greater than or equal to 500 barrels is 45-63%.

Because there was stakeholder concern regarding the applicability of Alaska North Slope onshore spill rates to the offshore, the MMS released a second request for proposals in July 2000. This request was for *Alternative Oil Spill Occurrence Estimators for the Beaufort and Chukchi Seas*. This effort was aimed at alternative methods to estimate oil-spill occurrence for areas where historical spill data are lacking. The final report was available in August 2002, several months after the 5-year final EIS was published. For the Beaufort Sea multiple sales, we use the mean 1.38 billion barrels, to which each sale contributes 0.46 billion barrels. The chance of one or more spills greater than or equal to 1,000 barrels for each sale is 8-10%. The chance of one or more spills greater than or equal to 1,000 barrels for all sales (Alternative I) is 26%.

Let's talk about why there are some of these differences. First, the 5-year final EIS and the Beaufort multiple-sale EIS are using two different size categories. The probabilities in the 5-year EIS were calculated on spill rates based on greater than or equal to 500 barrels, because no spills from facilities and pipelines on the North Slope (excluding the Trans-Alaska Pipeline System) exceed 1,000 barrels. The probabilities in the Beaufort Sea multiple-sale EIS were calculated based on spill rates greater than or equal to 1,000 barrels. Because of the logarithmic nature of oil spills, where more small spills and fewer large spills would occur, we would expect higher probabilities at greater than or equal to 500 barrels relative to the cut off of greater than or equal to 1,000 barrels. Second, the rates these probabilities were estimated from were derived from two different sources, as previously described. The Bercha Group Inc. (2002) report was not available for use in the 5-year EIS. The MMS has made continual progress in response to stakeholder concerns in obtaining information about spills and alternative methods to estimate oil-spill occurrence.

We understand that it may be frustrating to the reader that the values have changed. We hope this explanation helps the reader to understand the differences in the values between documents and why they have changed through time.

PH-Anchorage.030

See Responses PH-Anchorage.020 and L-0005.007.

PH-Anchorage.031

See Responses to L-0002.016 and L-0015.002.

PH-Anchorage.032

Impacts to resources in the arctic environment that would be irretrievable or lost on a permanent basis have not been identified. While some of the resources may be disturbed and some losses could occur, when factoring in recovery and alternative habitats, no known permanent loss can be identified. It is even more difficult to establish permanent loss of resources to onshore habitats from activities that are occurring primarily offshore. Going beyond the resilience of the biotic community, physical structures that are permitted to be established onshore are not considered a permanent or irretrievable loss. The infrastructure support facilities and transportation networks are ongoing and projected to be removed and the area or habitat reclaimed with natural vegetation, as onshore and offshore activities shift or shutdown upon completion.

PH-Anchorage.033

The MMS has presented alternatives and our rationale for each alternative within the body of the EIS. The MMS recommendations to the Secretary of the Interior are presented in Section II.I – Agency-Preferred Alternative.

PH-Anchorage.034

The commenter has not identified the unacceptable risks to protected onshore areas from the transportation of oil. Tankering is not a part of the transportation equation, at least to the protected areas of concern–Teshekpuk Lake and the Arctic National Wildlife Refuge. No onshore pipelines are present or projected that would pose a risk to protected areas, such as the Teshekpuk Lake Special Area. These areas are easily protected with environmentally sound planning of permitted pipeline rights-of-way and other mitigation, as appropriate. The limited scale of these proposed projects would require connecting with existing infrastructure and the existing landfalls, which include the Oliktok Point landfall, the Northstar landfall, and Badami. The Arctic National Wildlife Refuge is not going to be crossed with a pipeline or support any transportation infrastructure. Present pipelines and infrastructure have not been oppressive to wildlife populations, such as caribou in the Central Arctic Herd and polar bears, both of which are ubiquitous throughout the area.

PH-Anchorage.035

The MMS recognizes the importance of the Teshekpuk Lake Special Area for black brant and caribou (see Sections III.B.5 and III.B.7.a) and assumes that no onshore oil facilities would be located within this area.

PH-Anchorage.036

The MMS recognizes the importance of the Arctic National Wildlife Refuge for caribou and other terrestrial mammals (see Section III.B.7.a) and assumes that no onshore oil facilities, including pipelines, would be located within this area.

PH-Anchorage.037

The MMS does not consider opening up the Arctic National Wildlife Refuge for onshore facilities to support OCS development offshore of the Refuge to be reasonably foreseeable action under NEPA requirements. It will take an Act of Congress to open the Refuge to any type of oil development.

PH-Anchorage.038

Pipelines have many advantages over other types of oil transportation systems such as tankers, trucks, and railways. For that reason, pipelines continue to be the preferred method for transporting oil.

PH-Anchorage.039a & b

See Response PH-Barrow.004.

PH-Anchorage.040

See Responses L-0005.007 and PH-Anchorage.020.

PH-Anchorage.041

Cumulative effects must consider all activities, which are increasing. Aggressive future development includes the Liberty Project, the McCovey Project, the proposed Armstrong Resources in Harrison Bay, and the three proposed lease sales described in this EIS. There are no meaningful cumulative analyses to date, especially of air, noise, and water pollution, in addition to oil spills. An incremental expansion of oil-field roads and pipelines, support activities, and increased tanker traffic out of Valdez must be included.

Exploration and development activity for oil in the arctic environment has slowed significantly from former years, while the content and complexity of the commutative analysis has more than tripled during this same time period. This effort alone with the focus and forthcoming National Research Council report on arctic cumulative effects is evidence of the importance the MMS has given this ever-evolving topic of concern. The offshore projects of concern–Northstar, Liberty, McCovey, and Armstrong–represent most of the present and proposed future activities and are not "just a small sample." While these projects represent a potential concern they are separated by distances of from 25 to more than 100 miles and have timetables that do not coincide to yield a cumulative effect. The incremental contribution of these past, present, and reasonably foreseeable future activities have been assessed and are included in the Table V-2 (Past), Table V-5 (Present), and Table-6a (Reasonably Foreseeable Future). The overall contribution of these activities, as indicated by the production of oil, is about 4% (Table V-7a).

PH-Anchorage.042

Although much research has been done by other polar nations on the issue of human-health risks, there is not a large body of information available for the Alaskan Arctic. A short summary of human-health research is included in the Environmental Justice analysis in Section IV.C.16 of the EIS. Section V.C.8 - Cumulative Effects on Terrestrial Mammals did not find significant distribution or abundance impacts from the proposed lease sales on caribou; therefore, the Environmental Justice analysis did not included caribou in its assessment of disproportionate, high adverse effects.

PH-Anchorage.043

See Response L-0026.015.

PH-Anchorage.044

The concept of global climate change has been treated in the programmatic OCS Oil and Gas Leasing Program (2002-2007) 5-year EIS. See Section I.C.1.e(3). A "greenhouse effect" is recognized as occurring but remains very difficult to quantify as is the contribution of the various sources. Changes in solar radiation along with human activities are attributed to most of the global average surface temperature increase of 0.6 degrees Celsius during the past 100 years. Numerous variables and the extended timeframe of this ongoing investigation does not lend itself of a meaningful interpretation in the context of cumulative effects and the reasonably foreseeable future events, which is our best prediction of events during the expected 20-year life of this proposed project.

PH-Anchorage.045

The size of the sale has no direct applicability to the Federal Coastal Zone Management Act or the Alaska Coastal Management Program. The Alaska OCS Region has conducted seven oil and gas lease sales in the Beaufort Sea since 1979, some of which offered much more acreage than the current Proposal. Coastal zone consistency determinations were prepared for these sales, and the State of Alaska concluded that each of the sales was consistent with the Alaska Coastal Management Program. The analysis of areas in an EIS is only one of the preliminary steps in a process that involves opportunity for future public comment, including at the time MMS publishes a proposed notice of sale and after leases are issued–at the time site-specific lease activities are proposed. Each of these steps represents a narrowing of the area being considered. In the Beaufort Sea, for the past 18 years, an average of only 7% of the acres offered were actually leased. Of the 548 leases issued during that time only 14 leases have been explored (about 3% of the leases) and only one is producing. If the average 7% of the area in the current Proposal is leased, it could result in approximately 12-15 leases.

PH-Anchorage.046

The MMS believes that threatened and endangered species and their habitat are being adequately protected. The MMS is required under the Endangered Species Act to consult with the National Marine Fisheries Service (NMFS) on bowhead whales, because bowheads are listed as endangered, and with the Fish and Wildlife Service on spectacled and Steller's eiders, which are listed as threatened. As part of the consultation process, the MMS prepares a biological assessment analyzing the potential effects of leasing and exploration activities on these species and provides this document to the NMFS and the Fish and Wildlife Service. These agencies then determine whether the proposed lease sale and exploration activities are likely to jeopardize the population of these species and issue a biological opinion, which may include recommendations and/or conditions to reduce or eliminate any adverse effects. The MMS and lessees abide by those recommendations/conditions. Information on bowhead whales and on eiders provided in the biological assessment to the NMFS and Fish and Wildlife Service are found in Section IV.C.5 of the EIS.

The NMFS recently determined that it was not necessary to designate critical habitat for the bowhead whale because, among other things, the population is still increasing and existing laws and practices adequately protect the species and its habitat. The Fish and Wildlife Service recently determined that it was not necessary to designate critical habitat offshore for either eider species.

PH-Anchorage.047

In carrying out its mandate under the OCS Lands Act, the MMS ensures all activities that are subject to MMS regulation are conducted in accordance with all applicable laws and regulations, including NEPA, the Oil Pollution Act, and many others.

PH-Anchorage.048

As pointed out in Section I.A of the EIS, the NEPA regulations allow agencies to consider one large leasing area under a single EIS, even if the same geographical area is offered for lease several times, as long as the impacts and consequences are essentially the same. Following the first lease sale, subsequent offerings will have an Environmental Assessment prepared to evaluate any changes taken place since the initial EIS was written, and supplemental NEPA documentation will be prepared to document this change.

PH-Anchorage.049

The MMS has the responsibility to make resources available to meet the Nation's energy needs and balance orderly energy resource development with protection of the human, marine, and coastal environment. In carrying out these responsibilities the MMS reviews the proposed technology to ensure that things get done safely. The MMS also funds technological research to advance and assess new technology.

PH-Anchorage.050

The MMS analysis and decisions are set forth in the Final EIS. Deferral options, including deletion of OCS areas off of the Arctic National Wildlife Refuge, are evaluated within the body of the EIS. If these lease blocks do proceed forward under the Secretary of Interior decision process, we feel that the proposed Stipulations and Notices to Lessee's provide adequate environmental protection.

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERALS MANAGEMENT SERVICE

OFFICIAL TRANSCRIPT -- PUBLIC HEARING

DRAFT ENVIRONMENTAL IMPACT STATEMENT
BEAUFORT SEA MULTIPLE SALE PROPOSED OIL AND GAS LEASE SALES
(SALES 186, 195, AND 202)

Barrow, Alaska
Inupiat Heritage Center
Thursday, August 1, 2002
7:00 p.m.

00001

MMS PUBLIC MEETING

August 1, 2002

Barrow, Alaska

00002

P R O C E E D I N G S

(Barrow, Alaska - 8/1/02)

MR. STANG: We're going to go ahead and start, even though we -- there are only a couple here, that's fine. And we can -- if more come later, we can add to our discussion at that time. My name is Paul Stang. I'm the regional supervisor for Leasing Environment of Mineral Management Service, and we have some other people here today, too. On my left is Fred King who's the section head of our section called Environmental Assessment, and on my right is Angela Mazzullo, without an i. Back there is Albert Barros. Angela is with the budget group of MMS in Hernon, Virginia, and Albert Barros is our community liaison in Anchorage.

What we're here to talk about is this document here which is the environmental impact statement for multiple sales, three sales. The sales will occur, or are planned to occur in 2003, 2005 and 2007. The area that's represented is on the map back there, the pink area which runs basically from the Canadian border on the east to Barrow on the west, from about 3 to 60 nautical miles, three miles from shore out 60 nautical miles from shore. About 9.9 million acres are covered, and the particular sale numbers are sale 186, which is for 2003,

00003

195 is 2005, and 202 is 2007.

These three sales were selected by Interior Secretary Norton, and published in final in late June of this year, and that -- there's a blue document back there that has a description of that program. And this EIS covers each of those sales, and it's a little different than what we normally do. Normally we have one EIS for each sale, but because the area covered by all three sales is essentially identical, that pink area, and the alternatives considered are those areas on the other map, the subsistence whaling deferral off Barrow, the one off Cross Island, and one off Kaktovik, are the -- three of the four areas deferral areas, and the one, the eastern deferral, the reddish color is the fourth. These will apply for all three sales.

However, because we may gain new information and new insight, we will do an environmental assessment before we begin the second sale, and if need be, we will do a supplemental EIS. We will also do the same thing, and environmental assessment, and if need be a supplemental EIS for the third sale.

The State of Alaska and the North Slope Borough have coastal zone management programs, and we're obliged to do a consistency determination to see if our program is consistent to the maximum extent practicable

00004

with the enforceable policies of those programs, and we will do that consistency determination for all three sales.

So the documents we've got are this three volume EIS here, the -- this blue document is a Inupiat translation of the executive summary of the EIS. This is just a reproduction of the executive summary in English. And we have the EIS on a CD, you need Adobe Acrobat in order to be able to use the CD. There's also coffee in the back you're welcome to have, and there are some pencils that you can feel free to pick up.

The normal way most people hold hearings is they just go ahead and sit and listen to what people have to say, but we are most willing and interested in engaging in any discussion or answering any questions, of if they -- if you have questions, please feel free to ask them.

There are three ways you can submit comments, and it's on one of those sheets back there. There's a fax number, there's an address, and the other is here at these public hearings. We're fortunate to have Salena Hile with us, who's doing the court recording, and so she'll make a transcript of everything that's said. The comment due date is September 20th, so any written comments need to be submitted by then.

00005

I can tell you just a little bit about the area we're talking about here from an oil and gas perspective. We have been issuing or holding lease sales in the Beaufort Sea since about 1979, and we have held seven lease sales so far. And in that period of time during those seven lease sales, we've issued 690 leases, and currently there 54 of those that are remaining active. We've drilled about 30 exploratory wells, and yet to date the only production from the Outer Continental Shelf comes from a few of the down hole locations from wells drilled from Liberty Island, which.....

MR. KING: North Star.

MR. STANG: Excuse me, I did it again. From North Star Island, which is in, just inside state waters. It's out near the three-mile line, but just inside waters, so the North Star Island drills mainly into state reserves for oil, or state resources, but some into federal.

And speaking of Liberty, Liberty was a proposal that we -- was just about wrapped up and ready to go for final decision. We had completed the EIS and BP decided that it looked like it was too expensive after their experience with North Star, so they pulled back and asked us to hold off for a while, put the project on the

00006

shelf, and they withdrew their exploration -- I mean, their development and production plan and are currently rethinking the project to see if they can develop it in a way that would be less expensive.

MR. HOPSON: Do you the right to encourage industry to go drill after you tell them?

MR. STANG: Well, that's a good question. There's.....

MR. HOPSON: I don't see after you -- if something goes wrong, you know, (indiscernible).

MR. STANG: Could I ask you please to come and sit over at that microphone, Charles, because that way we can get your question on the record. Would you be willing to do that for us? Thank you.

MR. HOPSON: I was just asking you a question.

MR. STANG: I will answer it, if we can get it on the record.

MR. HOPSON: (Indiscernible)

MR. STANG: Or, wait a minute. Here. Here, she'll bring a microphone right to you.

UNIDENTIFIED VOICE: We'll get more answers if you keep asking.

MR. STANG: You can sit down, that's easiest. Okay. The question was can we encourage

00007

companies to drill. I guess we could verbally, but we have no legal mechanism to encourage them to drill. The way it works, is that once a lease is issued, the pri -- let's say the primary term is 10 years. We have some ability to determine what that primary term is and set it as part of the lease term, but let's say it's 10 years. And the company then has no obligation to do anything for ten years. They can hold that lease, but at the end of the 10th year, they have to relinquish that lease. That is, they've paid money for it, they've paid a rental, but all that ends. So there's no -- at the end of 10 years. Now, if on the other hand they are progressing in efforts to find oil through exploration and seismic work and whatever have you, and they continue that, at the end of the 10 years, we can extend their lease as long as they're actively pursuing. So in a sense the lease has a built-in incentive to encourage them to do something.

MR. HOPSON: Do they pay additional money after your 10 are up? Do they pay additional money to hold those leases?

MR. STANG: They pay a rental rate during the duration of the lease, and that continues on after the 10th year. So as long as they hold a lease, they keep paying a rental rate. The bonus money is an up front payment.

00008

MR. HOPSON: If I get a lease for a million dollars, and then you'd encourage me to rent this place, were -- like you say rent? Lease it?

MR. STANG: No, you -- if you get -- if you pay a million dollars for a lease.....

MR. HOPSON: Okay.

MR. STANG: You have to pay an annual -- I think it's annual rental?

MR. KING: It's an annual rental.

MS. MAZZULLO: Yes.

MR. STANG: Yeah. You have to pay an annual rental rate to hold that lease. That's an obligation you have.

MR. HOPSON: How much?

MR. KING: That's.....

MR. STANG: $25 a.....

MR. KING: No, it's -- the rental is $8 per hectare.

MR. STANG: That's $8 per hectare, which.....

MR. KING: Per year.

MR. HOPSON: .....comes out to, what is it.....

MR. KING: It's about three.....

MR. STANG: .....$8.....

00009

MR. KING: .....$3 per acre per year is what they have to pay rental.

MR. STANG: Right. Right. The.....

MR. KING: And.....

MR. STANG: .....$25 per acre is a minimum bid typically, is the minimum bid is $25 per acre, but the rental is $3.....

MR. KING: Is $8 per hectare, and $3 per acre.

MR. STANG: Right.

MR. KING: And then in addition, there's a royalty rate on that. If they discover oil, then they have to pay a percent of the royalty on top.

MR. STANG: They pay you.

MR. KING: Yeah, they pay the Federal Government.....

MR. STANG: They pay the Federal Government.

MR. KING: .....on top of that.

MR. STANG: That's correct.

MR. KING: Any money that's received from this goes directly into the OCS treasury, so any receipts go directly there. They don't come back to the agency. The agency doesn't get anything from issuing more or less leases. Any money received from the leases goes directly

00010

into the treasury.

MR. STANG: And.....

MR. HOPSON: So after 10 years the industry is literally getting a lot of this land for free.

MR. STANG: No, no, it's not.....

MR. KING: No, they either turn it back over or they're doing something with the land.

MR. STANG: The industry gets only -- when they buy a lease, all they get is the right to explore.....

MR. HOPSON: To explore?

MR. STANG: .....for and drill for.....

MR. HOPSON: Okay.

MR. STANG: .....oil. They have no other rights on that leasehold. They don't own the tract. They don't own any of the other resources on it. They don't -- if there was gold under that lease, they have no right to that gold. They have right to only to explore for and develop oil.

MR. HOPSON: So actually if there's -- you know, if someone was exploring, have a blow-out then I have the right to sue?

MR. STANG: If a company has a lease.....

MR. HOPSON: Or selling these leases.

00011

This is your -- you say this is your land.

MR. STANG: Okay. Well, in a sense. It's a question about right to sue. We are the agency that administers the Outer Continental Shelf Act. We issue the leases. If a company had a blow-out let's say, we have a provision under the law to how that will be dealt with with respect to liability for oil spills. There was an act passed in 1990, the Oil Pollution Act of 1990 which specifies how an oil spill must be cleaned up. It specifies the bonding required of companies to operate on the OCS.

MR. HOPSON: So at the same time if you're going to lease these lands over there, I'm going to hold you responsible, so I'm going to require you, if you're going to lease those, I'm going to require you, me and my whaling crew, there's 15 of them, we're going to require you to put a one billion dollar bonding on whatever happens on those leases. Me and my 15 crew members will do that. We have the right to do that, right?

MR. STANG: I can't answer that question, that you have the right to do that. I can tell you.....

MR. HOPSON: What right do I have?

MR. STANG: Well, I can tell you this, the OPA, the Oil Spill Pollution Act of 1990 specifies

00012

that companies, depending on what the project is, can be required to have a bond up to $150 million before they operate, and with respect to what happens if there's a spill, the law.....

MR. HOPSON: You're the responsible party.....

MR. STANG: Yes, the.....

MR. HOPSON: .....you're selling leases.

MR. STANG: The primary responsible party is the oil company under the Oil Pollution Act of 1990, so the company doing the spilling is the primary responsible party. Clearly the Department of Interior has a role, and I would say if we were negligent in carrying out our responsibilities under the Outer Continental Shelf Lands Act, or the under -- responsibilities under the Oil Pollution Act, and we were brought into court, and those -- and negligence on our part of not conducting the activities we're obliged to under the Act was proven, then I would say we'd be liable. But it would be hard for me to tell you precisely what your rights are with respect to suing the Department of Interior, because it would probably depend on the specific charge and issue at hand.

MR. HOPSON: Before you give out these leases, are you willing to sign a piece of paper saying

00013

that me and my 15 crew members, plus their wives and kids, have the right to do that? You know, we're willing to collect only $1 billion from you just for my crew. I don't know how many other captains would do that. You know, I have the right.

MR. STANG: I can't answer the question. I don't know. I doubt if my -- I can give you a guess, that is, I doubt if the Secretary of Interior or the Director of the Minerals Management Service would sign a contract between you and them.....

MR. HOPSON: This is -- I'm not talking for AEWC. I'm talking about myself as a whaling captain, plus my crew.

MR. STANG: Right.

MR. HOPSON: You know, so I'm not getting anybody involved. He's a captain over there, too.

MR. STANG: Right. I'm speaking specifically.....

MR. HOPSON: Yeah.

MR. STANG: .....of that. My guess is that neither the Secretary of Interior nor the Director of the Minerals Management Service would sign a contract with you and your crew with respect to the oil and gas leases and how operations would occur.

MR. HOPSON: The reason why I said that,

00014

you know, who did the studies on there? There's a deferral.....

MR. STANG: Yes.

MR. HOPSON: .....on those three.

MR. STANG: Yes.

MR. HOPSON: You know, I notice the deferral, because there's the Barrow, then there for that.....

MR. STANG: Yes.

MR. HOPSON: .....and Kaktovik.

MR. STANG: Yes.

MR. HOPSON: Who did those studies?

MR. STANG: Okay. I can answer that. We requested data from AEWC on whale strikes.

MR. HOPSON: The problem with those deferrals, you know, they're just -- you know, you're -- the pink area is the route of the migration of the whales whether going down or up, you know.

MR. STANG: Yes.

MR. HOPSON: Why, you know, you put a little -- you know, one for Barrow, one for Nuiqsut. It's not right. The whole thing should be that, you know, that's -- you know. And during the whaling season, you know, they do something. They're way off in the water. There's no, you know, -- I thought the American

00015

people were my -- our friends. Now we have Japanese working on our whaling. Now you, you know. What's going to happen next to us, you know? It looks like there's no stopping the industry. And -- but the whales migration, you know, the deferral should be all the pink. You keep away from that pink, we'll be okay.

MR. STANG: I hear you.

MR. HOPSON: You know, that's -- well, that's the truth. That's the migration route of the, you know, the bowhead, you know.....

MR. KING: Yeah.

MR. HOPSON: .....why you decided Barrow, just a little spot over there, and then Nuiqsut, you know.

MR. STANG: Those are the -- that's the strike data.

MR. KING: Yeah. To a certain extent what you're saying is the no action alternative, which is, one of the things we look at in the EIS is what happens if we don't do any leasing, which is a no action alternative, is -- it's one of the things that we're required by NEPA and which we evaluate in the EIS.

MR. HOPSON: Uh-huh.

MR. KING: And then the other is these other deferrals as options for the Secretary to consider.

00016

MR. HOPSON: What -- before you wrote these proposal, was there any ice studies on the 20-30 miles out before, you know, you're going to lease it out, was there any ice studies, you know, on that in your thing? I didn't get a chance to read the thing.

MR. STANG: I can't.....

MR. HOPSON: The reason why I said that, you know, the 40-mile limit or, you know, 30, 40 miles out, that is the base of the -- you know, the moving ice, outer shelf where, you know, it's kind of vicious. A lot of ice activity, and there's about three or four currents that happens. And I don't think anybody with an icebreaker have gotten into trouble, because -- and these are, you know, made to take this kind of thing. The American people always say, hey, we've got the top notch, you know, ice breakers to do this, you know, then they go home cripple. The same thing is going to happen. We have a top notch island we're going to build, or thing, and something happens, you know. We're -- you know, we'll be in a heap of trouble.

MR. STANG: I understand.

MR. HOPSON: You know, like anybody else, I spent a total of 11 years in the Arctic Ocean, the -- six of the 11 years, I spent six years floating around. I passed by that area three times coming in from the

00017

Barter Island, you know, on the -- that other side going to there, you know, and the further north you go is not too bad, but, you know, the further closer you get to the mainland, you're going to pressure cooking (ph), the inside ice is so big that you just -- momentum keep going there, you know, it just pushes you right out. And this island that I was in was four and a half miles wide, eight and a half miles longs, 115 feet thick, you know, it's part of a glacier from by Osmere, by Greenland, and when we got close, within 200 (ph) miles, we started moving, you know, 15 miles on a good, windy day. Fifteen miles, three knots, sometimes we just sit there. But it's kind of vicious, you know, but people need to do study before they start putting out leases, especially in the, you know, 30, 40 miles. You know, that's vicious country out there.

MR. STANG: I understand.

MR. KING: There's probably a couple of things that we acknowledge in the EIS, and that is, is you've got the ice conditions out there. You've also got water depth. Both of those in addition to what you're saying also translate into economic costs for the company. I think if you read the EIS you'll notice in there that we acknowledge that we think it's very unlikely companies would be interested out there because

00018

of the economics and what you've spoken about. We don't think there's a high degree of chance somebody's going to go out there and buy up a lot of land.

MR. STANG: That far offshore.

MR. KING: Yeah. We're not saying.....

MR. HOPSON: Well, then.....

MR. KING: .....that's a very likely thing.

MR. HOPSON: .....let's not do it. We all know it.

MR. KING: But we're not saying that's very likely to happen, but the other thing, the other problem you've got is oil is where oil is, and if a company wanted to buy a lease and then try to come in with proposals to show how they could do it safely, they can do that, and we would have to look at it further, and we'd have to have a lot more information like you're saying before we could approve a plan to go out there an operate.

MR. STANG: And we have to make an assessment that their proposal, should they make one, meets the technological and safety requirements under the Outer Continental Shelf Lands Act, so the environmental safety and also technical capability has to be demonstrated by the company before we'd go ahead and

00019

approve an exploration or development plan in that.....

MR. HOPSON: Anyway.....

MR. STANG: .....kind of a situation.

MR. HOPSON: Anyway, before you put any more leases out there, you know, we need to make improvement on the oil recovery system that they have. You know, they say they have it. No, they don't. These are some of the things that bother me, you know, the court (ph) -- the industry keep going this and that, you know. Maybe North Star was not a very good idea. We backed it, but, you know, they were going to spell a few hundred million. Yeah, they're approaching a billion dollars, you know, and, you know, and oil is starting to trickle a little bit, you know, maybe it -- you know, maybe further out, you know, you're going to talk about, you know, more money for the industry, maybe not worth the risk of, you know, having these lease sales, you know. I don't know. But.....

MR. STANG: Industry will have to make that judgment as to whether there's tracts out there that they think are developable and would produce enough oil to justify the costs associated with that development. And if they don't see that, they.....

MR. HOPSON: Well, that do you -- how much is justifiable?

00020

MR. STANG: Well, no, I meant -- what I'm saying is, before they buy a tract, they -- you know, as a sensible businessman, before they buy a tract, they have to look at the potential oil source that they think they could find, how much oil could they find if they did discover it, what their costs would be to produce it and bring it to shore and do a cost analysis of all that to decide even if.....

MR. HOPSON: I thought you were going to sell these things before they do anything, you know.

MR. STANG: Well, we.....

MR. HOPSON: Like you said, you know, the -- you're going to say, industry, give me your money, and we'll take it, let's do this. Under the table?

MR. STANG: No. No, there's no incentive. Here's the deal, and it's really kind of how the Outer Continental Shelf Lands Act is written. We make these tracts available for companies to bid on. Whether they bid or not is their option. It's their choice whether to bid or not to bid. If they're the high bidder, then that up front money that they put on the table will stay with the Federal Government. It won't go back to them. that money is spent. They don't get to recover it. And their judgment as to whether they want to proceed with exploration and development, they have to

00021

make. The great majority of tracts are purchased and relinquished without any exploration or development taking place. And we have in the Department of Interior gathered many billions of dollars and -- that have gone into the treasury, and to date the only thing which the oil companies have to show for that are some more knowledge that they've gained, but the only production is North Star. So companies have to make the judgment, should I buy a lease, and if so, can I develop it in a way that meets all the requirements and still make a profit. The company's obligation is to figure that out. We offer the leases as required by the Outer Continental Shelf Lands Act, and they have a choice to buy them or not to buy them. But to buy them, they have to bid on them, and they have to be the high bidder, and they have to meet all the requirements.

MR. HOPSON: Seismic boats, how do they -- are you on top of the seismic boats? How do you -- how do you go about, you know, going out with a seismic and to do these things? Who gives them the right?

MR. STANG: Okay. Two points here. One, at the moment to the best of my knowledge, there are no seismic boats on the North Slope.

MR. HOPSON: I mean actually that -- I didn't ask about the seismic boat, now who give the

00022

seismic crew the right to go out there at any time? I know there's none right now.

MR. STANG: Okay.

MR. HOPSON: Who -- do you give them a go ahead? Who gives them the permit to do that?

MR. STANG: They need to apply to us for a permit to do seismic work. They don't need a lease to do that. They just need a permit to shoot seismic. And basically what happens is companies shoot seismic on speculation. That is, they get a permit, shoot seismic on a whole bunch of tracts and then try to sell the data to oil companies who would subsequently want to bid on leases. So it's a totally speculative venture on their part. Now, obviously a company can contract for a seismic vessel to go shoot seismic, but basically the seismic work is done on speculation.

MR. HOPSON: And you issue the permits, right?

MR. STANG: We issue permits, correct, for them to.....

MR. HOPSON: Do they have to get a permit from the Borough, too?

MR. STANG: I imagine they do, but I can't be certain.

MR. KING: I don't know if they have to

00023

get a permit from the Borough for offshore for Federal, but I don't know at what point when they're shooting seismic, a lot of them move between federal and state, and in which case they were doing they'd have to -- I think as soon as they come under state, then it comes under your Borough jurisdiction.

MR. HOPSON: So the AEWC can control the seismic people, right, during whaling?

MS. LORD: Yes.

MR. STANG: There are agreements that are written, conflict avoidance agreements between the AEWC and the companies who are working the seismic boats, so that they have that very issue to avoid problems that would occur between seismic noise and the migration of the whale.

MR. HOPSON: On the leases, who determine over deferral areas in the maps? Who was the expert?

MR. STANG: Okay. The data on whale strikes we got from the AEWC.

MR. HOPSON: You know, when you make deferral, you don't do this on whale strike, you know, you're looking at the migrations of bowhead.

MR. STANG: Right. I understand your point. I'm trying to answer.....

MR. HOPSON: You know.

00024

MR. STANG: .....your specific question of who made that judgment, that we got data from AEWC, the regional director with staff from our office looked at that data and configured those candidate deferral areas, the Secretary of Interior has the job to make a decision of which, if any, of those she will select as candidate deferrals, and to actually defer them from a lease sale if we're to hold a lease sale.

MR. HOPSON: Did -- on any of the deferral, did they ever consider the feeding ground of these whales? The feeding area?

MR. STANG: We.....

MR. HOPSON: Those need -- if you're going to do that, you need to defer them also in there, maybe quadruple the size of the deferral area from Barrow north to Kaktovik.

MR. STANG: We.....

MR. HOPSON: Also in the feeding areas, you know, whales have to eat.....

MR. STANG: We got.....

MR. HOPSON: .....and.....

MR. STANG: .....other recommendations which we considered and looked at. We believe that the combination of these deferrals and the stipulations and information to lessees that we put out will provide

00025

protections needed for any conflicts that arise between the whaling issue and the development, and in particular, one stipulation, called stipulation 5, requires the companies who would purchase leases to have a conflict resolution agreement if conflicts arise between themselves and the AEWC, to resolve conflicts about exploration and development, much like the conflict resolution agreements that occur regarding seismic work.

MR. HOPSON: So we need -- so you guys need more ice studies in there?

MR. STANG: We.....

MR. HOPSON: Who does those, you know? Who does the ice studies?

MR. STANG: Well, it depends on the situation. Companies do some of their own ice studies. We at the Minerals Management Service have a science budget of several million dollars a year that we have to use for all of the science needs, be they ice studies, be they water quality issues, be they birds, part of our whale -- our BWASP (ph) program, the aerial overflight of the whale migration, comes all out of those budgets, so it's -- each year a priority is set up as to what's the highest priority. And studies are among those that we consider.

MR. HOPSON: You know, for years we've

00026

been talking about putting Arctic Res -- we had an Arctic Resource Lab out there for years, you know. Now so much activities are happening, we do need a science lab like we had NARL way back, so from the lease here, I think MMS have enough money, let's put up a good lab out there on UIC land and where MMS can use it, the -- you know, the onshore, ANWR can use it or -- and the NPR-A can use it. We need a lab that we can trust, you know. We have -- we're losing -- we are losing trust to the people that go there and study and never come back with the study that they did, you know. It's happening too much where, you know, you send up to do -- someone to do the study, and then they make a comment and they go home, then you never see that study again. We need some place to store it, so if we had a lab, we can now look at it, hey, look, this is what happened, you know. This has got to stop, you know. We need to, you know, we need to start doing these things here. I think you have enough money to help put up a good lab. Why don't you put in maybe $50 million, you know, will be a smoother meeting next time we have, you know, because we'll know, hey, we can look, remember this, we need to do this. We need to start helping each other. You need to start keeping some of the money here that you take off from our land, you know. That's all you want is take, take, take, you know, and here we are,

00027

you know, again. I've met you how many times through these meetings. Did I see any money from your last sale? No.

MR. KING: You didn't notice the.....

MR. HOPSON: I want a little bit, too. I'm getting old, you know.

MR. KING: You didn't notice your lower taxes after that sale?

MR. HOPSON: You know, well, we need to see some of that money, too, you know. Invest on a big lab out there at UIC. We can trust you better that way, you know. You made a bunch, a billion dollars, you know, then you take it home, you know, and here we are, still in the same situation we were 20 years ago, we're still arguing with you, don't do it, but you ignore us.

MR. STANG: Well.....

MR. HOPSON: We need to help each other. You need to help us whalers, you know. You're talking about my lifestyle, you're talking about my whaling crew and their kids. You know, we need to do something.

MR. STANG: Okay. Well, Angela's here from the budget shop and headquarters, and we're going to make sure.....

MR. HOPSON: I want to put in a request.....

00028

MR. STANG: .....she takes that back with her.

MR. HOPSON: .....for 50 million for a research.....

MR. STANG: Right. Okay.

MR. HOPSON: .....lab out there so you can put it out there, you know.

MS. MAZZULLO: Yeah. Well, I would like to address a couple of statements that were made earlier. You asked some questions about where the money goes from the lease sales, and actually we have two different rental rates. There's one rental rate for what's considered to be shallow water, and I think that's 7.50 a hectare, then there's 12.50 for deep water, but I think the majority of the proposed lease area is in shallow water, so.....

MR. STANG: Yeah.

MS. MAZZULLO: .....it would be at the lower amount.

MR. KING: Yeah, we don't have any deep water.

MS. MAZZULLO: Okay. And MMS actually does.....

MR. HOPSON: What do you call deep water?

MR. STANG: Gulf of Mexico. She's.....

00029

MR. KING: It's over 400.....

MR. STANG: referring to the Gulf of Mexico.

MR. KING: .....meters is what they consider.....

MR. HOPSON: How many?

MR. KING: Over 400 meters, so it's over 1,000 feet is what they consider deep water where they change the royalty rates.

MS. MAZZULLO: But also MMS does keep -- is permitted to keep some of the money from the rentals, from the lease sales to use as part of its budget.

MR. HOPSON: That's peanuts.

MS. MAZZULLO: And so part of that money is kept for use by MMS to operate.

MR. STANG: But let me just say that any money that comes from those receipts gets backed out of the appropriations bill.

MS. MAZZULLO: That's right.

MR. STANG: The Congress doesn't give us any extra.

MS. MAZZULLO: No.

MR. STANG: It's just -- if we take in money directly, then they give us less of an appropriation for that year, so.....

00030

MS. MAZZULLO: In fact, that's happened the last two years. We haven't gotten the amount from rental rates that we had in the past, and so they increased what they gave us out of the appropriated money.

MR. STANG: So it's a bit of a balancing act with funds.

MR. HOPSON: I think you guys need to take it more seriously when we testify this and that, you know, and -- I mean, you guys are going to be here next year, and, you know, we'll be talking about the same thing. You're going to ignore what I said today, a year.....

MR. STANG: Well.....

MR. HOPSON: .....and no money for a lab still, you know.

MR. STANG: Charles, we make sure that all of these comments get transmitted up to our bosses, and up to the director of MMS and to the Secretary, so she is aware of the comments that occur. And she keeps -- her job is to be -- understand those comments and the essence of them when she makes her decisions.

MR. HOPSON: Anyway, if you're going to ignore us and go ahead and put this out, I would quadruple the size of those deferrals for Barrow and

00031

Nuiqsut and Kaktovik, you know, 'cause, you know, it will give the whales more time to get back their path if they're ever, you know, deflected away, give them, you know, if there's any development out there, but these are the things that you need to consider, you know.

MR. STANG: Okay.

MR. HOPSON: That is too small, you know, where -- but I -- you know, if you ever do that, if you ever have these sales -- I know you're going to have the sale, but I would -- I'm opposed to these lease sales, you know, that -- you know, most of all I'm opposed to these lease sales in water out of our, you know, hunting areas for the villages. Maybe these guys have something to say, but I'll stand by for pretty much anything, and the comment of all.

MR. STANG: All right. Thank you.....

MR. KING: Thank you.

MR. STANG: .....very much, Charles.

MR. BROWER: I wasn't even going to say anything, all right.

MR. STANG: By the way, it's important that you state your name.....

MR. BROWER: Uh-huh.

MR. STANG: .....full name for the record, if you would, please?

00032

MR. BROWER: Yeah, Thomas Brower III, average (ph) Barrow employee. And, yes, I have reviewed your EIS on this environment -- on the project here, what not. And I've read one of your documents which is published by MMS which is called Sea Ice and Ocean Current Study, a Scientific Research, and I was kind of surprised to see that this scientific research study was a short-term study, but I was in with one of the conferences in Anchorage relating to ice current, ice movement and ocean current studies, and there was an individual from Japan that did a presentation there, but his English was pretty somewhat limited, but -- and one other request was -- by this -- some individual was to have this scientific research by this individual that did the Arctic Ocean study for over 40 plus years, but it would have taken somebody to translate it for X-number of years to translate it, because -- and his comment was that he stated that there was two type of currents in -- which provided in cycle terms, you know, anti-cyclonic and cyclonic system within the Arctic Circle, within the Arctic Ocean. And when I was reading the document that was put a contract by some firm or what not on this ice current and ocean current study, it was just a short-term study. And I was just kind of curious if MMS is going to look at or obtain this document from this Japanese

00033

scientific research program with data for 40 plus years or by a Russian scientist, which I guess they were pretty interesting. I talked to them when they did their presentation in Anchorage about a year and a half ago, when I sat in on it.

MR. STANG: I'm not familiar with that particular study, but I can check with our science staff if they have that. The conference was a year and a half ago, is that what you.....

MR. BROWER: Yeah, it was in Anchorage. It was called informational conference, which there was at least 40 -- I'm not sure, there were a good number of attendants there, so.....

MR. STANG: Specifically focused on ice, the whole conference, or.....

MR. BROWER: No, it was basically on the whole -- there was various -- I seen projects relating to, I think 40 some other projects having by contractors to MMS for.....

MR. STANG: It was an MMS meeting fundamentally?

MR. BROWER: Right. Uh-huh.

MR. STANG: It was an information transfer meeting?

MR. BROWER: Right.

00034

MR. STANG: Okay. I will check with our -- Cleve Coles, who's head of our section on Environmental Studies to see if we've got that copy. It's a Japanese study in 40.....

MR. BROWER: Yeah, and the Russian scientist also did that study, too, for 40 plus years on it.

MR. STANG: And the Russian scientist did.....

MR. BROWER: Uh-huh.

MR. STANG: .....the 40-year study?

MR. BROWER: Right.

MR. STANG: Okay.

MR. BROWER: I think the Japanese scientist did the ocean bottom, ocean currents -- ocean current study on there on the -- that.....

MR. STANG: Uh-huh.

MR. KING: One of the things we have is a scientific committee as -- do you remember how many members that is?

MR. STANG: It's 10 or so, 10 or 12.

MR. KING: Ten or 12 that includes all the different sciences and we rely heavily on them as an agency to help us say where, you know, how good the science is we're based on. They review stuff and help us

00035

with direction as well, so that's one of the things that we use, and I think there were some of those, or any time we have an ITM, we usually have a bunch of those coming to attend also to hear this, we'll have to get back. Right now I'm unaware of any proposed further studies on that is the best I can tell you, but we'll have to look into it.

MR. BROWER: I think just -- the study wouldn't have been conducted or what not, but then they was talking from the Russian scientist, and then translating it to English term would be very beneficial or what not.

MR. STANG: Okay. Good. We'll check on that, Thomas.

MR. BROWER: I think I've got the minutes in my office some place. I mean, I think I must have the individual's name on it, relating to that.....

MR. STANG: Good.

MR. BROWER: .....Russian scientist.

MR. STANG: If you could provide them to us, we'd sure appreciate it.

MR. BROWER: I think you guys should have it on record, too, on that.

MR. KING: We've probably got it on record where it's an ITM.

00036

MR. STANG: Right.

MR. BROWER: Yep, it was.

MR. STANG: Okay. Good. Thank you very much, Thomas.

MR. HOPSON: I've got one more issue.

MR. STANG: Certainly, would you mind coming up, Charles, please?

MR. HOPSON: One other thing that I forgot to mention, my name is Charlie Hopson, you know, one of the Barrow whaling captains. I think the Barrow whaling captains has expressed that, you know, the endangered species of bowhead. You know, the government really put forward what they have on endangered species, whale, you know, you're breaking your own law of endangered species, selling, you know, leases to where the endangered species travel. The government, you know, just about literally stop us from whaling a long time ago, because they say it would endanger species. Aren't you harming the endangered species more putting the leases over there? You know what I'm saying, you know?

MR. STANG: Yes, I know what you're saying.

MR. HOPSON: Because of the Barrow Eskimo -- AEWC, you know, the whale is almost out of endangered species because of the good job they have done counting

00037

the whale, this and that. It's going to devastate, you know, the population if something ever goes wrong and everything, and the government is backing us up, and then you turn around and give out leases where the passes of whales are, you know. You're breaking your own law that you made, you know, about endangered species, you know, forget them.

MR. STANG: We are obliged when we have an issue that affects or has a potential effect on endangered species, we're obliged to work with the National Marine Fisheries Service or the Fish and Wildlife Service, depending on which species, to provide them information about the activity and it's potential effects on that species. Then they have the obligation.....

MR. HOPSON: Do we get a chance to read it and see if it's right or wrong and.....

MR. STANG: I believe they -- well.....

MR. HOPSON: It's there?

MR. KING: Well, our assessment.....

MR. STANG: Right.

MR. KING: .....of the effects to, for example, the endangered species that would be involved here, and there's eiders as well as bowhead whales.....

MR. HOPSON: Uh-huh.

00038

MR. KING: .....is in this document, and that's.....

MR. STANG: Right.

MR. KING: .....part of the value of having it out for the review we've got now would be to have people read that, and if we've made what people consider to be a bad assessment or made some mistakes or anything in there for people to comment on them. That's part of the process we're in. So that assessment is part of this document.

MR. STANG: And I believe -- what I was going to say, is that the National Marine Fisheries Service in the case of bowhead whales has an obligation to write a biological opinion about that activity and the National Marine Fisheries Service assessment as to whether that activity would be a problem with respect to the particular endangered species, in this case, bowhead whale. And they're obliged to do that. I believe that they send that draft biological opinion to the North Slope, to -- and I can't tell you their mailing list, but I think they send it to the North Slope Borough and they -- I think they also sent it to AEWC.....

MR. KING: Yes, they send it to AEWC.

MR. STANG: .....to assure that the whalers have an opportunity to provide input into that

00039

before they make a judgement.

MR. HOPSON: Alfrieda?

MS. LORD: Uh-huh.

MR. HOPSON: We did make comments on those?

MS. LORD: Yes.

MR. HOPSON: Okay. I still have to read my thing. That's.....

MS. LORD: Yes.

MR. HOPSON: .....why I ask. I don't want to cross over to their stuff, too, you know, so.....

MR. STANG: Right.

MR. HOPSON: But I didn't want to -- you know, in case they haven't, I didn't want to, you know, you know, let it go if they haven't. I guess they did, but that was one of my concerns, too, is the endangered species.

MR. STANG: Certainly. And we have -- a good substantial part of this document deals with the effects on endangered species, and it's that information that the National Marine Fisheries Service and the Fish and Wildlife Services uses in writing their biological opinions.

MR. HOPSON: Okay. That was one of the ones that.....

00040

MR. STANG: Thanks very much, Charles.

(Whispered conversation)

MR. STANG: Would anybody else like to testify at this point? Or to provide comments, or ask questions or what have you?

MR. HOPSON: Take a break until you get more people.

MR. STANG: We can do that, and in a minute if somebody doesn't just up and.....

MR. HOPSON: (Indiscernible)

(Whispered conversations)

MR. STANG: Well, what we're going to do is take a break for about five or 10 minutes, because I think some people might not have gotten the word that we started at five, that they think we're starting at 7:00 and some people said they would be here at 7:00, so we'll take a break for a little bit here. Let's go off the record for a few minutes here.

(Off record - 6:57 p.m.)

(On record - 7:25 p.m.)

MR. STANG: We're going to go back on the record, and Alfrieda, you have some statement to make, if you would please state your name and who you're with, and then go ahead and make your statement? Thank you.

MS. LORD: My name is Alfrieda Lord. I'm

00041

with Alaska Eskimo Whaling Commission, and I'm here to official present Maggie Ahmaogak's, who is the executive director of Alaska Eskimo Whaling Commission, her comments on the Beaufort Sea Planning Areas Lease Sales 186, 195 and 202.

MR. STANG: Okay. We -- thank you, Alfrieda. We will take that testimony that you handed to Selena and make sure that that's part of the record verbatim.

TESTIMONY OF MS. MAGGIE AHMAOGAK:

The Alaska Eskimo Whaling Commission (AEWC) appreciates the opportunity to submit these preliminary comments, and reserves the right to submit additional comments on the DEIS for Oil and Gas Lease Sales 186, 195 and 202 by the U.S. Minerals Management Service by the deadline date in September of 2002.

The AEWC hereby endorses and incorporates by reference the comments submitted on this matter by the North Slope Borough.

Summary.

The draft Environmental Impact Statement (DEIS) prepared by the U.S. Minerals Management Service (MMS) for its proposed Oil and Gas Lease Sales 186, 195 and 202 in the Beaufort Sea Planning Area still fall short of the standards of review and analysis set under

00042

the National Environmental Police Act (NEPA). Important research results and other information from ongoing programs that could be used are still disregarded throughout the document. The AEWC applauds the MMS in its statements that it provided information from the consultation of the North Slope residents and the AEWC and this DEIS document. Unfortunately, one of the most important components of the DEIS, the cumulative effects/impacts analysis, contains only conclusive statements and entirely neglects any discussion of the past, present and reasonably foreseeable future activities whose impacts might interact with those of the proposed sale/action in federal activities.

Furthermore, this DEIS continues MMS' tradition of ignoring the dictates of federal law and Executive Order by continuing to refuse impact mitigation funding to our community. The DEIS responds to our request for impact assistance by refusing to acknowledge the possibility of pushing the administration to include mitigation impact assistance in the President's budget, or asking the Administration to put a request for impact assistance for North Slope communities in an energy bill. This is a fundamental flaw. We have heard agency officials claim that they would like to help us, but complain that MMS has no authority to fund impact

00043

assistance. We do not agree with the agency's legal opinion and we wonder whether MMS really wants to help us since we see no sign that you have ever asked for clearer legal authority to do what you say you want to do.

AEWC believes that MMS most certainly has the authority to budget for impact assistance. The one year allocation of funds to coastal states is evidence that Congress recognizes that coastal impacts from offshore oil development are a real problem. If MMS believes it does not have authority for funding, MMS needs to ask for it. This is part of MMS' responsibility to balance the orderly development of the OCS with protection of the human and marine environment.

Finally, AEWC believes that MMS has not performed or provided accurate and substantial analysis of the mitigation stipulations for this particular DEIS. A list of mitigation measures without analysis does not qualify as a "reasoned discussion" or a "hard look" as NEPA requires.

Requests from previous EIS to the 5-year leasing program.

On January 24, 2002, the AEWC submitted it comments on the DEIS for the OCS Oil and Gas Leasing Program: 2002-2007. In those comments, the AEWC noted a number of items that need to be addressed by the MMS

00044

before Lease Sales 826, 195 and 202 can be held. In particular, the AEWC requested that MMS acknowledge recent research results on the adverse industrial impacts of OCS development. MMS' failure to fully address these findings, especially given the participation of MMS representatives in hearings and meetings addressing these matters is extremely disappointing.

Again, the AEWC insists that MMS fully revise the sections of the DEIS in which it purports to address the "effects of accidental oil spills" and the "cumulative effects of past, present and future activities on the people and environment of Alaska's North Slope," as well as its conclusions within the Executive Summary on pages EXSUM 2, 3, 4, and 5. MMS had not performed or provided an accurate and substantial analysis of the mitigation stipulations for this particular DEIS. A list of mitigation measures without analysis does not qualify as a "reasoned discussion" or a "hard look" as NEPA requires.

For instance, the DEIS contains a stipulation prohibiting permanent facilities within a 10-mile zone around Cross Island unless the lessee can demonstrate that their placement in the zone will not have a significant impact on the subsistence harvest of whales. The DEIS claims that AEWC agreed to this, but we

00045

never did and do not now. The 10-mile figure is someone else's arbitrary and inaccurate invention. The document is dishonest in claiming our support. Our judgment now is the same as it has been. The exclusion zone should be expanded to include an area based on the real Nuiqsut traditional bowhead harvest area (which lies more to the north and east) and production noise effects on bowhead whales. The new zone should be defined in consultation with the AEWC and Nuiqsut and refined as noise monitoring studies produce more accurate information on impacts on whales.

In addition, we object to MMS' absurd characterization of an 8-10 percent chance of a major oil spill as "highly unlikely." Compared to what? What odds would you consider acceptable if your culture and your community were at stake? A risk of 8 percent to 10 percent is particularly unacceptable to AEWC and especially without an offer of impact assistance. We believe that the approach taken to risk evaluation and assignment in the DEIS violates the principles of environmental justice embodied in current executive order and other law.

Furthermore, given the vital importance of the analysis of oil spill and cumulative impacts to our community as a basis for understanding the impacts to

00046

our community from OCS industrial activity in the Arctic OCS, including the proposed lease sales, the AEWC insists that MMS revise the sections indicated above and make the revised DEIS available for review by the AEWC, the NSB and ICAS, and the consulting agencies including the National Marine Fisheries Service, the EPA, and the Marine Mammal Commission.

In addition to the above, in its comments on the DEIS for the OCS Oil and Gas Leasing Program: 2002-2007, the AEWC also requested that the MMS prepare a revised discussion on sociocultural impacts and environmental justice, including a balanced account of the "socioeconomic environment" for the North Slope, with a reasoned discussion of mitigation measures. the MMS has yet to provide this revised discussion.

In 1994, the National Research Council published a review of MMS' Environmental Studies Program in Alaska. The AEWC has pointed MMS to the conclusions and recommendations of this review on numerous occasions in recent years. These conclusions and recommendations remain relevant as MMS has yet to incorporate or otherwise address them. Notably, the NRC Committee conducting the 1994 review pointed out that, just as it does in the current DEIS, MMS in the past has devoted considerable attention the "amount and kind of

00047

subsistence activities, the importance of these subsistence activities for the maintenance of traditional cultures, and at least the potential for these activities to be disrupted in the case of catastrophic damage to the physical environment" without providing measures to protect against this potential disruptions.

In the first paragraph of Section 4.3.3.15. "Environmental Justice" within the 5-Year Leasing Program, it is noted that Executive Order 12898 alls for the development of mitigation measures to address "all identified effects." Agencies are also directed in the executive order to integrate those mitigation measures into the level of NEPA review required, in this case, into the environmental impact statement (EIS).

The AEWC hereby makes the statement that the MMS has failed to provide a clear analysis and reasoned discussion of all of the effects likely to result from the Lease Sales 186, 195 and 202.

Therefore, MMS has placed itself in a position where it cannot adequately identify mitigation measures necessary to address the "Environmental Justice" concerns raised by the proposed lease sales.

For these and other reasons, the present

00048

DEIS is in violation of the Outer Continental Shelf Lands Act and the regulations promulgated under the National Environmental Policy Act, which requires that the Secretary of the Interior provide "information needed for assessment and management of environmental impacts on human, marine, and coastal environments of the Outer Continental Shelf and the coastal areas which may be affected by oil and gas development." Furthermore, as noted before, the Council on Environmental Quality requires that MMS ensure the "professional integrity, including scientific integrity" of the analyses in the draft EIS.

The AEWC believes that preparation of a single EIS for three incremental lease sales is inappropriate.

The AEWC recognizes MMS' desire to expedite permitting of energy projects, but the agency's proposed "tiering" is not appropriate in Alaska's OCS for several reasons.

MMS approach inevitably will short-circuit the chance for thorough environmental review of the three lease sales. Indeed, we believe that your proposed approach is not "tiering" but is in fact impermissible "segmentation" because the projects will be carried out in changing circumstances and may have

00049

different impacts.

In a stable, low-risk environment, MMS' approach might have merit, but not here. Weather, ice, and other environmental conditions in the Beaufort Sea are shifting, both year-to-year and over the long term with climate change. Three days ago the Washington Post ran a story about glacial melting and the rapidity of change in the ice of the Arctic. Now more than ever is the time to fulfill NEPA's mandate to take a hard look at the impacts of these projects. A hard look means one EIS per lease sale. We cannot afford to do less. Every year we learn more about and change our understanding of the Beaufort Sea environment, the habitat needs of the whales, and the scale and pace of change in those things resulting from shifts in the global climate. Moreover, on almost a daily basis the Nation's policies and attitude toward energy production and consumption are themselves changing. NEPA requires an informed evaluation and weighing of facts, legal requirements, and social concerns to strike a "productive harmony between man and the environment." The projects must be evaluated pursuant to the most up-to-date information and perspectives.

MMS cannot continue to ignore the fiscal crisis its ongoing actions are creating for the North

00050

Slope communities.

When congress passed the OCS Lands Act, it recognized, in its declaration of policy, "the national interest in the effective management of the marine, coastal, and human environments." (43 US 1332(4)) In order to accomplish this goal, Congress recognized that affected states and local governments are likely to "require assistance" in dealing with adverse impacts from OCS development.

Congress then went on to give the Secretary of the Interior a very broad grant of authority to administer the leasing of the OCS for the development of non-renewable resources, directing the Secretary to "prescribe such rules and regulations as may be necessary to carry out" the provisions of the OCSLA. (43 USC 1334(a)) Congress further authorized the Secretary to:

> At any time prescribe and amend such rules and regulations as he determines to be necessary and proper in order to provide for the protection of correlative rights.

The AEWC was formed in 1977 for the purpose of representing the 10 bowhead whale subsistence hunting villages on issues related to the quota system imposed on our communities by the International Whaling Commission and for managing the bowhead whale subsistence

00051

hunt in compliance with that quota system. The Federal Government provides the AEWC a small grant through the U.S. Department of Commerce for these purposes. However, because of the aggressive leasing program administered by the MMS in the Beaufort Sea, and soon the Chukchi Sea, the AEWC has been forced to take on representation of our bowhead subsistence community in dealing with OCS oil and gas operators to try to protect our bowhead subsistence hunt from adverse impacts of OCS oil and gas activities.

Furthermore, the amount of work on OCS-related matters in recent years has grown to the point that it dominates the AEWC's staff time, again with no funding through the agency responsible for these impacts. Despite repeated requests, both formal and informal from the AEWC and residents of the NSB, MMS has yet to act to fulfill this statutory obligation.

As is the tradition of our community, we have taken whatever steps we can to protect ourselves. One of the most important mitigation measures in place at this time to protect our bowhead hunting is the annual "Open Water Season Conflict Avoidance Agreement". This agreement is the result of the extensive negotiations between the AEWC and oil and gas operators over more than 15 years, with no support from the U.S. Department of the Interior or the MMS. In recent years, the AEWC, along

00052

with the NSB and the Inupiat Community of the Arctic Slope (ICAS) has undertaken negotiations with oil and gas operators to try to address adverse impacts of North Slope oil and gas development, especially the OCS activities, on our traditional subsistence culture and on the physical and psychological well-being of our people. This is work that falls squarely within the Secretary's responsibility to protect "correlative rights) in the natural resources of the Outer Continental Shelf. Not withstanding this statutory responsibility and despite repeated requests, MMS continues to refuse to provide meaningful assistance to the AEWC, either through its regulatory or its funding authority.

In fact, in AEWC's September 21, 2001 comments on MMS's Draft Proposed Oil and Gas Leasing Program for 2002-2007, the AEWC specifically requested that MMS include mitigation funding in its agency budget to cover local mitigation costs under the new five-year OCS leasing plan. MMS has informed AEWC that the agency cannot do this. Furthermore, MMS representatives have indicated that the agency considers itself to be "unable" to provide this kind of support.

However, the Secretary has statutory responsibility for protecting our people's interests in our Beaufort Sea subsistence resources and for mitigating

00053

impacts to our community as a result of the OCS Leasing Program. Furthermore, the Secretary has been instructed by Congress to provide whatever measures "may be necessary" to protect our interests and mitigate impacts to our communities. Therefore, MMS is placing the Secretary of the Interior in direct violation of the OCS Lands Act by refusing to provide support for our community and to work with us to address and mitigate the adverse impacts of Beaufort Sea OCS oil and gas leasing and permitting.

Conclusion.

The Alaska Eskimo Whaling Commission, representing the bowhead whale subsistence whaling captains from ten villages of Kaktovik, Nuiqsut, Barrow, Wainwright, Point Hope, Kivalina, Wales, Little Diomede, Savoonga and Gambell, opposes OCS Lease Sales 186, 195, and 202 within the Beaufort Sea Planning Area due to the current and potential adverse impacts to our bowhead resource and our subsistence hunting. The AEWC continues to advise the MMS to heed the advice of the National OCS Policy Committee with respect to the need to address the fiscal issues raised and faced by our community.

Furthermore, the AEWC insists that the MMS to prepare a revised DEIS or a supplemental EIS to address the issues raised in these comments and in the

00054

comments submitted by the north Slope Borough.

Finally, let me share a general observation. MMS has an extensive environmental, social and economic studies program. MMS interviews our people. We see our traditional knowledge repeated in this and other MMS environmental studies.

But even with all that dialogue and all that purported understanding, MMS' decisions invariably run counter to our interests. We are gratified to see a cumulative effects analysis that pays attention to the long-term harmful effects of OCS development on our sociocultural systems, but we ask for meaningful mitigation, not more words and studies, to address it.

We have shown that we need coastal impact assistance. But MMS has not requested OCS mitigation funding in its agency budget, though the agency assures us that it has studied our way of life and needs.

MS combines three lease sales in one EIS, allowing an expedited and inevitably less accurate review of the impacts of these OCS lease sales on our hunt. It does not comfort us to know that there are thousands of pages of data on our culture when MMS sets up a process calculated to expedite damage to our interests.

The message you have delivered is that MMS, while claiming to know us by heart, chooses to

00055

refrain from making decisions that protect our way of life.

Thank you for this opportunity to express the views of the AEWC. I'd be happy to answer any questions you may have.

MR. STANG: Okay. And Robert?

MR. SNYDAM: Good evening. My name is Robert Snydam, I'm a wildlife biologist with the North Slope Borough, Department of Wildlife Management. First I'd like to say thank you to MMS for coming here today to hear testimony about the Beaufort Sea lease sales. This evening I would like to briefly talk about the mayor -- Mayor Ahmaogak's written testimony. I have a few comments I would like to pass on to you from Craig George, who's also a wildlife biologist with the North Slope Borough, and then I have a few comments as well.

First of all, I won't read the Mayor's testimony into the record, but I would certainly like to reference it and make sure that it gets typed into the record. You -- I understand you do have copies of his testimony?

MR. KING: Yes, we do.

MR. STANG: We will assure you that that will now become part of the record.

WRITTEN TESTIMONY BY MAYOR AHMAOGAK:

00056

I'd like to welcome the federal Minerals Management Service officials who have traveled to Barrow this evening. They have come to hear testimony from our North Slope residents on their agency's draft environmental impact statement for three proposed Beaufort Sea Outer Continental Shelf oil and gas lease sales. They will be traveling to Nuiqsut for a hearing on Wednesday evening and to Kaktovik for a hearing on Friday evening. MMS wants to hold one lease sale in 2003, one in 2005, and one in 2007. Each of the sales would offer all unleased blocks in the same planning area. Seven federal lease sales have been held in the Beaufort Sea since 1979. This is the first time MMS has published a single EIS covering more than one Beaufort Sea sale. We appreciate the chance to once again tell you what's on our minds, though if you've been paying attention for the last 25 years, you would have a pretty good idea of what you're going to hear tonight. You have heard from us many times before, and from our people in the affected villages. My comments tonight will be somewhat general, and preliminary to more detailed written comments we will submit by the close of the comment period on September 20th. Our review of the draft EIS is continuing, and we will consult with our villages, the AEWC, tribes and others before finalizing

00057

our comments.

I'll be honest and say that I'm not optimistic about our chances of convincing you to do the right thing from our perspective concerning oil and gas leasing in our Beaufort Sea. I've been mayor too long and testified at too many of these hearings over the years to expect that. You should not be leasing here, or in the neighboring Chukchi Sea. While in many ways this draft EIS seems better organized and more clearly written than similar documents we have reviewed in the past, it also seems in other alarming ways a step backward. MMS appears ready to roll back some of the hard-fought incremental positive steps we've taken during the planning of the seven previous sales. I'll touch on those points later. My comments tonight will be in two general areas: First, I'll again highlight some general process and policy concerns we have commented on before. Second, I will address the failure of the draft EIS to adequately respond to several points we raised during the scoping phase of this review. I'll hold off pointing out most specific concerns with the language and conclusions of the document until we finish our analysis and provide you with written comments.

Process and policy concerns. Leasing of Arctic Waters.

00058

Our concerns have been the same ever since the federal and state governments first considered offshore oil and gas leasing in the Beaufort and Chukchi Seas. We don't like it. We think it's a bad idea for all kinds of reasons. Offshore leasing leads to offshore exploration. Offshore exploration with minimal environmental impacts is perhaps possible in many cases with seasonal and other restrictions, but it leads to offshore development and production,. Even if there are no oil spills, production causes year-round impacts. Industrial noise in the marine environment has altered the distribution of bowhead whales and other subsistence resources in the past. The subsistence harvest of bowheads has defined our Inupiat culture forever. Our communities have known hardship in the recent past when industrial operations have put the whales out of the safe reach of our hunters. Protection of the opportunity for the Inupiat people to safely engage in the subsistence hunt of bowhead whales and other marine species should have the highest priority when governments are deciding on the best use of the Beaufort and Chukchi Seas.

We are frustrated that most OCS planning areas offshore of the Lower 48 states remain withdrawn from consideration for leasing by Executive Order or under a congressional moratorium. We do not think that

00059

these areas should be leased, but question why they are off limits while the Beaufort Sea is not. MMS has explained that several factors contribute to decisions about offering areas for leasing. The final EIS for the 2002-2007 OCS Oil and Gas Leasing Program was published in April. It says that these factors include not only environmental concerns, but also oil and gas potential, industry interest, and the views of the governors of coastal states. (Page 5-12) Other factors that we consider critical were not mentioned. Shouldn't it matter that the prevailing conditions of an area limit the ability to mitigate the potential risks of oil and gas operations? And shouldn't a primary factor be the views of the local residents who live adjacent to the planning area and who will feel 100 percent of the impacts of leasing? MMS continues to aggressively lease in remote, highly sensitive, challenging, and vulnerable arctic waters over the loud and continuous objections of the local Native Inupiat population. We are the population which bears all of the risks, and receives very little of the benefit. At the same time all other OCS planning areas except certain areas within the Gulf of Mexico are withdrawn or deferred from leasing. This raises significant questions of fundamental fairness and environmental justice.

00060

These questions have not been adequately addressed in the draft EIS or the five-year program final EIS. All OCS planning areas should be considered in an analysis of the equitable sharing of the benefits and environmental risks of leasing, development, and production. It is unfair that states adjacent to waters under a moratorium from leasing still receive federal 8(g) payments from OCS revenues, while the Borough and other local governments receive no direct payments, but suffer the greatest impact from ongoing leasing and industrial activity. Not weighing the potential environmental and cultural risks against the potential benefits of nationwide leasing choices is clear environmental injustice.

And the unfairness keeps getting worse. Adding insult to our ongoing injury was the President's announcement at the end of May that the federal government would spend $235 million to buy back oil and gas rights in the Everglades and in federal waters in the eastern Gulf of Mexico off the Florida coast. Of the total, $120 million would go to three oil companies to buy out offshore leases. Though not fully explored, the offshore unit is believed to contain at least 700 billion cubic feet of economically producible natural gas. The President announced the deal with his brother , the

00061

Florida Governor, at his side. It's no surprise that the popular moves to prevent oil and gas drilling are sure to help Governor Bush's standing with environmentalists as he seeks reelection this year. They also just happen to boost support for the President in the state, which decided his 2000 election. Speaking at the announcement, Interior Secretary Norton said, "When it comes to energy development on federal lands, each case must be evaluated individually in cooperation with the people who live in the area. IN this case, the amount of oil was relatively small compared to the nation's overall energy needs, the impact of development could be significant, and the government and people of Florida supported this action."

All I can say is, where's the justice in spending federal money to buy back Gulf of Mexico leases containing 700 billion cubic feet of producible gas, and continuing to offer oil leases in the Beaufort Sea? We're the people who live in this area, and for more than 25 years we have told you that you shouldn't be leasing here.

EIS process for Beaufort Sea Sales.

We are frustrated with MMS over the way you deal with public input in your reviews. We are always told that our concerns will be fully addressed during some later review. We review the five-year

00062

leasing program, and are told that addressing our concerns is premature at the program level. We review individual lease sales under the five-year program, and are told things will get worked out during a specific project review because a lease stipulation requires consultation. The Borough commented several times before publication of the final EIS for the 2002-2007 OCS Oil and Gas Leasing Program in April. At each step in the process it seemed that MMS ignored the comments we submitted at the preceding stage. These Beaufort Sea sales will fall under the 2002-2007 Leasing Program, but their review was started long before the leasing program was finalized. In our comments on both the leasing program and on this Beaufort Sea leasing proposal, the North Slope Borough has strongly objected to the new multiple sale review process. We believe that there should be a full public process associated with each of the three proposed sales. The public process and consultation with the Borough, the AEWC, and the affected communities, interested organizations, and general public has improved with each of the past Beaufort Sea sales. Improvement in the process has been slow over the years, but has led to stronger mitigation measures and appropriate area deferrals, and has stimulated necessary scientific study.

00063

We continue to believe that any marginal benefits in efficiency and reduction in burnout among MMS authors realized by consolidating three sales in a single EIS is outweighed by the reduction in public engagement and MMS interaction with the directly affected North Slope community. An EIS should be developed and a Coastal Management Program Consistency Analysis should be conducted for each sales. Both processes are valuable. MMS officials should not find it burdensome to visit the three most directly impacted communities of Barrow, Nuiqsut, and Kaktovik for scoping meetings and for public hearings for three lease sales in five years. And it should be the highest MMS officials in Alaska who should make those visits along with their staff to hear the concerns of the community.

The draft EIS does not adequately answer our concerns over this new process. It only says that multiple-sale EIS's have been used for other areas. It mentions the Gulf of Mexico and the NPR-A. There are differences between those areas and the Beaufort Sea. The Gulf of Mexico was highly industrialized long before MMS used a multiple-sale EIS process for the region under the last two five-year oil and gas leasing programs. The 2002-2007 Final EIS notes that "the Western and Central Gulf of Mexico Planning Areas...are two of the most

00064

active offshore oil and gas areas in the world." (Page 3-42) Production has occurred there for many years, and the issues raised during the public planning process are fairly well understood. The Beaufort Sea is a frontier area for the oil industry. The first production island was just constructed, and oil only began flowing at the end of October last year. Many issues remain unresolved, and new pipeline, spill response, and other technologies must be developed to cope with arctic conditions. Many information gaps exist, and traditional knowledge and western science do not always agree. The relationship of Inupiat subsistence users to our marine environment and our cultural, nutritional, and spiritual dependence on its resources is very different from the commercial and recreational relationship which the many Gulf of Mexico users share with that environment, no matter how deep their ties.

In the same way, onshore activities in the NPR-A are following long-established patterns developed and refined over three decades at Prudhoe Bay. Still, because it was essentially a newly leased area that had not been offered for many years, 79 mitigating measures were attached to the Northeast NPR-A sale in 1999. You now want to cover three Beaufort Sea sales with a single EIS, and only five assumed standard

00065

stipulations and 16 purely advisory clauses when there continue to be many unknowns about the Beaufort Sea and broad disagreements over potential impacts to many resources and uses. The reasons and justifications given for using a multiple-sale EIS for the Beaufort Sea just aren't good enough.

Inadequate response to previous comments. Area deferrals.

The North Slope Borough believes that areas around Barrow, Kaktovik, and Cross Island sufficient to protect vulnerable resources and the subsistence harvest of bowhead whales and other species should be deferred from leasing. The deferral alternatives developed for the draft EIS don't get the job done. They are inadequate and you have to some extent issued data we provided to define them. At a meeting with MMS Alaska Region Director John Goll in my Barrow office in November, I agreed to work with the Borough's Department of Wildlife Management and the AEWC to release to MMS bowhead whale subsistence harvest locations for the three Beaufort Sea whaling communities. It was made very clear to MMS in subsequent written and e-mail correspondence with members of my staff, and acknowledged by Director Goll, that it would be absolutely inappropriate to use the harvest locations

00066

alone to define either subsistence whaling zones or appropriate deferral areas intended to protect subsistence whaling opportunities. That, however, is exactly what MMS has done in this draft EIS.

The data are primarily provided as one tool to assist MMS in determining the appropriate extent of an offshore area around the Nuiqsut subsistence whaling base of Cross Island which should be considered for exclusion or heightened protection in future Beaufort Sea OCS oil and gas lease sales. Data were also provided to help in refining previously identified deferral areas offshore of Barrow and Kaktovik. I thought we had made it clear to MMS prior to release of the information that harvest data alone do not provide a true picture of the entire zone utilized by and essential to subsistence hunters in the successful harvest of bowhead whales include staging areas for crews, supplies and harvested product, areas of pursuit, routes used for the transportation of crews, supplies and harvested whales and whale product, and areas used for the processing of harvested whales. Harvest data alone also do not define the area east, or upstream of the full area utilized by subsistence crews from Barrow, Nuiqsut, and Kaktovik within which industrial disturbance would adversely impact subsistence efforts. This distinction is

00067

important. To provide a reasonable chance of a successful bowhead whale subsistence harvest, protection must be provided to a combination of two areas. First, there is clearly the area utilized directly by subsistence whalers for all related purposes. Let's call this the subsistence use area. Next, there's the area east of the subsistence use area we can call the area of influence. That's the area within which migrating whales could be affected significantly enough by industrial activities so that they are deflected beyond the subsistence use area of are made more difficult to harvest within the subsistence use area. These qualifications must accompany any publication and use of the harvest location data, and any conclusions drawn from the data.

Let's start with the Barrow area. Everyone should accept by now that the spring lead system concentrates wildlife resources and is too valuable and vulnerable to offer for lease and potential development. The area is also a critical year-round subsistence use area which extends farther offshore and to the east than the spring lead system alone. It reaches at least to Cape Halkett. Your own Stipulation 5 describes the timing and area utilized by Barrow hunters for subsistence whaling in the fall. It recognizes that occasional use may

00068

extend to Cape Halkett. As we have repeatedly stated, this area should never be lease, and the Borough will oppose the siting of any permanent industrial facilities in the vicinity of the spring lead system, and within the Barrow subsistence use area and area of influence east of that. The permitting of any permanent facility or non-winter exploratory operations in this area would be inconsistent with the Borough's Land Management Regulations (LMRs) and North Slope Borough Coastal Management Program (NSBCMP).

The eastern Beaufort Sea is a similar case. It is a feeding area for bowhead whales migrating westward in the fall, and a use area for subsistence hunters from the community of Kaktovik, Kaktovik hunters take whales as they move westward through the waters offshore of their community. In the past, fall exploratory drilling operations occurring to the east of that harvest zone have deflected whales beyond the reach of subsistence hunters. The community suffered great hardship, stress, anxiety, and depression when no whales were taken for two consecutive seasons. That experience would be evidence to support our opposition to any drilling operation within Kaktovik's subsistence use area or upstream area of influence proposed during the fall whaling season. Such a proposal would be inconsistent

00069

with those provisions of our LMRs and the NSBCMP that explicitly prohibit development which prevents subsistence user access to a subsistence resource. You have included two eastern Beaufort Sea deferrals as Alternatives V and VI in the draft EIS. You did not include as an alternative a deferral of all waters offshore of ANWR. We believe you should have, and that such an alternative would be preferable to Alternative IV, Alternative V, or any combination of the two. Sale 170 did not offer the waters offshore of ANWR. In doing that, MMS noted the lack of information on cumulative impacts on the Refuge, insufficient information on emergency response plans, and the inability to make direct landfall with a subsea production pipeline. Those problems still exist, and the deferral of all waters offshore of ANWR is appropriate.

Nuiqsut's subsistence whaling base of Cross Island presents a somewhat different case. A deferral area should be established for the protection of subsistence uses alone. The lease stipulation included in Beaufort Sea Sale 170 prohibits the placement of permanent facilities within a 10-mile zone around Cross Island unless the lessee can demonstrate that such facilities placed within the zone will not have a significant impact on the subsistence harvest of bowhead

00070

whales. The 10-mile distance was chosen somewhat arbitrarily after the community of Nuiqsut had requested a zone 50 miles in radius. You've played with that stipulation by breaking it into tow parts in the draft EIS. You've also included a Nuiqsut Subsistence Deferral Area as Alternative IV. We acknowledge that a zone of 60 miles in all directions from Cross Island is perhaps too large. WE also believe, however, that there should be acceptance by all parties that 10 miles north and east of Cross Island does not accurately define the full extent of the area within which impacts on fall migrating bowhead whales can disrupt the Nuiqsut subsistence hunt. Again, your Stipulation 5 recognizes that Nuiqsut whalers use an area extending east to Flaxman Island.

The Borough was pleased by the adoption of the current lease stipulation. We believe MMS should now be willing to consider the available harvest data as a starting point in defining the actual extent of a zone around Cross Island requiring heightened protection. A new zone which includes the full subsistence use area plus the upstream area of influence should be defined in consultation with the AEWC, Nuiqsut, and the National Marine Fisheries Service, and refined as noise monitoring studies, including those associated with the British Petroleum's Northstar Development Project, produce more

00071

accurate information on noise impacts to migrating whales.

Potential effects.

The analysis of the potential effects of leasing, exploration, and development in the EIS is driven largely by the development scenarios used. What makes no sense is the way MMS deals with the effects of the various deferral alternatives within those scenarios. MMS reaches a conclusion concerning the Barrow and two Eastern Beaufort deferrals that really defies logic. The draft EIS first finds that because these are far from existing infrastructure, they are less likely to be leased and developed. We agree. MMS then goes on to say that because these areas are less likely to be leased and developed, the consequences to resources and subsistence harvest patterns with or without the deferrals would be essentially the same. That's where we part company. The implication of that analysis is that if there would likely be no reduction in effects, but would be a reduction in resource potential, why defer the areas? That reasoning avoids the most critical question of what effects there could be if the deferrals are not adopted and leasing and development occurs in those areas. At the heart of our desire to see these areas deferred is the belief that if activities occur in these areas,

00072

impacts will be greatest compared with other blocks within the Beaufort Sea planning area. A reduced likelihood of activities occurring in the far eastern or western portions of the planning area does not mean that the effects would be insignificant if exploration and development do take place there.

A general flaw in the development scenarios applied in the draft EIS is that they do not consider the specific potential effects if one of the projects predicted is located in a particularly sensitive area. The very reason deferral areas are being discussed is that all areas within the Beaufort Sea planning area are not the same. Some contain resources which are more concentrated or sensitive. In many cases, these areas are also critical for subsistence. MMS should do impact analyses of alternatives using scenarios, which place one or more developments squarely within proposed deferral areas. Then you will get at the issues most important to the affected North Slope Inupiat community.

Cumulative Impacts.

The draft EIS significantly understands the current and potential levels of cumulative impacts of oil and gas activities on North Slope resources and community residents. These proposed Beaufort Sea sales

00073

and the offshore and onshore operations that would follow will not occur in isolation. More onshore exploration took place on the North Slope this past winter than at any time in decades. Development in the near term is likely from Point Thomson on the border of ANWR in the east to the National Petroleum Reserve-Alaska (NPR-A) in the west. Companies are looking south to the foothills of the Brooks Range. The Bureau of Land Management has held a second northeast NPR-A lease sale, and expects to offer a northwest area twice that size next year. MMS and other state and federal leasing agencies are moving ahead with their plans without a good handle on the cumulative impacts of all of this on the environment, wildlife resources, and residents of the North Slope. Serious cumulative impacts have already occurred, and are certain to increase. MMS should acknowledge and describe that.

The issue of cumulative impacts of oil and gas activities on the North Slope is being studied by a committee of the National Research Council. Its report due out this year. MMS should acknowledge the importance of the committee's work and agree to put forth appropriate effort and funds to see that any recommendations offered in its report are acted upon. This EIS should be modified as appropriate to reflect the

00074

Committee's findings.

The Borough and the people of the North Slope are the only ones now dealing with and paying for these impacts. We believe that through past Beaufort Sea lease sales, and continuing today, MMS has failed to meaningfully follow the intent of the OCS Lands Act with respect to the study of all effects of OCS leasing, exploration and development on the social, economic and cultural systems of the North Slope. We provide subsistence abuse treatment, counseling, public assistance, crisis lines and shelters, and other social service programs. We provide the search and rescue services, which must respond when hunters put themselves at risk in the pursuit of scarce or less accessible game deflected from normal migration paths. We provide the police force, which must respond to all of the kinds of unfortunate situations which arise when people and entire communities are subjected to long-term and persistent stress. We provide the biologists, planners, and other specialists who review and offer recommendations on the staggering volume of lease sale, exploration plan, and development project documents which are produced and distributed each year. We must absorb the ever-increasing expense of travel to Fairbanks, Anchorage, Juneau, Seattle, and Washington, D.C. where the agencies

00075

conduct most of their work and make most of their decisions. Travel to our own remote villages has greatly increased as areas under oil and gas leasing continue to expand. We again ask that the EIS provide a detailed description of ongoing costs borne by the Borough and other local entities as a direct or indirect result of OCS leasing, exploration, and development. That analysis should include the budgetary effects on the Borough, community, and tribal governments of attempting to fully participate in OCS review and planning processes. That information should be a necessary component of your impact assessment, and would serve as a means of identifying an appropriate level of impact assistance, which should accompany any continued OCS leasing.

Conclusion

In conclusion, I'll add that even at this early point in our review of the DEIS, we have notices many of the same problems we have seen in previous MMS documents. Analysis seems biased in favor of leasing. Impacts, and especially cumulative impacts, are understated. The potential impacts of vessel and aircraft traffic are all but dismissed. Figures given for "trips" should really be doubled to reflect that they are actually round trips and involve two passes between shore and drilling structures. The issue of increased

00076

skittishness of bowhead whales following exposure to industrial noise is not adequately addressed. The difficulties and delays due to weather, distance, and other factors in responding to oil spills in the more remote reaches of the planning area are not adequately discussed. The significance, value, and vulnerability of the traditional subsistence culture is not given appropriate weight in balancing its protection against the risks of leasing. After all these years of listening to us, MMS just doesn't seem to fully understand how hard it is to be successful at subsistence in this environment; how many things you have to do right, how many things out of your control have to go right, and how little it takes to cost you your harvest of your safety. Once again, it seems that traditional knowledge is included in the document, but does not contribute to your analysis or conclusions.

I thank you for coming tonight, and encourage you to listen closely to what you hear in Barrow and when you travel to the villages. We will provide more detailed written comments at a later date. You are going to have your lease sale I think. But I also think you should defer the areas most important to the people who will be most impacted, honestly talk about the impacts which have occurred and will occur, and use

00077

strong mitigating measures to protect resources in the areas you do lease.

MR. SNYDAM: Thank you very much. I would like to highlight a couple things that the Mayor has written in his testimony. First of all, again his thanks for coming here to hold a public hearing, to hear testimony about the lease sales in the Beaufort Sea. Probably the most important thing I would like to pass on from the Mayor's testimony though is the North Slope Borough's position that there shouldn't be any lease sales that are occurring in the Beaufort Sea, that it's an inappropriate place to lease. It's an inappropriate place to explore for oil, and it's an inappropriate place to develop oil fields.

And there are lots of different reasons for this that the Mayor has highlighted in his testimony. Among the important ones is that if an oil spill were to occur in the Beaufort Sea, the ability of Industry and agencies to clean up the oil spills is very low, that the technology isn't there to clean up an oil spill. And there are other issues related to noise and disturbance to bowhead whales and to other marine animals that are also of great concern to the people of the North Slope Borough.

Another issue that the Mayor points out

00078

has to do with something that recently has happened in Florida where the Federal Government has purchased, has bought back lease sales occurring in the Gulf of Mexico, off the Florida coast. And during that buy-back process, Interior Secretary Gail Norton is quoted as saying, when it comes to energy development and federal lands, each case must be evaluated individually in cooperation with the people who live in the area. In this case, the amount of oil was relatively small compared to the Nation's, excuse me, overall energy needs. The impact of development could be significant, and the Government and people of Florida supported this action.

That applies much more so to the Beaufort Sea than to the Florida coast. For years and years and years, maybe decades now, the people here have been saying the Beaufort Sea and the Chukchi Seas are inappropriate places to lease, that the technology isn't there to clean it up, the habitats are very -- are at risk because of noise and because of oil. And if the federal government is taking this approach in Florida, then they sure should be taking that same approach here in Alaska as well. The people here do not want development, do not want exploration in the Beaufort Sea.

There are many other topics in the Mayor's letter that I won't read, but I'm glad that it

00079

will be entered into the record and we look forward to the response by MMS in the final EIS.

Craig George is a wildlife biologist with the North Slope Borough. One of his primary responsibilities is to study bowhead whales, and Craig has been involved in bowhead whale studies since the late 1970s, and so he's certainly one of the world's leading experts, one of the most knowledgeable people on bowhead whales in the world. And he has a couple of comments about leasing in the Beaufort Sea related to bowhead whales.

One of the first comments that both he and I would like to make have to do with the hunting deferral areas that were put into the lease sale, into the draft EIS. Several years ago, a year and a half, two years ago, there was discussions of the North Slope Borough and Alaska Eskimo Whaling Commission providing the locations of strikes and landed whales in the Beaufort, particularly for Kaktovik, Nuiqsut and Barrow. When those data were handed over to the MMS, we asked that the data be used with great caution, that the deferral area shouldn't be just where those points -- where those whales were hunted, but the hunting area was much, much greater than that. The area around those landed whales was as important as the area where the

00080

whale was caught, so there was a great need to interpret those data with great caution. Unfortunately MMS used the data exactly like we feared they would, that a line was drawn around the points where whales were landed and saying these are the areas that should be deferred. And again, the areas are much, much greater that are important. The areas that are important for the whaling crews in Barrow, Nuiqsut, and Kaktovik and the area that's used to catch whales is as important as the areas where actually the whales are landed. So we hope that these data can be changed and the interpretation of the data changed, and that the hunting areas can be used as deferral areas for these lease sales. That's again the areas that the hunters use are as important as the locations where the whales are actually caught.

Seismic activity has always been a concern with oil and gas exploration in the Beaufort Sea. Many years hunters here, elders here has told the MMS, those people have told the MMS that seismic activity and noise in the ocean creates a great disturbance to whales. The distance at which whales are disturbed by this noise, at first we were saying, oh, it's only a short distance, and the hunters and the elders said, no, no, it's much, much greater. It took years and years and years for the science to finally tell -- to say the same thing that the

00081

elders were saying. And so we're pleased that the elders' knowledge has finally been verified by science.

But there's some additional science that has recently been reported on from Russia that also talks about seismic activity and how seismic activity displaces whales, and Craig asked me to talk a little bit about that this evening. Some recent work by an individual named David Weller and his colleagues on the Western Pacific stock of grey whales near Sahklene Island suggests that whales can be displaced from important and preferred feeding areas, and that this -- that they can be disturbed by seismic, and they can be moved away from areas. So David Weller's work showed that whales occurred in an area and fed in this area heavily, and then as soon as seismic ships moved in and seismic work occurred, that the whales moved away 30 kilometers and fed in another area, or attempted to feed in another area while the seismic activity was occurring. After the seismic activity stopped, the whales returned to this area that they preferred for feeding. So this is just additional data to show that whales are disturbed dramatically by seismic activity. We hope that this study will be used by MMS again to show that seismic activity has a big impact on bowhead whales -- has a big impact on whales, and likely bowhead whales are

00082

responding similarly to grey whales.

The next topic that Craig asked me to talk about was the Science Advisory Committee of the North Slope Borough is in the process of planning a thorough review of the statistical techniques and data basis that have been used to estimate oil spill probabilities, that we don't have great confidence in the oil spill probabilities that have been presented to us by the Federal Government, and so we feel like it's important to evaluate both the data sets that are being used as well as the statistical techniques that are used to estimate what the probabilities of oil spills will be. So that review will be ongoing, and hopefully will be available in the not too distant future for MMS to evaluate and hopefully incorporate into lease sales in the future.

The next topic that Craig asked me to talk about was a similar species to bowhead whales, and that's the right whales. The North Atlantic right whales are critically endangered. There's only a few hundred of them, probably 300 of them. They occur in an area where there's a considerable amount of industrial activity, lots of boat traffic. There's also a considerable amount of fishing activity and tourist traffic. One of the greatest threats to the North Atlantic right whale are

00083

these vessels in their habitat. Boats striking adults, boats are striking calves. Fishing gear is -- the whales are becoming entangled in fishing gear and this group of whales, this population of whales isn't growing, and in fact it's probably declining. We feel that this is a good model for what could occur here in the Beaufort Sea, or in the habitat of bowhead whales as well. If ice continues to shrink, and if traffic, vessel traffic increases, we've seen a dramatic increase in vessel traffic here in the last few years. There are many icebreakers here, industrial activity boats, tourist ships, fishing ships potentially, and if this continues, bowhead whales could be in a very similar place to right whales, but this activity could definitely negatively impact -- negatively impact bowhead whales.

The last topic Craig asked me to talk about was about habitat protection. Craig says as all good hunters know and understand, hunting removals or the animals that are taken by hunters are sustainable only if the habitat remains intact. That the habitat must be in good shape in order for whales to continue to live successfully, to continue to reproduce, continue to be here for the people that have relied on them for centuries, and so we ask that the habitat be protected in the Beaufort Sea. The Beaufort Sea is an important area

00084

for bowhead whales for feeding, and, of course, they migrate through the Beaufort Sea two times a year, and thus are vulnerable to impacts from oil exploration and oil development within the Beaufort Sea.

And, finally, as my responsibility, or some of my responsibilities with the North Slope Borough include the study of birds and beluga whales, and so I would like to briefly make a few comments on birds and belugas. The draft EIS I don't feel does an adequate job of dealing with birds in particular. And of the waterfowl species that are important up here, eiders is especially an issue that the EIS does not deal with appropriately. Eiders are an important subsistence resource for the people here in the North Slope. They're hunted in the springtime during spring migration, and then they're hunted again in the falltime during the molt or the fall migration. The two species of eiders that are most important here are the king and the common eider, and both of these populations have declined by about 50 percent in the last 20 or 25 years.

The EIS, the draft EIS, deals with eiders not from a migration standpoint typically, but more from a resident's standpoint. It often says that eider populations are in low densities, and that's probably true during most of the season, but when the eiders are

00085

migrating through, they're in extremely high densities. As an example, migration account occurred -- a migration count that occurred here in Barrow back in the 1970s, the two researches that were counting the birds estimated that 360,000 eiders passed in the 10-hour period with the peak passage within that 10 hours of 113,000 eiders in a half an hour. You can see that the densities of birds during migration isn't low. I mean, it's exceedingly high, so if oil exploration, if oil development occurs in an area where the peak passages of eiders occur, a large number of eiders risk more -- risk being killed or injured by this activity. Now, how could that occur? One way is through collisions with structures. The draft EIS says that mortality from collisions with structures is likely low, because eiders and other seabirds, sea ducks are at low density. Like I just stated, that that's not true. They can be at incredibly high densities. As is seen in North Star, and the development's already in offshore areas and OCS areas as well as state offshore, eiders have been seen -- eiders have hit the structures and died. So with more structures in the Beaufort Sea, this adds an incredible risk to the eiders. A large number of eiders could be killed in a short period of time just by physically striking structures. So the draft EIS has again not

00086

adequately evaluated the potential impacts of structures to migrating eiders or other seabirds.

The draft EIS also states that there is likely sufficient time between lease sales for regional bird populations to recover from the minor effects that may result from each sale. And I would like to state that this is absolutely not true, that eider populations in particular are declining. If there's any added mortality at all, it means that it steepens the decline. So no matter how much time may occur between sales, it's impossible for eider populations to recover because of a lease sale, no matter how much time occurs. Okay. There cannot be enough time for recovery if the population is declining anyway.

Additionally, eiders live long lives, and they have low reproductive success on an annual basis, and so they're adapted for the arctic environment to live long and produce very few young, which means that if a population declines, it takes a long time to recover. So again the EIS doesn't do a satisfactory job of dealing with recoveries for eiders, especially because the eider populations are declining.

I'd also like to say that eiders are at great risk to oil spills and other discharges within the Beaufort Sea. The draft EIS says staging and migrating

00087

flocks are generally dispersed, and thus would not necessarily occur in the vicinity of clean-up activity in the event of a spill. But on the same page of the draft EIS, the MMS states that migrating birds can occur in relatively large densities and that losses could be substantial. So on one hand it's saying there's not an impact, and then on the other hand it's saying it could be a huge impact, and I would agree with the latter statement that an oil spill has a potential to kill lots of eiders in a short period of time.

And finally I'd like to make a couple of comments about beluga whales, that there are two stocks of beluga whales that occur within the Beaufort Sea. There's a population of belugas that migrates in the springtime past western Alaska, past Barrow and across northern Alaska to Canada, the eastern Beaufort Sea stock. That stock is doing really -- relatively well, really well. It probably numbers 100,000 animals, even though scientists now say there's probably only about 30,000 animals, that many people off the record say that there are probably 100,000 animals in that stock. So it's doing well. But all of those belugas, almost all those belugas migrate across the shelf break when they return to the Bering Sea for wintertime, so those belugas are at risk, and the draft EIS recognizes that stock.

00088

There's another group of belugas however that the draft EIS doesn't do a very good job of recognizing exists, and that's the eastern Chukchi Sea stock. Over the last six or seven years, we've attached satellite transmitters to these belugas, and we've learned a great deal about their movements and their distribution. And we were actually quite surprised when many of the belugas that we've tagged ended up in the Beaufort Sea and spent the summer in the Beaufort Sea, some as far east as Canada. So the eastern Chukchi Sea stock is also at risk to offshore oil exploration and development. And those belugas from the eastern Chukchi Sea, there are many people that depend upon those belugas, and so any activity in the Beaufort Sea could negatively impact people in Point Lay that depend on these belugas in particular, and potentially the people in Kotzebue as well.

Also the draft EIS makes a statement about beluga whales and helicopter traffic. The statement in the draft EIS says some beluga and grey whales might be diverted by helicopter noise up to 100 meters away, and it cites Richardson, et al., 1995. It's not exactly clear what this means. What does it mean, helicopter noise up to 100 meters away. Is that a 100 meters laterally? Is it 100 vertically? It's not clear.

00089

But when I went back and read Richardson, et al., they actually state the belugas are often disturbed by helicopter noise when the helicopter is less than 250 meters laterally, and 460 meters in elevation. Okay. So it's not belugas might be diverted with helicopter noise up to 100 meters away, but it's a lot greater distance than that. So the EIS way understates what the data say. There could be a huge and likely would be a huge disturbance to belugas.

The other thing that I'd like to point out is that when Richardson did his study, he did it here in Barrow, and he was looking at bowhead and beluga whales. There are no grey whales within a long distance of where he was doing the study. So I'm not sure how the draft EIS came up to say that grey whales may be diverted by helicopter noise at that certain level. So the draft EIS again in this case needs to be cleaned up tremendously to reflect actually what the reference says.

We have only begun to review the draft EIS, and the North Slope Borough will definitely provide extensive written comments on many aspects of the EIS, and we will have those to you by the deadline I believe is September sometime, is.....

MR. STANG: The 20th.

MR. KING: 20th.

00090

MR. SNYDAM: So thank you again for the opportunity to comment tonight, and I hope that the comments that you receive, both testimony in public hearings here and in the other villages, as well as the written comments that you receive from the North Slope Borough as well as other residents of the North Slope. We hope that MMS can adequately address those and adjust the EIS accordingly. Thank you again.

MR. STANG: Okay. Thank you, Robert. Todd, you had mentioned you wanted to testify. Would this be a good time for you?

MR. O'HARA: Sure. I kind of think I'm the youngest in the crowd, so I (indiscernible, away from microphone) elderly (indiscernible - away from microphone). That's really a microphone?

REPORTER: It is.

MR. O'HARA: Wow. My name is Todd O'Hara. I'm a resident of Barrow, Alaska, and I also work for the Department of Wildlife Management. I'm speaking both I guess on behalf of the North Slope Borough, and as myself. Robert gave you a good introduction to some of the concerns we have related to wildlife and their habitat, so I'll just second what he said for Craig and on his behalf, too. We feel very strongly about that.

00091

So I'll follow up with some comments about the bowhead whale and the feeding areas, and the known feeding areas that exist within the lease sale area. We have overwhelming evidence in our opinion that's published as well as in reports and based on observations of scientists and hunters, that when we look at stomach contents, tissue chemistry, direct observation of the whales, and just basic common sense, this is an important feeding area between the border with Canada and Barrow. And the fact that this seems to enter some kind of debate is always interesting for us when it's so apparent. And so if it's ever confusing to you, please contact us. We'll be glad to share the reports with you. It's in the published literature as well as in a variety of reports that have been produced by federal agencies as well as the Borough, so I would encourage you to be more careful in describing it as a feeding area.

So then if we acknowledge it as a feeding area, which it is, how will the noise and the increased traffic that Robert was talking about affect the use of this area when it comes to feeding? We're very concerned about that. We know that MMS sponsored a study off of Kaktovik to address this, but I would encourage you that there's probably feeding areas equally or if not more important to the west of Kaktovik as well, and

00092

displacement from the feeding area, or changes in behavior in the feeding area, whether it's residence time, actual time feeding, we think it's very important, because the bottom line is we think the whales in the fall are in better condition than they are in the spring. We have evidence for this working with various universities on looking at the body condition of whales. This has been recently put out in a report of a workshop we held here in October of last year, so I would hope and encourage you to contact us about that. So the feeding area I think is something that you have addressed, but unfortunately it's probably very focal, and doesn't include the whole lease sale area, and I understand your spatial problems, especially with the massiveness of this area, and I think we need to be more aware of the feeding areas along that entire lease sale area.

Now I'd like to talk to you about hydrocarbons. I'm a toxicologist and I'll approach this from a variety of perspectives, that a lot of people talk about spills, and, of course, we're interested in the spill, because it can affect the health of the animal, but also it can affect the quality and palatability of food. And I think the last component there, palatability of food is often missed. So I had a question for MMS, is do we know current background concentrations in the many

00093

subsistence species from Canada to Barrow? In other words, do we know before they start producing oil, which they already are, what the levels, concentrations are in the various tissues and body components we'd be interested in? Those that are edible, for instance, for subsistence users, and also those components that would be important to the animal like their stomach contents or what they're exposed to in their eyes or in their lungs. The answer is no. And there is a program trying to address this, but it's not accomplishing its mission, and we can talk about that later.

Without the proper background data, I'm wondering how we'll be able to defend ourselves in court if it comes to a damage assessment. I don't think we will be able to. I think right now we're crippled in that regard, that we don't have the proper data, if there is a spill, to go and show that levels have changed if they actually have, because the proper background doesn't exist.

So if a spill occurs, what can we expect from the communities as far as response? One that worries me is unwarranted avoidance of subsistence foods due to fear or poor taste, that palatability issue. I'm afraid that this has already been documented in Alaska with other spills, and I think this is something that is

00094

usually understated in these EIS's or the concerns about what would happen in the face of a spill, is that the community response can be rather large when there's maybe an unwarranted reason. And if we were planning ahead, we might be able to offset that unfortunate avoidance response. This has been documented in many native communities in North America, Canada and U.S.

And then we already mentioned the concern about the health and -- of the wildlife, and, of course, this is direct toxicoses, and the information on that is practically nonexistent for arctic species. However, that lack seems to always translate into no effect in many of these EIS's, and I'd urge you to say in the absence of data, not to be so flippant with no effects in many of these species, especially when the studies have been conducted on animal models that are not ice-adapted species. We do not know how these animals will respond to an oil spill. And we know that one of the responses could be very dramatic, and as Robert pointed out, many of these animals are endangered, and that heightens our concerns.

So I would appreciate it in the absence of data that we're careful in extrapolations and flippant comments in EIS's about no effect on the animals.

Then if there is a spill, which we hope

00095

won't occur, my next major concern is how will we collect data from these potentially impacted wildlife in the legal context of the response. That is, now there will be higher scrutiny because it will become a legal issue, and data collection becomes extremely difficult. Just to conduct good science up here is logistically difficult, now to face the requirements of lawyers and judges, it would probably be impossible to accomplish, and I refer you to things like chain of custody. How in the world will we be able to respond to stranded animals whether alive or dead and maintain the rigors of sampling and datum quality here in the arctic? I don't think that's been properly addressed. And to be quite honest, we sit on some of the MMS boards that review studies, and the scientists there have great difficulty with quality assurance, quality control and chain of custody working in the arctic, so I think that's something we need to be very serious -- think very seriously about is how will we compete, or how will we be well represented in the legal system if a spill was to occur and we wanted to determine if damages were apparent or not. And I also advise you to think about these would be live and dead animals. There are no rehabilitation centers up here. There's no skilled volunteer group to go out and work with live animals like you might have in California, for instance.

00096

We do have skilled hunters, so examining some of these animals, if we had that in place, might work for the dead animals.

So with respect to hydrocarbons, I've mentioned many concerns that I think are legitimate if there's going to be much more activity offshore with production of oil.

We are aware of the ANIMIDA Program, and we've talked to some of you about it before, and unfortunately we feel it's not adequately addressing many of these issues. Some of the issues they are addressing in a rather good, scientific manner, but other components of the ANIMIDA Program have fallen well short of their goal, and quite frankly it left a void in your program. And we hope that that can be remedied, but right now here you are with an EIS, and this void exists. And we've been giving comments to you about ANIMIDA for the past two or three years, and unfortunately we think that the MMS and the contractors have fell short on the objectives of that ANIMIDA Program.

I also want to thank you for coming up here and for taking our comments seriously, and we very much want to help you in the process, and as has been pointed out by others, we are overwhelmed by the number of EIS's and responsibilities placed on the Borough

00097

Government, and when you think about impacts, think about the meeting as an impact, and the demand on our resources here, whether it's personnel, financial and data, and how much that is actually worth, and that that's mostly being supported by the Borough. And we do get some federal funding from various federal programs and agencies, but the majority of this is the responsibility and only would result from the Borough. Thank you for coming up, and I hope you understand how important wildlife are here between Barrow and Canada. Thank you.

MR. STANG: Thank you, Todd. Thank you very much. If I make one comment here, part of the reason for -- on your last point, part of the reason for a single environmental impact statement for the three sales is that very issue you raise with having to review environmental impact statements when one would be very similar to the next, and so that's why we're doing one multiple sale EIS for the three sales, and then we will do environmental assessments, and if necessary supplemental EIS's for the second and third sales. Thank you. Charles?

MR. HOPSON: Yeah, Charles Hopson again from Barrow. I had testimony earlier, I just want to add on that what the doctor said. I had mentioned the feeding area earlier on your map up there, and we need to

00098

also -- you need to also plot where the feeding area on the pink might be, like the deferral for the Barrow, Nuiqsut, Kaktovik. You need to identify those, because, you know, those are some of the -- you know, the feeding areas for the whales that Doc had mentioned. I had mentioned that earlier, too. You need to plot those on there. I think when you look at the map up there that would be about maybe 50 to 70 percent of the pink area that you have up there. I don't know. We need to identify those and put them on there, not just, you know, leave the whole thing, you know. That was just some follow-up that I had mentioned earlier.

MR. STANG: Okay. Thank you very much. Okay. Would anybody else like to provide some testimony at this time? Or anybody have any questions or observations that they'd like to make or ask?

UNIDENTIFIED VOICE: How big or what is the 30 kilo -- I had a question for one of you scientist. 30 kilometers is how many miles? What is that?

UNIDENTIFIED VOICE: About 17 or 18 miles.

UNIDENTIFIED VOICE: Seventeen or 18 miles, okay.

MR. STANG: Okay. Please.

MR. TEGOSEAK: Good evening. My name is

00099

Bill Tegoseak. I'm a life-long resident of the Village of Barrow. This evening I came to represent myself rather than any organizations that I either worked with or have had any association with, and I see right now I'm somewhat in a precarious situation, because we met in similar or identical situations so often that, Paul, you and I know each other, and Albert, and we've become pretty good friends over the years.

I'm sure that you've -- if you met with members of the whaling crews from Barrow this afternoon, that gives you a pretty good indication of the mood of the native people here in terms of their association with the Arctic Ocean. The native people here are historically tied to this ocean. They've lived in this region, we have, for a minimum of 5,000 years. We've seen many changes, but until the most recent past, we have always depended on the resources of the land and the ocean for survival.

I feel somewhat ill at ease to be talking with you on so many different occasions, particularly when the Minerals Management Service has already heard the mood of the native people, the interest that they have in the health of the land and the ocean, the natural resources we have always depended on for survival. Tonight I certainly wish that all of you representing the

00100

United States Government realized that this land, this ocean where you're at, or where you propose to drill is the last battlefield for American Indian environmental justice. There's been many wrong things that have happened in the history of the United States in terms of the treatment the American Indian has endured from the East Coast to the West. And you also realize the change in the lifestyles, the health of the lands and the air as America from the East Coast began industrialization to the West Coast, and then you are finally here at the top of the world.

The intent of the industry is to withdraw from the oceans fossil fuels to continue to provide the resources necessary for industrialization to continue, and in doing so, there's always been an increase in environmental health wherever industry has turned to fossil fuels for the sake of gaining a few dollars.

Today I came here to speak to each of you as an individual as I mentioned, because there has been so much decimation of Indian lands in the Lower 48, not only Indian lands, but also the American Indian. Here you cannot say at this point in time with your intent to industrialize the Arctic Ocean that you have in any way improved the lifestyles of those people and those tribal governments which have been here for the 5,000 years of

00101

our history. Other people have gained. Other organizations here in Barrow have gained, but our people continue to suffer poor health, poor housing, poor education. These things must be addressed if our relationship is to improve at all, because you have not given one red cent to the people that lived here before anybody else was here. My people's lives are changing, and for once if drilling in the Arctic Ocean, out here in front of this village occurs, there is a catastrophe. You have no proven clean-up technology to stop a major catastrophe, nor does oil industry or the United States Government have any type of monetary agreement for the damage that will eventually occur simply because anything that's manmade is bound to fail. And industrialization out in this ocean causes a tremendous amount of jeopardy, not only to the natural resources we depend on, but also the culture of those that depend on the natural resource.

I know I could sit here and speak for a length of time, but this is the message I want to bring across. You are making changes to the lifestyles of the native people here already, but not at one point have you offered anything in return for the natural resources that you have taken from underground from this place where we have lived and depended on the marine mammals, the land

00102

fast animals, the ducks and the fish. There will be damage, but I don't see how in the major -- in the event of a major spill that you will be able to respond and say that because we have a permit, it's okay, and maybe we'll clean up some of this stuff that might come up on the shores. You see what's happened with the Prince William Sound. The only cleanup happened there was the topsoil. The damage is still right under the beaches of Prince William Sound. We need to take a closer look, at least the United States Government needs to take a closer look as to whether or not technology exists to be able to respond to a catastrophe here which is bound to occur. Thank you.

MR. STANG: Thank you very much, Bill, I appreciate that. Okay. Anyone else who would like to make a statement or anybody else have a question or something they'd like to bring up?

MR. HOPSON: Bill just mentioned money earlier, can we get our $50 million for a research lab up here? They don't mention (indiscernible) taking money, (indiscernible) would be a good time to (indiscernible).

MR. STANG: Okay. We'll keep that as a note and the tie between those two testimonies. Anyone else who would like to make a statement of say something?

MR. KING: Go ahead.

00103

MR. STANG: Yes, please.

MR. BJORNSTED: Thank you.

MR. STANG: Just be sure to give your name and affiliation if you would, please?

MR. BJORNSTED: My name is Neil Bjornsted. I'm with the Native Village of Barrow. I'm the grant administrator. Again, Paul and Fred, I wanted to thank you on behalf of our tribe for showing the respect to our organization, to come by, and spend your valuable time explaining in a very brief way what your intentions are and to seek our input on what we feel.

I'd like to reiterate and put on record a concern that we have as a tribe in terms of our cooperation with natural resource development both on land and offshore, and how negative impacts are mitigated, and federal assistance that is intended to come to the tribe to help offset some of those damages is being denied the tribe, and I'd like to explain a little bit our concerns there, too.

For quite a bit of time now the Department of Interior has recognized the inherent right of the village, the Native Village of Barrow in its stewardship of many environmental aspects of the land and its people in the area around Barrow. And we appreciate many of the ongoing programs that our departments, such

00104

as Environment, have with you. A concern that we have however, is that the intent of certain programs declared by Congress that end up being administered by the State of Alaska are designed with very restrictive eligibility rules that we believe by intent preclude the participation of all natives tribes in the area. Specifically when legislation is passed in Congress, such as the NPR-A program, I believe it's called the Impact Program Grants, are passed into law, and where substantial amounts of money are set aside to help local people with present and future impacts, negative impacts from oil development, that we think as a tribe that we have been egregiously harmed by not being able to directly participate in and benefit from these programs. And this happens because of a process that we don't understand, and we wish we had the wisdom and financial resources to better understand. What we in our hearts wish to have the money and legal ability to do is basically to question federal law and it's application to state law, specifically with what authority does the State of Alaska have, if they indeed are the ones driving and determining such things as eligibility rules? Do the restrictive rules that they come up; with which shut out direct participation by all native villages come about through their own legislative processes, or are these

00105

issues to which the DOI perhaps through BLM gave some guidance to? Or if program rules and the administrative details were left up to the state, we would like to find a way to challenge those, because we believe those are unjust.

Obviously I'm not of this land, but in the time I have been here, I have become very involved with and empathetic for the concerns of the traditional way of life here. You can walk along the beach any evening, you look at people's homes. It's a very simple, very blessed way of life, and I can speak on behalf of our tribe, that I believe we're being asked to provide opinion on impacts of things to which the potential perceived dangers are very troubling to people, yet we lack the resources to properly understand them and to contemplate them properly. As has been more eloquently mentioned by our organization of the Borough here this evening, we're very hesitant to believe that in a process that is laid out which conducts lease sales every two years to which there's one EIS done, that the process that is established, actually would give enough deliberation between the lease sales to actually review and consolid -- not consolidate, but to hold dialogue with the affected people to make sure that we understand the process and if we see change on the land, that we

00106

have some resources by which to study it and to properly defend our interest in the land.

But again, in many ways we as a tribe view the government of the United States as being empathetic to our needs. We're delighted to have you here. We wish you can help us right the wrong of being excluded from programs which originated by the United States Government for the direct mitigation of impacts to which we as a native tribe are denied access to. I'd like to thank you for coming, and we wish to work with you on these issues.

MR. STANG: Thank you very much, I appreciate your coming and presenting that information. I guess, Neil, that on your request, I don't now exactly which programs, but it would seem to me that you could, to any federal agency, write a letter from a tribe, probably better to come from a tribe rather than come from an individual, to the federal agencies that administers program grants or whatever have you, which you say come through the state, and ask those very specific questions, and ask for a specific reply to how that's formulated so that you can -- certainly the Federal Government can answer half of that question, can answer these are the restrictions that we place on the grants. They probably would have a more difficult time

00107

answering as a matter of policy or a matter of information about what the state does, but at least you could build the groundwork for knowing that the specifics are that the federal agency adds, or the criteria that the federal agency gives to the state. You could do that. And.....

MR. BJORNSTED: (indiscernible - away from microphone) depends on this program.

REPORTER: Wait. You have to come up a little closer.

MR. BJORNSTED: I'm sorry.

MR. STANG: If you could just come up and rephrase that?

REPORTER: While you're getting in your dialogue. Thanks.

MR. BJORNSTED: And thank you, Paul. I appreciate your concern. We would like to know exactly on policies such as this, which are to help people, what the intent of Congress is so that we can use those guiding spirits to follow through the various legislative procedures to compare the current programs, as to whether they meet the intent of Congress or not.

I'd like to add one more thought on this whole process, and it's a troubling one from our viewpoint. A year and a half ago the Native Tribe of

00108

Barrow was one of the first tribes to sign the Millennium Agreement with the State of Alaska. Our tribe did so in good faith and in anticipation that the State would add some actual substance to self-governance rather than just platitudes and promises of cooperation and dialogue. We approached the Office of the Governor last Friday on this issue of being denied access to grants, and we're reminded within two hours that in effect, by signing the Millennium Agreement, we had compelled ourselves to respecting state law, and that the only way that we could attempt to gain inclusion as a participant in programs to help remedy the impacts, the adverse impacts of oil and gas development is either to petition Congress or go about a lengthy process through the State of Alaska's Legislature to seek amendment to existing rules.

We are extremely troubled by underfunding at the state level to such organizations as the American Inter Tribal Council, which as of yesterday no longer has an executive director, and concerns in the short-term political horizon in the state that we hear from many sources that the State of Alaska are in essence trying to move all native tribes to the side, and on all issues that impact land, and specifically when subsurface rights are involved, that the State of Alaska intends to recognize and deal only with the 13 native corporations.

00109

So we're very concerned that through our good faith efforts in trying to cooperate, except in many cases where we don't understand, we actually see that in the end it is only money that counts, it is not jobs for us, it's not justice, and that the program administrators that we have to deal with to try to seek benefit are pushing us aside. Thank you.

MR. STANG: Thank you again for that additional information, Neil. Good. Please, Charles.

MR. HOPSON: Yeah, Charles Hopson again.

On the proposed final Outer Continental Shelf Oil and Gas Leasing Program, on page 91 it says most of the ocean off northern Alaska is ice most of the year and cannot be fished. This is incorrect. We do a lot of our fishing from on top of the ice. So on page 91 it said it cannot be fished. It's incorrect.

MR. STANG: Okay. Thank you. And that's the -- let me look at the front of that document? Okay. That's the five-year program. Okay. It's too bad that a fellow who was on our team last week couldn't be here today. He was going to be here had we held the meeting last Monday, because he's intimately involved with that documents, so we would -- but we will pass that information back to him that that's incorrect. Anyone else have a statement or a question? An observation?

00110

Yes, please, May.

MS. AKPIK: One of my questions would be if you were to do some drilling down, you know, the -- for oil in the ocean, and if it's going to be have an impact and destroy the area where the -- not only the fish, but -- not only the birds and the whales, I'm wondering, a lot of the people in the community go subsistence hunting up this way, not in the ocean, but a lot of us are hunting down there. And if there was to be a spill down there, what would be the -- the problem would be, there wouldn't be any more animals that are surviving right now, because a lot of the people are not only eating the animal that -- which we hunt, and a lot of people do not eat hamburger or the chicken, or, you know, go to store, because it is very expensive, or they -- that's not their diet. And there would be a big impact on the waterfowl as well as the fish, if it's really in a bad condition where there was a spill for instance. Because right now everyone is living under the animal we're getting, and it's not fair for people to go ahead and starve maybe in the future, because we understand that whale is an animal that is an animal that is living 100 years maybe, over 100 years. They've studied that. They've learned that. And I wish you would take care of the people themselves as well as the

00111

animals and the drilling the ocean. That's what I'm really afraid of, because once this is gone, what is the problem? There will be a big problem there, and I wish like all the years we've been here, we hunt a lot. We don't go out and do any other thing, except stay home. Because if you're here, you're here to work, you're here to see what's the problem. You're looking at it. And you're not here all the time. You have to live to understand what would be the problem if this is gone. I wish everybody would have a say-so about it, because you have to feel it, you have to know it, and once you don't eat it, who cares about it? That's what people will say, bit it's for the safety of our people, our culture. And I just thought about, you know, many things, because this isn't the only place where the hunting is done. We have the outlying villages.

I was wondering also, is there a number to call for more -- you know, because I'm sure there's more people that would like to involve and have a say-so about situations like this and be heard.

MR. STANG: Certainly there is. We have -- back there actually there's a sheet of paper. Could you -- would you mind bringing me up a copy of that, Albert, please? We have a sheet of paper as a handout, and I think Albert's going to give you one directly, and

00112

let me just go over what's on it, because you can pick a copy up. The one -- and in fact, you have this copy, I'll give you the one piece of information you asked for, which is the 800 number to call. You have here how to submit comments on this document, through the mail, through e-mail or fax, but the 800 number to call for information at any time for MMS in Alaska is 1-800-764-2627. That's 1-800-764-2627. And during business hours, somebody will pick up that phone, and if you have a question about a particular species or an event, or a question about the EIS or whatever have you, we'll make sure you're routed to the correct person. If not, I believe it goes on answering machine if no one's there to answer that, and then we'll get back to you. We take that 800 number seriously, so if you do have any questions at any point anything to do with MMS's processes, whether it's our lease sale processes, whether it has to do with the document that Charles cited, which is the five-year program document, or any questions about what's going on with McCovey or with North Star, any questions about what's going on with our science program, please call that number and we'll get you a response, so I appreciate what you had said, May, and your points that you had made a moment or two ago.

Anyone else who would like to say

00113

something?

MS. GISH: My name is Diana Gish, I'll speaking representing myself. I didn't come here to speak, I came to listen, but someone asked me to speak, and I feel like I owe a debt of gratitude, so I'm going to try to get some words out here.

On the official seal of the Department of Interior, there's a buffalo, and I think that's very symbolic of what we're discussing today, because we know at one time it was federal policy to eliminate the buffalo, to get rid of the native people populations that were considered to be an obstacle in the western expansion of our country. And I guess I would like to address this comment to Secretary Norton and the Congress and the President, and I would just like to ask them to consider how they would like to be recorded in history, and I think this is a critical moment and a crucial opportunity to protect one of the rarest cultures in our country. And the Inupiat people are one of the only groups left that are integrated and connected with their lands, and so this hearing was supposed to be about the environmental impact statement, but there's no way you can talk about the environment here without talking about the people who's lives are completely integrated with that environment.

00114

And as I mentioned, I think this is a rare opportunity to either do incredible damage or incredible good, and people who have lived, no one's really sure, 8,000 years here? Have so much to teach the rest of us who don't have that kind of connection to the land and the sea and to life itself. And what lessons will we lose? What will be lost if this culture is lost?

And when I first saw the map of the lease sale, proposed lease sales, I was pretty much shocked, because to me it looked like a picture of the end of the Inupiat culture, because it looked like a picture of the end of whaling. Back to the buffalo, we know the serious social, economic problems that Native Americans are still facing hundreds of years after that western expansion began. One of the problems in approaching this issue is that Inupiat culture and whaling can't be assigned a monetary value. It's value goes way beyond money, and it would be so much easier if it could be assigned a number and then perhaps could look at it and say, well, there's too much to be lost here, because this is worth this many dollars, but whaling isn't about money. Whaling is about something -- is about sharing, and it's about life, and all these wonderful things that I've learned since I moved here in 1994. And it's because I owe -- I'm so

00115

grateful to be able to learn these lessons that I'm up here speaking, even though I wasn't prepared to do that.

I guess the last thing I would say is that I think it's common sense to listen and learn to the people who are experts in an area, and after thousands of years of life on the ice, there are no greater experts than the aboriginal people that live here, and I think it would be very foolish not to put their knowledge up front as the highest level of expertise when dealing with these issues.

And I would like to say that working at the radio station, I'm very aware that Minerals Management Service goes to a great deal of effort to make sure that the public is aware of what's going on. There's a lot of advance notice about these meetings, and I see the effort that goes into the communication process with the public. So I will -- would like to say thank you for that effort.

MR. STANG: Thank you. And thank you very much for your words you shared with us. Anyone else who would like to say a word? Well, I thank you for coming. We're going to be here until 9:00 o'clock, so feel free between now and then to come back and share your thoughts.

00116

(Off record - 8:34 p.m.)

(END OF PROCEEDINGS)

00117

C E R T I F I C A T E

UNITED STATES OF AMERICA)
)ss.
STATE OF ALASKA)

I, Joseph P. Kolasinski, Notary Public in and for the state of Alaska, and reporter for Computer Matrix Court Reporters, LLC, do hereby certify:

THAT the foregoing Mineral Management Service Hearing was electronically recorded by Nathan Hile on the 1st day of August 2002, at Barrow, Alaska;

That this hearing was recorded electronically and thereafter transcribed under my direction and reduced to print;

That the foregoing is a full, complete, and true record of said testimony.

I further certify that I am not a relative, nor employee, nor attorney, nor of counsel of any of the parties to the foregoing matter, nor in any way interested in the outcome of the matter therein named.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal this 29th day of August 2002.

____
Joseph P. Kolasinski
Notary Public in and for Alaska

My Commission Expires: 4/17/04

MMS Responses to Barrow Public Hearing Comments

PH-Barrow.001

Mr. Stang's response to Mr. Hopson's questions on pages 6 and 7 are substantially correct. Also, the MMS regulations at 30 CFR Part 250 discuss conditions for extensions and/or suspensions of a lessee's primary lease term.

Mr. Stang's responses to Mr. Hopson's questions on pages 8-12 regarding lease rentals, royalties, and bonds are essentially correct. The MMS regulations at 30 CFR Part 256 discuss rentals, royalties, and bond requirements.

Mr. Stang's response to Mr. Hopson's question on page 12, lines 24 and 25 and continued on page 13, lines 1-19 are substantially correct. See also discussions on the Oil Pollution Act.

PH-Barrow.002

Mr. Stang's dialogue with Mr. Hopson on pages 14 and 15 regarding sale deferrals is substantially correct.

PH-Barrow.003

Considerable effort has been made by the MMS to acquire observations on sea ice in the area considered in this EIS. Information about these studies can be found in the Environmental Studies Program Information System, which makes all completed Environmental Studies Program reports available online as full electronic "pdf" documents, including images and graphics. Technical summaries of more than 700 MMS-sponsored environmental research projects in addition to full "pdf" documents of more than 2,000 research reports are available for online, full-text search. The information is grouped geographically to help locate the most useful documents. In addition to the MMS's own funded science, we use data that has been certified by investigators available from several Federal archives (for example, the National Snow and Ice Data Center). Data also are available from researchers in their published results and data reports. Due to the scientific interest in the causes and impacts of global warming in the Arctic, several oceanographic research studies have been conducted in the late 1990's and early 2000's. Portions of the testimony have been added as traditional knowledge about sea ice in the description of the environment in Section III.A.4.

PH-Barrow.004

The MMS has participated in the equipment and tactic demonstrations conducted by industry in the Beaufort Sea during 1999, 2000, and 2002, in conditions ranging from open-water, spring broken-ice, and fall freezeup conditions. The equipment, tactics, and personnel are capable of responding to an oil spill in all of these environments. The oil-spill-response demonstrations conducted to date have identified individual tactic limitations and have led to the addition of new tactics to improve effectiveness in broken-ice conditions. In an actual response situation, industry would be able to use every tool at their disposal; they would not be limited to a single skimming configuration, but they would mix and match tactics to most efficiently access oil in the environment.

The MMS believes that industry will be able to conduct a credible spill response regardless of the time of year. Industry has an extensive spill-response toolbox that includes mechanical response, in situ burning, and tracking capabilities. Research to improve oil-spill response is being actively pursued by both industry and the MMS to add new tools and increase the effectiveness of existing methods and equipment.

PH-Barrow.005

Mr. Stang's comments to Mr. Hopson's questions on page 19, lines 24 and 25 and page 20 are substantially correct. After the high bidder receives a lease, the company must comply with the MMS regulations in 30 CFR Part 250 regarding submittal of exploration and/or development and production plans. The company cannot conduct activities without prior MMS approval. Applications for exploration plans or development and production plans undergo an environmental assessment prior to any activity being approved. If the company does not meet MMS requirements, either the applications will be disapproved or the company will be requested to provide additional information.

PH-Barrow.006

The MMS is responsible for issuing permits in Federal waters. A seismic operator does not need a permit from the North Slope Borough to collect data in Federal waters. Both the State and the Borough claim jurisdiction in State waters, and both the Borough and the State require a permit.

The Alaska Eskimo Whaling Commission can influence the actions of the seismic operator but does not control the operator. Whaling activities along with fishing, crabbing, and conventional maritime activities, are conducted in the same oceans and seas as seismic activities. The MMS tries to minimize, as much as possible, the conflict between oil and gas operations and other users of the oceans and seas. We require dialog between seismic operators and other individuals or groups (such as the Alaska Eskimo Whaling Commission) expected to be operating in the same waters at the same time. This was the origin of the conflict avoidance agreements. It is not essential that an avoidance agreement be signed for permits to be issued. It is not possible in all cases for parties to come to agreement. Seismic operators are required to make a concerted and conscientious effort to communicate and to conduct their activities in a way that minimizes the impact on other users.

PH-Barrow.007

Mr. Stang's responses to Mr. Hopson's questions on pages 23-25 are substantially correct.

PH-Barrow.008

Mr. Stang's response on page 25 answers Mr. Hopson's question on line 12.

PH-Barrow.009

The MMS has noted Mr. Hopson's objection to the proposed sale(s), and these objections will be conveyed to the decisionmaker(s).

PH-Barrow.010

The cyclonic and anticyclonic systems referred to are the two Arctic circulation regimes that cause the Beaufort Gyre to switch rotation, first discussed by Proshutinsky and Johnson (1997). The Russian scientist mentioned by the commenter is Dr. Proshutinsky, and the conference was an Alaska OCS Region Information Transfer Meeting. Dr. Proshutinsky has been involved in the collating of historical international data for a series of Arctic oceanography atlases, which cover the 40-plus years mentioned by the commenter. Japanese and Russian data have been translated and included in this effort. Dr. Proshutinsky has been contracted by the Alaska OCS Region since 1999 to interpret oceanographic data in context of these two circulation regimes. Although a final report is not yet available, Dr. Proshutinsky's project has completed three peer-reviewed papers, three conference papers, and three annual reports. This information has been made available to the MMS and has been used in this EIS. In a parallel effort, the hindcast circulation model used by the MMS in for the oil-spill-trajectory analysis has been extended to cover a 15-year period and includes circulation patterns for both Arctic circulation regimes (Haidvogel, Hedström, and Francis, 2001).

PH-Barrow.011

No laws are being violated by leasing and exploration activities in the Beaufort Sea. The MMS prepares an EIS that is made available to all interested governmental agencies, environmental organizations, and the general public for review and comment. All comments are addressed, and changes are made in the EIS, as needed and appropriate.

The MMS also is required under the Endangered Species Act to consult with the National Marine Fisheries Service (NMFS) on bowhead whales, because bowheads are an endangered species. The MMS prepares a biological assessment analyzing the potential effects of leasing and exploration activities on bowhead whales and provides this document to the NMFS. The NMFS then determines whether the proposed lease sale and exploration activities are likely to jeopardize the population, and then they issue a biological opinion that may include recommendations and/or conditions to reduce or eliminate any adverse effects. Information on bowhead whales provided to the NMFS in the biological assessment is found in Section IV.C.5 of the draft EIS.

The MMS also requires mitigating measures to provide protection to bowhead whales. Both the MMS and the NMFS require lessees to conduct a site-specific bowhead whale monitoring program during the open-water season to determine when whales are present in the vicinity of the drilling rig and to determine the extent of any behavioral effects from these activities on the bowhead whales. Lessees also are required to obtain an Incidental Harassment Authorization (IHA) from NMFS that permits the lessee to "take" whales by harassment only. The IHA requires the lessee to estimate the number of whales taken during the activity. The IHA would not be issued or it would be revoked, if it appeared that the activity could cause serious injury or harm to the species. The monitoring programs are designed and discussed in a peer-review forum with representatives from the NMFS, the Alaska Eskimo Whaling Commission, the North Slope Borough, the MMS, and industry. The results of these monitoring programs and IHA's are presented to the same forum.

PH-Barrow.012

See Responses L-0001.009 and L-0035.001.

PH-Barrow.013

See Response L-0035.067.

PH-Barrow.014

See Response L-0035.067.

PH-Barrow.015

Craig George has informed the MMS of the Science Advisory Committee review. The MMS is looking forward to providing information to the Committee.

PH-Barrow.016

We do not believe that the level of industrial activity, vessel traffic, fishing activity, and tourist activity in the Beaufort Sea will begin to approach the level of these activities on the Atlantic coast where the North Atlantic right whales are found. The Atlantic coast is heavily populated and has major cities/seaports that are centers for world trade and tourism. Some of the world's major fishing grounds are located in the North Atlantic. None of these are present in the Beaufort Sea. Vessel traffic in the Beaufort Sea is very limited, and vessels are relatively small compared to the number and size of vessels operating in the North Atlantic.

The MMS has no jurisdiction over any of these activities except those associated with oil and gas exploration and production. Oil and gas exploration and production activities in OCS waters in the Beaufort Sea have dramatically decreased since 1993. There have been no wells drilled in the Beaufort Sea during the open-water period since 1993, with the exception of development wells drilled at Northstar, which is not within the main bowhead migration route. Seismic surveys were shot, generally fairly close to shore, during the bowhead whale migration in three years since 1993. Overall, oil and gas activity in the Beaufort Sea (numbers of wells drilled and line-miles of seismic shot) during the 1990's is dramatically less than during the 1980's.

PH-Barrow.017

See Response PH-Barrow.011.

PH-Barrow.018

The comment correctly notes that although eiders generally occur at low density during the breeding season, they can occur at high density when in flocks migrating through an area. Sections IV.C.5.b(1)(a)1)c) and IV.C.6.a(1)(a)3) have been revised to address this point. The comment also addresses potential sources of eider mortality, specifically collision with structures and oil spills. With regard to collisions, the commenter says that the EIS suggests eider mortality from this factor would be low because of low duck density. In fact, this is not what is suggested. Rather, the EIS notes that collision of a flock of waterfowl with a structure could result in substantial mortality. It is stated that density of most species is *relatively* low in the Beaufort Sea; this is true most of the time over most of the area. The one exception is during the migration periods when migrating flocks are moving through the area. In this instance, substantial mortality could result if a collision occurred. The point made in the EIS is that very few structures (three or fewer as a result of these lease sales, unless the price of oil increases dramatically; Appendix F, Table F-3) will be constructed in the Beaufort Sea and will constitute a very low-density target. Thus, it is likely that the probability of a flock colliding with one of the structures would be quite low, unless structures were grouped in a small area or were coincidentally located along typical migration routes. Any such collision would result in substantial mortality, but it is not expected to occur frequently. To date, the largest number of ducks to strike Northstar Island in one breeding season is 20 (not counting any that were not retrieved); this does not suggest that "incredibly large numbers" will routinely collide with such structures. However, revisions added to Sections IV.C.5.b(1)(a)1)c) and IV.C.6.a(1)(a)3) clarify these statements. The MMS and the Fish and Wildlife

Service will cooperatively coordinate development of lighting systems for offshore structures, under terms of the Fish and Wildlife Service's biological opinion for this project, which may reduce the likelihood of bird collisions with structures. The discussion of low density of birds concerns onshore density during the nesting and postnesting periods, when the commenter notes they are at low density, and the low probability of collisions with pipelines.

The comment also addresses the potential for recovery of eider populations to former levels and the effects of oil spills. The opinion is expressed that eider populations still are declining. Recent eider aerial surveys indicate that king eiders, at least, are increasing at a nonsignificant rate. This would allow some recovery from minor mortality losses or maintenance of a stable population. The statements in the EIS do not imply that a population could be simultaneously declining and recovering. However, in the absence of specific information bearing on this question for any species occurring in the Beaufort Sea, it is reasonable to assume that any additional mortality occurring as a result of oil and gas development could increase not only the rate of decline for a declining species, at least temporarily, but also would delay the point (i.e., extend the time to status reversal) at which the population could enter a recovery mode (population decline reversed).

If additional mortality increases the rate of decline, the population presumably would decrease to a lower level over a given interval and, thus, it should take the population longer to recover to a specified former level (i.e., delay recovery) at a given rate of increase. Any statements noted as being contradictory with regard to bird densities, dispersion of flocks exposed to an oil spill, or recovery in Sections IV.C.6.a(2)(b)2c), IV.C.5.b(1)(a)1)a), and IV.C.5.b(1)(b)3) have been revised for clarity; however, the statement regarding ducks at high density specifically refers to flocks of the extremely numerous long-tailed duck, not to eiders that generally are present at much lower densities, as indicated in the comment.

PH-Barrow.019

The EIS describes the Eastern Chukchi Sea stock of beluga whales in Section III.B.6.f and states its most recent population at 3,700, in addition to the large stock of belugas that migrate into Canada during summer. Both stocks of beluga whales tend to frequent offshore waters of the Beaufort Sea. Thus, they have a low chance of coming in contact with a potential oil spill that is likely to occur in nearshore waters, where oil exploration and development is likely to take place. Their exposure to helicopter and fixed-wing aircraft and vessel traffic also is likely to be minimal. The 100-meter distance stated in the EIS is lateral distance from the aircraft. It does not represent the distance at which noise/sound can be detected. The reader quotes Richardson et al. "that the beluga whales were often disturbed by helicopter noise when the helicopter was less than 250 meters laterally and less than 460 meters in elevation." The 100-meter distance is within this range. Even if belugas were disturbed at greater distances, such as up to 250 meters laterally and up to 460 meters vertically, the disturbance would be very brief and likely would have no lasting effect on the belugas that were disturbed. The experiments by Richardson et al. were deliberate attempts to disturb the whales to try and measure reactions of the belugas to the noise and movement of the aircraft. The definition of whether the belugas were disturbed was subjective, such as the animal swam away or dove away when the aircraft was estimated to be at less than 250 meters and 460 meters altitude. This does not mean that the belugas were harmed by the aircraft. There is no scientific evidence that noise from aircraft has harmful effects on belugas or other cetaceans. In fact, their change in behavior may have had nothing to do with the aircraft. Helicopter traffic associated with OCS exploration and development would not have a "huge" effect on belugas. Beluga whales in the Bering Sea are subject to high levels of both air and vessel traffic and associated noise on the fishing grounds in Bristol Bay during the salmon season, when they compete with commercial fishing for the salmon. The noise from all this fishing activity has not displaced the belugas from their feeding areas in Bristol Bay.

PH-Barrow.020

Gray whales are found in the far western Beaufort Sea Planning Area during summer (see Figure III. B-3.g) and potentially could be exposed to some level of aircraft traffic and other oil and gas activities in the planning area. Although there were no gray whales present in the area during the Richardson et al. study, the same estimate of 100 meters is a reasonable estimate to be used for gray whales, because no particular estimate is available on gray whale reaction to aircraft in the Beaufort Sea.

PH-Barrow.021

Additional information on feeding areas in the Beaufort Sea and the importance of those feeding areas has been added to the text in Section III.B.4.a.

PH-Barrow.022

The MMS does not have a direct role in natural resource damage assessment; the MMS also is not authorized to fund damage assessment studies. Natural resource damage assessment in case of a major spill would be the responsibility of the Trustee agencies, such as the Fish and Wildlife Service and Bureau of Land Management, as was the case in the *Exxon Valdez* spill. It is the responsibility of the oil industry to monitor such assessments in case industry disagrees with the Trustees' assessment. However, the MMS has funded multiple studies related to its NEPA responsibilities, which would provide appropriate prespill background if a major spill occurred. Direct monitoring studies conducted by the MMS, per recommendations of the Sampling Design Workshop for the *Beaufort Sea Monitoring Program* (Houghton, Segar, and Zeh, 1984), include the Beaufort Sea Monitoring Program (Boehm et al., 1986; 1990); *Historical Changes in Trace Metals and Hydrocarbons in the Inner Shelf Sediments, Beaufort Sea: Prior and Subsequent to Petroleum-Related Industrial Developments* (Naidu et al., 2001); and *Arctic Nearshore Impact Monitoring In the Development Area (ANIMIDA)* (Boehm, 2001b; Brown, Boehm, and Cook, 2001). These studies have or are gathering baseline information on sediments, water, bivalves, amphipods, and fish. The MMS has initiated and/or cosponsors three tissue archival programs suitable for pre- and postspill comparisons: the *Arctic Marine Mammal Tissue Archive Project* (York et. al., 1999); the *Alaska Frozen Tissue Collection* (Cook and Jarrell, 2001); and *Seabird Samples as Resources for Marine Environmental Assessmen*t (Winker and Rocque, 2001).

PH-Barrow.023

The MMS acknowledges the seriousness of food tainting in case of an oil spill and the potential for an unwarranted community avoidance of subsistence foods. This is discussed using *Exxon Valdez* spill research in Section V.C.12 - Cumulative Effects on Sociocultural Systems. In the Environmental Justice analysis, we concluded that a spill would produce disproportionate, high adverse effects; part of the rationale for this conclusion is based on concerns over food palatability and tainting.

PH-Barrow.024

The EIS does not assume there would be no effects in the absence of information on spill effects on arctic marine mammals, such as ringed seals and polar bears. The EIS assumes that if seals and bears become oiled they will die from the contact, even though there are no specific studies that conclude that these animals will die if contact with oil happens. See Section IV.C.7.a(2)(b)2) - Specific Effects of a Large Oil Spill.

PH-Barrow.025

The MMS agrees with the commenter that it would be very difficult to maintain quality control, chain of custody, etc., and to document spill effects on wildlife if a spill occurs. We have no quick answers to the logistical problems that are likely to occur in working in the Arctic environment. The logistical problems that will come about in trying to establish rehabilitation centers on the North Slope and transportation of animals to these centers from spill locations will be far more difficult than they were for the *Exxon Valdez* oil spill, where more manpower, facilities, and established transportation were available.

PH-Barrow.026

We believe that the MMS and Core Contractor have implemented most of the North Slope Borough's and others' scientific recommendations. *The Arctic Nearshore Impact Monitoring in the Development Area (ANIMIDA)* study has been reviewed by the public in annual open meetings in Anchorage, by the Core Contractor's Science Review Board, and by the Alaska/ANIMIDA subcommittee of the MMS Scientific Committee. The ANIMDA Science Review Board meets twice a year and provides consensus and written recommendations on ANIMIDA research design and results. The North Slope Borough reviewed the statement of work for this study, and the commenter is one of five scientists on the Science Review Board.

The North Slope Borough is one of many stakeholders with divergent interests and recommendations for the ANIMIDA study. The MMS has been forced to disagree with a few North Slope Borough recommendations when they clashed with needs of other stakeholders and with MMS's programmatic requirements. For example, the North Slope Borough recommended that ANIMIDA not analyze for persistent organic pollutants (POP's) because POP's are not conventional oil-industry contaminants. However, POP's analyses in the ANIMIDA study area are a priority aspect of the MMS's implementation of the Environmental Justice Executive Order 12898. The Executive Order requires Federal Agencies to identify multiple and cumulative exposures from contaminants, and POP's are of Arcticwide concern. In addition, other stakeholders, such as the Fish and Wildlife Service, specifically requested

POP's analyses be done in ANIMIDA, and the International Arctic Marine Assessment Program recommends that POP's be monitored around existing Arctic oil fields.

PH-Barrow.027

We understand your concerns over the amount of effort and resources placed on individuals and the Borough to review and comment on our EIS's. We agree it takes time to review and then provide meaningful comments to us. This, in part, is why the MMS has prepared this multiple-sale EIS for the three proposed Beaufort Sea lease sales covered in the current 2002-2007 5-year program. This multiple-sale EIS assesses environmental effects of the three sales, all of which consider for leasing the same geographical area in the Beaufort Sea. For the remaining two sales, we will prepare an environmental assessment to determine if the EIS is still adequate or if a supplemental EIS is needed. Specific impacts and concerns within each area would be addressed at each separate sale stage. Those environmental assessments will be made available for public review and comment before a decision is made. Funds available to the State and the Borough through sharing of OCS revenues may be used, in part, to cover the costs of the Borough through the State to address requests for comments and reviews. See also Response L-0034.027.

PH-Barrow.028

Additional information on feeding areas in the Beaufort Sea and the importance of those feeding areas has been added to the text in Section III.B.4.a.

PH-Barrow.029

The MMS acknowledges Mr. Tegoseak's detailed history of the exploitation of the Arctic by Western society, but we differ with his belief that oil development has not contributed some benefits to the people of Barrow and the North Slope. Borough taxation of onshore oil facilities has funded the developing infrastructure of the North Slope Borough and the local communities within its boundaries. For MMS's monetary contributions, see Responses L-0034.020 and L-0034.027.

The MMS acknowledges the cultural importance of subsistence and the impossibility of replacing the harvest or the food harvested with store-bought food. We believe that the best deterrent to any disaster is to build facilities and pipelines that will withstand the rigors of arctic ice and weather forces and to provide mitigation and conflict-avoidance agreements that minimize any development impacts. However, nothing is absolutely certain, and there must be contingencies for oil spills. There are subsistence impact funds administered by the Coast Guard under the Oil Pollution Act of 1990 legislation that would be available to provide for subsistence food losses, but no escrow accounts or trust funds have been established.

In 1994, the National Research Council suggested that the MMS set up a trust fund for subsistence and sociocultural effects mitigation; to date, there has been no agency movement on such a policy mainly because OCS Lands Act legislation does not authorize it. Nevertheless, the MMS acknowledges the need for such funds and has actively promoted impact-assistance legislation as a way to mitigate some of the real and perceived impacts of oil development on the North Slope. In 2001, Congress provided coastal States with a one-time award of impact-assistance funds. Alaska received an appropriation of $12.2 million, of which $1,939,680 will go to the North Slope Borough.

Regarding the effectiveness of cleanup technology, the MMS has participated in the equipment and tactic demonstrations conducted by industry in the Beaufort Sea during 1999, 2000, and 2002, in conditions ranging from open-water, spring broken-ice, and fall freezeup conditions. The equipment, tactics, and personnel are capable of responding to an oil spill in all of these environments. The oil-spill-response demonstrations conducted to date have identified individual tactic limitations and have led to the addition of new tactics to improve effectiveness in broken-ice conditions. In an actual response situation, industry would be able to use every tool at their disposal and would not be limited to a single skimming configuration but would mix and match tactics to most efficiently access oil in the environment.

The MMS believes that industry will be able to conduct a credible spill response regardless of the time of year. Industry has an extensive spill-response toolbox that includes mechanical response, in situ burning, and tracking capabilities. Research to improve oil-spill response is being actively pursued by both industry and the MMS to add new tools and increase effectiveness of existing methods and equipment.

Also, because of the *Exxon Valdez* oil spill, new legislation in the form of the Oil Pollution Act of 1990 has mandated that industry and the government significantly increase and improve their oil-spill-response capabilities.

Oil-spill-contingency plans are routinely exercised by both industry and the government to ensure that response activities are initiated immediately following a release to limit the impacts of a spill on the environment.

PH-Barrow.030

We applaud your efforts to obtain funds for a research lab in Barrow. There are many Federal and State agencies that may have grant funds to support such an effort, including the Departments of Agriculture, Energy, and the Interior. Impact-assistance funds that are available to the Borough and local communities are discussed in detail in response L-0034.027 and see Section I.C.1.e(1). See also Response PH-Barrow.026 regarding ANIMIDA.

PH-Barrow.031

The MMS can appreciate your concerns with how congressional programs designed to assist Native tribes are administered. Generally, when Congress passes legislation that provides impact assistance from national resource development, the intent is to mitigate direct and indirect impacts to the local people. See Section I.C.1.e(1) for additional information. Impact-assistance programs administered by the Department of the Interior include the NPR-A Impact Program Grants you refer to, in which the Department of the Interior refunds a portion of fees received as a result of oil development in the reserve to the State of Alaska. These funds are for the purpose of granting moneys to communities that have experienced adverse effects due to oil development in NPR-A. There are several other laws and programs that provide impact assistance, including the OCS Lands Act, as amended; for example, the Land and Water Conservation Fund, the Historic Preservation Fund, the Reclamation Fund, the Tribal Preservation Fund, and section 8(g) of the OCS Lands Act. The Oil Pollution Act of 1990 and the Oil Spill Liability Trust Fund provides for compensation for losses due to an oil spill.

Please see Responses L-0034.027, L-0021.005, PH-Nuiqsut.001a and Section I.C.1.e(1), which discuss these various programs and funds available to States, local communities, individuals, or organizations.

Regarding your remaining questions on program grants, the State of Alaska, through its Department of Economic and Community Development, may be able to assist you concerning eligibility rules for the various program grants they administer.

PH-Barrow.032

As you stated in your testimony, the Millennium Agreement signed by tribes is with the State of Alaska and government-to-government relationships with the State. The Federal Government is not a party to this agreement. The MMS appreciates your concerns with how funding to directly impacted local communities is handled and that for Federal impact assistance, most funds and programs are administered by the State of Alaska.

Please see Responses PH-Barrow.031, L-0034.027 and Section I.C.1.e(1) regarding Federal programs that provide revenue to States for impact assistance.

PH-Barrow.033

We cannot locate the referenced information concerning fishing and winter ice.

PH-Barrow.034

See Responses PH-Barrow.023 and PH-Barrow.029.

PH-Barrow.035

See Responses L-0006.005, PH-Barrow.023, and PH-Barrow.029.

VII.F Representative E-Mail Messages Received

The MMS received 4,871 e-mail messages. Most of the e-mail messages were identical to or based on two different form messages posted on an environmental group's internet web site. The issues–comments mentioned in these e-mails and the MMS responses–were similar to previously received correspondence. Included are representative examples of e-mails received: those categorized as following example (a) are e-mails E-0012, E-0417, E-1088, E-1137, E-1468, E-1506, E-1588, E-1939, E-2392, and E-2517; and those categorized as following example (b) are e-mails E-2754, E-3079, E-3288, E-3472, E-3769, E-4481, E-4714, and E-4724. E-3105 is an example of an e-mail promoting the lease sales if the oil-spills can be effectively cleaned up.

September 10, 2002

Regional Director John Goll
Alaska OCS, Region, Minerals Management Service
949 East 36th Avenue, Room 308
Anchorage, AK 99508-4363

E-0012

Dear Mr. Goll,

I am writing to you on behalf of the Siksik Foundation, an organization concerned with the protection of Arctic wildlife and their habitats.

We are asking that you please support Alternative 2, No Action, because it is the only alternative that addresses concerns about oil spill risks and impacts to the Arctic National Wildlife Refuge and Teshekpuk Lake (NPR-A) coastline.

We also request that all those areas that were deferred or deleted from past Beaufort Sea Sales, including the area north of the coast of the Arctic National Wildlife Refuge, and the National Petroleum Reserve-Alaska, the fall bowhead whale feeding grounds and migratory route, and the entire spring lead system should be permanently removed from the lease sales. None of the EIS alternatives address concerns about potential harm to these areas.

Finally, it seems to us that the MMS is inappropriately lumping three lease sales into one Environmental Impact Statement. As these three sales are expected to be held sequentially, not simultaneously, there be three full public EIS processes also held sequentially. In this way, each EIS will reflect the most current knowledge, experience and technology at the time - not reflect outdated information, as may be the case when using this current EIS process for a lease sale not set to begin for 5 years.

Thank you for the opportunity to comment.

Sincerely yours,

Steven E. Slap
Executive Director
Siksik Foundation
173 Leyfred Terrace
Springfield, MA 01108

September 13, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-0417

Dear Regional Director John Goll,

I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

Sincerely,

Jay & Sandy Lynch
6425 Cloverblossom Lane NE
Bremerton, Washington 98311

cc: Secretary Gale Norton

September 14, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-1088

Dear Regional Director John Goll,

I have personally been to this area on an arctic trip. It is beautiful, stark and one of the last truly wild places in the world. The Bush administration's push to drill there is beyond unconscionable. It is criminal.

I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

Sincerely,

Mary Haan
314 Huntington Dr
Ann Arbor, Michigan 48104

cc: Secretary Gale Norton

September 14, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-1137

Dear Regional Director John Goll,

I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

I believe that we need to use our country's superior technology to develop new renewable energy sources, not to destroy our environment. Let's lead the world, as we always have, to a better future. As with technology, if you fall behind you will be eventually be trying to play catch-up.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

Sincerely,

Tony Greiner
5314 Pounds Drive N.
Stone Mountain, Georgia 30087-3522

cc: Secretary Gale Norton

September 14, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-1468

Dear Regional Director John Goll,

The idols of the Interior Dept, the Gas and Oil Barons, should not be allowed to terrorize the Bowhead Whales in the Beaufort Sea.I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

Sincerely,

Thomas Aldridge
296 s 13 st
san jose, California 95112

cc: Secretary Gale Norton

September 14, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-1506

Dear Regional Director John Goll,

I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

Why make a species extinct if it is not necessary? The oil that is extracted from Alaska will only last approximately six months. It's not like it will be a lifetime supply of oil. The only reason we are going to drill there and farther endanger the wildlife is because we are too lazy as a country to find an alternative source of energy. Also because of a lack of caring for the environment and wildlife. What doest that say for our country?

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement. Thank you for considering my views.

Sincerely,

Stephanie Hazlett
285 Cherrington Rd.
Westerville, Ohio 43081

cc: Secretary Gale Norton

September 14, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-1588

Dear Regional Director John Goll,

As a concerned citizen I'm 100% against lease sales in th Beaufort Sea. The cost to humanity and many other species is way to high. The risk of only one oil spill or ruptured gas line on the seas of this area would have reprecussions far in excess of just the immediate area. The food chain would be harmed to the possible extent of a major catastrophe. For what? An amount of oil and gas that might last 5 years.

I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

Sincerely,

D. Scanlon
1210 E. 89th
K.C., Missouri 64131

cc: Secretary Gale Norton

September 15, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-1939

Dear Regional Director John Goll,

I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

As an animal lover I am against hurting any wildlife whatsoever! God gave them to us for us to enjoy and not destroy! Surely oil and gas can be found in other areas besides this one. Even the slight leakage could cause damage to our wildlife. I don't want them to become extinct! Please have a heart and find alternative ways of getting our natural resources. Think of the consequences of a wrong decision. Don't you want our future generations to be able to have a vast supply of wildlife to enjoy? God has given us all that we need on this earth to supply our needs. Please pray and ask God for wisdom to make a wise decision that will affect the generations to come! Thank you for your time.

Sincerely,

Barbara Ann Dembek
2427 Sixth Street
East Meadow, New York 11554-3114

cc: Secretary Gale Norton

September 16, 2002

E-2392

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

Dear Regional Director John Goll,

There are other fuels than oil and many more years to develop yet more sources, but Bowhead Whale has but one life. I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

Sincerely,

Chris Jacobs
244 Pitkin Rd
Craftsbury Common, Vermont 05827

cc: Secretary Gale Norton

September 17, 2002

Regional Director John Goll
Alaska OCS Region, Minerals Management Services
949 East 36th Ave., Room 308
Anchorage, AR 99508-4363

E-2517

Dear Regional Director John Goll,

I am writing to provide my public comment on the Draft Environmental Impact Statement for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska (EIS). As someone who cares deeply about the health of our ocean waters, and the life they sustain, I strongly urge that the final EIS recommend Alternative II - that no lease sales go forward in the Beaufort Sea.

The Beaufort Sea is an important migratory route and feeding area for the endangered bowhead whale. The ecosystem is also important for other fish and wildlife including polar bears and migratory birds; as well as to the indigenous culture that relies on a close association with the environment. The Beaufort Sea is an area of harsh environmental extremes and field testing has shown an inability to contain and clean up an oil spill in Arctic waters during most of the year.

I am also concerned that if oil and gas development were allowed off the coast of the Arctic National Wildlife Refuge, it would lead to intense pressure for the development of onshore support facilities within the Refuge.

It is for these reasons that Beaufort Sea should be placed off limits to any further offshore oil and gas lease sales and I encourage the Mineral Management Service to make this recommendation in its final Environmental Impact Statement.

The surrounding areas in and around the Beaufort Sea are already subject to hundreds of miles of pipeline and wells as it is. This drilling would result in little additional oil,endanger wildlife and coastline and is what I think, a ploy to have future access to the Tongass area, which millions of Americans oppose.

Sincerely,

Adam Atherton
2233 Hedgerow Rd.
Columbus, Ohio 43220

cc: Secretary Gale Norton

September 17, 2002
Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

E-2754

Dear Mr. John Goll,

Please consider future generations when you propose to open the Arctic Refuge to oil drilling. I wish that you would spend that time and effort on working out new sources of fuel. As a part of the next generation, I am 15 years old and already have to worry about what will be left for my children. Today's earth is tomorrow's future.

Please enter these comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

I am opposed to oil drilling in the sensitive waters of the Arctic and write in support of Alternative II, which requests that these offshore lease sales do not go forward. Unless and until the oil industry can conclusively demonstrate that oil spills could be effectively cleaned up in the Beaufort Sea, the risks to wildlife in these waters, including bowhead whales, polar bears and migratory birds, and to the subsistence-based coastal communities in the area, are too great to allow new offshore leasing. Coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing. These areas include those that have been previously deferred or deleted from past Beaufort Sea oil lease sales, including the areas north of the coast of the Arctic National Wildlife Refuge, those areas off of the Teshekpuk Lake Special Area, bowhead whale feeding grounds and migratory routes, and those areas within the entire spring ice lead system.

Thank you.

Sincerely,

Sarah Julian
~~~~ ~~~~~~~~ ~~~~~
Clarkston, Michigan 48348
~~~~

September 17, 2002

E-3079

Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. John Goll,

Please enter these comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

I am opposed to oil drilling in the sensitive waters of the Arctic and write in support of Alternative II, which requests that these offshore lease sales do not go forward. Unless and until the oil industry can conclusively demonstrate that oil spills could be effectively cleaned up in the Beaufort Sea, the risks to wildlife in these waters, including bowhead whales, polar bears and migratory birds, and to the subsistence-based coastal communities in the area, are too great to allow new offshore leasing. Coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing. These areas include those that have been previously deferred or deleted from past Beaufort Sea oil lease sales, including the areas north of the coast of the Arctic National Wildlife Refuge, those areas off of the Teshekpuk Lake Special Area, bowhead whale feeding grounds and migratory routes, and those areas within the entire spring ice lead system.

Thank you.

Sincerely,

Jessica King
2563 University Ave
Madison, Wisconsin 53705

E-3105

September 17, 2002
Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. John Goll,

Please enter these comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

I am in support of oil drilling in the sensitive waters of the Arctic and write in support of proceeding as planned, provided that the oil industry can conclusively demonstrate that oil spills could be effectively cleaned up in the Beaufort Sea.

Thank you.

Sincerely,

Paul Davis
PO Box 230708
Anchorage, Alaska 99523

E-3288

September 17, 2002
Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. John Goll,

Please enter these comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

I am opposed to oil drilling in the sensitive waters of the Arctic and write in support of Alternative II, which requests that these offshore lease sales do not go forward. Unless and until the oil industry can conclusively demonstrate that oil spills could be effectively cleaned up in the Beaufort Sea, the risks to wildlife in these waters, including bowhead whales, polar bears and migratory birds, and to the subsistence-based coastal communities in the area, are too great to allow new offshore leasing. Coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing. These areas include those that have been previously deferred or deleted from past Beaufort Sea oil lease sales, including the areas north of the coast of the Arctic National Wildlife Refuge, those areas off of the Teshekpuk Lake Special Area, bowhead whale feeding grounds and migratory routes, and those areas within the entire spring ice lead system.

Thank you.

Sincerely,

Coreen Kendrick
591 Eckhardt Ave West
Penticton, BC, V2A 2B4
Canada

September 17, 2002
Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

E-3472

Dear Mr. John Goll,

Please include my comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

As an Alaskan, I write in support of Alternative II, which requests that offshore lease sales do not go forward in the waters offshore of the Arctic Refuge. The oil industry has not conclusively demonstrated that oil spills in the Beaufort Sea could be effectively cleaned up. The risks to subsistence-based coastal communities and to wildlife in these waters are too great to allow new offshore leasing. In fact, coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing, including those areas that have been previously deferred or deleted from past Beaufort Sea oil lease sales. These areas specifically include areas north of the coast of the Arctic National Wildlife Refuge, areas off of the Teshekpuk Lake Special Area, bowhead whale feeding grounds and migratory routes, and areas within the entire spring ice lead system. I will review the EIS to see that these comments have been included. After today's news regarding the Interior Department and BIA monies, it is apparent we need more citizens to monitor the integrity of the Secretary of the Interior.

Thank you.

Sincerely,

Janis Ohmstede
P.O. box 304
Ester, Alaska 99725

E-3769

September 18, 2002
Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. John Goll,

It seems that the current leadership in Washington is determined to get at all the oil they can with absolutely no thought to the consequences on the environment, wildlife and even human life. Alaska has basically been out of their reach until now. How obvious their intents are to anyone paying attention. Greed and revenge are two terrible motivators. Americans should being paying close attention to those in decision making positions because if they are not willing to protect wildlife and plant life on this planet, they care very little for human life. The proof of political leaders is in the results of their actions, not the words they speak. It is time for serious change in America. We need people who are willing to take a stand to protect and preserve our environment-not destroy it for the personal gain of a few.

Please enter these comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

I am opposed to oil drilling in the sensitive waters of the Arctic and write in support of Alternative II, which requests that these offshore lease sales do not go forward. Unless and until the oil industry can conclusively demonstrate that oil spills could be effectively cleaned up in the Beaufort Sea, the risks to wildlife in these waters, including bowhead whales, polar bears and migratory birds, and to the subsistence-based coastal communities in the area, are too great to allow new offshore leasing. Coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing. These areas include those that have been previously deferred or deleted from past Beaufort Sea oil lease sales, including the areas north of the coast of the Arctic National Wildlife Refuge, those areas off of the Teshekpuk Lake Special Area, bowhead whale feeding grounds and migratory routes, and those areas within the entire spring ice lead system.

Thank you.

Sincerely,

Brenda Morgan
5045-D Eltha Drive
WINSTON SALEM, North Carolina 27105

E-4481

September 19, 2002
Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. John Goll,

Please enter these comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

I am strongly opposed to oil drilling in the sensitive waters of the Arctic and write in support of Alternative II, which requests that these offshore lease sales do not go forward. Unless and until the oil industry can conclusively demonstrate that oil spills could be effectively cleaned up in the Beaufort Sea, the risks to wildlife in these waters, including bowhead whales, polar bears and migratory birds, and to the subsistence-based coastal communities in the area, are too great to allow new offshore leasing. Coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing. These areas include those that have been previously deferred or deleted from past Beaufort Sea oil lease sales, including the areas north of the coast of the Arctic National Wildlife Refuge, those areas off of the Teshekpuk Lake Special Area, bowhead whale feeding grounds and migratory routes, and those areas within the entire spring ice lead system. Disturbing these areas now will likely lead to routine disruption that may eventually cause further loss of rare species and fragile habitats.

Thank you.

Sincerely,

Christopher Johnson
803 West Avenue
Austin, Texas 78701

September 20, 2002

E-4714

Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. John Goll,

Drilling for oil in the sensetive waters of the arctic is irresponsible until the oil industry can conclusively demonstrate a effective way oil spills can be completely removed out of the Beaufort Sea.The risks to wildlife in these waters, including bowhead whales, polar bears and migratory birds, and to the subsistence-based costal communities in the area, are too great to allow new offshore leasing. Coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing. These areas include those that have been previously deferred or deleted from past Beaufort Sea oil lease sales, including the areas north of the coast of the Arctic National Wildlife Refuge, those areas off of the Teshekpuk Lake Special Areas, bowhead whale feeding grounds and migratory routes, and those areas within the entire spring ice lead system. Please step away from greedy motivs ... mother earth and every being is in danger we have to stop and turn around, and live in peace with nature. Believe it or not but we are a part of nature too.

Thank you

Sincerely,

Silvia Hanna
34 Autumn St.
Buxton, Maine 04093

September 19, 2002

E-4724

Mr. John Goll
Alaska OCS Region, Minerals Management Service
949 East 36th Ave., Room 308
Anchorage, AK 99508-4363

Dear Mr. John Goll,

I am a PhD candidate in ecology and an environmental policy fellow at Princeton University. Please enter these comments into the record for your agency's EIS on the three proposed federal offshore drilling lease sales for the Beaufort Sea in the Arctic.

I am opposed to oil drilling in the sensitive waters of the Arctic and write in support of Alternative II, which requests that these offshore lease sales do not go forward. Unless and until the oil industry can conclusively demonstrate that oil spills could be effectively cleaned up in the Beaufort Sea, the risks to wildlife in these waters, including bowhead whales, polar bears and migratory birds, and to the subsistence-based coastal communities in the area, are too great to allow new offshore leasing. Coastal waters in the Beaufort Sea area should be permanently removed from consideration for any future leasing. These areas include those that have been previously deferred or deleted from past Beaufort Sea oil lease sales, including the areas north of the coast of the Arctic National Wildlife Refuge, those areas off of the Teshekpuk Lake Special Area, bowhead whale feeding grounds and migratory routes, and those areas within the entire spring ice lead system.

Thank you.

Sincerely,

Kai Chan
40 Edwards Place
Princeton, New Jersey 08540

BIBLIOGRAPHY

Aagaard, K., C.H. Pease, and S.A. Salo. 1988. Beaufort Sea Mesoscale Circulation Study-Preliminary Results. NOAA Technical Memorandum ERL PMEL 82. Seattle, WA: USDOC,NOAA, PMEL, 171 pp. plus appendices.

Aagaard, K., C.H. Pease, A.T. Roach, and S.A. Salo. 1989. Beaufort Sea Mesoscale Circulation Study. OCS Study, MMS 90-002. Outer Continental Shelf Environmental Assessment Program Final Reports of Principal Investigators Vol. 65 (Jan. 1990). Anchorage, AK: USDOC, NOAA and USDOI, MMS, pp. 1-427.

Aagaard, K. and A.T. Roach. 1990. Arctic Ocean-Shelf Exchange: Measurements in Barrow Canyon. *Journal of Geophysical Research* 95:18,163-18,175.

Abbott, J. 2001. Telephone conversation between Jane Abbott, North Slope Borough, Administration and Finance, and Tim Holder, USDOI, MMS, Alaska OCS Region; subject: audited financial statements for the North Slope Borough.

Adams, B. 1986. Testimony. Barrow Sale 97 Public Hearing. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Adams, W.A., B.F. Scott, and N.B. Snow. 1975. Environmental Impact of Experimental Oil Spills in the Canadian Arctic. Water Quality Parameters. ASTM Special Publication. Philadelphia, PA: American Society for Testing and Materials, pp. 489-513.

Ahlund, M. and F. Gotmark. 1989. Gull Predation on Eider Ducklings, *Somateria mollissima*: Effects of Human Disturbance. *Biological Conservation* 48:115-127.

Ahmaogak, G N. 1989. Protecting the Habitat of the Bowhead Whale. *In*: Proceedings of the Sixth Conference of the Comite Arctique International, L. Rey and V. Alexander, eds. The Netherlands: E.J. Brill, pp. 593-597.

Ahmaogak, G.N. 1990. Letter dated May 9, 1990, from G.N. Ahmaogak to A.D. Powers, Regional Director, MMS, Alaska OCS Region.

Akootchook, I 1986. Testimony at the Barrow Public Hearing on Sale 97. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Alaska Clean Seas. 1998. North Slope Spill Response Technical Manual Scenarios. Anchorage, AK: Emcon, Alaska.

Alaska Consultants, Inc., C.S. Courtnage, and S.R. Braund and Assocs. 1984. Barrow Arch Socioeconomic and Sociocultural Description. Technical Report No. 101. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, 641 pp.

Alaska Consultants, Inc. and S.R. Braund and Assocs. 1984. Subsistence Study of Alaska Eskimo Whaling Villages. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Socioeconomic Studies Program, 248 pp. plus appendices.

Alaska Eskimo Whaling Commission. 1987-1995. Spring and Fall Bowhead Harvest Reports. Barrow, AK: AEWC.

Alaska Eskimo Whaling Commission. 2001. Letter dated Mar. 20, 2001, from the AEWC, Barrow to USDOI, MMS, Alaska OCS Region; subject: AEWC additional comments supporting the testimonies of Nuiqsut, 1 page.

Alaska Native Health Board, Inc. 1985. Rural Health Issues Study and Statewide Suicide Evaluation - A Resource Document. Anchorage, AK: Alaska Native Health Board, Inc, 147 pp.

Alaska Native Health Board, Inc. 1999. Alaska Pollution Issues. Anchorage, AK: Alaska Native Health Board, Inc.

Alaska Natives Commission. 1994. Joint Federal-State Commission on Policies and Programs Affecting Alaska Natives. Final report, 3 Vols. Anchorage, AK: Alaska Natives Commission.

Albert, T.A, ed. 1981. Some Thoughts Regarding the Possible Effects of Oil Contamination on Bowhead Whales, *Balaena mysticetus*. *In*: Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea. OCSEAP Final Report for the period Apr. 1, 1981-Jun. 30, 1981 Vol. 1. Anchorage, AK: USDOI, BLM, Alaska OCS Office, pp. 945-953.

Amstrup, S.C. 1993. Human Disturbance of Denning Polar Bears in Alaska. *Arctic* 463:245-250.

Amstrup S.C. 1995. Movements, Distribution, and Population Dynamics of Polar Bears in the Beaufort Sea, a Thesis. Ph.D. Dissertation. Fairbanks, AK: University of Alaska, 299 pp.

Amstrup, S.C., I. Stirling, and J.W. Lentfer. 1986. Past and Present Status of Polar Bears in Alaska. *Wildlife Society Bulletin* 143:241-254.

Amstrup, S.C. and D.P. DeMaster. 1988. Polar Bear. *In*: Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations, J.W. Lentfer, ed. Washington, DC: Marine Mammal Commission, pp. 39-56.

Amstrup, S.C., C. Garner, and G.M. Durner. 1992. Temporal and Geographic Variation of Maternity Denning Among Polar Bears of the Beaufort Sea. *In*: Research on the Potential Effects of Petroleum Development on Wildlife and their Habitat, Arctic National Wildlife Refuge, T.R. McCabe, B. Griffith, N.E. Walsh, and D.D. Young, eds. Terrestrial Research 1002 Area-Arctic National Wildlife Refuge Interim Report - 1988-1990. Anchorage, AK: USDOI, FWS, Alaska Fish and Wildlife Research, pp. 165-206.

Amstrup, S.C. and C. Garner. 1994. Polar Bear Maternity Denning in the Beaufort Sea. Journal *Wildlife Management* 581:1-10.

Amstrup S.C., G.M. Durner, and T.L. McDonald. 2000. Estimating Potential Effects of Hypothetical Oil Spills from the Liberty Oil Production Island on Polar Bears. Anchorage, AK: U.S. Geological Survey, Biological Resource Div., 42 pp.

Anderson, C.M. 2000. Possible Crude Oil-Spill Rates for North Slope Oil Production. Email dated Feb. 24, 2000, to C. Smith and R. Prentki, USDOI, MMS, Alaska OCS Region; subject: assistance with spill rates.

Anderson, C.M. and E.M. Lear. 1994. Tanker Spill Data Base. OCS Report, MMS 94-0002. Herndon, VA: USDOI, MMS.

Angerbjorn, A., B. Arvidson, E. Noren, and L. Stromgren. 1991. The Effect of Winter Food on Reproduction in the Arctic Fox, *Alopex Lagopus*: A Field Experiment. *Journal of Animal Ecology* 60:705-714.

Angliss, R.P., D.P. DeMaster, and A. Lopez. 2001. Alaska Marine Mammal Stock Assessments, 2001. NOAA Technical Memorandum. Seattle, WA: USDOC, NOAA, NMFS, pp. 170-175.

Angliss, R.P. and K.L. Lodge. 2002. Alaska Marine Mammal Stock Assessments, 2002 draft. NOAA Technical Memorandum. Seattle, WA: USDOC, NOAA, NMFS, pp. 185-190.

Anthony R.M., N.M. Barten, and P.E. Seiser. 2000. Foods of Arctic Foxes (*Alopex lagopus*) During Winter and Spring in Western Alaska. *Journal of Mammalogy* 813:820-828.

Archibald W.R., R. Ellis and A.N. Hamilton. 1987. Responses of Grizzly Bears to Logging Truck Traffic in the Kimsquit River Valley, British Columbia. *In*: Seventh International Conference on Bear Research and Management, P. Zager, ed. Williamsburg, Va., Feb. 1986. Knoxville, TN: University of Tennessee, pp. 251-257.

Arctec Canada. 1983. Site Visit of Oil Spill under Multi-Year Ice at Griper Bay, NWT. Calgary, Alberta, Canada: Environment Canada, Environmental Protection Service.

Arctic Geoscience, Inc. 1997. Beaufort Sea Shallow Hazards Synthesis Liberty #1 Well. Anchorage, AK: BPXA.

Arctic Monitoring and Assessment Programme. 1997. Arctic Pollution Issues: A State of the Arctic Environment Report. Oslo, Norway: AMAP, 188 pp.

Armstrong, D.A., P.A. Dinnel, J.M. Orensanz, J.L. Armstrong, T.L. McDonald, R.F. Cusimano, R.S. Nemeth, M.L. Landolt, J.R. Skalski, R.F. Lee, and R.J. Huggett. 1995. *Status of Selected Bottomfish and Crustacean Species in Prince William Sound following the Exxon Valdez Oil Spill*. *In*: *Exxon Valdez* Oil Spill: Fate and Effects in Alaskan Waters, P.G. Wells, J.N. Butler, and J.S. Hughes, eds. Philadelphia, PA: American Society for Testing and Materials.

Arnborg, L., H.J. Walker, and J. Peippo. 1966. Water Discharge in the Colville River, 1962. Geografiska Annaler 48A:195-210.

Aubrey, F.T., F.J. Thomas, W. Evans, and R. Kastelien. 1984. Behavioral and Physiological Responses of Belukha Whales to Oil-Related Noise as Determined by Playbacks of Underwater Drilling Noise and Hearing Threshold Tests. Technical Report. San Diego, CA: Hubbs Sea World Research Institute.

Babaluk, J.A., J.D. Reist, J.D. Johnson, and L. Johnson. 2000. First Records of Sockeye Salmon (*Oncorhynchus nerka*) and Pink Salmon (*O. gorbuscha*) from Banks Island and Other Records of Pacific Salmon in Northwest Territories, Canada. *Arctic* 532:161-164.

Balzar, J. 1994. To Catch A Whale. Anchorage, AK: *Anchorage Daily News*, H-9 to H-13, Sept. 11, 1994.

Barnes, P.W. and E. Reimnitz. 1974. Sedimentary Processes on Arctic Shelves off the Northern Coast of Alaska. *In*: Proceedings of a Symposium on Beaufort Sea Coast and Shelf Research, J.C. Reed and J.E. Sater, eds. Arlington, VA: Arctic Institute of North America, pp. 439-476.

Barnes, P.W., D. McDowell, and E. Reimnitz. 1978. Ice Gouging Characteristics, their Changing Patterns from 1975-1977, Beaufort Sea, Alaska. Open-File Report 78-730. U.S. Geological Survey.

Barnes, P.W. and D. Rearic. 1983. Characteristics of Ice Gouges Formed from 1975 to 1982 on the Alaskan Beaufort Sea inner Shelf. Environmental Assessment of the Alaskan Outer Continental Shelf Annual Reports of Principal Investigators for the Year Ending 1985. Juneau, AK: USDOC, NOAA, OCSEAP.

Becker, P.R. 2000. Concentrations of Chlorinated Hydrocarbons and Heavy Metals in Alaska Arctic Marine Mammals. *Marine Pollution Bulletin* 4010:819-829. Vicksburg, MS: U.S. Army Waterways Experiment Station.

Becker, P.R., E.A. Mackey, M.M. Schantz, R. Demiralp, R.R. Greenberg, B.J. Koster, S.A. Wise, and D.C.G. Muir. 1995. Concentrations of Chlorinated Hydrocarbons, Heavy Metals and Other Elements in Tissues Banked by the Alaska Marine Mammal Tissue Archival Project. OCS Study, MMS 95-0036. Silver Spring, MD: USDOC, NOAA, NMFS, and USDOC, National Institute of Standards and Technology.

Bell, M.C. 1990. Fisheries Handbook of Engineering Requirements and Biological Criteria. Portland, OR: U.S. Army Corps of Engineers, North Pacific Div.

Bendock, T.N. 1979. Inventory and Cataloging of Arctic Area Waters. Federal Aid in Fisheries Restoration Annual Performance Report G-I-I No. 20. Anchorage, AK: State of Alaska, Dept. of Fish and Game, pp. 50-52.

Bendock, T 1997. Fish Resources of Northeastern NPR-A. *In*: NPR-A Symposium Proceedings: Science, Traditional Knowledge, and the Resources of the Northeast Planning Area of the National Petroleum Reserve-Alaska, Anchorage, Ak., Apr. 16-18, 1997. Anchorage, AK: USDOI, MMS, Alaska OCS Region, pp. 5-3 to 5-4.

Bendock, T. and J. Burr. 1984. Freshwater Fish Distributions in the Central Arctic Coastal Plain (Ikpikpuk River to Colville River). Fairbanks, AK: State of Alaska, Dept. of Fish and Game, Sport Fish Div.

Bente, P. 2000. Western Alaska Caribou Management, M.V. Hicks, ed. Federal Aid in Wildlife Restoration, Annual Report 1 July to 30 June 2000, Grant w-27-3 study 3.0. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Wildlife Conservation.

Bergerud, A.T. 1974. The Role of the Environment in the Aggregation, Movement, and Disturbance Behavior of Caribou. *In*: The Behavior of Ungulates and its Relation to Management, V. Geist and F Walter, eds. Vol. 2. New Series, No. 2. Gland, Switzerland: International Union for the Conservation of Nature, pp. 552-584.

Bergerud, A.T. 1987. An Assessment of Petroleum on the Status of the Porcupine Caribou Herd. *In*: Arctic National Wildlife Refuge, Alaska Coastal Plain Resource Assessment. Report and Recommendation to the Congress of the U.S. and Final Legislative Environmental Impact Statement, Vol. 2. Appendix, Public Comments and Responses. Washington, DC: USDOI, Fish and Wildlife Service, pp 4-19.

Bergerud, A.T. and J.P. Elliot. 1986. Dynamics of Caribou and Wolves in Northern British Columbia. Canadian Journal *Zoology* 64:1515-1529.

Bergman, R.D., R.L. Howard, K.F. Abraham, and M.W. Weller. 1977. Water Birds and Their Wetland Resources in Relation to Oil Development at Storkerson Point, Alaska. Resource Publication 129. Washington, DC: USDOI, Fish and Wildlife Service, 38 pp.

Betts, R.C., C.B. Wooley, C.M. Mobley, J.D. Haggarty, and A. Crowell. 1991. Site Protection and Oil Spill Treatment at SEL-188, an Archaeological Site in Kenai Fjords National Park, Alaska. Anchorage, AK: Exxon Company, U.S.A., 79 pp. plus bibliography.

Bishop S.C., J.G. Kidd, T.C. Cater, R.C. Rossow, and M.T. Jorgenson. 1999. Land Rehabilitation Studies in the Kuparuk Oilfield, Alaska, 1998. Thirteenth Annual Report. Anchorage, AK: ARCO Alaska, Inc., 72 pp.

Bittner, J.E. 1993. Cultural Resources and the *Exxon Valdez* Oil Spill. *In*: *Exxon Valdez* Oil Spill Symposium, Program and Abstracts, B.J. Spies, L.J. Evans, B. Wright, M. Leonard, and C. Holba, eds. and comps. Anchorage, Ak., Feb. 2-5, 1993. Anchorage, AK: *Exxon Valdez* Oil Spill Trustee Council; UAA, University of Alaska Sea Grant College Program; and American Fisheries Society, Alaska Chapter, pp. 13-15.

Blackwell, S.B. and C.R. Greene, Jr. 2001. Sound Measurements, 2000 Break-up and Open-water Seasons. *In*: Monitoring of Industrial Sounds, Seals, and Whale Calls During Construction of BP's Northstar Oil Development, Alaskan Beaufort Sea, 2000. LGL Report TA 2429-2. King City, Ontario, Canada: LGL Ecological Research Associates, Inc., 55 pp.

Boehm, P.D., W. Steinhauer, D. Cobb, S. Duffy, and J. Brown. 1983. Baffin Island Oil Spill Project Chemistry Component-2: Analytical Biogeochemistry Report on 1983 Field Experiments. Edmonton, Alberta, Canada: Environment Canada, Environmental Protection Service, BIOS Project Office.

Boehm, P.D., J. Brown, H. Camp, L. Cook, J. Trefry, R.P. Trocine, R.D. Rember, G. Shepard, C. Malme, P. Krumhansl, and M.L. Knack. 2001. Arctic Nearshore Impact Monitoring in the Development Area (ANIMIDA) Phase I. Draft Final Report. Contract No. 143501-99-CT-30998. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Bonnell, M.L. and M.D. Dailey. 1990. Marine Mammals of the Southern California Bight. *In*: Ecology of the Southern California Bight: A Synthesis and Interpretation, M.D. Dailey, D.J. Reish , and J.W. Anderson, eds. Final Report. Los Angeles, CA: USDOI, MMS, Pacific OCS Region, 541 pp.

BP Exploration (Alaska), Inc. 1996. Badami Project Description and Environmental Assessment Supplement. Anchorage, AK: BPXA.

BP Exploration (Alaska), Inc. 1998a. Liberty Development Project, Environmental Report. Anchorage, AK: BPXA.

BP Exploration (Alaska), Inc. 1998b. Letter dated July 17, 1998, from P. Hanley, Supervisor, HSE-Alaska, BPXA, to J. Walker, Regional Supervisor, Field Operations, MMS, Alaska OCS Region; subject: Liberty Development (OCS-Y-1650) comments on the preliminary draft EIS.

BP Exploration (Alaska), Inc. 1998c. Letter dated Sept. 11, 1998, to J. Walker, Regional Supervisor, Field Operations, MMS, Alaska OCS Region, from P. Hanley, BPXA; subject: Liberty Development Project (OCS-Y-1650), additional information requests by MMS analysts.

BP Exploration (Alaska), Inc. 1999. Oil Discharge Prevention and Contingency Plan, Liberty Development Area, North Slope, Alaska. 4/99, Rev. 0. Anchorage, AK: BPXA.

BP Exploration (Alaska), Inc. 2000. Oil Discharge Prevention and Contingency Plan, Liberty Development Area, North Slope, Alaska. 6/00, Rev.0. Anchorage, AK: BPXA.

Brabets, T.P. 1996. Evaluation of the Streamflow-Gaging Network of Alaska in Providing Regional Streamflow Information. USGS Water Resources Investigations Report 96-4001. U.S. Geological Survey, 73 pp.

Brannon, E.J., L.L. Moulton, L.G. Gilbertson, A.W. Maki, and J.R. Skalski. 1995. An Assessment of Oil Spill Effects on Pink Salmon Populations following the *Exxon Valdez* Oil Spill-Part 1: Early Life History. *In*: *Exxon Valdez* Oil Spill: Fate and Effects in Alaskan Waters, American Society for Testing and Materials, Third Symposium on Environmental Toxicology and Risk Assessment: Aquatic, Plant, and Terrestrial, Atlanta, Ga., Apr. 25-28, 1995. Philadelphia, PA: American Society for Testing and Materials, pp. 548-584.

Bratton, G.R., C.B. Spainhour, W. Flory, M. Reed, and K. Jayko. 1993. Presence and Potential Effects of Contaminants. *In*: *The Bowhead Whale Book*, J.J. Burns, J.J. Montague, and C.J. Cowles, eds. Special Publication of The Society for Marine Mammalogy, 2. Lawrence, KS: The Society for Marine Mammalogy, 701-744.

Bratton, G R., W. Flory, C.B. Spainhour, and E.M. Haubold. 1997. Assessment of Selected Heavy Metals in Liver, Kidney, Muscle, Blubber, and Visceral Fat of Eskimo Harvested Bowhead Whales *Balaena mysticetus* from Alaska's North Coast. North Slope Borough Contracts 89-293; 90-294. College Station, TX: Texas A&M University, pp. 233.

Braund, S.R., W.M. Marquette, and J.R. Bockstoce. 1988. Data on Shore-Based Bowhead Whaling at Sites in Alaska. *In*: Quantification of Subsistence and Cultural Needs for Bowhead Whales by Alaskan Eskimos, S.R. Braund, S.W. Stoker and J.A. Kruse, eds. IWC TC/40/AS2. Washington, DC: USDOI, BIA, and the IWC.

Breiwick, J.M., D.J. Rugh, D.E. Withrow, M.E. Dahlheim, and S.T. Buckland. 1989. Preliminary Population Estimate of Gray Whales during the 1987/88 Southbound Migration. Report of the International Whaling Commission 39. Cambridge, England: IWC, 465 pp.

Brewer, K.D., M.L. Gallagher, P.R. Regos, P.E. Isert, and J.D. Hall. 1993. ARCO Alaska, Inc. Kuvlum #1 Exploration Prospect Site Specific Monitoring Program Final Report. Anchorage, AK: ARCO Alaska, Inc., pp. 1-80.

Brigham, L. 2002. Arctic Science Journeys. Radio script. Fairbanks, AK: University of Alaska, Fairbanks, Alaska Sea Grant College Program.

British Petroleum. 2001. BP Statistical Review of World Energy 2001. http//www.bp.com/centres/energy2002/2001inreview.asp. London: BP.

Brower, H., Jr. and R.T. Opie. 1997. North Slope Borough Subsistence Harvest Documentation Project: Data for Nuiqsut, Alaska for the Period July 1, 1994 to June 30, 1995. Barrow, AK: North Slope Borough, Dept. of Wildlife Management.

Brower, H. and T. Hepa. 1998. Letter dated Jan. 20, 1998, to Thomas Napageak; subject: a point he raised at the Nuiqsut Public Hearing for the Northeast NPR-A Draft IAP/EIS.

Brower, T.P. 1980. Qiniqtuagaksrat Utuqqanaat Inuuniagninisiqun: The Traditional Land Use Inventory for the Mid-Beaufort Sea. Vol. I. Barrow, AK: North Slope Borough, Commission on History and Culture.

Brower, W.A., Jr., R.G. Baldwin, C.N. Williams, Jr., J.L. Wise, and L.D. Leslie. 1988. Climatic Atlas of the Outer Continental Shelf Waters and Coastal Regions of Alaska, Vol. I. Gulf of Alaska. Document ID: NAVAIR 50-1C-551; MMS 87-0011. Asheville, NC and Anchorage, AK: USDOD, NOCD; USDOI, MMS, Alaska OCS Region; and USDOC, NOAA, NOS, 530 pp.

Brown, J., P. Boehm, and L. Cook. 2001. ANIMIDA: Hydrocarbon Chemistry of Sediments and Biota in the Nearshore Beaufort Sea. *In*: Proceedings of the Eighth Information Transfer Meeting, Anchorage, Ak., Apr. 3-5, 2001. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Brown, J., P. Boehm, and L. Cook. 2001. Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) Program: A Multi-Year Monitoring Program in the Nearshore Beaufort Sea. *In*: Proceedings of the Eighth MMS Information Transfer Meeting, Anchorage, Ak., Apr. 3-5, 2001. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Bryner, W.M. 1995. Toward a Group Rights Theory for Remedying Harm to the Subsistence Culture of Alaska Natives. *Alaska Law Review* 122:293-94.

Buckland, S.T., J.M. Breiwick, K.L. Cattanach, and J.L. Laake. 1993. Estimated Populat ion Size of the California Gray Whale. *Marine Mammal Science* 93:235-249.

Buist, I. A., W.M. Pistruzak, and D.F. Dickens. 1981. Dome Petroleum's Oil and Gas Undersea Ice Study. *Spill Technology Newsletter* 6:120-146.

Buist, I.A. and I. Bjerkelund. 1986. Oil in the Ice Pack. *In*: Proceedings of the Ninth AMOP Symposium, pp. 379-396.

Buist, I.A., S.P. Joyce, and D.F. Dickens. 1987. Oil Spills in Leads: Tank Tests and Modelling. Ottawa, Ont., Canada: Environment Canada, Environmental Protection Directorate.

Buist, I.A. and D.F. Dickens. 1988. Experimental Spills of Crude Oil in Pack Ice. *In*: Proceedings of the Eleventh AMOP Symposium, pp. 373-381.

Buist, I.A., S. Potter, D. Mackay, and M. Charles. 1989. Laboratory Studies on the Behaviour and Cleanup of Waxy Crude Oil Spills. *In*: Proceedings of the 1989 International Oil Spill Conference, pp. 105-113.

Burch, E.S., Jr. 1970. The Eskimo Trading Partnership in North Alaska: A Study in Balanced Reciprocity. *Anthropological Papers of the University of Alaska* 151:49-80.

Burch, E.S., Jr. 1971. The Nonempirical Environment of the Arctic Alaskan Eskimos. *Southwestern Journal of Anthropology* 272.

Burch, E.S., Jr. 1975a. *Eskimo Kinsmen: Changing Family Relationships in Northwest Alaska*. St. Paul, New York, Boston, Los Angeles, San Francisco: West Publishing Company.

Burch, E.S., Jr. 1975b. Inter-Regional Transportation in Traditional Northwest Alaska. *Anthropological Papers of the University of Alaska, Fairbanks* 172:1-11.

Burgess, M. 2000. Arctic Fox. Chapter 8. *In*: The Natural History of an Arctic Oil Field Development and the Biota, J.C. Truett and S.R. Johnson, eds. San Diego, CA: Academic Press, Harcourt Science and Technology Co., pp. 159-178.

Burgess, R.M. and P.W. Banyas. 1993. Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992. Northern Alaska Research Studies. Anchorage, AK: BPXA, pp. 89.

Burgess R.M., R. Rose, R., P.W. Banyas, and B.E. Lawhead. 1993. Arctic Fox Studies in the Prudhoe Bay Unit and Adjacent Undeveloped Areas, 1992. Northern Alaska Research Studies. Anchorage, AK: BPXA, 16 pp.

Burns, J.J., L.H. Shapiro, and F.H. Fay. 1980. The Relationship of Marine Mammal Distributions, Densities, and Activities to Sea Ice Conditions. Environmental Assessment of the Alaskan Continental Shelf. Final Report of Principal Investigators, Vol. 11 Biological Studies (Jul. 1981). Boulder, CO: USDOC, NOAA, OCSEAP, and USDOI, BLM, pp. 489-670.

Burns, J.J. and B.P. Kelly. 1982. Studies of Ringed Seals in the Alaskan Beaufort Sea during Winter: Impacts of Seismic Exploration. Annual Report. Juneau, AK: USDOC, NOAA, OCSEAP.

Burns, J.J., B.P. Kelly, L.D. Aumiller, K.J. Frost, and S. Hills. 1983. Studies of Ringed Seals in the Alaska Beaufort Sea during Winter: Impacts of Seismic Exploration. Annual Report. Juneau, AK: USDOC, NOAA, OCSEAP, and USDOI, MMS, 57 pp.

Burwell, M. 1996. Conversation between M. Burwell and M. Hope, both with the MMS, Alaska OCS Region; subject: shipwreck database.

Burwell, M. 1999. Meeting Notes. Liberty Project Information Update Meetings, Barrow. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Calef, G., E. DeBock, and G. Lortie. 1976. The Reaction of Barren-Ground Caribou to Aircraft. *Arctic* 29:201-212.

Cameron, R.D. 1994. Distribution and Productivity of the Central Arctic Caribou Herd in Relation to Petroleum Development: Case History Studies with a Nutritional Perspective. Final report. Federal Aid in Wildlife Restoration Study 3.35 Grant 2-23-1, w-23-2, w-23-3, w-23-4, w-23-5, w-24-2, w-24-3. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Wildlife Conservation, 35 pp.

Cameron, R.D., K.R. Whitten, and W.T. Smith. 1981. Distribution and Movement of Caribou in Relation to the Kuparuk Development Area. Preliminary Report and Second and Third Interim Reports, 1980-1981. Juneau, AK: State of Alaska, Dept. of Fish and Game.

Cameron, R.D., K.R. Whitten, and W.T. Smith. 1983. Responses of Caribou to Petroleum-Related Development on Alaska's Arctic Slope. Federal Aid in Wildlife Restoration Research Program Progress Report, Vol. VII Project W-21-2 and W-22-1, Job 3, 18R. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Game, 75 pp.

Cameron, R.D., D.J. Reed, J.R. Dau, and W.T. Smith. 1992. Redistribution of Calving Caribou in Response to Oil Field Development on the Arctic Slope of Alaska. *Arctic* 454:338-342.

Cannon, T.C., D.R. Glass, and C.M. Prewitt. 1991. Habitat Use Patterns of Juvenile Arctic Cod in the Coastal Beaufort Sea near Prudhoe Bay, Alaska. *In*: Proceedings of the American Fisheries Society Symposium 11: Fisheries and Oil Development on the Continental Shelf. Bethesda, MD: American Fisheries Society.

Carmack, E.C., R.W. MacDonald, R.G. Perkin, F.A. McLaughlin, and R.J. Pearson. 1995. Evidence for Warming of Atlantic Waters in the Southern Canadian Basin of the Arctic Ocean: Results from the Larsen-93 Expedition. *Geophysical Research Letters* 22:1061-1064.

Carroll, G. 1991. Game Management Unit 26A Western North Slope. *In*: Brown Bear, S.M. Abbott, ed. Federal Aid in Wildlife Restoration Annual Performance Report of Survey-Inventory Activities 1 July 1990-30 June 1991 XXII, Part V Project W-23-4, Study 4.0. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Wildlife Conservation, 271pp.

Carrroll, G. 1992. Teshekpuk Lake Caribou Herd, Game Management Unit 26A. *In*: Caribou Surveys-Inventory Management Report, 1 July 1989-30 June 1991, S.M. Abbott, ed. Caribou Survey-Inventory Management Report 1 July 1989-30 June 1991. Federal Aid in Wildlife Restoration Project W-23-1 and W-23-4 Study 3.0. Juneau AK: State of Alaska, Dept. of Fish and Game.

Carroll, G.M., J.C. George, L.F. Lowry, and K.O. Coyle. 1987. Bowhead Whale (*Balaena mysticetus*) Feeding near Point Barrow, Alaska during the 1985 Spring Migration. *Arctic* 40105-110.

Casey, P. 1997. Summary memorandum of meeting dated Jan. 10, 1997, between T. Napageak and MMS, Alaska OCS Region; subject: possible State 170 Nuiqsut deferral.

Cater T.C., L.J. Rossow, and M.T. Jorgenson. 1999. Long-Term Ecological Monitoring of Tundra Affected by a Crude Oil Spill near Drill Site 2U, Kuparuk Oilfield, Alaska 1996. Annual Report. Fairbanks, AK: Alaska Biological Research, Inc., 53 pp.

Cavalieri, D.J., P. Gloersen, C.L. Parkinson, J.C. Cosimo, and H.J. Zwally. 1997. Observed Hemispheric Asymmetry in Global Sea Ice Changes. *Science* 278:1104-1106.

Chance, N.A. 1966. *The Eskimo of North Alaska*. New York: Holt, Rinehart and Winston.

Chance, N.A. 1990. *The Inupiat and Arctic Alaska*. Fort Worth, TX: Holt, Rinehart and Winston.

Chesemore, D.L. 1967. Ecology of the Arctic Fox in Northern and Western Alaska. Fairbanks, AK: University of Alaska, 148 pp.

Childers, J.M., D.R. Kemodle, and R.M. Loeffler. 1979. Hydrologic Reconnaissance of Western Arctic Alaska, 1976 and 1977. Open-File Report 79- 699. Anchorage, AK: U.S. Geological Survey, 70 pp.

City of Nuiqsut. 1995. Nuiqsut Paisanich: A Cultural Plan. Nuiqsut, AK: City of Nuiqsut, Native Village of Nuiqsut, and the Kuukpik Corp.

Clark, C.W., W.T. Ellison, and K. Beeman. 1986. A Preliminary Account of the Acoustic Study Conducted during the 1985 Spring Bowhead Whale, *Balaena mysticetus*, Migration Off Point Barrow, Alaska. Report of the International Whaling Commission 36. Cambridge, England: IWC, pp. 311-317.

Cleator, H.J. and I. Stirling. 1990. Winter Distribution of Bearded Seals (*Erignathus barbatus*) in the Penny Strait Area, Northwest Territories, as Determined by Underwater Vocalizations. *Canadian Journal Fisheries Aquatic Sciences* 47:1071-1076.

Cline, J.D. 1981. Distribution of Dissolved LMW Hydrocarbons in Bristol Bay, Alaska: Implications for Future Gas and Oil Development. *In*: The Eastern Bering Sea Shelf: Oceanography and Resources, D.W. Hood and J.A. Calder, eds. Vol. 1. Seattle, WA: University of Washington Press, pp. 425-444.

Cluck, R. 2000. Personal communication to Mike Burwell, USDOI, MMS, Alaska OCS Region; subject: 10/16/00 review of Burwell's Sociocultural Systems sections for the Liberty Draft EIS. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

CNN.com. 2000. Ships Rerouted to Protect Marine Sanctuaries. http://www.cnn.com/2000/NATURE/06/05/shipsafe.enn/.

Coachman, L.K. and C.A. Barnes. 1961. The Contribution of Bering Sea Water to the Arctic Ocean. *Arctic* 14:147-161.

Coastal Frontiers Corporation. 2000. Post-Abandonment Island Inspection Seal and Northstar Islands, Beaufort Sea, Alaska, Summer 1999. Final Report. Amerada Hess Corp., 29 pp.

Cohen, M.J. 1993. The Economic Impacts of the *Exxon Valdez* Oil Spill on Southcentral Alaska's Commercial Fishing Industry. *In*: *Exxon Valdez* Oil Spill Symposium Abstract Book, B. Spies, L.J. Evans, B. Wright, M. Leonard, and C. Holba, eds. and comps. Anchorage, Ak., Feb. 2-5, 1993. Anchorage, AK: *Exxon Valdez* Oil Spill Trustee Council; University of Alaska Sea Grant College Program; and American Fisheries Society, Alaska Chapter, pp. 227-230.

Colonell, J.M. and A.W. Niedoroda. 1988. Nearshore Oceanographic Processes of Potential Importance to Marine and Anadromous Fishes. *In*: Fisheries Oceanography A Comprehensive Formulation of Technical Objectives for Offshore Application in the Arctic, R.M. Meyer and T.M. Johnson, eds. Anchorage, AK: USDOI, MMS, pp. 35-42.

Comfort, G. and W. Purves. 1982. The Behavior of Crude Oil Spilled under Multi-Year Ice. Technology Development Report. Ottawa, Ont., Canada: Environment Canada, Environmental Protection Service, Environmental Impact Control Directorate.

Consiglieri, L.D., H.W. Braham, M.E. Dahlheim, C. Fiscus, P.D. McGuire, C.E. Peterson, and D.A. Pippenger. 1982. Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska. OCSEAP Final Reports of Principal Investigators Vol. 61. Anchorage, AK: USDOC, NOAA and USDOI, MMS, pp. 189-343.

Cooper, L.W., I.L. Larsen, T.M. O'Hara, S. Dolvin, V. Woshner, and G.F. Cota. 2000. Radionuclide Contaminant Burdens in Arctic Marine Mammals Harvested During Subsistence Hunting. *Arctic* 532:174-182.

Cover, D.E. 1991. Meteorology. *In*: 1988 Endicott Environmental Monitoring Program Final Report, Vol. IV, Science Applications International Corp, ed. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District, pp. 1-1 through 6-1.

Cox, J.C. and L.A. Schultz. 1981. The Containment of Oil Spilled under Rough Ice. *In*: Proceedings of the 1981 Oil Spill Conference (Prevention, Behavior, Control, Cleanup). Washington, DC: American Petroleum Institute, pp. 203-308.

Cox, J.C., L.A. Schultz, R.P. Johnson, and R.A. Shelsby. 1981. The Transport and Behavior of Oil Spilled in and under Sea Ice (1980). Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators. Juneau, AK: USDOC, NOAA, OCSEAP and USDOI, BLM.

Craig, P.C. 1984. Fish Use of Coastal Waters of the Alaskan Beaufort Sea: A Review. *Transactions of the American Fisheries Society* 113:265-282.

Craig, P.C. 1987. Anadromous Fishes in the Arctic Environment--A Precarious or Relatively Stable Existence? Biological Papers of the University of Alaska. Juneau, AK: University of Alaska, Juneau.

Craig, P.C. 1989. An Introduction to Anadromous Fishes in the Alaskan Arctic, D.W. Norton, ed. Biological Papers of the University of Alaska Number 24. Research advances on anadromous fish in arctic Alaska and Canada - Nine papers contributing to an ecological synthesis. Fairbanks, AK: University of Alaska, Fairbanks, Institute of Arctic Biology, 166 pp.

Craig, P.C. and L. Halderson. 1981. Beaufort Sea Barrier Island-Lagoon Ecological Processes Studies: Final Report, Simpson Lagoon, Part 4, Fish. Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators, Vol. 7 Biological Studies (Feb. 1981). Boulder, CO: USDOC, NOAA, OCSEAP and USDOI, BLM, pp. 384-678.

Craig, P.C., W.B. Griffiths, S.R. Johnson, and D.M. Schell. 1984. Trophic Dynamics in an Arctic Lagoon. *In*: The Alaskan Beaufort Sea Ecosystems and Environments, P.W. Barnes, D. M. Schell and E. Reimnitz, eds. New York: Academic Press, Inc., pp. 347-380.

Cramer, D. 1996. FAX message dated Jan. 30, 1996 to M. Burwell, MMS, Alaska OCS Region; subject: latest Barrow walrus-harvest figures.

Crecelius, E.A., J.H. Trefry, M.S. Steinhauer, and P.D. Boehm. 1991. Trace Metals in Sediments from the Inner Continental Shelf of the Western Beaufort Sea. *Environmental Geology and Water Science* 181:71-79.

Cronin M.A., H.A. Whitlaw, and W.B. Ballard. 2000. Northern Alaska Oil Fields and Caribou. *Wildlife Society Bulletin* 284:919-922.

Curatolo, J.A. 1984. A Study of Caribou Response to Pipelines in and Near the Eileen West End, 1983. Anchorage, AK: Sohio Alaska Petroleum Co.

Curatolo, J.A. and S.M. Murphy. 1986. The Effects of Pipelines, Roads, and Traffic on the Movements of Caribou, *Rangifer tarandus*. *Canadian Field-Naturalist* 1002:218-224.

Cutter Information Corp. 1997. International Oil Spill Statistics. *Oil Spill Intelligence Report.*

D.F. Dickins Assocs., Ltd. 1992. Behaviour of Spilled Oil at Sea (BOSS): Oil-in-Ice Fate and Behavior. Ottawa, Ont., Canada: Environment Canada.

Dahlheim, M.E. and T.R. Loughlin. 1990. Effects of the *Exxon Valdez* Oil Spill on the Distribution and Abundance of Humpback Whales in Prince William Sound, Southeast Alaska, and the Kodiak Archipelago. *In*: *Exxon Valdez* Oil Spill Natural Resource Damage Assessment. Unpublished report. NRDA Marine Mammals Study No. 1. Seattle WA: USDOC, NOAA.

Dahlheim, M.E. and C.O. Matkin. 1994. Assessment of Injuries to Prince William Sound Killer Whales. *In*: *Exxon Valdez* Oil Spill Symposium Abstract Book, B. Spies, L.G. Evans, M. Leonard, B. Wright, and C. Holba, eds. and comps. Anchorage, Ak., Feb. 2-5, 1993. Anchorage, AK: *Exxon Valdez* Oil Spill Trustee Council; University of Alaska Sea Grant College Program; and American Fisheries Society, Alaska Chapter, pp. 308-310.

Dale, R.J. 1996. Conversation between M. Hope, Archaeologist, MMS Alaska OCS Region, and R.J. Dale, Archaeologist, State Historic Preservation Office, Anchorage; subject: Alaska Heritage Resources Survey (AHRS) file.

Dames and Moore. 1985. Oil Spill Contingency Plan and Spill Prevention Control and Countermeasure Plan, Mars Prospect, Beaufort Sea OCS, Alaska. Anchorage, AK: Amoco Production Company, (various pagings).

Dames and Moore. 1985. Spill Prevention Control and Countermeasure Plan and Oil Spill Contingency Plan for Harrison Bay Lease Area, Beaufort Sea OCS, Alaska. Houston, TX: Tenneco Oil Co, (various pagings).

Dames and Moore. 1996a. Northstar Project Community Meeting, Nuiqsut, Aug. 13-16, 1996. Anchorage, AK: Dames and Moore.

Dames and Moore. 1996b. Northstar Project Whalers' Meeting, Nuiqsut, Aug. 1-2, 1996. Anchorage, AK: Dames and Moore.

Dames and Moore. 1996c. Northstar Project Community Meeting, Nuiqsut, Mar. 27, 1996. Anchorage, AK: Dames and Moore.

Danenberger, E.P 1993. Outer Continental Shelf Blowouts, 1971-1991. Paper presented at the 25th Annual Offshore Technology Conference, Houston, Tex., May 3-6, 1993. Houston, TX: OTC

Dau, C.P. and E.J. Taylor. 2000. Aerial Population Survey of Common Eiders and Other Waterbirds in Nearshore Waters and along Barrier Islands of the Arctic Coastal Plain of Alaska, 3-12 July 2000. Unpublished report. Anchorage, AK: USDOI, Fish and Wildlife Service, 23 pp.

Dau, C.P. and P.D. Anderson. 2001. Aerial Population Survey of Common Eiders and Other Waterbirds in Nearshore Waters and along Barrier Islands of the Arctic Coastal Plain of Alaska, 30 June-3 July 2001. Anchorage AK: USDOI, Fish and Wildlife Service, 16 pp.

Dau, J.R. and R.D. Cameron. 1986. Responses of Barren-Ground Caribou to Petroleum Development near Milne Point, Alaska. Final Report. Anchorage, AK: Conoco, Inc. and Continental Pipeline Co.

Dau, J.R. and R.D. Cameron. 1986a. Effects of a Road System on Caribou Distribution During Calving. *Rangifer* 1(Special Issue):95-101.

Dau, J.R. and R.D. Cameron. 1986b. Responses of Barren-Ground Caribou to Petroleum Development near Milne Point, Alaska. Final Report. Anchorage, AK: Conoco, Inc. and Continental Pipeline Co.

Davenport, J. 1982. Oil and Planktonic Ecosystems. *In*: The Long-Term Effects of Oil Pollution on Marine Populations, Communities, and Ecosystems, R.B. Clark, ed. London: The Royal Society, pp. 369-382.

Davies, J.R. 1997. The Impact of an Offshore Drilling Platform on the Fall Migration Path of Bowhead Whales: A GIS-Based Assessment. MS Thesis. Seattle, WA: Western Washington University.

Davis, J.L., P. Valkenburg, and H.V. Reynolds. 1980. Population Dynamics of Alaska's Western Arctic Caribou Herd. *In*: Proceedings of the Second International Reindeer/Caribou Symposium, E. Reimers, S. Skennsberg, and E. Gaare, eds. Roros, Norway, Sept. 17-21, 1979. Trondheim, Norway: Direktorat for vilt og ferskvannsfisk.

Davis, J.L., P. Valkenburg, and R. Boertje. 1982. Home Range Use, Social Structure and Habitat Selection of the Western Arctic Caribou Herd. Fairbanks, AK: USDOI, National Park Service.

Davis, R.A. 1987. Integration and Summary Report. *In*: Responses of Bowhead Whales to an Offshore Drilling Operation in the Alaskan Beaufort Sea, Autumn 1986. Anchorage, AK: Shell Western E&P, Inc., pp. 1-51.

Davis, R.A., C.R. Greene, and P.L. McLaren. 1985. Studies of the Potential for Drilling Activities on Seal Island to Influence Fall Migration of Bowhead Whales Through Alaskan Nearshore Waters. King City, Ontario: LGL Limited Environmental Research Associates, 70 pp.

Dawe, B.R., S.K. Parashar, J.P. Ryan, and R.D. Worsfold. 1981. The Use of Satellite Imagery for Tracking the *Kurdistan* Oil Spill. Ottawa, Ont., Canada: Environment Canada, Environmental Protection Service.

Dean, T., M. Stekoll, and R. Smith. 1996. Kelps and Oil: The Effects of the Exxon Valdez Oil Spill on Subtidal Algae. *In*: American Fisheries Society Symposium 18. Bethesda, MD: American Fisheries Society, pp. 412-423.

DeCola, E. 2001. International Oil Spill Statistics 2000. Arlington, MA: Cutter Information Corp., 70 pp.

Dehn, L.A., G. Sheffield, E.H. Follmann, L.K. Duffy, T.W. Bentzen, G.R. Bratton, V.M. Woshner, P. F. Hoekstra, and T.M. O'Hara. 2002. Feeding Ecology of Arctic Phocids - Implications for Heavy Metal Dynamics. Abstract. *In*: Program for the 53rd Arctic Science Conference, University of Alaska, Fairbanks, Sept. 18-21, 2001. Fairbanks, AK: UAF, American Assoc. for the Advancement of Science, Arctic Div.

Dekin, A.A., Jr. 1993. *Exxon Valdez* Oil Spill Archaeological Damage Assessment, Management Summary, Final Report. Juneau, AK: U.S. Dept. of Agriculture, Forest Service.

Derksen, D.V., K.S. Bollinger, D. Esler, K.C. Jensen, E.J. Taylor, M.W. Miller, and M.W. Weller. 1992. Effects of Aircraft on Behavior and Ecolo gy of Molting Black Brant near Teshekpuk Lake, Alaska. Final Report. Anchorage, AK: USDOI, Fish and Wildlife Service, 227 pp.

Derocher A.E. and I. Stirling. 1991. Oil Contamination of Polar Bears. *Polar Record* 27160:56-57.

Dickins, D.F., I.A. Buist, and W.M. Pistruzak. 1981. Dome Petroleum's Study of Oil and Gas under Sea Ice. *In*: Proceedings of the 1981 Oil Spill Conference (Prevention, Behavior, Control, Cleanup). Washington, DC: USEPA, USCG, and API, pp. 183-189.

Dickson, D.L., R.S. Suydam, and G. Balogh. 2000. Tracking the Movement of King Eiders from Nesting Grounds at Prudhoe Bay, Alaska to their Molting and Wintering Areas using Satellite Telemetry. 1999/2000 Progress Report. Edmonton, Alberta, Canada: Canadian Wildlife Service, 37 pp.

Divoky, G.J., G. Watson, and J.C. Bartonek. 1974. Breeding of the Black Guillemot in Northern Alaska. *Condor* 76:339-343.

Divoky G.J., S.A. Hatch, and J.C. Haney. 1988. Fall Migration of Ross' Gull *Rhodostethia rosea* in Alaskan Chukchi and Beauf ort Seas, Monitoring Seabird Populations in Areas of Oil and Gas Development on the Alaskan Continental Shelf. OCS Report, MMS 88-0023. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 30 pp.

Divoky, G.J. and V. Mendenhall. 2000. Storm Alters Marine Bird Habitats on Alaska's North Slope. *Pacific Seabirds* 272:68.

Dohl, T.P., R.C. Guess, M.L. Duman, and R.C. Helm. 1983. Cetaceans of Central and Northern California, 1980-1983: Status, Abundance, and Distribution. OCS Study, MMS 84-0045. Los Angeles, CA: USDOI, MMS, Pacific OCS Region, 284 pp.

Duane Miller & Assocs. 1997. Geotechnical Exploration, Liberty Development Project, Foggy Island Bay, Alaska. Anchorage, AK: BPXA.

Duane Miller & Assocs. 1998. Geotechnical Exploration, Liberty Development North Slope, Alaska. Anchorage, AK: BPXA.

Duncan, P.B., A.J. Hooten, and R.C. Highsmith. 1993. Influence of the *Exxon Valdez* Oil Spill on Intertidal Algae: Tests of the Effect of Residual Oil on Algal Colonization. *In*: *Exxon Valdez* Oil Spill Symposium Abstract Book, B. Spies, L.J Evans, B. Wright, M Leonard, and C. Holba, eds and comps. Anchorage, Ak., Feb. 2-5, 1993. Anchorage, AK: *Exxon Valdez* Oil Spill Trustees; University of Alaska Sea Grant College Program; and American Fisheries Society, Alaska Chapter, pp. 179-182.

Dunton, K.H. and S.V. Schonberg. 2000. The Benthic Faunal Assemblage of the Boulder Patch Community. *In*: *The Natural History of an Arctic Oil Field. Development of the Biota*, J.C. Truett and S.R. Johnson, eds. San Diego, CA: Academic Press.

Duval, W., L. Martin, and R. Fink. 1981. A Prospectus on the Biological Effects of Oil Spills in Marine Environments. Calgary, Alberta, Canada: Dome Petroleum Ltd.

e.g&G Idaho, Inc. 1991. Alaska Oil and Gas: Energy Wealth or Vanishing Opportunity. Oak Ridge, TN: U.S. Dept. of Energy.

Eastland, W.G., R.T. Bowyer, and S.G. Fancy. 1989. Effects of Snow Cover on Selection of Calving Sites by Caribou. *Journal of Mammalogy* 70:824-828.

EBA Engineering, Inc. 1991. Warthog No. 1, OCS Y-1663, Camden Bay, Beaufort Sea Shallow Hazard Survey Results. Anchorage, AK: ARCO Alaska.

Eberhardt, L.E., W.C. Hanson, J.L. Bengtson, R.A. Garrott, and E.E. Hanson. 1982. Arctic Fox Home Range Characteristics in an Oil-Development Area. Jo urnal *Wildlife Management* 461:183-190.

Endter-Wada, J. 1992. Social, Economic, and Subsistence Effects of the *Exxon Valdez* Oil Spill on the Kodiak Region. *In*: Conference Proceedings, Alaska OCS Region, Fourth Information Transfer Meeting, Anchorage, Ak., Jan. 28-30, 1992. Anchorage, AK: USDOI, MMS, AK OCS Region, pp. 283-288.

Engelhardt, F.R. 1987. Assessment of the Vulnerability of Marine Mammals to Oil Pollution. *In*: Fate and Effects of Oil in Marine Ecosystems. Proceedings of the Conference on Oil Pollution Organized under the auspices of the International Association on Water Pollution Research and Control (IAWPRC) by the Netherlands Organization for Applied Scientific Research TNO Amsterdam, The Netherlands, J. Kuiper and W.J. Van Den Brink. The Netherlands and Boston: Martinus Nijhoff Publishers, pp. 101-115.

Environmental Protection Agency. 1995. Arctic NPDES General Permit No. AKG284200. Seattle, WA: USEPA, Region 10, 55 pp.

Environmental Protection Agency, U.S. Coast Guard, and State of Alaska, Dept. of Environmental Conservation. 1999. North Slope Subarea Contingency Plan. Anchorage, AK: USEPA, U.S. Coast Guard, and State of Alaska, DEC.

Environmental Science and Engineering, Inc. 1987. Kuparuk Aerometric Monitoring Program - Annual Data Summary. Anchorage, AK: ARCO Alaska, Inc., 20 pp.

Envirosense. 1997. Summary of the Environmental Justice Movement. http//es.inet.gov/program/initiative/justice/ejovrvw.html.

Envirosphere Company. 1988. Draft Report for the Endicott Environmental Monitoring Program. Draft report, Sept. 1988. Vol. 1. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District.

Envirosphere Company. 1988. Prudhoe Bay Waterflood Project Comprehensive Marine Report, Vol. 1, Integration and Assessment. Assessment of the Effects of the West Dock Causeway and its Waterflood Extension on the Marine Environment, Chapter 2. Final report, May 1988. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District.

ERT Company. 1987. Prudhoe Bay Air Quality Monitoring Program Quarterly and Annual Data Report. Report No. D816. Anchorage, AK: Standard Alaska Production Company, 68 pp.

Evans, D.D. 1988. Combustion of Oil Spills on Water. *In*: Technology Assessment and Research Program for Offshore Minerals Operations. OCS Study, MMS 86-0057. Washington, DC: USDOI, MMS, pp. 169-177.

Evans, D.D., G. Mulholland, D. Gross, H. Baum, and K. Saito. 1987. Environmental Effects of Oil Spill Combustion. *In*: Proceedings of the Tenth Arctic Marine Oil Spill Program Technical Seminar, Edmonton, Alberta, Canada, June 9-10, 1987. Ottawa, Ontario, Canada: Environment Canada, pp. 95-130.

Exxon Valdez Oil Spill Trustee Council. 2001. 2001 Status Report. Anchorage, AK: *Exxon Valdez* Oil Spill Trustee Co uncil, 16 pp.

Fairweather E&P Services, Inc. 1997a. The Warthog No. 1 Camden Bay, Beaufort Sea, Shallow Hazards Survey Results. Anchorage, AK: ARCO Alaska.

Fairweather E&P Service, Inc. 1997b. Final Report, Warthog Winter Geotechnical and Bathymetric Programs. Anchorage, AK: ARCO Alaska, Inc.

Fall, J.A. 1992. Changes in Subsistence Uses of Fish and Wildlife Resources in 15 Alaska Native Villages Following the *Exxon Valdez* Oil Spill. *In*: MMS-Alaska OCS Region, Fourth Information Transfer Meeting Conference Proceedings, Anchorage, Ak., May 1992. Anchorage, AK: USDOI, MMS, Alaska OCS Region, pp. 261-270.

Fall, J.A. and C.J. Utermohle. 1995. An Investigation of the Sociocultural Consequences of Outer Continental Shelf Development in Alaska. Vol. VI. Anchorage, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence.

Fall, J.A. and C.J. Utermohle. 1999. Subsistence Harvests and Uses in Eight Communities Ten Years After the *Exxon Valdez* Oil Spill. Technical Paper No. 252. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence.

Fall, J.A., L.J. Field, T.S. Nighswander, N. Peacock, and U. Varansi, eds. 1999. Overview of Lessons Learned from the *Exxon Valdez* Oil Spill: A 10-Year Retrospective. *In*: Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context. Pensacola, FL: SETAC Press, 338 pp.

Fay, F.H. and E.H. Follman. 1982. The Arctic Fox (*Alopex lagopus*) Species Account. Issue 3917. Juneau, AK: USDOC, NOAA, OCSEAP, 27 pp.

Fechhelm, R.G. and D.B. Fissel. 1988. Wind-Aided Recruitment of Canadian Arctic Cisco (*Coregonus autumnalis*) into Alaskan Waters. *Canadian Journal of Fisheries and Aquatic Sciences* 45:906-910.

Fechhelm, R.G. and W.B. Griffiths. 1990. Effect of Wind on the Recruitment of Canadian Arctic Cisco (*Coregonus autumnalis*) into the Central Alaskan Beaufort Sea. *Can. J. Fish. Aquat. Sci.* 47:2164-2171.

Fechhelm, R.G. and W.W. Griffiths. 2001. Status of Pacific Salmon in the Beaufort Sea, 2001: A Synopsis. Anchorage, AK: LGL Alaska Research Assocs., Inc., 13 pp.

Fechhelm, R.G., P.S. Fitzgerald, J.D. Bryan, and B.J. Gallaway. 1993. Effect of Salinity and Temperature on the Growth of Yearling Arctic Cisco (*Coregonus autumnalis*) of the Alaskan Beaufort Sea. *Journal of Fish Biology* 43:463-474.

Fechhelm, R.G., M. Millard, W.B. Griffiths, and T. Underwood. 1996. Change in the Abundance Patterns of Arctic Flounder (*Pleuronectes glacialis* Pallas, 1776) in the Coastal Waters of the Alaskan Beaufort Sea, 1982-1995. *In*: The 1996 Endicott Fish Monitoring Program, Synthesis Supplement. Vol. III: Published Literature for Synthesis. Final draft. Anchorage, AK: BPXA and the North Slope Borough.

Fechhelm, R.G.. L.R. Martin, B.J. Gallaway, W.J. Wilson, and W.B. Griffiths. 2001. Estimating the Hydrographic Effects of Prudhoe Bay Causeway Breeches using the Before-After Control-Impact (BACI) Analysis. *Arctic* 542:162-173.

Federal Energy Regulatory Commission. 1995. Yukon Pacific LNG Project: Final Environmental Impact Statement. FERC/EIS 0-071. Washington, DC: FERC, Office of Pipeline Regulation.

Federal Register. 1999. Notification of Aboriginal Subsistence Whaling Quotas. 64 *Federal Register*. 28413-28414.

Federal Register. 2000. Marine Mammals; Incidental Take during Specified Activities; Marine Seismic-Reflection Data Collection in Southern California. 65 *Federal Register* 16828-16843.

Federal Register. 2000. Small Takes of Marine Mammals Incidental to Specified Activities. 65 *Federal Register* 16374-16379.

Federal Register. 2000. Marine Mammals; Incidental Take during Specified Activities. 65 *Federal Register* 16828-16843.

Federal Register. 2002. Endangered and Threatened Species; Final Determination on a Petition to Designate Critical Habitat for the Bering Sea Stock of Bowhead Whales. 67 *Federal Register* 55767-55771.

Federal Register. 2002. Endangered and Threatened Species; Final Determination on a Petition to Designate Critical Habitat for the Bering Sea Stock of Bowhead Whales. 67 *Federal Register* 55767-55771.

Ferrero, R.C., D.P. DeMaster, P.S. Hill, M.M. Muto, and A.L. Lopez. 2000. Alaska Marine Mammal Stock Assessments, 2000. NOAA Technical Memorandum NMFS-AFSC-119. Seattle, WA: USDOC, NOAA, NMFS, 195 pp.

Field, L.J., J.A. Fall, T.J. Nighswander, N. Peacock, and U. Varanasi, eds. 1999. *Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context*. Pensacola, FL: SETAC Press, 338 pp.

Fingas, M.F., F. Ackerman, P. Lambert, K. Li, and Z. Wang. 1995. The Newfoundland Offshore Burn Experiment: Further Results of Emissions Measurement. *In*: Proceedings of the Eighteenth Arctic and Marine Oil Spill Technical Seminar, Edmonton, Alberta, Canada, Jun. 15-16, 1995.

Finley, K.J. and R.A. Davis. 1984. Reactions of Beluga Whales and Narwhals to Ship Traffic and Ice-Breaking along Ice Edges in the Eastern Canadian High Arctic, 1982-1984: An Overview. Environmental Studies No. 37. Ottawa, Ontario, Canada: Canadian Dept. of Indian Affairs and Northern Development, Northern Environmental Protection Branch, Northern Affairs Program, 42 pp.

Finnish Min istry of the Environment. 1997. Guidelines for Environmental Impact Assessment in the Arctic. Helsinki, Finland: Ministry of the Environment.

Fischer, J.B. 2001. Beaufort Shelf Offshore Survey, July 23-26, 2001. 2001 Trip Report. Anchorage, AK: USDOI, Fish and Wildlife Service, 14 pp.

Fischer, J.B. 2002. Beaufort Shelf Offshore Survey, July 23-26, 2001. 2002 Trip Report. Anchorage, AK: USDOI, Fish and Wildlife Service, 14 pp.

Fischer, J.B., T.J. Tiplady, and W.W. Larned. 2002. Monitoring Beaufort Sea Waterfowl and Marine Birds–Aerial Survey Component. Anchorage, AK: USDOI, Fish and Wildlife Service, 138 pp.

Fleury, M.G.R. 1983. Outer Continental Shelf Oil and Gas Blowouts 1979-1982. Open-File Report 83-562. Anchorage, AK: U.S. Geological Survey, 27 pp.

Flint, P., R. Lanctot, J. Fischer, J., J.C. Franson, and J.B. Grand. 2000. Monitoring Beaufort Sea Waterfowl and Marine Birds. Quarterly Progress Report, 10 October 2000. Anchorage, AK: U.S. Geological Survey, Biological Resources Div., 5 pp.

Ford, R.G. 1985. Oil Slick Sizes and Length of Coastline Affected: A Literature Survey and Statistical Analysis. Contract No 14-12-0001-30224. Los Angeles, CA: USDOI, MMS, Pacific OCS Region, 34 pp.

Fraker, M.A. 1984. *Balaena mysticetus:* Whales, Oil, and Whaling in the Arctic. Anchorage, AK: Sohio-Alaska Petroleum Company and BP Alaska Exploration, Inc.

Fraker, M.A., D.A. Sergeant, and W. Hoek. 1978. Bowhead and White Whales in the Southern Beaufort Sea. Beaufort Sea Technical Report No. 4. Sidney, B.C., Canada: Beaufort Sea Project, Dept. of Fisheries and the Environment, 114 pp.

Fraker, M.A., D.K. Ljungblad, W.J. Richardson, and D.R. Van Schoik. 1985. Bowhead Whale Behavior in Relation to Seismic Exploration, Alaskan Beaufort Sea, Autumn 1981. OCS Study, MMS 85-0077. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 40 pp.

Fraker, P.N. 1983. White Whale Monitoring Program, Mackenzie Estuary. Sidney, B.C., Canada: LGL Limited, Environmental Research Associates.

Frost, K.J. and L.F. Lowry. 1981. Marine Mammals. *In*: Proceedings of a Synthesis Meeting: Beaufort Sea (Sale 71) Synthesis, D.W. Norton and W.M. Sackinger, eds. Chena Hot Springs, Ak., Apr. 21-23, 1981. Juneau, AK: USDOC, NOAA and USDOI, MMS, pp. 43-46.

Frost, K.J. and L.F. Lowry. 1983. Demersal Fishes and Invertebrates Trawled in the Northeastern Chukchi and Western Beaufort Seas, 1976-1977. NOAA Technical Report NMFS SSRF- 764. Seattle, WA: USDOC, NOAA, NMFS, 22 pp.

Frost K.J. and L.F. Lowry. 1999. Monitoring Distribution and Abundance of Ringed Seals in Northern Alaska. Interim Report, April 1998-March 1999. Juneau, AK: State of Alaska, Dept. of Fish and Game, 37 pp.

Frost, K.J., L.F. Lowry, and J.J. Burns. 1988a. Ringed Seals in the Beaufort Sea. Chapter 5. *In*: Beaufort Sea Information Update, P.R. Becker, ed. OCS Study, MMS 86-0047. Anchorage, AK: USDOC, NOAA, OCSEAP, and USDOI, MMS, Alaska OCS Region, pp. 41-49.

Frost, K.J., L.F. Lowry, and J.J. Burns. 1988b. Distribution, Abundance, Migration, Harvest and Stock Identity of Belukha Whales in the Beaufort Sea. Chapter 4. *In*: Beaufort Sea Information Update Meeting, P.R. Becker, ed. Anchorage, AK: USDOC, NOAA, OCSEAP, and USDOI, MMS, pp. 27-40.

Frost, K.J., L.F. Lowry, and G. Carroll. 1993. Beluga Whale and Spotted Seal Use of a Coastal Lagoon System in the Northeastern Chukchi Sea. *Arctic* 461:8-16.

Frost, K.J., G. Pendleton, and C. Hessinger. 2002. Monitoring Distribution and Abundance of Ringed Seals in Northern Alaska. *In*: Alaska OCS Region Eighth Information Transfer Meeting, MBC Applied Environmental Sciences, comp. Anchorage, Ak., Apr. 3-5, 2001. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 61 pp.

Frost, K.J., L.F. Lowry, J.R. Gilbert, and J.J. Burns. 1988. Ringed Seal Monitoring: Relationships of Distribution and Abundance to Habitat Attributes and Industrial Activities. OCS Study, MMS 89-0026. OCSEAP Final Reports of Principal Investigators, Vol. 61 (Jun. 1989). Anchorage, AK: USDOC, NOAA, and USDOI, MMS, pp. 345-445.

Gales, R.S. 1982. Effects of Noise of Offshore Oil and Gas Operations on Marine Mammals: An Introductory Assessment. NOSC Technical Report 844 Vols. I and II. New York: USDOI, BLM, 79 pp.

Galginaitis, M. 2003. Annual Assessment of Subsistence Bowhead Whaling near Cross Island. ANIMIDA Task Order 004: Draft Annual Report for 2001. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Gallaway, B., W. Griffiths, P. Craig, W. Gazey, and J. Helmericks. 1983. An Assessment of the Colville River Delta Stock of Arctic Cisco (*Coregonus autumnalis*)–Migrants from Canada? Biological Papers of the University of Alaska No. 21. Fairbanks, AK: University of Alaska, Institute of Arctic Biology, pp. 4-23.

Garner G.W. and P.E. Reynolds. 1987. Mammals. *In*: Arctic National Wildlife Refuge Coastal Plain Resource Assessment, Base Line Study of the Fish Wildlife, and their Habitats. Vol. 1. Anchorage, AK: USDOI, Fish and Wildlife Service, 392 pp.

Garner, G.W. and P.E. Reynolds, eds. 1986. Arctic National Wildlife Refuge Coastal Plain Resource Assessment: Final Report: Baseline Study of the Fish, Wildlife and Their Habitats. Anchorage, AK: USDOI, Fish and Wildlife Service, Region 7, 695 pp.

George, J.C. and R. Kovalsky. 1986. Observations on the Kupigruak Channel (Colville River) Subsistence Fishery, October 1985. Barrow, AK: North Slope Borough, 60 pp.

George, J.C. and B.P. Nageak. 1986. Observations on the Colville River Subsistence Fishery at Nuiqsut, Alaska for the period July 4-November 1, 1984. Barrow, AK: North Slope Borough, 25 pp.

George, J.C. and A.S. Fuller. 1997. Evaluation of Subsistence Harvest Data from the North Slope Borough 1993 Census for Eight North Slope Villages for Calendar Year 1992. Barrow, AK: North Slope Borough, Dept. of Wildlife Management.

George, J.C., C. Clark, G.M. Carroll, and W.T. Ellison. 1989. Observations on the Ice-Breaking and Ice Navigation Behavior of Migrating Bowhead Whales (*Balaena mysticetus*) near Point Barrow, Alaska, Spring 1985. *Arctic* 42(1):24-30.

George, J.C., G.M. Carroll, L.M. Philo, and T.F. Albert. 1993. Report of Field Activities of the Spring 1988 Census of Bowhead Whales (*Balaena mysticetus*) off Point Barrow, Alaska with Observations on the Subsistence Hunt. Report of the International Whaling Commission No. 40. Cambridge, England: IWC, 383 pp. plus.

George, J.C., L.M. Philo, K. Hazard, D. Withrow, G.M. Carroll, and R. Suydam, R. 1994. Frequency of Killer Whale (*Orcinus orca*) Attacks and Ship Collisions Based on Scarring on Bowhead Whales (*Balaena mysticetus*) of the Bering-Chukchi-Beaufort Seas Stock. *Arctic* 47(3):247-255.

George, J.C., R.S. Suydam, L.M. Philo, T.F. Albert, J.E. Zeh, and G.M. Carroll. 1995. Report of the Spring 1993 Census of Bowhead Whales, *Balaena mysticetus*, off Point Barrow, Alaska, with Observations on the 1993 Subsistence Hunt of Bowhead Whales by Alaska Eskimos. *Rep. Int. Whal. Commn* 45:371-384.

George, J.C., J. Bada, J.E. Zeh, L. Scott, S.E. Brown, T. O'Hara, and R.S. Suydam. 1999. Age and Growth Estimates of Bowhead Whales (*Balaena mysticetus*) via Aspartic Acid Racemization. *Canadian Journal of Zoology* 774:571-580.

George, J.C., J. Zeh, R.S. Suydam, and C. Clark. 2002. Population Size of the Bering-Chukchi-Beaufort Seas Stock of Bowhead Whales, *Balaena mysticetus*, Based on the 2001 Census off Point Barrow, Alaska. Paper presented to the International Whaling Commission Scientific Committee. SC/44/BRG5. Shimonski, Japan: IWC.

Geraci, J.R. 1990. Physiologic and Toxic Effects on Cetaceans. *In*: Sea Mammals and Oil: Confronting the Risks, J.R. Geraci and D.J. St. Aubin, eds. San Diego, CA: Academic Press, Inc., and Harcourt Brace Jovanovich, pp. 167-197.

Geraci, J.R. and T.G. Smith. 1976. Direct and Indirect Effects of Oil on Ringed Seals (*Phoca hispida*) of the Beaufort Sea. *Journal of the Fisheries Resource Board of Canada* 33:1976-1984.

Geraci, J.R. and D.J. St. Aubin. 1980. Offshore Petroleum Resource Development and Marine Mammals: A Review and Research Recommendations. *Marine Fisheries Review* 4211:1-12.

Geraci, J.R. and D.J. St. Aubin. 1982. Study of the Effects of Oil on Cetaceans. Final report. Washington, DC: USDOI, BLM, 274 pp.

Geraci, J.R. and D.J. St. Aubin. 1985. Expanded Studies for the Effects of Oil on Cetaceans. Part 1. Contract No 14-12-0001-29169. Washington, DC: USDOI, MMS, 144 pp.

Geraci, J.R. and D.J St. Aubin, eds. 1990. Sea Mammals and Oil: Confronting the Risks. San Diego, CA: Academic Press, Inc., 282 pp.

Gilbert, J., G. Fedoseev, D. Seagars, E. Razlivalov, and A. Lachugin. 1992. Aerial Census of Pacific Walrus, 1990. Anchorage, AK: USDOI, FWS, Marine Mammal Management, 33 pp.

Gilders, M.A. and M.A. Cronin. 2000. North Slope Oil Field Development. *In*: The Natural History of an Arctic Oil Field, J.C. Truett and S.R. Johnson, eds. San Diego, CA: Academic Press, 15-32.

Gilfillan, E.S, T.H. Suchanek, P.D. Boehm, E.J. Harner, D.S. Page, and N.A. Sloan. 1993. Shoreline Impacts in the Gulf of Alaska Region Following the *Exxon Valdez* Oil Spill. *In*: American Society for Testing and Materials, Third Symposium on Environmental Toxicology and Risk Assessment: Aquatic, Plant and Terrestrial, Atlanta, Ga., Apr. 26-28, 1993. Unpublished Preprint. Philadelphia, PA: American Society for Testing and Materials.

Gollop, M.A., J.R. Goldsberry, and R.A. Davis. 1974. Disturbance to Birds by Gas Compressor Noise Simulators, Aircraft and Human Activity in the Mackenzie Valley and the North Slope, 1972, A. Gunn and J.A. Livingston, eds. Arctic Gas Biological Report Series 14. Calgary, Alberta, Canada: Canadian Arctic Gas and Alaskan Arctic Gas Study Co., pp. 225-230.

Gorbics, C.S., J.L. Garlich-Miller, and S.L. Schliebe. 1998. Draft Alaska Marine Mammal Stock Assessments 1998, Sea Otters, Polar Bear, and Walrus. Anchorage, AK: USDOI, Fish and Wildlife Service, 45 pp.

Gotthardt, T. 2001. Status Report on the Red-Throated Loon (*Gavina stellata*). Anchorage, AK: USDOI, Fish and Wildlife Service, 176 pp.

Grantz, A., D.A. Dinter, E.R. Hill, R.E. Hunter, S.D. May, R.H. McMullin, and R.L. Phillips. 1982. Geological Framework, Hydrocarbon Potential and Environmental Conditions for Exploration and Development of Proposed Oil and Gas Lease Sale 87 in the Beaufort and Northeast Chukchi Seas. Open-File Report 82-48. Menlo Park, CA: U.S. Geological Survey, 73 pp.

Greene, C.R. 1981. Underwater Acoustic Transmission Loss and Ambient Noise in Arctic Regions. *In*: The Question of Sound from Icebreaker Operations, Proceedings of a Workshop, Toronto, Ontario, Canada, Calgary, Albert, Canada: Arctic Pilot Project, Petro-Canada.

Greene, C.R. 1997. Underice Drillrig Sound, Sound Transmission Loss, and Ambient Noise near Tern Island, Foggy Island Bay, Alaska, February 1997. Greeneridge Report 187-1. Santa Barbara, CA: Greeneridge Sciences, Inc., 22 pp.

Greene, C.R. 1998. Underwater Acoustic Noise and Transmission Loss during Summer at BP's Liberty Prospect in Foggy Island Bay, Alaskan Beaufort Sea. Greenridge Report 189-1. Santa Barbara, CA: Greeneridge Sciences, Inc., 39 pp.

Greene, C.R., Jr., N.S. Altman, W.J. Richardson, and R.W. Blaylock. 1999. Bowhead Whale Calls. *In*: Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1998, LGL and Greeneridge. LGL Report TA 2230-3. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Greene, C.R., Jr. and M.W. McLennan. 2001. Acoustic Monitoring of Bowhead Whale Migration, Autumn 2000. *In*: Monitoring of Industrial Sounds, Seals, and Whale Calls During Construction of BP's Northstar Oil Development, Alaskan Beaufort Sea, Summer and Autumn 2000: 90-Day Report, LGL and Greeneridge. LGL Report TA 2431-1. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Greene, J.E. and G.R. Johnson. 1983. The Distribution and Abundance of Ringed Seals in Relation to Gravel Island Construction in the Alaskan Beaufort Sea. *In*: Biological Studies and Monitoring at Seal Island, Beaufort Sea, Alaska, 1982, B.J. Gallaway, ed. Anchorage, AK: Shell Oil Co., 149 pp.

Gregor, D.J. and W.D. Gummer. 1989. Evidence of Atmospheric Transport and Deposition of Organochlorine Pesticides and Polychlorinated Biphenyls in Canadian Arctic Snow. *Environmental Science and Technology* 235:561-565.

Griffiths, W.B. 1999. Zooplankton. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information. Retrospective and 1998 Results, W.J. Richardson and D.H. Thomson, eds. LGL Report TA-2196-2. King City, Ontario, Canada: LGL Ecological Research Associates, Inc., 57 pp.

Griffiths, W.B. and R.E. Dillinger. 1980. Invertebrates. Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators Vol. 8 Biological Studies. Juneau, AK: USDOC, NOAA, OMPA and USDOI, BLM, pp. 1-198.

Griffiths, W.B. and B. Gallaway. 1982. Prudhoe Bay Waterflood Project, Fish Monitoring Program. Prudhoe Bay Waterflood Project Environmental Monitoring Program 1981 (4). Anchorage, AK: Woodward-Clyde Consultants, Inc. and U.S. Army Corps of Engineers, Alaska District.

Griffiths, W.B., W.J. Richardson, and D.H. Thomson. 2001. Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea. *In*: Proceedings of the Eighth MMS Information Transfer Meeting, Anchorage, Apr. 3-5, 2001. Anchorage, AK: USDOI, MMS, Alaska OCS Region, pp. 51-52.

Griffiths, W.B., D.R. Schmidt, R.G. Fechhelm, and B.J. Gallaway. 1983. Fish Ecology. *In*: Environmental Summer Studies (1982) for the Endicott Development, B.J. Gallaway and R. Britch, eds. Vol. III. Anchorage, AK: Sohio Alaska Petroleum Company, 342 pp.

Griffiths, W.B., D.H. Thomson, and M.S.W. Bradstreet. 2002. Zooplankton and Water Masses at Bowhead Whale Feeding Locations in the Eastern Beaufort Sea. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information, W.J. Richardson and D.H. Thomson, ed. LGL Report TA2196-7. King City, Ontario: LGL Limited, environmental research associates, pp. 1-44.

Grotefendt, K., K. Logermann, D. Quadfasel, and S. Ronski. 1998. Is the Arctic Ocean Warming? *Journal of Geophysical Research* 103C12:27,679-27,687.

Hadland, J. 2002. Table received Aug. 9, 2002, from J. Hadland, State of Alaska, Dept. of Labor and Workforce Dev.; subject: State database for Alaska 2000 resident/nonresident workers and wages by reported place of work, oil industry workers, standard industrial code 13, North Slope Borough, 32.2% nonresident workers.

Hadland, J. and G. Landry. 2002. Nonresidents Working in Alaska 2000. www.labor.state.ak.us/research/research.thm and http://146.63.75.50/research/reshire/nonres.pdf. Juneau, AK: State of Alaska, Dept. of Labor and Workforce Dev.

Haggarty, J.C., C.B. Wooley, J.M. Erlandson, and A. Crowell. 1991. The 1990 *Exxon Valdez* Cultural Resource Program: Site Protection and Maritime Cultural Ecology in Prince William Sound and the Gulf of Alaska. Anchorage, AK: Exxon Company, USA.

Haldiman, J.T., Y. Abdelbaki, F.K. Al-Bagdadi, D.W. Duffield, W.G. Henk, and R.W. Henry. 1981. Determination of the Gross and Microscopic Structure of the Lung, Kidney, Brain and Skin of the Bowhead Whale, *Balaena mysticetus*. *In*: Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea, T.F. Albert, ed. Anchorage, AK: USDOI, BLM, Alaska OCS Office, pp. 305-662.

Haldiman, J., W. Henk, R. Henry, T. Albert, Y. Abdelbaki, and D.W. Duffield. 1985. Epidermal and Papillary Dermal Characteristics of the Bowhead Whale (*Balaena mysticetus*). *The Anatomical Record* 211:391-402.

Hall, J.D., M.L. Gallagher, K.D. Brewer, P.R. Regos, and P.E. Isert. 1994. ARCO Alaska, Inc. 1993 Kuvlum Exploration Area Site Specific Monitoring Program Final Report. Anchorage, AK: ARCO Alaska, Inc.

Hamilton, C.I., S.J. Starr, and L.L. Trasky. 1979. Recommendations for Minimizing the Impacts of Hydrocarbon Development on the Fish, Wildlife, and Aquatic Plant Resources of Lower Cook Inlet. Vols. I and II. Anchorage, AK: State of Alaska, Dept. of Fish and Game, Marine and Coastal Habitat Management, 420 pp.

Hammill, M.O. and T.G. Smith. 1991. The Role of Predation in the Ecology of the Ringed Seal in Barrow Strait, Northwest Territories, Canada . *Marine Mammal Science* 7:123-135.

Hanna, B. 2002. Conversation Feb. 19 between Bruce Hanna, Habitat Biologist, Dept. of Fisheries and Oceans Canada, and Kate Wedemeyer, USDOI, MMS, Alaska OCS Region; subject: effects of seismic sound waves on fish.

Hanna, S.R. and P.J. Drivas. 1993. Modeling VOC Emissions and Air Concentrations from the *Exxon Valdez* Oil Spill. *Journal of the Air & Waste Management Association* 43:298-309.

Hansen, D.J. 1985. The Potential Effects of Oil Spills and Other Chemical Pollutants on Marine Mammals Occurring in Alaskan Waters. OCS Report, MMS 85-0031. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 21 pp.

Hansen, D.J. 1992. Potential Effects of Oil Spills on Marine Mammals that Occur in Alaskan Waters. OCS Report, MMS 92-0012. Anchorage, AK: USDOI, MMS Alaska OCS Region, 25 pp.

Hanzlick, D., K. Short, and L. Hachmeister. 1990. Integration of Circulation Data in the Beaufort Sea. Anchorage, AK: USDOI, MMS and USDOC, 87 pp.

Harcharek, R.C. 1992. North Slope Borough 1992 Economic Profile, Vol. VI. Barrow, AK: North Slope Borough, Department of Planning and Community Services.

Harcharek, R.C. 1995. North Slope Borough 1993/94 Economic Profile and Census Report. Vol. VII. Barrow, AK: North Slope Borough, Dept. of Planning and Community Services.

Harding, L.E. 1976. Den-Site Characteristics of Arctic Coastal Grizzly Bears (*Ursus arctos*) on Richards Island, Northwest Territories, Canada. *Canadian Journal Zoology* 54:1357-1363.

Harding L.E. and J.A. Nagy. 1980. Responses of Grizzly Bears to Hydrocarbon Exploration on Richards Island, Northwest Territories, Canada. *In*: Fourth International Conference Bears Resource and Management, pp. 277-280.

Harding Lawson Assocs. 1979. U.S. Geological Survey Geotechnical Investigation, Beaufort Sea, 1979. Anchorage, AK: U.S. Geological Survey.

Harding Lawson Assocs. 1981a. Geophysical and Geotechnical Site Evaluation, Karluk Prospect, Beaufort Sea Alaska in support of Chevron USA's Karluk OCS-Y 0194 Well #1. Anchorage, AK: Chevron USA.

Harding Lawson Assocs. 1981b. Geotechnical Investigation Tract 42 Well Site, Beaufort Sea, Alaska, for Shell Oil Company's Tern Prospect. Anchorage, AK: Shell Oil Co.

Harding Lawson Assocs. 1988. Karluk Prospect, Geophysical and Geological Site Evaluation, Beaufort Sea, Alaska. Anchorage, AK: Chevron USA, Inc.

Harris R.E., G.W. Miller, W.J. Richardson. 2001. Seal Responses to Airgun Sounds during Summer Seismic Surveys in the Alaskan Beaufort Sea. *Marine Mammal Science* 174:795-812.

Harvey, J.T. and M.E. Dahlheim, 1994. Cetaceans in Oil. *In*: Marine Mammals and the *Exxon Valdez,* T.R. Loughlin, ed. San Diego , CA: Academic Press, 257-264 pp.

Haynes, T. and S. Pedersen. 1989. Development and Subsistence: Life after Oil. *Alaska Fish and Game* 216:24-27.

Hazard, K. 1988. Beluga Whale, *Delphinapterus leucas*. *In*: Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations, J.W. Lentfer, ed. Washington, DC: Marine Mammal Commission, 275 pp.

Heard, D.C. and T.M. Williams. 1991. Wolf Den Distribution on Migratory Barren-Ground Caribou Ranges in the Northwest Territories (Abstract). *In*: Proceedings of the Fourth North American Caribou Workshop, C. Butler and S.P. Mahoney, eds. St John's Newfoundland, pp. 249-250.

Hemming and Ott. 1994. Tundra Stream Fish Habitat Investment in North Slope Oil Fields. Technical Report 94. 464 pp.

Hemming, C.R. 1988. Aquatic Habitat Evaluation of Flooded North Slope Gravel Mine Sites (1986-1987). Anchorage, AK: State of Alaska, Dept. of Fish and Game, Div. of Habitat, 40 pp.

Hemming, C.R. 1993. Tundra Stream Fish Habitat Investigations in the North Slope Oilfields. Technical Report No. 93-1. Juneau, AK: State of Alaska, Dept. of Fish and Game, Habitat and Restoration Div, 64 pp.

Hemming, C.R. 1996. Fish Surveys of Selected Coastal Streams Sagavanirktok River to Bullen Point, 1995. Technical Report No. 96-3. Juneau, AK: State of Alaska, Dept. of Fish and Game, Habitat and Restoration Div, 28 pp.

Hemming, C.R., P.K. Weber, and J.F. Winters. 1989. Limnological and Fisheries Investigations of Flooded North Slope Gravel Mine Sites, 1988. Technical Report No. 89-1. Juneau, AK: State of Alaska, Dept. of Fish and Game, Habitat Div., 60 pp.

Hemming, J.E. 1971. The Distribution Movement Patterns of Caribou in Alaska. Technical Bulletin No. 1. Federal Aid in Wildlife Restoration Project W-17-R. Juneau, AK: State of Alaska, Dept. of Fish and Game.

Henk, W.G. and D.L. Mullan. 1997. Common Epidermal Lesions of the Bowhead Whale (*Balaena mysticetus*). *Scanning Microscopy Intl.* 103:905-916.

Henshaw, J. 1968. The Activities of the Wintering Caribou in Northwestern Alaska in Relation to Weather and Snow Conditions. *International Journal of Biometeorology* 12:18-24.

Hill, S.H. 1978. A Guide to the Effects of Underwater Shock Waves on Arctic Marine Mammals and Fish. Pacific Marine Science Report 78-26. Patricia Bay, Sidney, B.C. Canada: Institute of Ocean Sciences.

Hinzman, L.D., D.L. Kane, and K.R. Everett. 1993. Hillslope Hydrology in an Arctic Setting. *In*: Proceedings of the Sixth International Conference on Permafrost, Beijing, China, pp. 267-271.

Hoekstra, K.A. L.A. Dehn, J.C. George, K.R. Solomon, D.C.G. Muir, and T.M. O'Hara. 2002. Trophic Ecology of Bowhead Whales (*Balaena mysticetus*) Compared with that of Other Arctic Marine Biota as Interpreted from Carbon-, Nitrogen-, and Sulphur-Isotope Signatures. *Canadian Journal of Zoology* 802:223-231.

Hoffman, D., D. Libby, and G. Spearman. 1988. Nuiqsut: A Study of Land Use Values through Time. Occasional Paper No. 12. NPR-A Study for the North Slope Borough. Fairbanks, AK: University of Alaska, Fairbanks.

Holst, M., G.W. Miller, V.D. Moulton and R.E. Elliott. 2002. Aerial Monitoring, 2001. *In*: Marine Mammal and Acoustical Monitoring of Anderson Exploration Limited's Open-Water Seismic Program in the Southeastern Beaufort Sea, 2001, LGL and JASCO Research Ltd. LGL Report TA 2618-1. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Hom et al. 1999. Measuring the Exposure of Subsistence Fish and Marine Mammal Species to Aromatic Compounds following the *Exxon Valdez* Oil Spill. *In*: Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context. L.J. Field, T. S. Nighswander, N. Peacock, U. Varanasi, and J.A. Fall, eds. Pensacola, FL: SETAC Press.

Hopkins, D.M, ed. 1967. Quarternary Marine Transgressions in Alaska. *In*: *The Bering Land Bridge*. Stanford, CA: Stanford University Press, pp. 47-90.

Horejsi, B. 1981. Behavioral Response of Barren-Ground Caribou to a Moving Vehicle. *Arctic* 342:180-185.

Houghton, J.P., R.H. Gilmour, D.C. Lees, P.J. Hague, W.B. Driskell, and S.C. Lindstrom. 1996. Evaluation of the Condition of Prince William Sound Shorelines Following the E*xxon Valdez* Oil Spill and Subsequent Shoreline Treatment, G. Shigenaka, ed. Vol. I. 1994 Biological Monitoring Survey. Seattle, WA: USDOC, NOAA, NOS.

Hubbard, R.J., S.P. Edrich, and R.P. Rattey. 1987. Geological Evolution and Hydrocarbon Habitat of the "Arctic Alaska Microplate." *Marine and Petroleum Geology* 4:2-34.

Human Relations Area Files, Inc. 1992. Social Indicators Study of Alaskan Coastal Villages, I. Key Informant Summaries, Vol. 1: Schedule A Regions (North Slope, NANA, Calista, Aleutian-Pribilof), J.G. Jorgensen, Principal Investigator. OCS Study, MMS 92-0031. Technical Report No. 151. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program.

Human Relations Area Files, Inc. 1994. Social Indicators Study of Alaskan Coastal Villages VI. Analysis of the *Exxon Valdez* Spill Area. OCS Study, MMS 94-0064. Technical Report No. 157. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Environmental Studies Program.

Hummer, P.G. 1990. Meteorology. *In*: 1986 Final Report for the Endicott Environmental Monitoring Program, Vol. 2. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District, pp. 1-47 plus appendices.

Hummer, P.G. 1991. Meteorology. *In*: 1987 Final Report for the Endicott Environmental Monitoring Program, Vol. 3. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District, pp. 1-29 plus appendices.

Humphrey, B., P.D. Boehm, M.C. Hamilton, and R.J. Norstrom. 1987. The Fate of Chemically Dispersed and Untreated Crude Oil in Arctic Benthic Biota. *Arctic* 40(Suppl. 1):149-161.

Humphrey, B., D.R. Green, B.R. Fowler, D. Hope, and P.D. Boehm. 1987. The Fate of Oil in the Water Column following Experimental Oil Spills in the Arctic Marine Nearshore. *Arctic* 40(Suppl. 1):124-132.

Impact Assessment, Inc. 1990a. Northern Institutional Profile Analysis: Chukchi Sea. OCS Study, MMS 90-0022. Technical Report No. 141. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, 750 pp.

Impact Assessment, Inc. 1990b. Northern Institutional Profile Analysis: Beaufort Sea. OCS Study, MMS 90-0023. Technical Report No. 42. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, 670 pp.

Impact Assessment, Inc. 1990c. Subsistence Resource Harvest Patterns: Kaktovik. OCS Study, MMS 90-0039. Special Report No. 9. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Alaska Social and Economic Studies Program, 193 pp.

Impact Assessment, Inc. 1998. *Exxon Valdez* Oil Spill, Cleanup, and Litigation: A Collection of Social-Impacts Information and Analysis. Final Report. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Industry Task Group. 1983. Oil Spill Response in the Arctic, Part 2: Field Demonstrations in Broken Ice. Anchorage, AK: Sohio Alaska Petroleum Company; Exxon Company, U.S.A.; and Amoco Production Company, 108 pp.

International Whaling Commission. 1987. Annex G: Report of the Subcommittee on Protected Species and Aboriginal Subsistence Whaling. Reports of the International Whaling Commission No. 37. Cambridge, England: IWC, pp. 113-120.

Jacobs Engineering Group, Inc. 1989. Air Quality Impact of Proposed OCS Lease Sale 95, Final Report. Camarillo, CA: USDOI, MMS, Pacific OCS Region.

Jacobson, M.J. and C. Wentworth. 1982. Kaktovik Subsistence Land Use Values Through Time in the Arctic National Wildlife Refuge Area. Fairbanks, AK: USDOI, Fish and Wildlife Service, Northern Alaska Ecological Services, 142 pp.

Jingfors, K.T. 1982. Seasonal Activity Budgets and Movements of a Reintroduced Alaskan Muskox Herd. *Journal Wildlife Management* 462:344-350.

Johannessen, O.M., E.V. Shalina, and M.W. Miles. 1999. Satellite Evidence for an Arctic Sea Ice Cover in Transformation. *Science* 2865446:312-314.

Johnson, C.B., M.T. Jorgenson, R.M. Burgess, B.E. Lawhead, J.R. Rose, and A.A. Stickney. 1996. Wildlife Studies on the Colville River Delta, 1995. Fourth Annual Report. Anchorage, AK: ARCO Alaska, Inc. and the Kuparuk Unit Owners, 154 pp.

Johnson, D.R. and M.C. Todd. 1977. Summer Use of a Highway Crossing by Mountain Caribou. *The Canadian Field-Naturalist* 91(3):312-314.

Johnson, F.G. 1977. Sublethal Biological Effects of Petroleum Hydrocarbon Exposures: Bacteria, Algae, and Invertebrates. *In*: Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms, D.C. Malins, ed. Vol. II, Biological Effects. New York, NY: Academic Press, Inc., pp. 271-318.

Johnson, S.R. 1979. Fall Observations of Westward Migrating White Whales (*Delphinapterus leucas*) Along the Central Alaskan Beaufort Sea Coast. *Arctic* 323:275-276.

Johnson, S.R. 1984. Continuing Investigations of Oldsquaws (*Clangula hyemalis* L.) during the Molt Period in the Alaskan Beaufort Sea. Environmental Assessment of the Alaskan Continental Shelf 23. Juneau, AK: USDOI, BLM, and USDOC, NOAA, OCSEAP, pp 549-635.

Johnson, S.R. 1994a. The Status of Black Brant in the Sagavanirktok River Delta Area, Alaska: 1991-1993. Northern Alaska Research Studies. Anchorage, AK: BPXA, 19 pp.

Johnson, S.R. 1994b. The Status of Lesser Snow Geese in the Sagavanirktok River Delta Area, Alaska: 1980-1993. Final Report. Northern Alaska Research Studies. Anchorage, AK: BPXA, 43 pp.

Johnson, S.R. 1998. Distribution and Movement of Brood-Rearing Lesser Snow Geese in Relation to Petroleum Development in Arctic Alaska. *Arctic* 54:336-344.

Johnson, S.R. and W.J. Richardson. 1981. Beaufort Sea Barrier Island-Lagoon Ecological Process Studies: Final Report, Simpson Lagoon. OCSEAP Final Report (1980) Vol. 7 (1981). USDOC, NOAA, pp. 109-383.

Johnson, S.R. and W.J. Richardson. 1982. Waterbird Migration near the Yukon and Alaskan Coast of the Beaufort Sea: Moult Migration of Seaducks in Summer. *Arctic* 35(2):291-301.

Johnson, S.R., C.R. Greene, R.A. Davis, and W.J. Richardson. 1986. Bowhead Whales and Underwater Noise near the Sandpiper Island Drillsite, Alaskan Beaufort Sea, Autumn 1985. King City, Ontario: LGL Limited Environmental Research Associates, 130 pp.

Johnson, S.R. and D.R. Herter. 1989. The Birds of the Beaufort Sea. Anchorage, AK: BPXA.

Johnson, S.R. and L.E. Noel. 1996. The Status of Lesser Snow Geese in the Sagavanirktok River Delta Area, Alaska, 1995 Monitoring Program. Anchorage AK: BPXA, 19 pp. + appendices.

Johnson, S.R. and W.J. Gazey. 1992. Design and Testing of a Monitoring Program for Beaufort Sea Waterfowl and Marine Birds. OCS Study, MMS 92-0060. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 114 pp.

Johnson, S.R., D. Wiggins, and R.J. Rodrigues. 1993. Use of Gravel Causeways by Nesting Common Eiders, Beaufort Sea, Alaska, 1992. Final Report. Northern Alaska Research Studies. Anchorage AK: BPXA, 17 pp.

Johnson, W.R. 1989. Current Response to Wind in the Chukchi Sea: A Regional Coastal Upwelling Event. *Journal of Geophysical Research* 94:2057-2064.

Jones, M.L. and S.L. Swartz. 1987. Radio-Telemetric Study and Aerial Census of Gray Whales in the Channel Islands National Marine Sanctuary during the Southward Migration, January 1986. Draft Final Report. Juneau, AK: USDOC, NOAA, NMFS, Northwest and Alaska Fisheries Center.

Jordan, R.E. and J.R. Payne. 1980. *Fate and Weathering of Petroleum Spills in the Marine Environment*. Ann Arbor, MI: Ann Arbor Science.

Jorgenson, M.T. 1997. Effects of Petroleum Spills on Tundra Ecosystems. *In*: Proceedings: Science, Traditional Knowledge, and the Resources of the Northeast Planning Area of the National Petroleum Reserve in Alaska, Anchorage, Ak., Apr. 16-18, 1997. OCS Study, MMS 97-0013. Anchorage, AK: USDOI, MMS and BLM, 99 pp. plus attachments.

Kaleak, J. 1996. History of Subsistence Whaling in Kaktovik. *In*: Proceedings of the 1995 Arctic Synthesis Meeting, Anchorage, Ak., Oct. 23-25, 1995. OCS Study, MMS 95-0065. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Kalxdorff, S.B. 1997. Collection of Local Knowledge Regarding Polar Bear Habitat Use in Alaska. FWS Technical Report MMM 97-2. Anchorage, AK: USDOI, Fish and Wildlife Service, Marine Mammals Management, 55 pp.

Kato H. 1982. Scientific Report No 34. Tokyo, Japan: Whales Research Institute, pp. 123-136.

Kelly, B.P. 1988. Ringed Seal. *In*: Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations, J.W. Lentfer, ed. Washington, DC: Marine Mammal Commission, pp. 57-77.

Kevin Waring Associates. 1989. A Demographic and Employment Analysis of Selected Alaska Rural Communities, Vol. II (Northern Communities). OCS Study, MMS 89-0083. 3 Vols. Technical Report No. 137. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, 133 pp.

Kim, S.L. and J.S. Oliver. 1989. Swarming Benthic Crustaceans in the Bering and Chukchi Seas and their Relation to Geographic Patterns in Gray Whale Feeding. *Canadian Journal of Zoology* 67:1531-1542.

Kineman, J.J., R. Elmgren, and S. Hansson, eds. 1980. The *Tsesis* Oil Spill: Report of the First Year Scientific Study (October 26, 1977 to December 1978). Boulder, CO: USDOC, NOAA, OMPA, 296 pp.

King, RJ. and A.W. Brackney. 1977. Aerial Breeding Pair Surveys of the Arctic Coastal Plain of Alaska 1996. Fairbanks, AK: USDOI, Fish and Wildlife Service, Migratory Bird Management, 12 pp.

Kirstein, B.E. and R.T. Redding. 1987. Ocean-Ice Oil-Weathering Computer User's Manual. OCSEAP Final Reports of Principal Investigators, Vol. 59 (Nov. 1988). OCS Study, MMS 89-003. Anchorage, AK: USDOC, NOAA and USDOI, MMS, pp. 1-145.

Kohut, R.J., J.A. Lawrence, P. King, and R. Raba. 1994. Assessment of the Effects of Air Quality on Arctic Tundra Vegetation at Prudhoe Bay, Alaska, Final Report. Ithaca, NY: Cornell University, Boyce Thompson Institute for Plant Research.

Koski, W.R. 2000. Bowheads: Summary. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information. Results of Studies Conducted in Year 3, W.J. Richardson and D.H. Thomson, eds. LGL Report TA 2196-5. King City, Ontario: LGL Limited, environmental research associates, pp. 1-4.

Koski, W.R. and S.R. Johnson. 1987. Behavioral Studies and Aerial Photogrammetry. *In*: Responses of Bowhead Whales to an Offshore Drilling Operation in the Alaskan Beaufort Sea, Autumn 1986. Anchorage, AK: Shell Western E&P, Inc.

Koski, W.R., T.A. Thomas, G.W. Miller, R.E. Elliott, R.A. Davis, and W.R. Richardson. 2002. Rates of Movement and Residence Times of Bowhead Whales in the Beaufort Sea and Amundsen Gulf during Summer and Autumn. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information, W.J. Richardson and D.H. Thomson, eds. LGL Report TA2196-7. King City, Ontario: LGL Limited, environmental research associates, pp. 1-41.

Kovacs, A., R.M. Morey, D.F. Cundy, and G. Decoff. 1981. Pooling of Oil under Sea Ice. *In*: Proceedings II. The Sixth International Conference, Port and Ocean Engineering under Arctic Conditions, Quebec, Canada, pp. 912-922.

Kovacs K.M., C. Lydersen, and I. Gjertz. 1996. Birth-Site Characteristics and Prenatal Molting in Bearded Seals (*Erignathus barbatus*). *Journal Mammalogy* 774:1085-1091.

Kovalsky, M. 1984. Testimony at the Public Hearing on the Endicott Development Project, Nuiqsut.

Kowalik, Z. and J.B. Matthews. 1982. The M2 Tide in the Beaufort and Chukchi Seas. *Journal of Physical Oceanography* 127:743-746.

Kowalik, Z. and A.Y. Proshutinsky. 1994. Diurnal Tides in the Arctic Ocean. *In*: *The Polar Oceans and Their Role in Shaping the Global Environment*, O.M. Johannessen, R. D. Muench, and J.E. Overland, eds. Washington, DC: American Geophysical Union, pp. 137-159.

Krembs, C., J. Deming, and H. Eicken. 2002. Can Microorganisms, Especially *Melosira arctica*, Significantly Alter the Physical Properties of Sea Ice and to What Biological Advantage. Abstract. *In*: Program for the 53rd Arctic Science Conference, University of Alaska, Fairbanks, Sept. 18-21, 2001. Fairbanks, AK: UAF, American Assoc. for the Advancement of Science, Arctic Div.

Kruse, J. 1982. Subsistence and the North Slope Inupiat: The Effects of Energy Development. Monograph No. 4. Anchorage, AK: University of Alaska, Institute of Social and Economic Research.

Kruse, J.A., M. Baring-Gould, W. Schneider, J. Gross, G. Knapp, and G. Sherrod. 1983. A Description of the Socioeconomics of the North Slope Borough. Technical Report No. 85. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, 292 pp.

Kuropat, P. and J. Bryant. 1980. Foraging Behavior of Cow Caribou on the Utukok Calving Grounds in Northwestern Alaska. *In*: Proceedings of the Second Reindeer/Caribou Symposium, E. Reimers, E. Gaare, and S. Skjennsberg, eds. Roros, Norway, Sept. 17-21, 1979. Trondheim, Norway: Direktorater for vilt og ferskvannsfisk.

LaBelle, J.C., J.L. Wise, R.P. Voelker, R.H. Schulze, and G.M. Wohl. 1983. Alaska Marine Ice Atlas. Anchorage, AK: University of Alaska, AEIDC, 302 pp.

LaBelle, R.P. and C.M. Marshall. 1995. Application of Oil Spill Simulations to Tanker Routing off the U.S. Coast. *In*: Proceedings of the 1995 International Oil Spill Conference, Long Beach, Calif., Feb. 27, 1995. Baltimore, MD: Port City Press, Inc., pp. 265-273.

LaBelle, R.P., C.M. Marshall, C.M. Anderson, W. Johnson, and E. Lear. 1996. Oil Spill Risk Analysis for Alaska North Slope Oil Exports (Domestic Movement). Herndon, VA: USDOI, MMS, Branch of Environmental Operations and Analysis, 9 pp plus tables.

Lampe, L. 1999. Liberty Project Information Update Meetings, Nov. 1-6, 1999, Barrow, Nuiqsut, and Kaktovik. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Lanctot, R.B., J. Reed, D. Lacroix, P. Flint, M.D. Howell, J.C. Franson, T. Hollmen, and J.B. Grand. 2001. Monitoring Beaufort Sea Waterfowl and Marine Birds. 2001 Annual Progress Report. Anchorage, AK: USDOI, Fish and Wildlife Service, 70 pp.

Langdon, S. 1996. An Overview of North Slope Society: Past and Future. *In*: Proceedings of the 1995 Synthesis Meeting, Anchorage, Ak., Oct. 23-25, 1995. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Lantis, M. 1959. Alaskan Eskimo Cultural Values. *Polar Notes* 1:35-48.

Lantis, M. 1973. The Current Nativistic Movement in Alaska. *In*: Circumpolar Problems: Habitat, Economy, and Social Relationships in the Arctic, G. Berg, ed. Elsmford, NY: Pergamon Press.

Larned, W.W. and G.R. Balogh. 1997. Eider Breeding Population Survey Arctic Coastal Plain, Alaska 1992-96. Final Report. Anchorage AK: USDOI, Fish and Wildlife Service, 51 pp.

Larned, W.W., R. Platte, and R. Stehn. 2001. Eider Breeding Population Survey Arctic Coastal Plain, Alaska 1999-2000. Annual Report. Anchorage, AK: USDOI, Fish and Wildlife Service, 20 pp. + 38 figures.

Larned, W.W., R. Stehn, J. Fischer, and R. Platte. 2001. Eider Breeding Population Survey Arctic Coastal Plain, Alaska 2001. Anchorage, AK: USDOI, Fish and Wildlife Service, 48 pp.

Larned, W.W., T. Tiplady, R. Platte, and R. Stehn. 1999. Eider Breeding Population Survey, Arctic Coastal Plain, Alaska, 1997-98. Final Report. Anchorage, AK: USDOI, Fish and Wildlife Service, 22 pp.

Lavrakas, D. 1996. Meeting Yields Northstar Questions. *Arctic Sounder*, 1, 5. Aug. 1, 1996.

Lawhead B.E. 1997. Caribou and Oil Development in Northern Alaska: Lessons from the Central Arctic Herd. *In*: NPR-A Symposium Proceedings, Science, Traditional Knowledge, and the Resources of the Northeast Planning Area of the National Petroleum Reserve-Alaska, D. Yokel, comp. Anchorage, Ak., Apr. 16-17, 1997. OCS Study, MMS 97-0013. Anchorage, AK: USDOI, BLM and MMS, pp. 7-5 to 7-7.

Lawhead, B.E. and D.A. Flint. 1993. Caribou Movements in the Vicinity of the Planned Drill Site 3-T Facilities, Kuparuk Oilfield, Alaska, 1991-1992. Progress Report. Anchorage, AK: ARCO Alaska, Inc. and the Kuparuk River Unit, 62 pp.

Lawhead, B.E., C.B. Johnson, A.M. Wildman, and J.R. Rose. 1997. Caribou Distribution, Abundance and Calf Production in the Kuparuk Oilfield during the 1996 Calving Season. Final report. Fairbanks, AK: ABR, Inc, 17 pp.

Lawhead B.E. and A.K. Prichard. 2001. Surveys of Caribou and Muskoxen in the Kuparuk-Colville Region, Alaska 2000. Anchorage, AK: Phillips Alaska, Inc, 39 pp.

Laws, E.A. 1987. Water Pollution and Toxicology. *In*: *Encyclopedia of Physical Science and Technology*, R.A. Meyers, ed. Orlando, FL: TRW, Inc., 523-556.

Lee, S.H. and D.M. Schell. 2002. Regional and Seasonal Feeding by Bowhead Whales as Indicated by Stable Isotope Ratios. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information, W.J. Richardson and D.H. Thomson, eds. LGL Report TA2196-7. King City, Ontario: LGL Limited, environmental research associates, pp. 1-28.

Lent P.C. 1970. Muskox Maternal Behavior: a Preliminary Description. *American Zoologist* 104:35.

Lent, P.C. 1980. Synoptic Snowmelt Patterns in Arctic Alaska in Relation to Caribou Habitat Use. *In*: Proceedings of the Second International Reindeer/Caribou Symposium, E. Reimers, E. Gaare, and S. Skennsberg, eds. Roros, Norway, Sept. 17-21, 1979. Trondheim, Norway: Direktoratet for vilt og ferskvannsfisk.

Lewbel, G.S., ed. 1983. Bering Sea Biology: An Evaluation of the Environmental Data Base Related to Bering Sea Oil and Gas Exploration and Development. Anchorage, AK: Sohio Alaska Petroleum Company, Environmental Affairs Dept., 180 pp.

Lewbel, G.S. and B.J. Gallaway. 1984. Transport and Fate of Spilled Oil. *In*: Proceedings of a Synthesis Meeting: The Barrow Arch Environment and Possible Consequences of Planned Offshore Oil and Gas Development (Sale 85), J.C. Truett, ed. Girdwood, Ak., Oct. 30-Nov. 1, 1983. Anchorage, AK: USDOC, NOAA, OCSEAP and USDOI, MMS, pp. 7-29.

LGL Alaska Research Assocs Inc., Woodward-Clyde Consultants, and Applied Sociocultural Research. 1998. Liberty Development Project-Project Description and Environmental Report. Anchorage, AK: BPXA, 150 pp.

LGL Ecological Research Assocs, Inc. 1993. Guidelines for Oil and Gas Operations in Polar Bear Habitats, J.C. Truett, ed. OCS Study, MMS 93-0008. Washington DC: USDOI, MMS, 104 pp.

LGL Ecological Research Assocs, Inc. 1998. LGL Liberty Development Project Boulder Patch Winter ROV Survey. *In*: Liberty Development Project Boulder Patch Survey. Anchorage, AK: BPXA, 8 videotapes.

LGL Ltd., Environmental Research Assocs. 2001. Request by WesternGeco, LLC, for an Incidental Harassment Authorization to Allow the Incidental Take of Whales and Seals During an Open-Water Seismic Program in the Alaskan Beaufort Sea, Summer-Autumn 2001. King City, Ontario, Canada: LGL.

LGL Ltd. Environmental Research Assocs. 2002. Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information. OCS Study, MMS 2002-012. Herndon, VA: USDOI, MMS.

Link M.R., T.L. Olson, and M.T. Williams. 1999. Ringed Seal Distribution and Abundance Near Potential Oil Development Sites in the Central Alaskan Beaufort Sea, Spring 1998. LGL Report P-430. Anchorage, AK: BPXA, 48 pp.

Ljungblad, D.K., S.E. Moore, J.T. Clarke, D.R. Van Schoik, and J.C. Bennett. 1985. Aerial Surveys of Endangered Whales in the Northern Bering, Eastern Chukchi, and Alaska Beaufort Seas, 1984: With a Six Year Review, 1979-1984. OCS Study, MMS 85-0018. NOSC Technical Report 1046. Anchorage, AK: USDOI, MMS, 312 pp.

Ljungblad, D.K., S.E. Moore, J.T. Clarke, and J.C. Bennett. 1986. Aerial Surveys of Endangered Whales in the Northern Bering, Eastern Chukchi, and Alaskan Beaufort Seas, 1985: With a Seven Year Review, 1979-85. OCS Study, MMS 86-0002. NOSC Technical Report 1111. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 142 pp.

Ljungblad, D.K., S.E. Moore, J.T. Clarke, and J.C. Bennett. 1987. Distribution, Abundance, Behavior, and Bioacoustics of Endangered Whales in the Western Beaufort and Northeastern Chukchi Seas, 1979-86. OCS Study, MMS 87-0039. NOSC Technical Report 1177. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 187 pp.

Ljungblad, D.K., S.E. Moore, J.T. Clarke, and J.C. Bennett. 1988. Distribution, Abundance, Behavior, and Bioacoustics of Endangered Whales in the Western Beaufort and Northeastern Chukchi Seas, 1979-87. OCS Study, MMS 87-0122. NOSC Technical Report 1232. Anchorage, AK: USDOI, MMS, 213 pp.

Long, E.R. and L.G. Morgan. 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. Seattle, WA: USDOC, NOAA, 175 pp.

Long, F., Jr. 1996. History of Subsistence Whaling in Nuiqsut. *In*: Proceedings of the 1995 Arctic Synthesis Meeting, Anchorage, Ak., Oct. 23-25, 1995. OCS Study, MMS 95-0065. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Loughlin, T.R. 1994. *Marine Mammals and the Exxon Valdez*. San Diego, CA: Academic Press, Inc.

Lowenstein, T. 1981. Some Aspects of Sea Ice Subsistence Hunting in Point Hope, Alaska. Barrow, AK: North Slope Borough, Coastal Zone Management Plan, 83 pp.

Lowry, L.F. 1993. Foods and Feeding Ecology. *In*: *The Bowhead Whale Book*, J.J. Burns, J.J. Montague, and C.J. Cowles, eds. Special Publication of The Society for Marine Mammalogy, 2. Lawrence, KS: The Society for Marine Mammalogy, 201-238 pp.

Lowry. L.F. and F.H. Fay. 1984. Seal Eating by Walruses in the Bering and Chukchi Seas. *Polar Record* 3:11-18.

Lowry, L.F. and G. Sheffield. 2002. Stomach Contents of Bowhead Whales Harvested in the Alaskan Beaufort Sea. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information, W.J. Richardson and D.H. Thomson, eds. LGL Report TA2196-7. King City, Ontario: LGL Limited, environmental research associates, pp. 1-28.

Lowry. L.F., V.N. Burkanov, K.J. Frost, M.A. Simpkins, R. Davis, D.P. DeMaster, R. Suydam, and A. Springer. 2000. Habitat Use and Habitat Selection by Spotted Seals (*Phoca largha*) in the Bering Sea. *Canadian Journal of Zoology* 78:1959-1971.

Luton, H.H. 1985. Effects of Renewable Resource Harvest Disruptions on Socioeconomic and Sociocultural Systems: Wainwright, Alaska. Technical Report No. 91. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, 603 pp.

Lynch, S., M. Roghstein, L. Cassanto M. Koslow, and J.A. Maslanki. 2001. Climate Change in Barrow: Average Conditions and Big Storms. *In*: Seminar presented in Barrow, Alaska, Aug. 21, 2001. Boulder, CO: University of Colorado, 1 p. http/www.colorado.edu/Research/HARC/index.html.

Malins, D.C., ed. 1977. *Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms*. New York: Academic Press, Inc.

Mallek, E.J. 2001. Aerial Breeding Pair Surveys of the Arctic Coastal Plain of Alaska-2000. Fairbanks, AK: USDOI, Fish and Wildlife Service, 15 pp.

Mallek, E.J. and R.J. King. 2000. Aerial Breeding Pair Surveys of the Arctic Coastal Plain of Alaska – 1999. Final Report. Fairbanks, AK: USDOI, Fish and Wildlife Service, 17 pp.

Mallek, E.J., R. Platte, and R. Stehn. 2002. Aerial Breeding P air Surveys of the Arctic Coastal Plain of Alaska. Fairbanks, AK: USDOI, Fish and Wildlife Service, 25 pp plus 17 maps.

Martin, G.K. and C.J. Jonkel. 1983. Use of Sea Ice by Polar Bears. *In*: International Conference on Bear Research and Management, E.C. Meslow, ed. International Association for Bear Research and Management, pp. 255-259.

Martin, L.R. and B.J. Gallaway. 1994. The Effects of the Endicott Development Project on the Boulder Patch, an Arctic Kelp Community in Stefansson Sound, Alaska. *Arctic* 471:54-64.

Martin, S. 1979. A Field Study of Brine Drainage and Oil Entrainment in First-Year Sea Ice. *Journal of Glaciology* 22:473-502.

Martin, S. 1981. Anticipated Oil-Ice Interactions in the Bering Sea. *In*: The Eastern Bering Sea Shelf, Oceanography and Resources, D.W. Hood and J.A. Calder, eds. Juneau, AK: USDOC, NOAA, OMPA.

Martin, S., P. Kauffman, and P.E. Welander. 1978. A Laboratory Study of the Dispersion of Crude Oil within Sea Ice Grown in a Wave Field. *In*: Proceedings of the 27th Alaska Science Conference, pp. 261-287.

Marty, G.D., M.S. Okihiro, E.D. Brown, D. Hanes, and D.E. Hinton. 1999. Histopathology of Adult Pacific Herring in Prince William Sound, Alaska, After the *Exxon Valdez* Oil Spill. *Can. J. Fish. Aquat. Sci*. 56:419-426.

Maslanki, J.A., M.C. Serreze, and R.G. Barry. 1996. Recent Decreases in Arctic Summer Ice Cover and Linkages to Atmospheric Circulation Anomalies. *Geophysical Research Letters* 2313:1677-1680.

Mate, B.R., G.K. Krutzikowsky, and M.H. Winsor. 2000. Satellite-Monitored Movements of Radio-Tagged Bowhead Whales in the Beaufort and Chukchi Seas during the Late-Summer Feeding Season and Fall Migration. *Canadian Journal of Zoology* 78:1168-1181.

Matthews, J.B. 1980. Characterization of the Nearshore Hydrodynamics of an Arctic Barrier Island-Lagoon System. Environmental Assessment of the Alaskan Continental Shelf Annual Reports of Principal Investigators for the Year Ending March 1980 Vol. VI Transport. Boulder, CO: USDOC, NOAA and USDOI, BLM, pp. 577-601.

McCarthy, T.M. and R.J. Seavoy. 1994. Reducing Nonsport Losses Attributable to Food Conditioning: Human and Bear Modification in an Urban Environment. *In*: Ninth International Conference on Bear Research and Management Bears-Their Biology and Management, J.J. Claar and P. Schullery, eds. Missoula, Mont., Feb. 1992. Vancouver, BC, Canada: International Association for Bear Research and Management, 500 pp.

McCarty, S. 1981. Survey of Effects of Outer Continental Shelf Platforms on Cetacean Behavior. *In*: Effects of Noise of Offshore Oil and Gas Operations on Marine Mammals, an Introductory Assessment, R.S. Gales, ed. NOSC Technical Report 844-1982.

McCold, L.N. and J.W. Saulsbury. 1996. Including Past and Present Impacts in Cumulative Impact Assessments. *Environmental Management* 205:767-776.

McCrea, M. 1983. Federal and State Coastal Management Programs. Reference Paper 83-1. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 24 pp. and appendices.

McDowell Group, Inc. 1999. Economic and Social Effects of the Oil Industry in Alaska 1975 to 1995. OCS Study, MMS 99-0014. Technical Report 162. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

McGrattan, K.B., W.D. Walton, A.D. Putorti, W.H. Twilley, J. McElroy, and D.D. Evans. 1995. Smoke Plume Trajectory from In Situ Burning of Crude Oil in Alaska - Field Experiments. *In*: Proceedings of the Eighteenth Arctic and Marine Oilspill Program Technical Seminar, Edmonton, Alberta, Canada, Jun. 14-16, 1995. Gaithersburg, MD: National Institute of Standards and Technology, pp. 901-913.

McKendrick, J. and W. Mitchell. 1978. Fertilizing and Seeding Oil-Damaged Arctic Tundra to Effect Vegetation Recovery, Prudhoe Bay, Alaska. *Arctic* 313:296-304.

McLaughlin, F.A., E.C. Carmack, R.W. MacDonald, and J.K.B. Bishop. 1996. Physical and Geotechnical Properties across the Atlantic/Pacific Water Mass Boundary in the Southern Canadian Basin. *Journal of Geophysical Research* 101:1183-1197.

McLellan, B.N. 1990. Relationships between Human Industrial Activity and Grizzly Bears. *In*: Eighth International Conference on Bear Research and Management. Bears-Their Biology and Mangement, L.M. Darling and W.R. Archibald, eds. Victoria, B.C., Feb. 1989. Vancouver, BC, Canada: International Association for Bear Research and Management, pp. 57-6

McLellan, B.N. and D.M. Shackleton. 1989. Immediate Reactions of Grizzly Bears to Human Activities. *Wildlife Society Bulletin* 17:269-274.

McLoughlin P.D., H.D. Cluff, and F. Messsier. 2002. Denning Ecology of Barren-Ground Grizzly Bears in the Central Arctic. Journal *Mammalogy* 831:188-198.

McMullen, E. 1993. Testimony dated March 24, 1993, of Elenore McMullen, Chief, Native Village of Port Graham, Alaska, before the U.S. House of Representatives' Committee on Merchant Marine and Fisheries. Washington, DC: U.S. Government Printing Office.

McRoy, C.P. and S.L. Williams. 1977. Sublethal Effects on Seagrass Photosynthesis. Environmental Assessment of the Alaskan Continental Shelf, Annual Reports Vol. 12. Boulder, CO: USDOC, NOAA OCSEAP, 636-673.

Meyer, R.M. 1990. Assessing the Risk to Pacific Herring from Offshore Gas and Oil Development in the Southeastern Bering Sea. *In*: Proceedings of the International Herring Symposium, Anchorage, Ak., Oct. 1990.

Milan, F.A. 1964. The Acculturation of the Contemporary Eskimo of Wainwright, Alaska. *Anthropological Papers of the University of Alaska* 112.

Miles, P.R., C.I. Malme, and W.J. Richardson. 1987. Prediction of Drilling Site-Specific Interaction of Industrial Acoustic Stimuli and Endangered Whales in the Alaskan Beaufort Sea. OCS Study, MMS 87-0084. BBN Report No. 6509. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 341 pp.

Miller, D.R. 1974. Seasonal Changes in the Feeding Behavior of the Barren-Ground Caribou on the Taiga Winter Range. *In*: The Behavior of Ungulates and Its Relationship to Management, V. Geist and F. Walters, eds. Alberta, Canada, 1971. IUCN Pub. New Series No. 24. Calgary, Alberta, Canada: University of Calgary.

Miller, F.L. and A. Gunn. 1979. Responses of Peary Caribou and Muskoxen to Turbo-Helicopter Harassment, Prince of Wales Island, Northwest Territories, 1976-1977. Occasional Paper No 40. Edmonton, Alberta, Canada: Canadian Wildlife Service, 90 pp.

Miller, F.L., A. Gunn, and E. Broughton. 1985. Surplus Killing as Exemplified by Wolf Predation on Newborn Caribou. *Canadian Journal Zoology* 632:295-300.

Miller, G.W. 2002. Seismic Program Described, 2001. *In*: Marine Mammal and Acoustical Monitoring of Anderson Exploration Limited's Open-Water Seismic Program in the Southeastern Beaufort Sea, 2001, LGL and JASCO Research Ltd. LGL Report TA 2618-1. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Miller, G.W. and R.A. Davis. 2002. Marine Mammal and Acoustical Monitoring of Anderson Exploration Limited's Open-Water Seismic Program in the Southeastern Beaufort Sea, 2001. LGL Report TA 2618-1. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Miller, G. W., Elliott, R. E., and Richardson, W. J. 1996. Marine Mammal Distribution, Numbers and Movements. *In*: Northstar Marine Mammal Monitoring Program, 1995: Baseline Surveys and Retrospective Analyses of Marine Mammal and Ambient Noise Data from the Central Alaskan Beaufort Sea . LGL Report TA 2101- 2. King City, Ontario, Canada: LGL Ecological Research Associates, Inc., pp 3-72.

Miller, G.W., R.E. Elliott, W.R. Koski, and W.J. Richardson. 1997. Whales. *In*: Northstar Marine Mammal Monitoring Program, 1996: Marine Mammal and Acoustical Monitoring of a Seismic Program in the Alaskan Beaufort Sea. LGL Report TA 2121-2. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Miller, G.W., R.E. Elliott, and W.J. Richardson. 1998. Whales. *In*: Marine Mammal and Acoustical Monitoring of BP Exploration (Alaska)'s Open-Water Seismic Program in the Alaskan Beaufort Sea, 1997. LGL Report TA 2150-3. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Miller, G.W., R.E. Elliott, W.R. Koski, V.D. Moulton, and W.J. Richardson. 1999. Whales. *In*: Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1998. LGL Report TA 2230-3. King City, Ontario, Canada: LGL Ecological Research Associates, Inc., 109 pp.

Miller, G.W., R.A. Davis, V.D. Moulton, A. Serrano, and M. Holst. 2002. Integration of Monitoring Results, 2001. *In*: Marine Mammal and Acoustical Monitoring of Anderson Exploration Limited's Open-Water Seismic Program in the Southeastern Beaufort Sea, 2001. LGL Report TA 2618-1. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Miller R.V., J.H. Johnson, and N.V. Doroshenko. 1985. Gray Whales (*Eschrichtius robustus*) in the Western Chukchi and Eastern Siberian Seas. *Arctic* 381:58-60.

Miller S.D. and M.A. Chihuly. 1987. Characteristics of Nonsport Brown Bear Deaths in Alaska. *In*: Seventh International Conference on Bear Research and Management-Bears- their Biology and Management, P. Zager, J. Beecham, G. Matula, and H. Reynolds III, eds. Williamsburg, Va., Feb.-Mar. 1986. Washington, DC: Port City Press, Inc, pp. 51-58.

Mobley, C.M., J.C. Haggarty, C.J. Utermohle, M. Eldridge, R.E. Reanier, A. Crowell, B.A. Ream, D.R. Yeaner, J.M. Erlandson, P.E. Buck, W.B. Workman, and K.W. Workman. 1990. The 1989 *Exxon Valdez* Cultural Resource Program. Anchorage, AK: Exxon Shipping Company and Exxon Company, USA, 300 pp.

Montgomery Watson. 1997. Liberty Island Route Water/Sediment Sampling. Anchorage, AK: BPXA.

Montgomery Watson. 1998. Liberty Island Route, Water/Sediment Sampling, March 18-19, 1998. Anchorage, AK: BPXA.

Moore, S.E. 1992. Summer Records of Bowhead Whales in the Northeastern Chukchi Sea. *Arctic* 454:398-400.

Moore, S.E. 2000. Variability of Cetacean Distribution and Habitat Selection in the Alaskan Arctic, Autumn 1982-91. *Arctic* 534:448-460.

Moore, S.E. and J.T. Clark. 1992. Patterns of Bowhead Whale Distribution and Abundance near Barrow, Alaska, in Fall 1982-1989. *Marine Mammal Science* 8(1)27-36.

Moore, S.E. and R.R. Reeves. 1993. Distribution and Movement. *In*: *The Bowhead Whale Book*, J.J. Burns, J.J. Montague, and C.J. Cowles, eds. Special Publication of The Society for Marine Mammalogy, 2. Lawrence, KS: The Society for Marine Mammalogy, 313-386 pp.

Moore S.E. and D.P. DeMaster. 1998. Cetacean Habitats in the Alaskan Arctic. *Journal of Northwest Atlantic Fishery Science* 22:55-69. Reprint from the journal on NAFO/ICES Symposium titled The Role of Marine Mammals in the Ecosystem.

Moore, S.E., D.P. DeMaster, and P.K. Dayton. 2000. Cetacean Habitat Selection in the Alaskan Arctic during Summer and Autumn. *Arctic* 534:432-447.

Moore, S.E., J.C. George, K.O. Coyle, and T.J. Weingartner. 1995. Bowhead Whales along the Chukotka Coast in Autumn. *Arctic* 482:155-160.

Morehead, M.D., R.K. Dewey, M.S. Horgan, J.T. Gunn, G.D. Pollard, and C.B. Wilson. 1992. Oceanography, Part 1, Main Report. *In*: 1989 Endicott Environmental Monitoring Program Final Report. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District, pp. 1-1 to 8-3.

Morrison, J., M. Steele, and R. Andersen. 1998. Hydrography of the Upper Arctic Ocean Measured from the Nuclear Submarine *USS Pargo*. *Deep-Sea Research* I 451:15-38.

Morrow, J.E. 1980. *The Freshwater Fishes of Alaska*. Anchorage, AK: Alaska Northwest Publishing Co, 248 pp.

Moulton, L.L. 1994. Colville Delta Winter Fish Habitat Study 1991- 1993. Final Report. Anchorage, AK: ARCO Alaska Inc., 40 pp.

Moulton, L.L. 1995. The 1994 Endicott Development Fish Monitoring Program. Vol. II: The 1994 Colville River Fishery. Unpublished report. Anchorage, AK: BPXA, 60 pp plus appendices.

Moulton, L.L. 1996. The 1995 Endicott Development Fish Monitoring Program. Vol. II: The 1994 Colville River Fishery. Unpublished report. Anchorage, AK: BPXA, 60 pp. plus appendices.

Moulton, L.L. 1997. The 1996 Colville River Fishery. *In*: The 1997 Endicott Development Fish Monitoring Program, Vol. II. Anchorage, AK: BPXA.

Moulton, L.L. 1999. Alpine Development Project Fish Survey - 1999. Anchorage, AK: ARCO Alaska, Inc., 14 pp.

Moulton, L.L. and L.J. Field. 1988. Assessment of the Colville River Fall Fishery, 1985-1987. Anchorage, AK: ARCO Alaska, Inc., 41 pp.

Moulton, L.L. and L.J. Field. 1991. The 1989 Colville River Fishery. Vol. III: The 1989 Endicott Development Fish Monitoring Program. Unpublished report. Anchorage, AK: BPXA, 320 pp. plus appendices.

Moulton, L.L. and L.J. Field. 1994. The 1992 Colville River Fishery. Vol. II: The 1992 Endicott Development Monitoring Program. Unpublished report. Anchorage, AK: BPXA and North Slope Borough.

Moulton, L.L., M.H. Fawcett, and T.A. Carpenter. 1985. Fish. *In*: Lisburne Development Environmental Studies: 1984. Final Report. Anchorage, AK: ARCO Alaska, Inc.

Moulton, L.L., L.J. Field, and S. Brotherton. 1986. Assessment of the Colville River Fishery in 1985, Chapter 3. *In*: Colville River Fish Study Annual Report, 1985, J.M. Colonell and L.L. Moulton, eds. Anchorage and Barrow, AK: ARCO Alaska, Inc., North Slope Borough, and City of Nuiqsut.

Moulton, V.D., G.W. Miller, and A. Serrano. 2002. Vessel-Based Monitoring, 2001. *In*: Marine Mammal and Acoustical Monitoring of Anderson Exploration Limited's Open-Water Seismic Program in the Southeastern Beaufort Sea, 2001. LGL Report TA 2618-1. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Mountain, D.G. 1974. Bering Sea Water on the North Alaskan Shelf. Ph. D. Thesis. Seattle, WA: University of Washington.

Murphy, G.M. and J.A. Curatolo. 1984. Responses of Caribou to Ramps and Pipelines in the West End of the Kuparuk Oilfield, Alaska, 1983. Final Report. Anchorage, AK: ARCO Alaska, Inc.

Murphy, S.M. and B.A. Anderson. 1993. Lisburne Terrestrial Monitoring Program. The Effects of the Lisburne Development Project on Geese and Swans, 1985-1989. Final Synthesis Report. Fairbanks, AK: ARCO Alaska, Inc., 255 pp.

Nageak, B.P. 1998. Letter dated Mar. 12, 1998, from B.P. Nageak, Mayor, North Slope Borough, to B. Babbitt, Secretary of the Interior; subject: comments on the NPR-A IAP/EIS.

Naidu, A.S., J.J. Kelley, J.J. Goering, and M.I. Venkatesan. 2001. Historical Changes in Trace Metals and Hydrocarbons in the Inner Shelf Sediments, Beaufort Sea: Prior and Subsequent to Petroleum-Related Industrial Developments. OCS Study, MMS 2001-061. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

National Energy Board. 1998. Probabilistic Estimates of Hydrocarbon Volumes in the MacKenzie Delta and Beaufort Sea Discoveries. Calgary, Alberta, Canada: National Energy Board.

National Marine Fisheries Service. 1991. Endangered Whales: Status Update. Silver Spring, MD: USDOC, NOAA, NMFS, 51 pp.

National Marine Fisheries Service. 1993. Public Testimony of Burton Rexford, Chairman, Alaska Eskimo Whaling Commission, concerning a Letter of Authorization for bowhead whale monitoring at the Kuvlum Prospect. Anchorage, AK: USDOC, NOAA, NMFS.

National Marine Fisheries Service. 1999. Endangered Species Act Section 7 Consultation (Biological Opinion) for the Proposed Construction and Operation of the Northstar Oil and Gas Project in the Alaskan Beaufort Sea. Anchorage, AK: USDOC, NMFS, 75 pp.

National Marine Fisheries Service. 2001. Endangered Species Act Section 7 Consultation (Biological Opinion) for the Arctic Region for Federal Oil and Gas Leasing and Exploration in the Alaskan Beaufort Sea. Anchorage, AK: USDOC, NMFS.

National Marine Fisheries Service. 2002. 50 CFR 600 Magnuson-Stevens Act Provisions; Essential Fish Habitat. *Federal Register* Vol. 67 12 Jan. 17,2002/Rules and Regulations. Washington, DC: National Archives, pp. 2343-2383.

National Research Council. 1985. *Oil in the Sea: Inputs, Fates, and Effects*. Washington, DC: National Academy Press, 601 pp.

National Research Council. 1994. *Environmental Information for Outer Continental Shelf Oil and Gas Decisions in Alaska*. Washington, DC: National Academy of Science, 180 pp.

National Research Council (U.S.A.). 1983. *Drilling Discharges in the Marine Environment. Panel on Assessment of Fates and Effects of Drilling Fluids and Cuttings in the Marine Environment, September 26, 1983*. Washington, DC: National Academy Press, 180 pp.

Neff, J.M. 1990. Effects of Oil on Marine Mammal Populations: Model Simulations Cetaceans. *In*: Sea Mammals and Oil: Confronting the Risks, J.R. Geraci and D.J. St. Aubin, eds. San Diego, CA: Academic Press, Inc., and Harcourt Brace Jovanovich, pp. 35-54.

Neff, J.M. 1991. Long-Term Trends in the Concentrations of Polycyclic Aromatic Hydrocarbons in the Water Column of Prince William Sound and the Western Gulf of Alaska Following the *Exxon Valdez* Oil Spill. *In*: Fourteenth Annual Arctic and Marine Oilspill Program Technical Seminar. Vancouver, BC, Canada, Jun. 12-14, 1991. Ottawa, Canada: Environment Canada, pp. 27-38.

Nellemann C. and R.D. Cameron. 1996. Effects of Petroleum Development on Terrain Preferences of Calving Caribou. *Arctic* 491:23-28.

Nellemann C. and R.D. Cameron. 1998. Cumulative Impacts of an Evolving Oil-Field Complex on the Distribution of Calving Caribou. *Canadian Journal of Zoology* 76:1425-1430.

Nelson, R.K. 1969. *Hunters of the Northern Ice*. Chicago and London: University of Chicago Press.

Netsch, F.N., E. Crateau, G. Love, and N. Swanton. 1977. Prelininary Report- Freshwater Fisheries Reconnaissance of the Coastal Plain of National Petroleum Reserve-Alaska. Vol. 1. Anchorage, AK: USDOI, Fish and Wildlife Service, Various paging.

Niedoroda, A.W. and J.M. Colonell. 1991. Regional Sediment Transport in the Coastal Boundary Layer of the Central Alaskan Beaufort Sea. *In*: Coastal Sediments, Seattle, Wash., Jun. 25-27, 1991. New York, NY: American Society of Civil Engineers, pp. 1488-1502.

Nighswander, T.S. and N. Peacock. 1999. The Communication of Health Risk from Subsistence Food in a Cross Cultural Setting: Lessons Learned from the Exxon Valdez Oil Spill. *In*: Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context. L.J. Field, J.A. Fall, T.S. Nighswander, N. Peacock, and U. Varanasi, eds. Pensacola, FL: SETAC Press, 338 pp.

Noel, L.E. and S.R. Johnson. 1996. The Status of Snow Geese in the Sagavanirktok Riv er Delta Area, Alaska: 1996 Monitoring Program. Northern Alaska Research Studies. Anchorage, AK: BPXA.

Noel, L.E., S.R. Johnson, and P.F. Wainwright. 2000. Aerial Surveys of Molting Waterfowl in the Barrier Island-Lagoon Systems between Spy Island and Brownlow Point, Alaska, 1999. Final Report. Anchorage, AK: BPXA, 64 pp + appendices.

Noel, L.F., R.H. Pollard, W.B. Ballard, and M.A. Cronin. 1998. Activity and Use of Active Gravel Pads and Tundra by Caribou, *Rangifer tarandus granti*, Within the Prudhoe Bay Oil Field, Alaska. *The Canadian Field -Naturalist* 112:400-408.

North Pacific Fisheries Management Council. 1997. Preliminary Essential Fish Habitat Assessment Report for Salmon Fisheries in the EEZ off the Coast of Alaska. Anchorage, AK: North Pacific Fisheries Management Council, 71 pp.

North Pacific Fisheries Management Council. 1999. Environmental Assessment for Essential Fish Habitat. Anchorage, AK: North Pacific Fisheries Management Council, 364 pp.

North Slope Borough. 1995. North Slope Borough 1993/1994 Economic Profile and Census Report, Vol. VII. Barrow, AK: North Slope Borough, Dept. of Planning and Community Services.

North Slope Borough. 1997. Scoping Comments and Recommendations of the North Slope Borough. Integrat ed Activity Plan/EIS for the NPR-A Proposed Oil and Gas Leasing Program, submitted Apr. 18, 1997, by Mayor Benjamin P. Nageak. Barrow, AK: North Slope Borough.

North Slope Borough. 1998. Economic Profile and Census Report. Barrow, AK: North Slope Borough.

North Slope Borough. 1999. Economic Profile and Census Report. Barrow, AK: North Slope Borough.

North Slope Borough. 2000. Memorandum dated Apr. 10, 2000, to Fred King, USDOI, MMS, Alaska OCS Region, from Tom Lohman, Environmental Resource Specialist, North Slope Borough, Department of Wildlife Management; subject: Liberty Development Project Preliminary Draft EIS.

North Slope Borough. 2002. Letter from the North Slope Borough to USDOI, MMS, Alaska OCS Region; subject: comments on the Beaufort Sea Planning Area Sales 186, 195, and 202 draft EIS. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

North Slope Borough, Commission on History and Culture. 1980. *Qiniqtuagaksrat Utuqqanaat Inuuniagninisiqun: The Traditional Land Use Inventory fo r the Mid-Beaufort Sea*, Vol. I. Barrow, AK: NSB, Commission on History and Culture, 209 pp.

North Slope Borough Contract Staff. 1979. Native Livelihood and Dependence: A Study of Land Values through Time. Field Study (National Petroleum Reserve in Alaska 105(c) Land Use Study (US) 1. Anchorage, AK: USDOI, BLM, NPR-A, Work Group 1, 166 pp.

North Slope Borough, Dept. of Planning and Community Services. 1989. North Slope Borough Census, Preliminary Report on Population and Economy. Draft report. Barrow, AK: NSB, Dept of Planning and Community Services, Warren Matumeak, Director.

North Slope Borough, Planning Dept. 1993. Map of Bowhead Whale Harvest Data for the Communities of Nuiqsut and Kaktovik. Barrow, AK: NSB, Planning Dept.

North Slope Borough, Science Advisory Committee. 1987. A Review of the Report: Importance of the Eastern Beaufort Sea to Feeding Bowhead Whales, 1985-86. NSB-SAC-OR- 109. Barrow, AK: North Slope Borough, 53 pp.

Northern Technical Services. 1985a. Hammerhead (631) Data Report NR 6-4, Federal OCS Lease Blocks, Beaufort Sea, Alaska, OCS Y-0854. Anchorage, AK: Union Oil Co.

Northern Technical Services. 1985b. Hammerhead (624 and 625) Data Report NR 6-4, Federal OCS Lease Blocks, Beaufort Sea, Alaska, OCS Y-0849 and 0850. Anchorage, AK: Union Oil Co.

Norton, D. and G. Weller, 1984. The Beaufort Sea; Background, History, and Perspective. *In*: The Alaskan Beaufort Sea, Ecosystems and Environments, P.W. Barnes, D.M. Schell, and E. Reimnitz, eds. San Diego, CA: Academic Press, Inc., 466 pp.

Nummedal, D. 1980. Persistence of Spilled Oil along the Beaufort Sea Coast. Boulder, CO: USDOC, NOAA, OCSEAP, 50 pp.

Okkonen, S. 2002. Presentation given by S. Okkonen, Oceanography, University of Alaska, Fairbanks on Mar. 5, 2002, at the MMS Alaska OCS Region office; subject: ANIMIDA monitoring project in the Beaufort Sea.

Olson, J.E. 1982. Acid Pollution and Acid Rain: Report 8, The Effects of Air Pollution and Acid Rain on Fish, Wildlife, and Their Habitats-Arctic Tundra and Alpine Meadows. FWS/OBS-80/40-8. Washington, DC: USDOI, Fish and Wildlife Service, Biological Services Program, Eastern Energy and Land Use Team, 27 pp.

Olson, T.L. and B.K. Gilbert. 1994. Variable Impacts of People on Brown Bear Use of an Alaskan River. *In*: Ninth International Conference on Bear Research and Management, J.J. Claar and P. Schullery, eds. Missoula, Mont., Feb. 1992. Victoria, BC, Canada: International Assoc. for Bear Research and Management, 500 pp.

Opie, R.T., H. Brower, Jr., and D. Bates. 1997. North Slope Borough Subsistence Harvest Documentation Project: Data for Atqasuk, Alaska for the Period July 1, 1994 to June 30, 1995. Barrow, AK: NSB, Dept. of Wildlife Management.

Oritsland, N.A., F.R. Engelhardt, F.A. Juck, R.J. Hurst, and P.D. Watts. 1981. Effects of Crude Oil on Polar Bears. Environmental Study No. 24. Ottawa, Ontario, Canada: Canadian Dept of Northern Affairs, 268 pp.

Owens, E.H., C.R. Foget, J.R. Harper, and W. Robson. 1983. Shoreline Experiments and the Persistence of Oil on Arctic Beaches. *In*: Proceedings of the 1983 Oil Spill Conference. Paper 027. Washington, DC: American Petroleum Institute, 30 pp.

Pacyna, J.M. 1995. The Origin of Arctic Air Pollutants: Lessons Learned and Future Research. *The Science of the Total Environment* 160/161:39-53.

Parametrix, Inc. 1996. Alpine Development Project Environmental Evaluation Document. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District.

Parkinson, C.L., D.J. Cavalieri, P. Gloersen, H.J. Zwally, and J.C. Cosimo. 1999. Arctic Sea Ice Extents, Areas, and Trends, 1978-1996. *Journal of Geophysical Research* 104(C9):20,837-20,856.

Patenaude, N.J., M.A. Smultea, W.R. Koski, W.J. Richardson, and C.R. Greene. 1997. Aircraft Sound and Aircraft Disturbance to Bowhead and Beluga Whales during the Spring Migration in the Alaskan Beaufort Sea. King City, Ontario, Canada: LGL Ltd. Environmental Research Associates, 37 pp.

Payne, J.R. 1987. Oil and Ice Interaction. *In*: Chukchi Sea Information Update, D.A. Hale, ed. Anchorage, Ak., Mar. 27, 1986. OCS Report, MMS 87-0097. Anchorage, AK: USDOI, MMS, and USDOC, NOAA, OCSEAP, pp. 67-79.

Payne, J.R., G.D. McNabb, Jr., and J.R. Clayton. 1991. Oil Weathering Behavior in Arctic Environments. *Polar Research* 102:631-662.

Payne, J.R., G.D. McNabb, Jr., B.E. Kirstein, R. Redding, J.L. Lambach, C.R. Phillips, S. Hachmeister, and S. Martin. 1984. Development of a Predicting Model for the Weathering of Oil in the Presence of Sea Ice. Anchorage, AK: USDOC, NOAA, OCSEAP and USDOI, MMS, Alaska OCS Region.

Payne, J.R., B.E. Kirstein, G.D. McNabb, Jr., J.L. Lambech, R. Redding, R.E. Jordan, W. Hom, C. de Oliveira, G.S. Smith, D.M. Baxter, and R. Gaegel. 1984. Multivariate Analysis of Petroleum Weathering in the Marine Environment - Sub Arctic. Vol. II - Appendices. Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators, Vol. 22 (Feb. 1984). Juneau, AK: USDOC, NOAA, and USDOI, MMS, pp. 1-56.

Payne, J.R., G.D. McNabb, Jr., L.E. Hachmeister, B.E. Kirstein, J.R. Clayton, Jr., C.R. Phillips, R.T. Redding, C.L. Clary , G.S. Smith, and G.H. Farmer. 1987. Development of a Predictive Model for Weathering of Oil in the Presence of Sea Ice. OCSEAP Final Reports of Principal Investigators. Anchorage, AK: USDOC, NOAA, OCSEAP and USDOI, MMS, Alaska OCS Region.

Payne, J.R., J.R. Clayton, Jr., G.D. McNabb, Jr., B.E. Kirstein, C.L. Clary, R.T. Redding, J.S. Evans, E. Reimnitz, and E.W. Kempema. 1989. Oil-Ice-Sediment Interactions during Freezeup and Breakup. OCSEAP Final Reports of Principal Investigators. Anchorage, AK: USDOC, NOAA, OCSEAP and USDOI, MMS, Alaska OCS Region.

Payne, J.R., L.E. Hachmeister, G.D. McNabb, Jr., J.E. Sharpe, G.S. Smith, and C.A. Manen. 1991. Brine-Induced Advection of Dissolved Aromatic Hydrocarbons to Arctic Bottom Waters. *Environmental Science and Technology* 25:940-951.

Peacock, N. and L.J. Field. 1999. The March 1989 *Exxon Valdez* Oil Spill: A Case Study in Responding to Subsistence Food Safety Issues. *In*: Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context. L.J. Field, J.A. Fall, T.S. Nighswander, N. Peacock, and U. Varanasi, eds. Pensacola, FL: SETAC Press, 338 pp.

Pearson, W.H., R.A. Elston, R.W. Blenert, A.S. Drum, and L.D. Antrim. 1999. Why Did the Prince William Sound, Alaska, Pacific Herring (*Clupea pallasi*) Fisheries Collapse in 1993 and 1994? Review of Hypotheses. *Can. J. Fish. Aquat. Sci.* 56:711-727.

Pedersen, S. 1995a. Kaktovik, Chapter XXI. *In*: An Investigation of the Sociocultural Consequences of Outer Continental Shelf Development in Alaska, J.A. Fall and C.J. Utermohle, eds. Vol. V. Anchorage, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence.

Pedersen, S. 1995b. Nuiqsut, Chapter XXII. *In*: An Investigation of the Sociocultural Consequences of Outer Continental Shelf Development in Alaska. J.A. Fall and C.J. Utermohle, eds. Anchorage, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence.

Pedersen, S. 1996. Nuiqsut: Wild Resource Harvests and Uses in 1993. Fairbanks, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence.

Pedersen, S. 1997. Presentation at the NPR-A Symposium Proceedings. Mike Burwell's notes. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 14 pp.

Pedersen, S. 1998. Paper presented to MMS, Alaska OCS Region staff; subject: subsistence economics and oil development: case studies from Nuiqsut and Kaktovik, Alaska.

Pedersen, S. and M. Coffing. 1985. Caribou Hunting: Land Use Dimensions and Recent Harvest Patterns in Kaktovik, Northeast Alaska. Technical Paper 92. Fairbanks, AK: State of Alaska, Dept. of Fish and Game, Subsistence Div, 57 pp.

Pederson, S. and N.S. Shishedo. 1988. Subsistence Study at Nuiqsut. Fairbanks, AK: State of Alaska, Dept. of Fish and Game, Subsistence Div.

Pedersen, S., R.J. Wolfe, C. Scott, and R.A. Caulfield. 2000. Subsistence Economies and Oil Development: Case Studies from Nuiqsut and Kaktovik, Alaska. Fairbanks, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence and UA Fairbanks, Coastal Marine Institute.

Pedersen, S., R.J. Wolfe, C. Scott, and R.A. Caulfield. In prep. Subsistence Economies and Oil Development: Case Studies from Nuiqsut and Kaktovik, Alaska. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Pelletier, M. C., R.M. Burgess, K.T. Ho, A. Kuhn, R.A. McKinney, and S.A. Ryba. 1997. Phototoxicity of Individual Polycyclic Aromatic Hydrocarbons and Petroleum to Marine Invertebrate Larvae and Juveniles. *Environmental Toxicology and Chemistry* 16(10):2190-2199.

Perry, J.A. and D. Renouf. 1987. Further Studies of the Role of Harbor Seal (*Phoca vitulina*) Pup Vocalizations in Preventing Separation of Mother-Pup Pairs. *Canadian Journal of Zoology* 66:934-938.

Pessah, E. 1982. Dredging Activities of Dome Petroleum in the Arctic and its Environmental Impact. Calgary, Alberta, Canada: Dome Petroleum Ltd.

Petersen, M.R. 1997. Discussion in January 1997; subject: information concerning migration and staging distribution and habits of spectacled and Steller's eiders.

Petersen, M.R., W.W. Larned, and D.C. Douglas. 1999. At-Sea Distribution of Spectacled Eiders: A 120-Year-Old Mystery Resolved. *Auk* 1164:1009-1020.

Petersen, M.R., J.B. Grand, and C.P. Dau. 2000. Spectacled Eider (*Somateria fischeri*). *In*: *Birds of North America*, A. Poole and F. Gill, eds. Issue No. 547.

Petroleum News Bulletin. 2001. Phillips Submits Applications for Colville River Satellite Development, CD South (Nanuq). *Petroleum News Bulletin* 793:2.

Phillips, R.L. and T.E. Reiss. 1983. Nearshore Marine Geologic Investigations, Point Barrow to Skull Cliff Northeast Chukchi Sea. *In*: Geologic Processes and Hazards of the Beaufort and Chukchi Sea Shelf and Coastal Regions, P.W. Barnes, E. Reimnitz, R.E. Hunter, R.L. Phillips, and S. Wolf, eds. OCSEAP Final Reports of Principal Investigators, Vol. 34 (Aug. 1985). Anchorage, AK: USDOC, NOAA, and USDOI, MMS, pp. 157-181.

Philo, L.M., G.M. Carroll, and D.A. Yokel. 1993. Movements of Caribou in the Teshekpuk Lake Herd as Determined by Satellite Tracking. Barrow, AK: North Slope Borough, 60 pp.

Philo, M., J.C. George, R. Suydam, T.F. Albert, and D. Ramey. 1993. Report of Field Activities of the Spring 1992 Census of Bowhead Whales, *Balaena mysticetus*, off Point Barrow, Alaska with Observations on the Subsistence Hunt of Bowhead Whales 1991 and 1992. Report of the International Whaling Commission No. 44. Cambridge, England: IWC, pp. 335-342.

PI/Dwigh'ts Plus Drilling Wire. 2001a. Commission Issues Pool Rules for North Slope's Aurora Field. *PI/Dwigh'ts Plus Drilling Wire Alaska* 47(88):pp. 1-3.

PI/Dwigh'ts Plus Drilling Wire. 2001b. Phillips Outlines Development Program fro North Slope's Meltwater Field. *PI/Dwigh'ts Plus Drilling Wire Alaska* 47(19):pp. 1-2.

PI/Dwight's Plus Drilling Wire. 2001c. Phillips, Anadarko Announce Five Discoveries in NPR-A. *PI/Dwight's Plus Drilling Wire Alaska* 47(21):1.

PI/ Dwight's Plus Drilling Wire. 2002. BP: North Slope's Boreallis Satellite Pool contains up to 277 Million BO. *PI/Dwigh'ts Plus Drilling Wire Alaska* 46(18):p. 3.

Piatt, J.F., C.J. Lensink, W. Butler, M. Kendziorek, and D.R. Nysewander. 1990. Immediate Impact of the Exxon Valdez Oil Spill on Marine Birds. *The Auk* 107:387-397.

Pickart, R.S. 2001. Poster Mean Hydrographic Structure of the Beaufort Shelf and Slope. Western Arctic Shelf-Basin Interactions Phase I Principal Investigator Meeting, Albuquerque, New Mex., Feb. 8-9, 2001. Woods Hole, MA: Woods Hole Oceanographic Institution, 1 pp.

Picou, J.S. and D.A. Gill. 1993. Long-Term Social Psychological Impacts of the *Exxon Valdez* Oil Spill. *In*: *Exxon Valdez* Oil Spill Symposium Abstract Book, B. Spies, L.J. Evans, B. Wright, M. Leonard, and C. Holba, eds. and comps. Anchorage, Ak., Feb. 2-5, 1993. Anchorage, AK: *Exxon Valdez* Oil Spill Trustee Council; University of Alaska, Sea Grant College Program; and American Fisheries Society, Alaska Chapter, pp. 223-226.

Picou, J.S. and D.A. Gill. 1996. The Exxon Valdez Oil Spill and Chronic Psychological Stress. In: Proceedings of the Exxon Valdez Oil Spill Symposium, Anchorage, Ak., Feb. 2-5, 1993. Bethesda, MD: American Fisheries Society, pp. 879-893.

Picou, J.S., D.A. Gill, C.L. Dyer, and E.W. Curry. 1992. Disruption and Stress in an Alaskan Fishing Community: Initial and Continuing Impacts of the *Exxon Valdez* Oil Spill. *Industrial Crisis Quarterly* 63:235-257.

Pollard, R.H. and W.B. Ballard. 1993. Caribou Distribution in the Prudhoe Bay Oil Field, Summer 1992. Northern Alaska Research Studies. Anchorage, AK: BPXA.

Proshutinsky, A.Y. and M.A. Johnson. 1997. Two Circulation Regimes of the Wind-Driven Arctic Ocean. *Journal of Geophysical Research* 102(C6):12493-12514.

Proshutinsky, A.Y., M.A. Johnson, J.A. Maslanki, and T.O. Proshutinsky. 2000. Beaufort and Chukchi Sea Seasonal Variability for Two Arctic Climate States. OCS Study, MMS 2000-070. Annual Report No. 7. Fairbanks and Anchorage, AK: UA Fairbanks, Coastal Marine Institute and USDOI, MMS, Alaska OCS Region.

Quakenbush, L. and R.S. Suydam. 1999. Periodic Nonbreeding of Steller's Eiders near Barrow, Alaska, with Speculations on Probable Causes. *In*: Behavior and Ecology of Seaducks, R.J. Goudie, M.R. Petersen, and G.J. Robertson, eds. Occasional Paper No. 100. Ottawa, Ontario, Canada: Canadian Wildlife Service, Environment Canada, pp. 34-40.

Quakenbush, L., R.S. Suydam, K.M. Fluetsch, and C.L. Donaldson. 1995. Breeding Biology of Steller's Eiders Nesting near Barrow, Alaska, 1991-1994. Technical Report NAES-TR-95-03. Fairbanks, AK: USDOI, Fish and Wildlife Service, 53 pp.

Quakenbush, L.T., 1988. Spotted Seal. *In* : Selected Marine Mammals of Alaska, J.W. Lentfer, ed. Washington, D.C: Marine Mammal Commission, pp. 107-124.

Quinlan S.E. and W.A. Lehnhausen. 1982. Arctic Fox, *Alopex lagopus*, Predation on Nesting Common Eiders, *Somateria mollissma,* at Icy Cape, Alaska. *Canadian Field Naturalist* 964:462-466.

Rahn, K.A. 1982. On the Causes, Characteristics and Potential Environmental Effects of Aerosol in the Arctic Atmosphere. *In*: The Arctic Ocean: The Hydrographic Environment and the Fate of Pollutants, L. Ray, ed. New York: John Wiley and Sons, pp. 163-195.

Ramsay, M.A. and I. Stirling. 1990. Fidelity of Female Polar Bears to Winter-Den Sites. *Journal of Mammalogy* 712:223-236.

Raveling, D.G. 1989. Nesting-Predation Rates in Relation to Colony Size of Black-Brant. *Journal Wildlife Management* 531:87-90.

Reed, M., K. Jayko, A. Bowles, E. Anderson, S. Leatherwood, and M. Spaulding. 1987. Computer Simulation of the Probability That Endangered Whales Will Interact with Oil Spills. OCS Study MMS 86-0045. Washington, DC: USDOI, MMS.

Reed, M., N. Ekrol, P. Daling, Ø. Johansen, and M.K. Ditlevsen. 2000. SINTEF Oil Weathering Model User's Manual Version 2.0. Trondheim, Norway: SINTEF Applied Chemistry, 39 pp.

Reese, C.S., J.A. Calvin, J.C. George, and R.J. Tarpley. 2001. Estimation of Fetal Growth and Gest ation in Bowhead Whales. *Journal of the American Statistical Association* 964(55):915-923.

Reeves R.R., B.S. Stewart , and S. Leatherwood. 1992. The Sierra Club Handbook of Seals and Sirenians. Hong Kong: Dai Nippon Printing Co. Ltd.

Reimers, E. 1980. Activity Pattern: The Major Determinant for Growth and Fattening in *Rangifer*. *In*: Proceedings of the Second International Reindeer/Caribou Symposium, E. Reimers, E. Gaare, and S. Skjennsberg, eds. Roros, Norway, Sept. 17-21, 1979. Trondheim, Norway: Direktoratet for vilt og ferskvannsfisk.

Reimnitz, E., C.A. Rodeick, and S.C. Wolf. 1974. Strudel Scour, A Unique Arctic Marine Geologic Phenomenon. *Journal of Sedimentary Petrology* 44(d2):409-420.

Reimnitz, E., R. Ross, and P. Barnes. 1979. Dinkum Sands. Environmental Assessment of the Alaskan Continental Shelf, Quarterly Reports of Principal Investigators for April-December 1979 Vol. 2. Boulder, CO: USDOC, NOAA, OCSEAP, pp. 213-220.

Reynolds, P.E. 1986. Responses of Muskoxen Groups to Aircraft Overflights in the Arctic National Wildlife Refuge, 1982-1985. *In*: Arctic National Wildlife Refuge Coastal Plain Resource Assessment 1985 Update Report. Baseline Study of the Fish, Wildlife, and Their Habitats, G.W. Garner and P.E. Reynolds, eds. Volume 3, Appendix V - Impacts. ANWR Progress Report No. FY86-5-Impacts. Anchorage, AK: USDOI, Fish and Wildlife Service, 1,281 pp

Reynolds, P.E. 1992. Seasonal Differences in the Distribution and Movements of Muskoxen (*Ovibos moschatus*) in Northeastern Alaska. *Rangifer* 123:171-172.

Reynolds, P.E. 1998. Dynamics and Range Expansion of a Reestablished Muskoxen Population. Journal *Wildlife Managemen* 622:734-744.

Reynolds, P.E. and D.J. LaPlant. 1985. Effects of Winter Seismic Exploration Activities on Muskoxen in the Arctic National Wildlife Refuge. *In*: Arctic National Wildlife Refuge Coastal Plain Resource Assessment. Baseline Study of the Fish, Wildlife, and Their Habitats, Vol. I, G.W. Garner and P.E. Reynolds, eds. 1984 Update Report. ANWR Progress Report No. FY85- 2. Anchorage, AK: USDOI, Fish and Wildlife Service, 777 pp.

Reynolds, P.E. and D.J. LaPlant. 1986. Effects of Winter Seismic Exploration Activities on Muskoxen in the Arctic National Wildlife Refuge, January-May, 1984-1985. Arctic National Wildlife Refuge Coastal Plain Resource Assessment, G.W. Garner and P.E. Reynolds, eds. 1985 Update Report Baseline Study of the Fish, Wildlife, and Their Habitats. ANWR Progress Report No. FY86-4, Vol. 3, Appendix V. Anchorage, AK: USDOI, Fish and Wildlife Service, 1281 pp.

Reynolds, P.E., H.V. Reynolds III, and E.H. Follmann. 1986. Responses of Grizzly Bears to Seismic Surveys in Northern Alaska. *In*: International Conference on Bear Research and Management, pp. 169-175.

Rice, D.W. and A.A. Wolman. 1971. The Life History and Ecology of the Gray Whale (*Eschrichtius robustus*). Special Publication No. 3. Seattle, WA: The American Society of Mammalogists, 142 pp.

Rice, D.W., A.A. Wolman, and H.W. Braham. 1984. The Gray Whale, *Eschrichtius robustus*. *Marine Fisheries Review* 464:7-14.

Rice, S.D., S. Korn, and J.F. Karinen. 1981. Lethal and Sublethal Effects on Selected Alaskan Marine Species after Acute and Long-Term Exposure to Oil and Oil Components. Unpublished quarterly report. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Richards, B. No date. Mitigating Psychological and Social Impacts of the *Exxon Valdez* Spill on Small Villages. Paper presented at the SFAA Meetings; Disaster Research Conference.

Richardson, W.J., ed. 1986. Importance of the Eastern Alaskan Beaufort Sea to Feeding Bowhead Whales, 1985. OCS Study, MMS 86-0026. Reston, VA: USDOI, MMS, 315 pp.

Richardson, W.J., ed. 1987. Importance of the Eastern Alaskan Beaufort Sea to Feeding Bowhead Whales 1985-86. OCS Study, MMS 87-0037. Reston, VA: USDOI, MMS, 547 pp.

Richardson, W.J., ed. 1999. Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1998. LGL Report TA- 2230-3. King City, ON, Canada: LGL Ltd., environmental research associates, 390 pp.

Richardson, W.J., ed. 2000. Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1999. LGL Report TA- 2313-4. King City, ON, Canada: LGL Ltd., Environmental Research Associates, 155 pp.

Richardson, W.J. and S.R. Johnson. 1981. Waterbird Migration near the Yukon and Alaskan Coast of the Beaufort Sea: I. Timing, Routes and Numbers in Spring. *Arctic* 342:108-121.

Richardson, W.J. and C.I. Malme. 1993. Man-Made Noise and Behavioral Responses. *In*: *The Bowhead Whale Book*, J.J. Burns, J.J. Montague, and C.J. Cowles, eds. Special Publication of The Society for Marine Mammalogy, 2. Lawrence, KS: The Society for Marine Mammalogy, 631-700.

Richardson W.J. and M.T. Williams, eds. 2001. Monitoring of Industrial Sounds, Seals, and Whale Calls during Construction of BP's Northstar Oil Development, Alaska Beaufort Sea, 2000. King City, Ontario Canada: LGL Ltd., 200 pp.

Richardson, W.J. and D.H. Thomson. 2002. Email dated Apr. 25, 2002, to S. Treacy, USDOI, MMS, Alaska OCS Region; subject: bowhead whale feeding study.

Richardson, W.J. and D.H. Thomson, eds. 2002. Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information. OCS Study, MMS 2002-012. Herndon, VA: USDOI, MMS.

Richardson, W.J. and D.H. Thomson, eds. 2002. Executive Summary. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information. LGL Report TA2196-7. King City, Ontario: LGL Limited, environmental research associates, pp. 1-44.

Richardson, W.J., R.A. Davis, C.R. Evans, and P. Norton. 1985. Distribution of Bowheads and Industrial Activity, 1980-84. *In*: Behavior, Disturbance Responses, and Distribution of Bowhead Whales, *Balaena mysticetus*, in the Eastern Beaufort Sea, 1980-84, W.J. Richardson, ed. OCS Study, MMS 85-0034. Anchorage, AK: USDOI, MMS, Alaska OCS Region, pp. 255-306.

Richardson, W.J., B. Wursig, and C.R. Greene, Jr. 1990. Reactions of Bowhead Whales, *Balaena mysticetus*, to Drilling and Dredging Noise in the Canadian Beaufort Sea 1980-1984. Report No. 29. Great Britain: Marine Environmental Research, pp. 135-160.

Richardson, W.J., C.R. Greene Jr., W.R. Koski, and M.A. Smultea. 1991. Acoustic Effects of Oil Production Activities on Bowhead and White Whales Visible During Spring Migration Near Pt. Barrow, Alaska-1990 Phase: Sound Propagation and Whale Responses to Playbacks of Continuous Drilling Noise from an Ice Platform, as Studied in Pack Ice Conditions. OCS Study, MMS 95-0037. Anchorage, AK: USDOI, MMS, Alaska OCS Region, pp. 1-311.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995a. Man-Made Noise. *In*: *Marine Mammals and Noise*. San Diego, CA: Academic Press, Inc., pp. 1-576.

Richardson, W.J., C.R. Greene, Jr., J.S. Hanna, W.R. Koski, G.W. Miller, N.J. Patenaude, and M.A. Smultea. 1995b. Acoustic Effects of Oil Production Activities on Bowhead and White Whales Visible During Spring Migration Near Pt. Barrow, Alaska-1991 and 1994 Phases: Sound Propagation and Whale Responses to Playbacks of Icebreaker Noise. OCS Study, MMS 95-0051. Anchorage, AK: USDOI, MMS, Alaska OCS Region, pp. 1-392.

Ritchie, R.J., R.M. Burgess, and R.S. Suydam. 2000. Status and Nesting Distribution of Lesser Snow Geese and Brant on the Western Arctic Coastal Plain. *Canadian Field-Naturalist* 114:395-404.

Ritchie, R.J. and J.G. King. 2001. Results of Steller's Eider Surveys near Barrow, Admiralty Bay, and Meade River, Alaska, 1999 and 2000. Fairbanks, AK: ABR, Inc.

Ritchie, R.J., P. Lovely, and M.J. Knocke. 2002. Aerial Surveys for Nesting and Brood-Rearing Brant and Snow Geese, Barrow to Fish Creek Delta, Alaska, 2001. Final Report. Fairbanks, AK: ABR, Inc.

Robertson, T.L. and E. DeCola, preps. 2000. Joint Agency Evaluation of the Spring and Fall 2000 North Slope Broken Ice Exercises, 51 pp.

Roby D.D. 1978. Behavior Patterns of Barren-Ground Caribou of the Central Arctic Herd Adjacent to the Trans-Alaska Oil Pipeline. MS Thesis. Fairbanks, AK: University of Alaska, Fairbanks, 500 pp.

Roby, D.D. 1980. Winter Activity of Caribou on Two Arctic Ranges. *In*: Proceedings of the Second International Reindeer/Caribou Symposium, E. Reimers, E. Gaare, and S Skjensberg, eds. Roros, Norway, pp. 537-543.

Rodrigues R., R.H. Pollard and R.O. Skoog. 1994. Inventory of Arctic Fox Dens in the Prudhoe Bay Oil Field. Abstract. *In*: Proceedings of the North Slope Environmental Studies Conference, Anchorage, Ak., Feb.14-15, 1994. Anchroage, AK: ARCO Alaska, Inc, p. 33.

Rosenegger, L.W. 1975. Movement of Oil under Sea Ice. Beaufort Sea Project, Beaufort Sea Technical Report. Victoria, B.C., Canada: Department of the Environment.

Rothrock, D.A., Y. Yu, and G.A. Maykut. 1999. Thinning of the Arctic Sea-Ice Cover. *Geophysical Research Letters* 26(23):3469-3472.

Rowe, L., J. Dollahite, and B. Camp. 1973. Toxicity of Two Crude Oils and of Kerosene to Cattle. *Journal of American Veterinary Medicine Association* 16:60-66.

Rugh, D.J. and H. Braham. 1979. California Gray Whale (*Eschrichtius robustus*) Fall Migration Through Unimak Pass, Alaska, 1977: A Preliminary Report. Report of the International Whaling Commission No. 29. Cambridge, England: IWC, pp. 315-320.

Rugh, D.J., K.W. Shelden, and D.E. Withrow. 1997. Spotted Seals, *Phoca largha*, in Alaska. *Marine Fisheries Review* 591:1-18.

Rugh, D.J., M.M. Muto, S.E. Moore, and D.P. DeMaster. 1999. Status Review of the Eastern North Pacific Stock of Gray Whales. Seattle, Washington: USDOC, NOAA/NMFS, Marine Mammal Lab., 96 pp.

S.L. Ross Environmental Research Ltd. 1998. Laboratory Testing to Determine Spill Related Properties of Liberty Crude Oil. Anchorage, AK: BPXA.

S.L. Ross Environmental Research Ltd., D.F. Dickins and Assocs. Ltd., and Vaudrey and Assocs. Ltd. 1998. Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea during Periods of Broken Ice. Anchorage, AK: Alaska Clean Seas and USDOI, MMS, Alaska OCS Region.

S.R. Braund and Associates. 1989. North Slope Subsistence Study, Barrow, 1988. OCS Study, MMS 89-0077. Technical Report No. 135. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program.

S.R. Braund and Assocs. 1996. Subsistence Overview and Impacts. *In*: Beaufort Sea Oil and Gas Development/Northstar Project. Anchorage, AK: U.S. Army Corps of Engineers.

S.R. Braund and Assocs. In prep. Subsistence Overview prepared for Dames & Moore for the Beaufort Sea Oil and Gas Development/Northstart Project EIS, 1998. Anchorage, AK: U.S. Army Corps of Engineers.

S.R. Braund and Assocs. and University of Alaska Anchorage, Institute of Social and Economic Research. 1993. North Slope Subsistence Study: Barrow, 1987, 1988 and 1989. OCS Study, MMS 91-0086. Technical Report No. 149. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, 466 pp.

Sackinger, W.M., G. Weller, and S.T. Zimmerman. 1983. Outer Continental Shelf Environmental Assessment Program: Beaufort Sea (Sale 87) Synthesis Report. *In*: Proceedings of a Synthesis Meeting, Chena Hot Springs, Alaska, Jan. 25-28, 1983. Juneau, AK: USDOC, NOAA and USDOI, MMS.

Salter, R.E. 1979. Site Utilization, Activity Budgets, and Disturbance Responses of Atlantic Walruses. Canadian Journal *Zoology* 576:1169-1180.

Sayed, M. and S. Løset. 1993a. Laboratory Experiments of Oil Spreading in Brash Ice. *In*: Proceedings of the Third (1993) International Offshore and Polar Engineering Conference (SOPE '93), J.S. Chung, B.J. Natvig, B.M. Das, and Li Yu-Cheng, eds. Golden, CO: International Society of Offshore and Polar Engineers, pp. 224-231.

Sayed, M. and S. Løset. 1993b. Laboratory Experiments of Oil Spreading in Brash Ice. *International Journal of Offshore and Polar Engineering* 34:306-312.

Scandpower. 2001. Blowout Frequency Assessment of Northstar. Report no. 27.83.01/R1. Anchorage, AK: BPXA, 40 pp. plus appendices.

Schallenberger, A. 1980. Review of Oil and Gas Exploitation Impacts on Grizzly Bears. *In*: Bears-Their Biology and Management, Fourth International Conference on Bear Research and Management, C.J. Martinka and K.J. McArthur, eds. Kalispell, Mont., Feb. 7, 1977. Tonto Basin, AZ: Bear Biology Association, pp. 271-277.

Schamel, D.L. 1978. Bird Use of a Beaufort Sea Barrier Island in Summer. *Canadian Field-Naturalist* 921:55-60.

Schell, D.M. 1999a. North Pacific and Bering Sea Carrying Capacity: A Hindcast and a Look at Changes Ahead. *In*: Alaska OCS Region Seventh Information Transfer Meeting Proceedings. OCS Study, MMS 99-0022. Costa Mesa, CA: USDOI, MMS, pp. 34.

Schell, D.M. 1999b. Habitat Usage as Indicated by Stable Isotope Ratios. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information, W.J. Richardson and D.H. Thomson, eds. LGL Report TA 2196-2. Herndon, VA: USDOI, MMS, pp. 179-192.

Schell, D.M., S.M. Saupe, and N. Haubenstock. 1987. Bowhead Whale Feeding: Allocation of Regional Habitat Importance Based on Stable Isotope Abundances. *In*: Importance of the Eastern Alaskan Beaufort Sea to Feeding Bowhead Whales 1985-86, W.J. Richardson, ed. OCS Study, MMS 87-0037. Reston, VA: USDOI, MMS, pp. 369-415.

Schell, D.M. and S.M. Saupe. 1993. Feeding and Growth as Indicated by Stable Isotopes. *In*: *The Bowhead Whale Book*, J.J. Burns, J.J Montague, and C.J. Cowles, eds. Special Publication of The Society for Marine Mammalogy, 2. Lawrence, KS: The Society for Marine Mammalogy, 491-509 pp.

Schick, R.S. and D.L. Urban. 2000. Spatial Components of Bowhead Whales (*Balaena mysticetus*) Distribution in the Alaskan Beaufort Sea. *Canadian Journal of Fisheries Aquatic Science* 57:2193-2200.

Schliebe, S.L. 1983. Alaska Polar Bear Harvest Characteristics 1980-1982 Status Report. Anchorage, AK: USDOI, FWS, Region 7.

Schmidt, D.R., R.O. McMillan, and B.J. Gallaway. 1989. Nearshore Fish Survey in the Western Beaufort Sea Harrison Bay to Elson Lagoon. OCS Study, MMS 89-0071. OCSEAP Final Reports of Principal Investigators Vol. 63. Anchorage, AK: USDOC, NOAA, and USDOI, MMS, Alaska OCS Region, pp 491-552.

Schneider, W., S. Pedersen, and D. Libbey. 1980. The Barrow-Atqasuk Report: A Study of Land Use through Time. Occasional Paper No. 24. Fairbanks, AK: University of Alaska, Fairbanks, Anthropology and Historic Preservation Cooperative Park Studies Unit, and the North Slope Borough.

Scholten, M., P. Leendertse, and P.A. Blaauw. 1987. The Effects of Oil Pollution on Interacting Salt Marsh Species. *In*: Fate and Effects of Oil in Marine Ecosystems, J. Kuiper and W.J. Van Den Brink, eds. Amsterdam and Dordrecht, The Netherlands: Martinus Nijhoff Publishers, Kluwer Academic Publisher Group, pp. 225-228.

Schulze, R.H., W.G. Grasskopf, J.C. Cox, and L.A. Schultz. 1982. Oil Spill Response Scenarios for Remote Arctic Environments. Technical Report EPA-600/2- 82-036. Cincinnati, OH: USEPA, Municipal Environmental Research Laboratory, 7 pp.

Seagars, D.J. 1992. Letter dated Jan. 15, 1992, to Regional Director, USDOI, MMS, Alaska OCS Region, from D.J. Seagars, Wildlife Biologist, USDOI, FWS; subject: Pacific walrus population estimates.

Sease, J.L. and D.G. Chapman. 1988. Pacific Walrus, *Odobenus rosmarus divergens*. *In*: Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations, J.W. Lentfer, ed. Washington, DC: Marine Mammal Commission, 275 pp.

Segar, D. 1990. Physical Oceanography Workshop Summary. *In*: A Synthesis of Environmental Information on Causeways in the Nearshore Beaufort Sea, Alaska Workshop Proceedings, Anchorage, Ak., Apr. 17-20, 1989. Anchorage, AK: USDOI, MMS, Alaska OCS Region, pp. 81-84.

Shannon and Wilson Consultants. 1996. Flood-Frequency Analysis for the Colville River, North Slope, Alaska. Anchorage, AK: Michael Baker, Jr., Inc.

Shapiro, L. and R. Metzner. 1979. Ice conditions on Alaska's Sea Coast: Extending the Observations. *The Northern Engineer* 112:22-27, 35.

Shapiro, L., H. Metzner, and R.C. Toovak, K. 1979. Historical References to Ice Conditions along the Beaufort Sea Coast of Alaska. Fairbanks, AK: University of Alaska, Geophysical Institute, 65 pp.

Shelden, K.E.W. and D.J. Rugh. 1995. The Bowhead Whale, *Balaena mysticetus*: Its Historic and Current Status. *Marine Fisheries Review* 57(3-4):20 pp.

Shelden, K.E.W. and D.J. Rugh. 2002. The Bowhead Whale, *Balaena mysticetus*: Its Historic and Current Status. NOAA website: http://nmml.afsc.noaa.gov/CetaceanAssessment/bowhead/bmsos.htm.

Shelden, K.E.W., D.P. DeMaster, D.J. Rugh, and A.M. Olson. 2001. Developing Classification Criteria under the U.S. Endangered Species Act: Bowhead Whales as a Case Study. *Conservation Biology* 155:1300-1307.

Sheppard, E.P. and P.E. Georghiou. 1981. The Mutagenicity of Prudhoe Bay Crude Oil and its Burn Residues. *In*: Proceedings of the Fourth Arctic Marine Oilspill Program Technical Seminar, Edmonton, Alberta, Canada, June 16-19, 1981. Ottawa, Ontario, Canada: Environmental Emergency Branch, Environmental Protection Service, pp. 195-213.

Shideler, R. and J. Hechtel. 1995. Grizzly Bear Use of Oil Fields around Prudhoe Bay, Alaska. *In*: Tenth International Conference on Bears Resources and Management, Fairbanks, Ak., Jul. 16-20, 1995.

Shideler R. and J. Hechtel. 2000. Grizzly Bear. *In*: The Natural History of an Arctic Oil Field Development and the Biota, J.C. Truett and S.R. Johnson, eds. San Diego, CA: Academic Press, 105-132 pp.

Shirley, T.C. and S. Duesterloh. 2001. An Experimental Investigation of the Role of Zooplankton in the Distribution of Hydrocarbons. *In*: Proceedings of the Eighth MMS Information Transfer Meeting, Anchorage, Ak., Apr. 3-5, 2001. Anchorage, AK: USDOI, MMS, Alaska OCS Region, p. 23.

Short, J. 2002. Talk given by J. Short, NOAA Auke Bay Lab, at the 2002 *Exxon Valdez* Oil Spill Symposium.

Short, K.S., G.C. Schrader, L.E. Hachmeister, and C.J. Van Zee. 1990. Oceanography, Part II, Chapter 3. *In*: 1986 Final Report for the Endicott Environmental Monitoring Program. Vol. 2. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District, pp. 1 -246.

Shotts, E.B., T.F. Albert, R.E. Wooley, and J. Brown. 1990. Microflora Associated with the Skin of the Bowhead Whale (*Balaena Mysticetus*). *Journal of Wildlife Diseases* 263:351-359.

Sloan, C.E. 1987. Water Resources of the North Slope, Alaska. *In*: Alaska North Slope Geology, I. Tailleur and P. Weimer, eds. The Pacific Section, Society of Economic Paleontologist and Minerologists, and The Alaska Geological Society.

Slovic, P. 1987. Perception of Risk. *Science* 236:280-285.

Smith, T., M.O. Hammill, and G. Taugbol. 1991. A Review of the Development Behavioural and Physiological Adaptations of the Ringed Seal, *Phoca hispida*, to Life in the Arctic Winter. *Arctic* 442:124-131.

Smith, T.E. 1989. The Status of Muskoxen in Alaska. *In*: Proceedings of the Second International Muskoxen Symposium, P.F. Flood, ed. Saskatoon, Saskatchewan, Canada, Oct. 1-4, 1987. Ottawa, Canada: National Research Council of Canada, 350 pp.

Smith W.T., R.D. Cameron and D.J. Reed. 1994. Distribution and Movements of Caribou in Relation to Roads and Pipelines, Kuparuk Development Area, 1978-90. Wildlife Technical Bulletin No. 12. Juneau, AK: State of Alaska, Dept. of Fish and Game, 54 pp.

Smythe, C.W. 1990. In the Second Year: Continuing Village Impacts of the *Exxon Valdez* Oil Spill. *In*: 1990 Alaska Science Conference, Proceedings of the 41st Arctic Science Connference: Circumpolar Perspectives, Anchorage, Ak., Oct. 8-10, 1990. Anchorage, AK: American Association for the Advancement of Science, Alaska Division.

Smythe, C.W. and R. Worl. 1985. Monitoring Methodology and Analysis of North Slope Institutional Response and Change, 1979-1983. OCS Study, MMS 85-0072. Technical Report No. 117. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program.

Snyder-Conn, E., D. Densmore, C. Moitoret, and J. Stroebele. 1990. Persistence of Trace Metals in Shallow Arctic Marine Sediments Contaminated by Drilling Effluents. *Oil and Chemical Pollution* 7:225-247.

St. Aubin, D.J., R.H. Stinson, and J.R. Geraci. 1984. Aspects of the Structure and Composition of Baleen and Some Effects of Exposure to Petroleum Hydrocarbons. *Canadian Journal of Zoology* 622:193-198.

Starr, S.J., M.N. Kuwada, and L.L. Trasky. 1981. Recommendations for Minimizing the Impacts of Hydrocarbon Development on the Fish, Wildlife, and Aquatic Plant Resources of the Northern Bering Sea and Norton Sound. Anchorage, AK: State of Alaska, Dept. of Fish and Game, Habitat Div, 525 pp.

State of Alaska, Alaska Oil and Gas Conservation Commission. 1982. Statistical Report, 1982. Anchorage, AK: State of Alaska, AOGCC.

State of Alaska, Alaska Oil and Gas Conservation Commission. 1994. Statistical Report for 1994. Anchorage, AK: State of Alaska, AOGCC, 230 pp.

State of Alaska, Alaska Oil and Gas Conservation Commission. 1995. Alaska Oil and Gas Conservation Commission Bulletin. Anchorage, AK: State of Alaska, AOGCC.

State of Alaska, Dept. of Environmental Conservation. 1982. Air Quality Control Regulations 18AAC 50. Juneau, AK: State of Alaska, DEC, 31 pp.

State of Alaska, Dept. of Environmental Conservation. 2001. Oil Spill Database. Juneau, AK: State of Alaska, DEC.

State of Alaska, Dept. of Fish and Game. 1993a. An Investigation of the Sociocultural Consequences of Outer Continental Shelf Development in Alaska: A Preliminary Overview of Selected Findings from the Household Harvest Survey for the First and Second Years of Research, 1992 and 1993, J.A. Fall, C.J. Utermohle, eds. L. Brown, J. Evak, J. Fall, S. Georgette, L. Hutchinson-Scarbrough, G. Jennings, J. Magdanz, R. Mason, R. Miraglia, C. Mishler, S. Pedersen, J. Seitz, S. Skaggs, R. Stanek, K. Thomas, L. Tomrdle, and C. J Utermohle, comps. Anchorage, AK: State of Alaska, Dept. of Fish and Game, Subsistence Div .

State of Alaska, Dept. of Fish and Game. 1993b. Community Profile Database. Vol. 5, Arctic Region. Juneau, AK: State of Alaska, Dept. of Fish and Game, Subsistence Div .

State of Alaska, Dept. of Fish and Game. 1995a. An Investigation of the Sociocultural Consequences of Outer Continental Shelf Development in Alaska. OCS Study, MMS 95-0014. Technical Report 160 Vol. V, Alaska Peninsula and Arctic. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

State of Alaska, Dept. of Fish and Game. 1995b. Community Profile Database. Update to Vol. 5, Arctic Region. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence.

State of Alaska, Dept. of Fish and Game. 1995c. Community Profile Database. Update to Vol. 5, Arctic Region. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Subsistence.

State of Alaska, Dept. of Natural Resources. 1971. Annual Report, 1971. Juneau, AK: State of Alaska, DNR, Div. of Oil and Gas.

State of Alaska, Dept. of Natural Resources. 1997. Historical and Projected Oil and Gas Consumption. Anchorage, AK: State of Alask a, DNR, Div. of Oil and Gas, 67 pp.

State of Alaska, Dept. of Natural Resources. 2000. 2000 Annual Report. Anchorage, AK: State of Alaska, Department of Natural Resources, Division of Oil and Gas, 112 pp.

Steele, M. and T. Boyd. 1998. Retreat of the Cold Halocine Layer in the Arctic Ocean. *Journal of Geophysical Research* 103:10419-1-435.

Stehn, R. and R. Platte. 2000. Exposure of Birds to Assumed Oil Spills at the Liberty Project. Final Report. Anchorage, AK: USDOI, Fish and Wildlife Service.

Stenhouse, G.B., L.J. Lee, and K.G. Poole. 1988. Some Characteristics of Polar Bears Killed During Conflicts with Humans in the Northwest Territories, 1976-86. *Arctic* 414:275-278.

Stephensen, W.M., D.W. Cramer, and D.M. Burn. 1994. Review of the Marine Mammal Marking, Tagging, and Reporting Program 1988-1992. FWS Technical Report MMM 94-1. Anchorage, AK: USDOI, FWS, Region 7.

Stephenson R.O. 1999. Game Management Unit 25A, 25B, 25D and 26C Porcupine Caribou Herd. *In*: Caribou, M.V. Hicks, ed. Federal Aid Wildlife Restoration Management Report Survey-inventory activities 1 July 1996 to 30 June 1998 Grants w-24-5 and w-27-1, study 3.0. Juneau, Alaska: State of Alaska, Dept. of Fish and Game, Div. of Wildlife Conservation, 235 pp.

Stewart, B.S., F.T. Awbrey, and W.E. Evans. 1983. Belukha Whale (*Delphinapterus leucas*) Response to Industrial Noise in Nushagak Bay, Alaska. OCS Study, MMS 86-0057. Technical Report 83-161. OCSEAP Final Reports of Principal Investigators, Vol. 43 (Jun. 1986). Juneau, AK: USDOC, NOAA and USDOI, MMS, pp. 587-616.

Stickney, A.A. and R.J. Ritchie. 1996. Distribution and Abundance of Brant (*Branta bernicla*) on the Central Arctic Coastal Plain of Alaska. *Arctic* 491:44-52.

Stirling, I. 1988. Attraction of Polar Bear *Ursus maritimus* to Offshore Drilling Sites in the Eastern Beaufort Sea. *Polar Record* 24:1-8.

Stirling I. and N.A. Oritsland. 1995. Relationships Between Estimates of Ringed Seal (*Phoca hispida*) and Polar Bear (*Ursus maritimus*) Populations in the Canadian Arctic. *Canadian Journal of Fisheries and Aquatic Sciences* 52:2594-2612.

Stirling I., D. Andriashek, and W. Calvert. 1993. Habitat Preferences of Polar Bears in Western Canadian Arctic in Late Winter and Spring. *Polar Record* 29:13-24.

Stringer, W.J. and G. Weller. 1980. Studies of the Behavior of Oil in Ice. Fairbanks, AK: USDOC, NOAA, OCSEAP, Arctic Project Office.

Stutz, M.L., A.C. Trembainis, and O.H. Pilkey. 1999. Barrier Island Morphology on the U.S., Canadian, and Russian Arctgic Coasts. *In*: American Geophysical Union 1999 Fall Meeting in San Francisco. Washington, DC: American Geophysical Union.

Suydam, R.S., J.C. George, P.B. Nader, and T.F. Albert. 1994. Subsistence Harvest of Bowhead Whales (*Balaena mysticetus*) by Alaska Eskimos, 1994. Paper SC/47/AS12. Cambridge, UK: IWC.

Suydam, R., L. Quakenbush, M. Johnson, J.C. George, and J. Young. 1997. Migration of King and Common Eiders Past Point Barrow, Alaska, in Spring 1987, Spring 1994, and Fall 1994, D.L. Dickson, ed. Occasional Paper No. 94. Ottawa, Ontario, Canada: Canadian Wildlife Service, pp. 21-29.

Suydam, R.S., D.L. Dickson, J.B. Fadely, and L.T. Quakenbush. 2000. Population Declines of King and Common Eiders of the Beaufort Sea. *Condor* 102:219-222.

Suydam R.S., L.F. Lowry, K.J. Frost, G.M. O'Corry-Crowe, and D. Pikok, Jr. 2001. Satellite Tracking of Eastern Chukchi Sea Beluga Whales into the Arctic Ocean. *Arctic* 543:237-243.

Swem, T.R. 1997. Personal commnication in April 1997 at the MMS NPR-A Symposium; subject: distribution, and abundance of arctic peregrine falcons and gyrfalcons in the NPR-A.

Swift, J.H., E.P. Jones, K. Aagaard, E.C. Carmack, M. Hingston, F.A. MacDonald, and R.B. Perkin. 1998. Watgers of the Makarov and Canadian Basin. *Deep Sea Research* 44:1502-1529.

Sydnes, L.K., T.H. Hemmingsen, S. Skare, S.H. Hansen, I.B. Falk-Peterson, S. Lonning, and K. Østgaard. 1985. Seasonal Variations in Weathering and Toxicity of Crude Oil on Seawater under Arctic Conditions. *Environmental Science and Technology* 1911:1076-1081.

Tarpley, R.J., R.F. Sis, T.F. Albert, L.M. Dalton, and J.C. George. 1987. Observations on the Anatomy of the Stomach and Duodenum of the Bowhead Whale, *Balaena Mysticetus*. *The American Journal of Anatomy* 180:295-322.

Taylor, E. 2001. Request for Records of Sea Duck Collision Mortality at Northstar Island.

Teal, J.M. and R.W. Howarth. 1984. Oil Spill Studies: A Review of Ecological Effects. *Environmental Management* 81:27-44.

Tebeau, P.A., T.M. Meehan, and J.C. Myers. 1982. A Laboratory Experiment on Oil Weathering under Arctic Conditions. Groton, CT: U.S. Dept. of Treasury, U.S. Coast Guard.

Telford, W.M., L.P. Geldart, R.E. Sheriff, and D.A. Keys. 1978. *Applied Geophysics*. New York: Cambridge University Press.

Terhune, J.M. 1981. Influence of Loud Vessel Noises on Marine Mammal Hearing and Vocal Communication. *In*: The Question of Sound from Icebreaker Operations. Proceedings of a Workshop, N.M. Peterson, ed. Toronto, Ontario, Canada, Toronto, Ontario, Canada: Arctic Pilot Project, Petro-Canada.

Tetra Tech, Inc. 1994. Ocean Discharge Criteria Evaluation for Arctic State and Federal Waters. Draft report. Seattle, WA: U.S. Environmental Protection Agency, Region 10.

The Arctic Sounder. 2001. Whale Count Rising. Anchorage, AK: *Anchorage Daily News*, June 21, 2001.

Thomas, M. 1976. Long-Term Biological Effects of Bunker C Oil in the Intertidal Zone. *In*: Fate and Effects of Petroleum Hydrocarbons in Marine Organisms and Ecosystems, D.A. Wolfe, ed. New York: Pergamon Press, pp. 238-246.

Thompson, D.C. and K.H. McCourt. 1981. Seasonal Diets of the Porcupine Caribou Herd. *American Midland Naturalist* 1051:70-76.

Thompson, P.B. and W. Dean. 1996. Competing Conceptions of Risk. *Risk: Health Safety and Environment* 7:361-375.

Thomson, D.H. and W.J. Richardson. 1987. Integration. *In*: Importance of the Eastern Alaskan Beaufort Sea to Feeding Bowhead Whales, 1985-86, W.J. Richardson, ed. OCS Study, MMS 87-0037. Reston, VA: USDOI, MMS, pp. 449-511.

Thomson, D.H., W.R. Koski, and W.J. Richardson. 2002. Integration and Conclusions. *In*: Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information, W.J. Richardson and D.H. Thomson, eds. LGL Report TA2196-7. King City, Ontario: LGL Limited, environmental research associates, pp. 1-35.

Thorsteinson, L.K, L.E. Jarvela, and D.A. Hale. 1991. Arctic Fish Habitat Use Investigations: Nearshore Studies in the Alaskan Beaufort Sea, Summer 1990. Annual Report. Anchorage, AK: USDOC, NOAA, National Ocean Services, 166 pp.

Thurston, D.K., D.R. Choromanski, and R.P. Crandall. 1999. Shallow Geology of the Warthog Prospect Site, Camden Bay, Beaufort Sea, Alaska, 1999. Abstract. *In*: Proceedin gs of the Alaska Geological Society, 1999 Alaska Science and Technology Symposium, Fairbanks, Ak.

Tornfelt, E. and M. Burwell. 1992. Shipwrecks of the Alaskan Shelf and Shore. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Travis, R. 1989. Unemployment Isn't Prime Factor in Native Suicide. Anchorage, AK: *Anchorage Daily News*, Mar. 1, 1989.

Treacy, S.D. 1988. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1987. OCS Study, MMS 89-0030. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 141 pp.

Treacy, S.D. 1989. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1988. OCS Study, MMS 89-0033. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 101 pp.

Treacy, S.D. 1990. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1989. OCS Study, MMS 90-0047. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 104 pp.

Treacy, S.D. 1991. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1990. OCS Study, MMS 91-0055. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 107 pp.

Treacy, S.D. 1992. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1991. OCS Study, MMS 92-0017. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 92 pp.

Treacy, S.D. 1993. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1992. OCS Study, MMS 93-0023. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 135 pp.

Treacy, S.D. 1994. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1993. OCS Study, MMS 94-0032. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 78 pp.

Treacy, S.D. 1995. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1994. OCS Study, MMS 95-0033. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 116 pp.

Treacy, S.D. 1996. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1995. OCS Study, MMS 96-0006. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 119 pp.

Treacy, S.D. 1997. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1996. OCS Study, MMS 97-0016. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 115 pp.

Treacy, S.D. 1998. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1997. OCS Study, MMS 98-0059. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 143 pp.

Treacy, S.D. 2000. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1998-1999. OCS Study, MMS 2000-066. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 135 pp.

Treacy, S.D. 2001. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 2000. OCS Study, MMS 2001-014. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 111 pp.

Treacy, S.D. 2002. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 2001. OCS Study, MMS 2002-061. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 117 pp.

Trent, J.N. 1986. Brown/Grizzly Bear Survey-Inventory Progress Report Game Management Unit 26A: Western Arctic Slope. *In*: Brown/Grizzly Bear, B. Townsend, ed. Federal Aid in Wildlife Restoration Annual Report of Survey-Inventory Activities XVII, Part V Projects W-22-4 and W-22-5, Job 4.0. Juneau, AK: State of Alaska, Dept. of Fish and Game, 70 pp.

Troy, D.M. 1988. Bird Use of the Prudhoe Bay Oil Field during the 1986 Nesting Season. Anchorage, AK: Alaska Oil and Gas Association, 96 pp.

Troy, D. M. 1995. Bird Use of Coastal Habitats. *In*: Proceedings of North Slope Environmental Studies Conference, Anchorage Ak., Mar. 9-10, 1995. Anchorage, AK: BPXA, pp. 16-26.

Troy Ecological Research Associates. 1993. Bird Use of the Prudhoe Bay Oil Field. Final Report. Northern Alaska Research Studies. Anchorage, AK: BPXA, 58 pp.

Troy Ecological Research Associates. 1995a. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1991-1993. Final Report. Northern Alaska Research Studies. Anchorage AK: BPXA, 20 pp.

Troy Ecological Research Associates. 1995b. Preliminary Characterization of Summer Bird Use of the Proposed Badami Development Area. Final Report. Anchorage, AK: BPXA, 29 pp.

Troy Ecological Research Associates. 1996. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1994 Status Report. Final Report. Northern Alaska Research Studies. Anchorage, AK: BPXA.

Troy Ecological Research Associates. 1997. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1996 Status Report. Final Report. Northern Alaska Research Studies. Anchorage, AK: BPXA.

Troy Ecological Research Associates. 1999. Spectacled Eiders in the Beaufort Sea: Distribution and Timing of Use. Final Report. Anchorage, AK: BPXA, 19 pp.

Truett, J.C. 2000. The Natural History of An Arctic Oil Field.

U.S. Army Corps of Engineers 1984. Public Hearing for the Endicott Development Project EIS, Feb. 29, 1984. Anchorage, AK: U.S. Army Corps of Engineers, 23 pp.

U.S. Army Corps of Engineers. 1987. 1985 Final Report for the Endicott Environmental Monitoring Program. Vol. 2, Meteorology, River Discharge. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District.

U.S. Army Corps of Engineers. 1993. 1988 Endicott Environmental Monitoring Program. Vol. IV, Ice Breakup/Freezeup, Meteorology, River Discharge, Caribou. Anchorage, AK: U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers. 1996. Transcript of Proceedings, Public Scoping Meeting, Northstar EIS Project, Northstar Beaufort Sea Oil and Gas Development, Kaktovik, Mar. 26, 1996. Anchorage, AK: U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers. 1998. Draft Environmental Impact Statement. Beaufort Sea Oil and Gas Development/Northstar Project. Appendix B. Anchorage, AK: U.S. Army Corps of Engineers, 7 Vols.

U.S. Army Corps of Engineers. 1999. Final Environmental Impact Statement. Beaufort Sea Oil and Gas Development/Northstar Project. Anchorage, AK: U.S. Army Corps of Engineers, 7 Vols.

U.S. Department of Energy. 1997. Sale of Naval Petroleum Reserve No. 1 (Elk Hills) Kern County, California. Draft Supplemental EIS for the Sale of NPR-1. DOE/SEIS/PEIR-0158S. Washington, DC: USDOE.

U.S. Dept. of State. 1980. Draft Environmental Impact Statement for the Agreement between the United States and Canada for the Conservation of Migratory Caribou. Washington, DC: U.S. Government Printing Office.

U.S. Geological Survey. 1978. Water Resources Data for Alaska Water Year 1978. Water-Data Report AK-78-1. Reston, VA: U.S. Geological Survey, 425 pp.

U.S. Geological Survey. 1979. An Environmental Evaluation of Potential Petroleum Development on the National Petroleum Reserve in Alaska.

U.S. Geological Survey. 1985. The National Petroleum Reserve in Alaska, Earth Science Considerations.

U.S. Geological Survey. 1987. Water Resources Data for Alaska Water Year 1986. Water-Data Report AK87-1. Reston, VA: U.S. Geological Survey, 278 pp.

U.S. Geological Survey. 1995. USGS Circular 1145.

U.S. Geological Survey. 1996. Water Resources Data for Alaska, Water Year 1995. Water-Data Report AK95-1. Reston, VA: U.S. Geological Survey, 278 pp.

U.S. Geological Survey. 1998. Arctic National Wildlife Refuge Assessment Team. USGS Open-File Report 98-34. Anchorage, AK: U.S. Geological Survey.

Underwood, T.J., J.A. Gordon, L.A. Thorpe, M.J. Millard, and B.M. Osbourne. 1995. Characteristics of Selected Fish Populations of Arctic National Wildlife Refuge Coastal Waters, Final Report 1988-1991. Alaska Fisheries Technical Report 28. Fairbanks, AK: USDOI, Fish and Wildlife Service, Fisheries Resource Office.

University of Alaska, Institute for Social and Economic Research. 1982. Economic and Demographic Structural Change in Alaska. Technical Report No. 73. Anchorage, AK: USDOI, BLM, Alaska OCS Office, Socioeconomic Studies Program, 292 pp.

USDOC, Bureau of the Census. 1971. 1970 Census of Population and Housing, Alaska Final Population and Housing Unit Counts. Washington, DC: U.S. Government Printing Offic.

USDOC, Bureau of the Census. 1991. 1990 Census of Population, Vol. 1: Pacific Division. 1990 Census of Population and Housing, Summary Tape File 1A. Issued September 1991. CD90-1A-9-1. Washington, DC: USDOC, Bureau of the Census, Data User Div.

USDOC, Bureau of the Census. 2000. htpp://quickfacts.census.gov/qfd/index.html.

USDOC, Bureau of the Census. 2001. htpp://quickfacts.census.gov/qfd/index.html.

USDOI, BLM. 1978a. NPR-A 105(c) Values and Resource Analysis. Vol. 3, Study Report 2. Anchorage, AK: USDOI, BLM, NPR-A Task Force, 224 pp.

USDOI, BLM. 1978b. NPR-A 105(c) Ecological Profile. Study Report 4. Anchorage, AK: USDOI, BLM, NPR-A Task Force, 118 pp.

USDOI, BLM. 1978c. NPR-A 105(c) Land Use Study, Socioeconomic Profile. Study Report 3. Anchorage, AK: USDOI, BLM, NPR-A Task Force.

USDOI, BLM. 1979. NPR-A 105(c) Land Use Study, Planning Area Analysis. Study Report 6. Anchorage, AK: USDOI, BLM, NPR-A Task Force.

USDOI, BLM. 1979a. Public Hearing, Official Transcript of Proceedings, Beaufort Sea BF Oil and Gas Lease Sale, Nuiqsut, May 16, 1979. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1979b. Public Hearing, Official Transcript of Proceedings, Beaufort Sea BF Oil and Gas Lease Sale, Kaktovik, May 15, 1979. Anchorage, AK: USDOI, BLM, p. 16.

USDOI, BLM. 1981. Engineering Considerations for Gravel Alternatives in the NPR-A. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1981. NPR-A: Final Environmental Assessment Federal Oil and Gas Lease Sale. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1982a. Scoping Document for Future Oil and Gas Leasing in NPR-A. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1982b. The Scoping Process as a Decision Framework: The NPR-A Experience. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1982c. Barrow Subsistence Hearing. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1983a. Oil and Gas Leasing in the National Petroleum Reserve in Alaska, Final EIS. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1983b. A Record of Decision. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1983c. 810 Analysis. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1990. Western Arctic Resource Management Plan, Subsistence Management Situation Analysis. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1997a. Public Scoping Meeting Transcripts for the NPR-A IAP/EIS, Barrow, Atqasuk, Anchorage, Fairbanks, and Nuiqsut, Mar. 17, 18, 25, 27, and Apr. 10, 1997. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1997b. Symposium on the National Petroleum Reserve-Alaska. Anchorage, AK: USDOI, BLM.

USDOI, BLM. 1998. Public Hearings for the Northeast NPR-A Integrated Activity Plan/Environmental Impact Statement, Nuiqsut, Alaska, Jan. 13, 1998. Anchorage, AK: USDOI, BLM.

USDOI, BLM and MMS. 1998. Northeast National Petroleum Reserve-Alaska Final Integrated Activity Plan/ Final Environmental Impact Statement. BLM/AK/PL-98/016+3130+930. Anchorage, : USDOI, BLM and MMS.

USDOI, Fish and Wildlife Service. 1992. Subsistence Management for Federal Public Lands in Alaska, Final EIS. Anchorage, AK: USDOI, FWS, Region 7, Subsistence Branch, 375 pp.

USDOI, Fish and Wildlife Service, ed. 1995. Stock Assessments Polar Bears (*Ursus maritimus*): Alaska Chukchi/Bering Seas Stock Beaufort Sea Stock. Anchorage, AK: USDOI, FWS, 20 pp.

USDOI, Fish and Wildlife Service. 1996. Spectacled Eider Recovery Plan. Final Report. Anchorage, AK: USDOI, FWS, 157 pp.

USDOI, Fish and Wildlife Service. 1999a. Final Biological Opinion/Conference Report for the Proposed Northstar Development Project, Alaska. Fairbanks, AK: USDOI, FWS, Northern Alaska Ecological Services, 172 pp.

USDOI, Fish and Wildlife Service. 1999b. Population Status and Trends of Sea Ducks in Alaska. Final Report. Fairbanks, AK: USDOI, FWS, Migratory Bird Management, 137 pp.

USDOI, Fish and Wildlife Service. 2002. Polar Bear (*Ursus maritimus*), Southern Beaufort Sea Stock. Anchorage, AK: USDOI, FWS, pp. 1-5.

USDOI, MMS. 1982a. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 71 Draft EIS, Kaktovik, Feb. 4, 1982. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1982b. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 71 Draft EIS, Nuiqsut, Feb. 3, 1982. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1983a. Public Teleconference for the Proposed Arctic Sand and Gravel Lease Sale, Anchorage, Jan. 4, 1983. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1983b. Public Hearing for the Diapir Field Lease Offering (June 1984), Barrow, Oct. 24, 1983. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1984. Diapir Field Lease Offering (Sale 87) Final Environmental Impact Statement. OCS EIS/EA, MMS 84-0009. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 2 Vols.

USDOI, MMS. 1986a. Public Hearings, Official Transcript of Proceedings, Oil and Gas Lease Sale 97, Nuiqsut, Dec. 12, 1986. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1986b. Public Hearings, Official Transcript of Proceedings, Oil and Gas Lease Sale 97. Kaktovik , Dec. 10, 1086. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1986c. Public Hearing, Official Transcript of Proceedings, Oil and Gas Lease Sale 97, Barrow, Dec. 8, 1986. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1987a. Public Hearing for the Chukchi Sea Sale 109 Final EIS, Barrow, Apr. 10, 1987. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1990a. Beaufort Sea Planning Area Oil and Gas Lease Sale 124, Final Environmental Impact Statement. OCS EIS/EA, MMS 90-0063. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1990b. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 124 Draft EIS, Barrow, Apr. 17, 1990. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1990c. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 124 draft EIS, Kaktovik, Apr. 18, 1990. Anchorage, AK: USDOI, MMS, Alaska OCS Region, p. 22.

USDOI, MMS. 1990d. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 124 Draft EIS, Nuiqsut, Apr. 19, 1990. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1994. Scoping Report, Beaufort Sea Sale 144. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1995a. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 144 Draft EIS, Nuiqsut, Nov. 6, 1995. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1995b. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 144 Draft EIS, Barrow, Nov. 8, 1995. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1995c. Public Hearing, Official Transcript of Proceedings, Beaufort Sea Sale 144 Draft EIS, Kaktovik, Nov. 7, 1995. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1995d. Beaufort Sea Sale 144 EIS Workshop, Nuiqsut, Aug. 29, 1995. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1996a. Beaufort Sea Planning Area Oil and Gas Lease Sale 144 Final EIS. OCS EIS/EA, MMS 96-0012. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1996b. Nuiqsut Community Meeting, Aug. 14, 1996. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1996c. Barrow Whaling Captains' Meeting, Aug. 27-28, 1996. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1996d. Proceedings of the 1995 Arctic Synthesis Meeting, Anchorage, Oct. 23-25, 1995. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 37 pp.

USDOI, MMS. 1996e. Public Teleconference for the MMS 5-Year Draft Proposed OCS Oil and Gas Leasing Program 1997-2002, Barrow, Mar. 21, 1996. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 80 pp.

USDOI, MMS. 1996f. Outer Continental Shelf Oil and Gas Leasing Program: 1997-2002, Final Environmental Impact Statement. OCS EIS/EA, MMS 96-0043. Herndon, VA: USDOI, MMS.

USDOI, MMS. 1997. Public Hearing on the Beaufort Sea Sale 170 Draft EIS, Nuiqsut, Jun. 24, 1997. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 1998. Beaufort Sea Planning Area Oil and Gas Lease Sale 170 Final Environmental Impact Statement. OCS EIS/EA, MMS 98-0007. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 2000. MMS Regional Offshore Advisory Committee Meeting, Jan. 6, 2000. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 2000. MMS Update Assessment for 2002-2007 OCS Program. Herndon, VA: USDOI, MMS.

USDOI, MMS. 2001a. Energy Alternatives and the Environment. OCS Report, MMS 2001-096. Herndon, VA: USDOI, MMS.

USDOI, MMS. 2001b. Liberty Development and Production Plan Draft Environmental Impact Statement. OCS EIS/EA, MMS 2001-001. 4 Vols. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 2002a. Final 5-Year Program Environmental Impact Statement for 2002-2007. Herndon, VA: USDOI, MMS, Alaska OCS Region.

USDOI, MMS, Alaska OCS Region. 1987. Chukchi Sea Oil and Gas Lease Sale 109 Final Environmental Impact Statement. OCS Report, EIS/EA MMS 87-011. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS, Alaska OCS Region. 1996. Cook Inlet Planning Area Oil and Gas Lease Sale 149 Final Environmental Impact Statement. 2 Volumes. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS, Alaska OCS Region. 1997. Arctic Seismic Synthesis and Mitigating Measures Workshop, Barrow, Mar. 5-6, 1997. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS, Alaska OCS Region. 1998a. Arctic Kelp Workshop Proceedings, Anchorage, May 12, 1998. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 20 pp.

USDOI, MMS, Alaska OCS Region. 1998b. Liberty Scoping Meeting, Nuiqsut, Mar. 18, 1998. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS, Alaska OCS Region. 1999. Public Meeting Notes. Liberty Project Information Update Meeting, Nuiqsut, Nov. 2, 1999. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS, Alaska OCS Region. 2002a. Liberty Development and Production Plan Draft Environmental Impact Statement. OCS EIS/EA, MMS 2002-019. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS, Alaska OCS Region. 2002b. MMS Public Meeting Beaufort Sea Sales 186, 195, and 202, Barrow, Aug. 1, 2002. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Valkenburg, P. and J.L. Davis. 1985. The Reaction of Caribou to Aircraft: A Comparison of Two Herds. *In*: Caribou and Human Activity. Proceedings of the First North American Workshop, A.M. Martell and D.E. Russell, eds. Whitehorse, Y.T., Canada, Sept. 28-29, 1983. Ottawa, Ontario, Canada: Canadian Wildlife Service, pp. 7-9.

Valkenburg, P. and J.L. Davis. 1986. Population Status of the Fortymile Caribou Herd and Identification of Limiting Factors. Progress Report. Federal Aid in Wildlife Restoration Project W22-4, W22-5, Job 3.32R. Juneau, AK: State of Alaska, Dept. of Fish and Game, 26 pp.

Van Tamelen, P.G. and M.S. Stekoll. 1993. Damage and Recovery Rates of *Fucus* in Herring Bay, Knight Island. *In*: *Exxon Valdez* Oil Spill Symposium Abstract Book, B. Spies, B., J. Evans, B. Wright, M. Leonard, and C. Holba, eds and comps. Anchorage, Ak., Feb. 2-5, 1993. Anchorage, AK: *Exxon Valdez* Oil Spill Trustees; University of Alaska Sea Grant College Program; American Fisheries Society, Alaska Chapter, pp. 173-176.

Vinnikov, K.Y., A. Robock, R.J. Stouffer, J.E. Walsh, C.L. Parkinson, D.J. Cavalieri, J.F.B. Mitchell, D. Garrett, and V.F. Zakharov. 1999. Global Warming and Northern Hemisphere Sea Ice Extent. *Science* 2895468:1934-1937.

von Ziegesar, O., E. Miller, and M.E. Dahlheim . 1994. Impacts on Humpback Whales in Prince William Sound. *In*: Marine Mammals and the *Exxon Valdez*, T.R. Loughlin, ed. San Diego, CA: Academic Press, Inc., pp. 173-191.

Walker, D.A. and W. Acevedo. 1987. Vegetation and a Landsat-Derived Land Cover Map of the Beechy Point Quadrangle, Arctic Coastal Plain, Alaska. CRREL Report 87-5. Hanover, NH: U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory.

Walker, D.A., E.F. Binnian, N.D. Lederer, E.A. Nordstrand, R.H. Meehan, M.D. Walker, and P.J. Webber. 1986. Cumulative Landscape Impacts in the Prudhoe Bay Oil Field 1949-1983. Anchorage, AK: USDOI, Fish and Wildlife Service, 52 pp. plus 3 appendices.

Walker, D.A., P.J. Webber, E.F. Binnian, K.R. Everett, N.D. Lederer, E. Norstrand, and M.D. Walker. 1987. Cumulative Impacts of Oil Fields on Northern Alaskan Landscapes. *Science* 238(4828):757-761.

Walter, B.A., M.S. Horgan, and D.E. Cover. 1991. Meteorology. *In*: 1989 Endicott Environmental Monitoring Program. Final Report, Vol. IV. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District, pp. 1-1 - 5-1 plus appendices.

Walter, B.A., M.S. Horgan, and D.E. Cover. 1992. Meteorology. *In*: 1990 Endicott Environmental Monitoring Program Final Report, Vol. V. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District, pp. 1-1 - 4-1 plus appendices.

Wang, J. and M. Ikeda. 2000. Arctic Oscillation and Arctic Sea Ice Oscillation. *Geophysical Research Letters* 27:1287-1290.

Ward, J.G. and E. Pessah. 1988. Industry Observations of Bowhead Whales in the Canadian Beaufort Sea, 1976-1985. *In*: Port and Ocean Engineering Under Arctic Conditions: Symposium on Noise and Marine Mammals, J.L. Imm and S.D. Treacy, eds. Fairbanks, Alaska: The Geophysical Institute, University of Alaska Fairbanks, pp. 75-88.

Wartzok, D., W.A. Watkins, B. Wursig, and C.I. Malme. 1989. Movements and Behavior of Bowhead Whales in Response to Repeated Exposures to Noises Associated with Industrial Activities in the Beaufort Sea. Anchorage, AK: AMOCO Production Company.

Wartzok, D., W.A. Watkins, B. Wursig, R. Maiefski, K. Fristrup, and B. Kelley. 1990. Radio Tracking Studies of the Behavior and Movements of Bowhead Whales in the Beaufort Sea, Fall 1988-1989. *In*: Fifth Conference on the Biology of the Bowhead Whale *Balaena Mysticetus*. Anchorage, AK: AMOCO Production Company.

Watson Company. 1998a. Liberty High Resolution Geophysical Survey, Foggy Island Bay in Stefansson Sound, Alaska. Anchorage, AK: B PXA.

Watson Company. 1998b. Liberty Pipeline Route Survey, Foggy Island Bay in Stefansson Sound. Anchorage, AK: BPXA.

Watson Company. 1999. Cultural Resource Assessment, Foggy Island Bay in Stefansson Sound, Alaska. Anchorage, AK: BPXA.

Weingartner, T.J. and S.R. Okkonen. 2001. Beaufort Sea Nearshore Under-Ice Currents: Science, Analysis and Logistics. *In*: University of Alaska Coastal Marine Institute Final Report. OCS Study, MMS 2001-068. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 17 pp.

Whitten, K. 1995. Telephone conversation in 1995 from K. Whitten, State of Alaska, Dept. of Fish and Game, to D. Hansen, USDOI, MMS, Alaska OCS Region; subject: population status of the Central Arctic caribou herd.

Whitten K. 1997. Conversation between K. Whitten, State of Alaska, Dept. of Fish and Game, and D. Hansen, Biologist, USDOI, MMS, Alaska OCS Region; subject: population status of the Central Arctic caribou herd.

Whitten K. 1998. Personal communication dated July 24, 1998, from K. Whitten, State of Alaska, Dept. of Fish and Game, to D. Hansen, MMS, Alaska OCS Region; subject: population census of the Central Arctic Caribou Herd east and west of the Sagavanirktok River and differences in calf production between these segments of the herd.

Whitten, K.R. 1990. Movement Patterns of the Porcupine Caribou Herd in Relation to Oil Development. Federal Aid in Wildlife Restoration Progress Report, Project w-232 study 3.34. Juneau, AK: State of Alaska, Dept. of Fish and Game, Div. of Wildlife Conservation.

Whitten, K.R. 1992. Movement Patterns of the Porcupine Caribou Herd in relation to Oil Development. Federal Aid in Wildlife Restoration Research Progress Report, Project W-23-5, Study 3.34. Juneau, AK: State of Alaska, Dept. of Fish and Game, 5 pp.

Whitten, K.R. and R.D. Cameron. 1980. Nutrient Dynamics of Caribou Forage on Alaska's Arctic Slope. *In*: Proceedings of the Second International Reindeer/Caribou Symposium, E. Reimers, E. Gaare, and G. Skjensberg, eds. Roros, Norway, pp 159-166.

Winters, J.F. and R.T. Shideler. 1990. An Annotated Bibliography of Selected References of Muskoxen Relevant to the National Petroleum Reserve-Alaska. Fairbanks, AK: State of Alaska, Dept. of Fish and Game, 82 pp.

Withrow, D.E. 1989. Using Aerial Surveys to Determine the Offshore Distribution of Southbound Migrating Gray Whales off Central California in order to Develop the 1988 Population Estimate (Abstract). *In*: The Eighth Biennial Conference on the Biology of Marine Mammals, Pacific Grove, Calif. Seattle, WA: USDOC, NOAA, NMFS, NMML, p. 73.

Wolfe, D.A., M.J. Hameedi, J.A. Galt, G. Watabayashi, J.W. Short, C.E. O'Clair, S. Rice, J. Michel, J.R. Payne, J.F. Braddock, S. Hanna, and D.M. Sale. 1993. Fate of the Oil Spilled from the T/V *Exxon Valdez* in Prince William Sound, Alaska. *In*: *Exxon Valdez* Oil Spill Symposium Abstract Book, B. Spies, L. J. Evans B. Wright M. Leonard and C. Holba, eds and comps. Anchorage, Ak., Feb. 2-5, 1993. Anchorage, AK: *Exxon Valdez* Oil Spill Trustees; University of Alaska Sea Grant College Program; American Fisheries Society, Alaska Chapter, pp. 6-9.

Wolfe, D.A., M.J. Hameedi, J.A. Galt, G. Watabayashi, J. Short, C.E. O'Clair, S. Rice, J. Michel, J.R. Payne, J. Braddock, S. Hanna, and D. Sale. 1994. The Fate of the Oil Spilled from the *Exxon Valdez*. *Environmental Science and Technology* 2813:561A-568A.

Woodward-Clyde Consultants. 1980. Gravel Removal Studies in Arctic and Subarctic Floodplains in Alaska. FWS/OBS-80/08. Anchorage, AK: USDOI, Fish and Wildlife Service.

Woodward-Clyde Consultants. 1983. Lisburne Development Area: 1983 Environmental Studies - Final Report. Anchorage, AK: ARCO Alaska, Inc.

Woodward-Clyde Consultants. 1998. Section 103 Marine Protection, Research and Sanctuaries Act Dredged Material Disposal Site Evaluation in Support of the Liberty Development Project, US Army Corps of Engineers Permit Application. Anchorage, AK: BPXA, pp. 1-1 to 10-4.

Woody, D.A. and D.B. Botkin. 1993. Stock Sizes Prior to Commercial Whaling. *In*: *The Bowhead Whale Book*, J.J. Burns, J.J. Montague, and C.J. Cowles, eds. Special Publication of The Society for Marine Mammalogy, 2. Lawrence, KS: The Society for Marine Mammalogy, 387-407.

Wooley, C.B. and J.C. Haggarty. 1993. Archaeological Site Protection: An Integral Component of the *Exxon Valdez* Shoreline Cleanup. American Society for Testing and Materials, Third Symposium on Environmental Toxicology and Risk Assessment: Aquatic, Plant, and Terrestrial, Atlanta, Ga., Apr. 26-29, 1993. Unpublished Preprint. Philadelphia, PA: American Society for Testing and Materials.

Worl, R. 1978. Beaufort Sea Region Sociocultural Systems. Technical Report No. 9. Anchorage, AK: USDOI, BLM, Alaska OCS Office, Socioeconomic Studies Program.

Worl, R. 1979. Sociocultural Assessment of the Impact of the 1978 International Whaling Commission Quota on the Eskimo Communities. Anchorage, AK: University of Alaska, AEIDC.

Worl, R. and C. Smythe. 1986. A Decade of Modernization. OCS Study, MMS 86-0088. Technical Report. No. 125. Anchorage, AK: USDOI, MMS, Alaska OCS Region, Social and Economic Studies.

Wright, M. 2001. Telephone conversation in 2001 between Marsha Wright, Lead Tax Auditor, North Slope Borough, Administration and Finance and Tim Holder, USDOI, MMS, Alaska OCS Region; subject: certified tax roll.

Zeh, J.E., J.C. George, and R. Suydam. 1995. Population Size and Rate of Increase, 1978-1993, of Bowhead Whales, *Balaena mysticetus*. Forty-Fifth Report of the International Whaling Commission. SC/46/AS12. Cambridge, UK: IWC, pp. 339-344.

Zhang, T., T.E. Osterkamp, and K. Stamnes. 1996. Some Characteristics of the Climate in Northern Alaska, USA. *Arctic and Alpine Research* 284:509-518.

Zhang, J., D.A. Rothrock, and M. Steele. 1998. Warming of the Arctic Ocean by a strengthened Atlantic Inflow: Model Results. *Geophysical Research Letters* 25:1745-1748.

Zieman, J.C., R. Orth, R.C. Phillips, G. Thayer, and A. Thorhaug. 1984. The Effects of Oil on Seagrass Ecosystems. *In*: *Restoration of Habitats Impacted by Oil Spills*, J. Carns, Jr. and A.L. Buikema Jr., eds. Chapter 2. Boston, MA: Butterworth Publishers, pp. 37-64.

INDEX

Index

Index of selected headings and keywords in headings. The EIS analyzes the following alternatives and resources:

Alternatives: Proposal for Sales 186, 195, 202 (Alternative I); No action (Alternative II); Barrow, Nuiqsut, and Kaktovik Subsistence Whaling Deferrals (Alternatives III, IV, V); Eastern Deferral (Alternative VI), and the Agency Preferred Alternative.

Resources: Water Quality, Lower Trophic Level Organisms, Fishes, Essential Fish Habitat, Endangered and Threatened Species, Marine and Coastal Birds, Marine Mammals, Terrestrial Mammals, Vegetation and Wetlands, Economy, Subsistence Harvest Patterns, Sociocultural Systems, Archaeological Resources, Land Use Plans and Coastal Management Programs, Air Quality, Environmental Justice.

Alaska Outer Continental Shelf

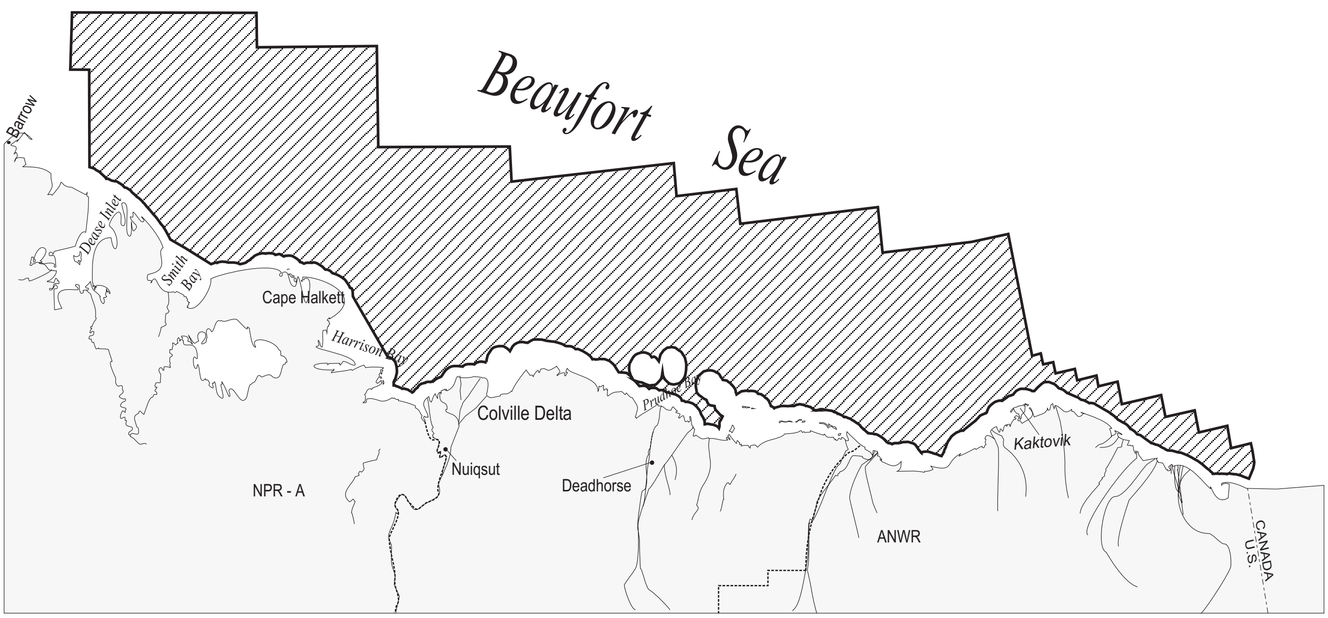
OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area

Oil and Gas Lease Sales
186, 195, and 202

Final Environmental
Impact Statement

Volume III
(Tables, Figures, and Maps for Volumes I and II)



U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

BEAUFORT SEA PLANNING AREA OIL AND GAS LEASE SALES 186, 195, AND 202
Final Environmental Impact Statement
OCS EIS/EA, MMS 2003-001, in 4 volumes:
Volume I, Executive Summary, Sections I through VI
Volume II, Section VII, Bibliography, Index
Volume III, Tables, Figures, and Maps for Volumes I and II
Volume IV, Appendices

The summary is also available as a separate document:
Executive Summary, **MMS 2003-002.**

The complete EIS is available on CD-ROM (**MMS 2003-001 CD**) and on the Internet (**http://www.mms.gov/alaska/cproject/Beafort Sea/**).

This Environmental Impact Statement (EIS) is not intended, nor should it be used, as a local planning document by potentially affected communities. The exploration, development and production, and transportation scenarios described in this EIS represent best-estimate assumptions that serve as a basis for identifying characteristic activities and any resulting environmental effects. Several years will elapse before enough is known about potential local details of development to permit estimates suitable for local planning. These assumptions do not represent a Minerals Management Service recommendation, preference, or endorsement of any facility, site, or development plan. Local control of events may be exercised through planning, zoning, land ownership, and applicable State and local laws and regulations.

With reference to the extent of the Federal Government's jurisdiction of the offshore regions, the United States has not yet resolved some of its offshore boundaries with neighboring jurisdictions. For the purposes of the EIS, certain assumptions were made about the extent of areas believed subject to United States' jurisdiction. The offshore-boundary lines shown in the figures and graphics of this EIS are for purposes of illustration only; they do not necessarily reflect the position or views of the United States with respect to the location of international boundaries, convention lines, or the offshore boundaries between the United States and coastal states concerned. The United States expressly reserves its rights, and those of its nationals, in all areas in which the offshore-boundary dispute has not been resolved; and these illustrative lines are used without prejudice to such rights.

Alaska Outer Continental Shelf

OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, and 202

Final Environmental Impact Statement

Volume III

(Tables, Figures, and Maps for Volumes I and II)

Author
Minerals Management Service
Alaska OCS Region

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

February 2003

TABLE OF CONTENTS

Contents

VOLUME III – TABLES, FIGURES AND MAPS

TABLES

Table Number — **Title**

Section II

Section III

Table Number **Title**

Figures

Figure Number **Title**

Section III

Maps

Map Number	Title
Map 1	Program Area
Map 2	Beaufort Sea Multiple-Sale Deferral Options
Map 3	Cross Island Stipulations 6a and 6b
Map 4	Geographic Zones
Map 5	Generalized Circulation and Currents in the Chukchi and Beaufort Seas
Map 6	Landfast Ice
Map 7	Fall Bowhead Whale Sightings on Transect (1982-2000), Showing Mean Distance from Shore
Map 8	Fall Sighting Rates of Bowhead Whales on Transect (1982-2000), For Years of Heavy, Moderate, and Light Sea-Ice Severity
Map 9a	Spectacled and Steller's Eider Distribution: Aerial Survey Sightings
Map 9b	Spectacled and Steller's Eider Distribution: Eider Locations
Map 10a	Onshore and Offshore Species Distribution: Pacific Loon, Surf Scoter, and Glaucous Gull
Map 10b	Onshore and Offshore Distribution: Long-Tailed Duck
Map 11a	Onshore and offshore Distribution: King Eider and Common Eider
Map 11b	Satellite Transmitter Locations: King Eider and Common Eider
Map 12	Historical Subsistence Land Use for Nuiqsut 1973-1986
Map 13	Essential Fish Habitat (EFH) for Salmon
Map 14a	Known Permitted Gravel and Water Sources
Map 14b	Northeast NPR-A Permitted Water Sources and Ice Roads through 2001
Map 15	Archaeology Blocks and Location of Shipwrecks in the Multiple-Sale Area
Map 16	Historical Sales, Blocks Leased in Previous Beaufort Sales
Map 17	Historical Sales, Areas Previously Offered in Beaufort Lease Sales

TABLES

Table II.A-1
Possible Sales-Related Activities

	Near/Shallow Zone		Midrange/Medium Zone		Far/Deepwater Zone		
	Leasing and Exploration	Development Projects	Leasing and Exploration	Development Projects	Leasing and Exploration	Development Projects	Total Projects
Sale 186	70%	2	20%	1	10%	0	3
Sale 195	50%	1	30%	1	20%	0	2
Sale 202	40%	0	30%	0	30%	1	1
Total	53%	3	27%	2	20%	1	6

Table II.A-2
Area and Deferral Comparisons for Alternatives I through VI

Alternative	Whole or Partial Blocks Deferred	Whole or Partial Blocks in Alternative	Hectares Deferred	Hectares in Alternative	Acres Deferred	Acres in Alternative
Alternative I						
Program Area Proposal	1,877	NA	NA	3,953,832	NA	9,769,921
Alternative II						
No Action	0	NA	NA	NA	NA	NA
Alternative III						
Barrow Subsistence Whaling Deferral	26	1,851	55,735	3,898,097	137,721	9,632,199
Alternative IV						
Nuiqsut Subsistence Whaling Deferral	30	1,847	65,518	3,888,314	161,895	9,608,025
Alternative V						
Kaktovik Subsistence Whaling Deferral	28	1,849	49,116	3,904,715	121,367	9,648,553
Alternative VI						
Eastern Deferral	60	1,817	114,395	3,839,437	282,670	9,487,250

Table II.A-3
Resource Potential Affected by Deferrals

Beaufort OCS	**Opportunity-Index**
Deferral Areas	**(Commercial Chance)**
No Action	100%
Barrow Subsistence Whaling Deferral	0.01
Nuiqsut Subsistence Whaling Deferral	0.05
Kaktovik Subsistence Whaling Deferral	0.03
Eastern Deferral	0.03
1. For purposes of analysis, we assume that 460 million barrels of oil could be discovered and produced from a typical lease sale offering the entire Beaufort Sea Planning Area.	
2. One or more prospects could exist in any of the deferral areas that could hold oil resources totaling 460 million barrels of oil.	
3. The chance that all of the resources are located, will be leased and discovered, and eventually become commercial oil fields in a deferral area is given by the Opportunity Index. For example, there is a 5% chance (or 1 in 20) that commercial fields will be discovered and produced from the Nuiqsut Subsistence Whaling Deferral. There is a 95% chance that the assumed 460 million barrels will be leased, discovered, and produced elsewhere in the planning area.	

Note:
OCS = Outer Continental Shelf.

Table II.A-4 Summary of Effects for Sale 186

Beaufort Sea Multiple Lease Sale Environmental Impact Statement

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

This table provides summary information by alternative and resource for Sale 186. For each resource, this table first summarizes the effects that are common to all alternatives, except for Alternative II (No Lease Sale). It then summarizes the effects of the Proposal (Alternative I) and all other deferral alternatives having the same effects. When applicable, this table identifies the other alternative combinations that have different effects. Tables II.A-5 and II.A-6 provide similar summaries of effects by resource and alternative for Sales 195 and 202. The bold text in column 2 of Tables II.A-5 and II.A-6, help identify the differences in effects between Sale 186, 195, and 202. Table IV-Summary provides a comparison of effects for all resources, for all deferral alternatives and sales. In evaluating the alternatives, an analyst may identify different effects between alternatives, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered. However, if economic oil and gas resources are discovered in the remaining area the level of development activity and the amount of production (460 million barrels) will be the same. This assumption reflects the real-world situation that only larger economic fields can and will be developed. Small, noneconomic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based on the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis “conditional” number assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, the MMS requires companies to have and to implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based on location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analyses provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analyses.

Water Quality (Section IV.C.1)

Lower Trophic-Level Organisms (Section IV.C.2)

Fishes (Section IV.C.3)

Essential Fish Habitat (Section IV.C.4)

Endangered and Threatened Species (Section IV.C.5)

Bowhead Whales (Section IV.C.5.a)

Steller’s Eiders (Section IV.C.5.b)

Spectacled Eiders (Section IV.C.5.c)

Marine and Coastal Birds (Section IV.C.6)

Marine Mammals (Section IV.C.7)

Terrestrial Mammals (Section IV.C.8)

Vegetation and Wetlands (Section IV.C.9)

Economy (Section IV.C.10)

Subsistence-Harvest Patterns (Section IV.C.11)

Sociocultural Systems (Section IV.C.12)

Archaeological Resources (Section IV.C.13)

Land Use Plans and Coastal Management Programs (Section IV.C.14)

Air Quality (Section IV.C.15)

Environmental Justice (Section IV.C.16)

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).
Cumulative Effects	Based on the total number of projects or the number of offshore projects, the contribution from Sale 186 could range up to one-tenth of the foreseeable cumulative effects. A spill could affect water quality for 10 or more days in a local area. The effects of discharges and offshore construction activities are expected to be short term, lasting as long as the individual activity, and have the greatest impact in the immediate vicinity of the activity. The contribution from Sale 186 to the total number of offshore projects (11) is about 9%, and it would contribute about one-tenth of the cumulative effects described in the preceding paragraph.
Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas, and even small spills of refined petroleum in relatively shallow water could affect benthic organisms, including kelp communities.. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Cumulative Effects	One offshore oil spill of about 3,000 barrels is estimated for the past, present, and reasonably foreseeable developments. About half of the reasonably foreseeable developments would be outside of the barrier islands, and the cumulative risk to river deltas and other sensitive portions of the coastline would not increase proportionally. Also, none of the developments other than possibly Liberty would be near the Boulder Patch and, therefore, the cumulative risk to it would be slightly greater with Sale 186. Benthos would be disturbed (buried) during pipeline and island construction for the reasonably foreseeable developments. The total disturbed area probably would be less than 800 acres, and the effect would be moderated by benthic colonization on old exploration islands that were abandoned during the past decade. The contribution of Sale 186 to the cumulative analysis for lower-trophic-level organisms is minimal for disturbance effects and is estimated at about 4% of the effects from a large oil spill to the cumulative case. Sale 186 is not expected to make a measurable contribution to the cumulative effects on these organisms.

Fishes	
Effects Common to Alternatives I, III, IV, V, and VI	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). A few fish could be harmed or killed, but most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.
Cumulative Effects	Disturbances associated with Sale 186 are not likely to make a measurable contribution to the overall cumulative effect on fishes. Some fish in the vicinity of a large oil spill may be adversely affected by it. Those that are affected are likely to experience effects ranging from minor and short-term to no effect at all. Large oil spills associated with Sale 186 are not likely to have a measurable additive effect on fish populations. The contribution of Sale 186 to the cumulative effects from disturbances and oil spills is not likely to make a measurable contribution to the overall cumulative effect on fishes.
Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could affect salmon smolt. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.
Cumulative Effects	The low level of effects from seismic surveys, exploration and drilling activities, and drilling mud are unlikely to increase above the present level of effects. The substantial accumulation of effects on essential fish habitat are more likely to occur from oil spills effects on freshwater and estuarine water than on marine water essential fish habitat. However, because of the low water temperatures, the marine habitat is unlikely to support any salmon, even with a maximum trend of temperature increases each decade. Therefore, no cumulative effect of oil spills on marine essential fish habitat is likely, because the effects likely would dissipate before salmon ever use the habitat. If there are cumulative effects on essential fish habitat, they are a decrease in the theoretical time to extinction of any existing marginal salmon populations using freshwater or estuarine habitat. The contribution of Sale 186 to the cumulative-effect level of seismic surveys, exploratory drilling, and drilling-mud disposal is unlikely to increase above the present low level of effects. If a large oil spill actually occurs as a result of Sale 186, the greatest likelihood of oil reaching the coastal freshwater essential fish habitat is 3-14%.

Endangered and Threatened Species - Bowhead Whale	
Effects Common to Alternatives I, III, IV, V, and VI	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowhead's prey species likely would be negligible. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration. The differences in noise and oil-spill effects to bowhead whales from these deferrals likely would be difficult to measure. Overall, leasing, exploration, and production activities associated with Sale 186 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.
Cumulative Effects	Overall, exposure of bowhead whales to noise from oil and gas operations is not expected to kill any bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The incremental contribution of effects from Sale 186 to the overall effects under the cumulative case is not likely to cause an adverse effect on the bowhead whale population.

Endangered and Threatened Species --Steller's Eider	
Effects Common to Alternatives I, III, IV, V, and VI	Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.
Cumulative Effects	Although little Steller's eider mortality is expected from an oil spill, knowledge regarding their numbers and distribution in this region is insufficient to allow realistic calculation of risk or effects from cumulative adverse factors. Contribution of Sale 186 to the cumulative case is likely to be about 4% of the local short-term disturbance and habitat alteration effects on eiders. Only in the case of a large, offshore oil spill would these projects be expected to increase cumulative adverse effects to potentially significant population-level consequences.

Endangered and Threatened Species -- Spectacled Eider	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from normal activities associated with oil and gas exploration and development in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter-support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a nonsignificant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.
Alternatives I, III, V, and VI	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by eiders that have higher contact probabilities indicated by the MMS oil-spill model.
Alternative IV	The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I.
Cumulative Effects	The effects from normal activities associated with cumulative exploration and development of oil and gas prospects in the Beaufort Sea are expected to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds are frequently exposed to various disturbance factors, particularly helicopter-support traffic. The frequency of such disturbance is expected to be highest in the vicinity of primary support facilities. Overlap between cumulative project developments could increase disturbance effects. The spectacled eider population, currently declining at a nonsignificant rate, may be slow to recover from small losses or declines in fitness or productivity. No significant overall population effect is expected to result from small losses. In the event a large oil spill occurs in the marine environment, spectacled eider mortality is expected to be less than 100 individuals; however, any substantial loss (for example, 25+ individuals) would represent a significant effect. Mortality resulting from the cumulative effects of oil and gas projects would be additive to natural mortality and interfere with the recovery of the Arctic Coastal Plain population. Recovery from substantial mortality is not expected to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers. The contribution Sale 186 to the cumulative case is likely to be about 4% of the local short-term disturbance and habitat alteration effects on eiders. Only in the case of a large, offshore oil spill would these projects be expected to increase cumulative adverse effects to potentially significant population-level consequences.

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI	The adverse effects on marine and coastal birds from normal exploration and development/production activities in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred-use areas and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a nonsignificant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus nonmolting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternatives I, III, V and VI	The effects from activities include nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by marine and coastal birds that have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur in any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects of an unlikely large oil spill could result in significant effects for long-tailed ducks and king and common eiders. Because Alternatives III, V, and VI defer areas well removed from primary support facilities in the central Beaufort, where most leasing and development is likely to occur, effects from activities and any oil spill on marine and coastal birds are likely to be the same as under Alternative I.
Alternative IV	The effects from activities associated with Alternatives IV on several bird species are likely to be somewhat less than under Alternative I; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.
Cumulative Effects	Overall cumulative effects of oil-industry activities on marine and coastal birds potentially could be substantial in the case of loon species and the king eider, and significant in the case of the long-tailed duck and common eiders, primarily as a result of mortality from oil spills. Although the chance of oil-spill occurrence is small, the potential is highest for contact with bird concentrations in the vicinity of primary support facilities in the central Beaufort where most projects assumed in the cumulative case likely would occur. Also, as a result of the apparent decline in populations of some species and the challenge of recovering spilled oil, particularly in broken-ice conditions, there is uncertainty as to the ultimate effect of any spills on bird populations. Disturbance may cause some small loss of productivity and lowered fitness or survival of birds occupying areas with high levels of industry-activity, but these effects are not expected to be significant. Effects resulting from oil and gas development activities likely would be additive to naturally occurring effects.

Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10% chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.
Cumulative Effects	The overall effects (mainly from one oil spill assumed for this analysis) would be the potential losses of perhaps up to 10 polar bears, a few hundred seals and walruses, and small numbers (probably fewer than 10) of beluga and gray whales. In the likely cumulative case, pinnipeds, polar bear, and beluga and gray whale populations are expected to recover within 1 year, assuming only one large spill (greater than or equal to 1,000 barrels) occurs. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have long-term (more than one generation, or perhaps 5-10 years) effect on sea otters and perhaps harbor seals and other marine mammals. Cumulative noise and disturbance in the Beaufort Sea Planning Area is expected to briefly and locally disturb or displace a few seals, walruses, beluga and gray whales, and polar bears. A few polar bears could be temporarily attracted to the production island, with no significant effects on the population's distribution and abundance. The contribution of Sale 186 is expected to be about 2-4% of the local short-term disturbance and habitat effects on pinnipeds, polar bears, and beluga and gray whales (based on 0.46-billion barrel/11.5-billion barrel oil reserves in Table V-12). Sale 186 likely would contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).
Terrestrial Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.
Cumulative Effects	Terrestrial mammals that would be affected include caribou, muskoxen, grizzly bears, and arctic foxes. Oil development in the Prudhoe Bay area could continue to displace some caribou during the calving season within about 4 kilometers (2.48 miles) of some roads with vehicle traffic that crosses calving habitat. The general shift of caribou calving away from the extensive oil fields may persist. Cows and calves of the Central Arctic Herd may, over time, reduce calving and the use of summer habitats near roads with high levels of traffic. If they do, these activities potentially could affect the caribou's productivity and abundance over the long term. However, this potential effect may not be measurable, because the caribou's productivity greatly varies under natural conditions. Some oil-development projects, such as Badami and Alpine, do not include roads constructed to connect to Prudhoe Bay and the Dalton Highway. They are not likely to disturb or displace calving caribou or change caribou movements across the Arctic Slope. Cumulative oil development is likely to have only local effects on the distribution and abundance of caribou, muskoxen, arctic foxes, and grizzly bears on the North Slope of Alaska but not affect overall distribution and abundance. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have short-term (1-3 years) effects on other terrestrial mammals. The contribution from Sale 186 to the cumulative case is expected to be about 4% of the local short-term disturbance and habitat effects on of caribou, muskoxen, grizzly bears, and arctic foxes and zero reduced use of habitat for calving (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). It could attract few if any foxes to facilities and construction sites, with no effects on distribution and abundance. Sale 186 is estimated to contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).

Vegetation and Wetlands	
Effects Common to Alternatives I, III, IV, V, and VI	Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed. The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs, there is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.
Cumulative Effects	Oil-field development on Alaska's North Slope centers on the Arctic Coastal Plain, which covers about 13 million acres. Existing gravel-mine reserve pits, pads, and other facilities cover more than 7,800 acres (Tables V-3 and V-5). About 50 miles of shoreline, including vegetation and wetland habitats, potentially would be affected by cumulative development within the for Sale 186 area. (See Section III.B.8 for a description of the distribution of vegetation and wetland in the project area.) All projects in Maps 1 and 2 either have or would destroy vegetation through construction of onshore gravel pads, gravel mines, and roads; burial of pipelines; or installation of vertical support members for elevated pipelines. Sources of past and potential impacts include directly digging up and burying vegetation; changes in snow drifting and water drainage; accumulation of dust, salt, and chemicals along roads and near gravel pads; and damage from oil spills and other accidental chemical spills. In terms of acres of land affected, construction causes more than 99% of the effects, with spills having a very minor role. Rehabilitation of gravel pads can result in the growth of grasses-sedges within 2 years after abandonment of the pads. Natural growth of plant cover on abandoned gravel pads would be very slow. Construction of existing facilities, past exploration pads, and vehicle tracts across the tundra landscape have affected a small percentage of the total tundra-wetland habitats on the Arctic Coastal Plain. However, local additive effects of gravel pads, roads, mines, and other facilities on tundra wetlands are expected to persist decades long after the oil fields are abandoned. Complete recovery of oiled coastal wetlands from an unlikely large oil spill could take several decades to fully recover from the spill and associated cleanup activities. Sale 186 would contribute about 4% of the cumulative disturbance effects on over 7,800 acres of tundra and wetlands now affected by oil development (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). Sale 186 is estimated to contribute about 17% mean number of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65 , but the most likely number of offshore spills is zero (Table V-12).

Economy	
Effects Common to Alternatives I, III, IV, V, and VI	Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale. For purposes of analysis, we assume that the exploration and development scenario for Sale 186, will be the same as for each deferral alternative; that is, the OCS activity will occur in a different area and be the same for each deferral alternative.
Cumulative Effects	In total, the cumulative case would generate the following additive annual revenues: • $15 million to the North Slope Borough • $90 million to the State • $125 to the Federal Government This cumulative case is projected to generate additive employment and personal income increases as follows: • 160 jobs annual average for North Slope Borough residents during development, declining to 40 during production. • $10 million in total average annual personal income for workers residing in the North Slope Borough during development, declining to $2.8 million during production. • 5,800 jobs annual average during development, declining to 3,300 during production. $367 million in total average annual personal income for workers residing in Southcentral Alaska and Fairbanks during development, declining to $211 million during production. • $367 million in total average annual personal income for workers residing in residing in the rest of the U.S. during development, declining to $211 million during production. • 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea. The contribution of Sale 186 to the cumulative effect would be as follows: • $1 million revenue average annually to the North Slope Borough annually for 22 years of production • $27 million revenue average annually to the State for 22 years of production • $57 million revenue average annually to the Federal Government for 22 years of production • 40 jobs annual average for North Slope Borough residents during development declining to 9 during production. • $3.4 million in total average annual personal income for workers residing in the North Slope Borough development and declining to $0.7 million during production. • 600 jobs annual average during development, declining to 390 during production. • $38 million in total average annual personal income for production workers, declining to $25 million during production for these workers. • 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea • 10,000 jobs for 6 months for cleanup of an unlikely tanker spill in the Gulf of Alaska

<table>
<tr><th colspan="2">Subsistence-Harvest Patterns</th></tr>
<tr><td>Effects Common to Alternatives I, III, IV, V, and VI</td><td> For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt.
The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik.
Overall, oil spills could affect subsistence resources periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities.
Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations.
Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill.
Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant. </td></tr>
<tr><td>Alternative IV</td><td>Even though effects on subsistence would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.</td></tr>
</table>

Subsistence-Harvest Patterns (Continued)	
Cumulative Effects	Cumulative effects on subsistence-harvest patterns include effects from Sale 186 exploration and development and other past, present, and reasonably foreseeable projects on the North Slope with one or more important subsistence resources becoming unavailable or undesirable for use for 1-2 years, a significant adverse effect. Sources that could affect subsistence resources include potential oil spills, noise and traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. The communities of Barrow, Nuiqsut, and Kaktovik potentially would be most affected. Nuiqsut potentially would be the most affected community, because it is within an expanding area of oil exploration and development both onshore (Alpine and the Northeast National Petroleum Reserve-Alaska) and offshore (Northstar and McCovey). In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive (but not synergistic) significant effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Because a large oil spill is unlikely, attaining a level of significant effect also is unlikely. The contribution of Sale 186 is about 4% of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. While the most likely number of oil spills greater than or equal to 500 barrels from all past, present, and future activities onshore is estimated to be 5, the most likely number of offshore spills is estimated to be 0 Sale 186 is estimated to contribute about 17% of the estimated mean number of cumulative offshore spills, with a most likely number of spills of 0 (Table V-12). In the unlikely event of a spill from Sale 186, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads, threatening a critical underpinning of Inupiat culture. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated.
Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I, III, V, and VI	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternative IV	The effects to subsistence-harvest patterns are expected to be reduced under this alternative, Subsequent effects reductions to sociocultural systems also would be expected.
Cumulative Effects	The contribution from Sale 186 to cumulative effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from oil-spill-cleanup activities, small changes in population and employment, and disruption of subsistence-harvest patterns from oil spills and oil-spill cleanup. Disturbance effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. Community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill.

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. • Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks • Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks • Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks • Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI	The potential effects on archaeological resources are essentially the same as discussed for general effects, with activity concentrated in the Near Zone, close to existing infrastructure. If extended-reach drilling techniques are used instead of offshore platforms or islands, possible offshore effects would be minimized. More potential effects could occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Although all the projected development is in the Near and Midrange zones where there is a higher potential for archaeological resources to occur, prehistoric and historic resources both onshore and offshore will be identified by archaeological surveys and avoided or mitigated.
Alternative III	Alternatives III would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.
Cumulative Effects	In addition to Sale 186, other activities associated with this cumulative analysis that may affect archaeological resources in the Beaufort Sea include lease sales and activity in the National Petroleum Reserve-Alaska and State lands, State oil and gas fields, oil and gas transportation, noncrude carriers, and any Federal activities. Cumulatively, these proposed projects likely would disturb the seafloor more often, but remote-sensing surveys made before approval of any Federal or State lease actions should keep these effects low. Federal laws would preclude effects to most archaeological resources from these planned activities. The contribution of Sale 186 to the cumulative case is expected to be minimal for archaeological resources, because any surface-disturbing activities that could damage archaeological sites would be mitigated by current State and Federal procedures, which require identification and mitigation of archaeological resources in the proposed project areas. Overall effects of Sale 186 would be additive to effects anticipated for other future projects and, in the case of oil spills, is uncertain. However, data from the Exxon Valdez oil spill indicate that less than 3% of the resources within a spill area would be significantly affected.

Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.
Cumulative Effects	The potential for conflicts arising from the cumulative case is the same as those discussed in Section IV.C Effects Common to All Alternatives. Conflicts with Statewide standards of the ACMP and the policies of the NSB CMP are not inherent in the hypothetical scenarios presented in the cumulative case. Sale 186 represents a small proportion (4%) of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. No conflicts are anticipated for activities associated with Sale 186 and its contribution to the cumulative case does not alter the conclusion for the cumulative case. This conclusion is based partly on the small contribution of Sale 186, but predominantly on the conclusion that exploration and development and production can proceed consistent with the enforceable policies of the ACMP and the NSB CMP. The MMS regulatory oversight and lease stipulations address many of the concerns applicable to the enforceable standards. In addition, the consistency review of these activities will address the applicable policies at the time that specific plans are submitted.
Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.
Cumulative Effects	The cumulative effects of all projects affecting the North Slope of Alaska in the past and occurring now have caused generally little deterioration in air quality, which remains better than required by national standards. All reasonably foreseeable North Slope projects (see Table V-1a) would not change this situation. Considering that predicted discoveries and development from Sale 186 would represent only a few percent of the existing North Slope activity, air emissions from Sale 186 would have no significant contribution to cumulative effects for air quality.

Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.
Cumulative Effects	Potential effects would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the North Slope Borough; however, effects are not expected from routine activities and operations. If a large spill assumed in the cumulative case occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives, because oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health. Any potential effects to subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated. Only in the event of a large spill, which is a low likelihood event, would disproportionate high adverse effects be expected on Alaska Natives from Sale 186.

Table II.A-5 Summary of Effects for Sale 195

Beaufort Sea Multiple Lease Sale Environmental Impact Statement

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

The information in this summary provides summary information by alternative and resource for Sale 195. For each resource, this table first summarizes the effects that are common to all alternatives, except for Alternative II, No Lease Sale. See Section IV.B for the effects of Alternative II. This table then summarizes the effects of the Proposal (Alternative I) and all Alternatives III-VI having the same effects. When applicable, this table identifies the other alternative combinations that have different effects. Tables II.A-4 and II.A-6 provide similar summaries of effects by resource and alternative for Sales 186 and 202. The bold text in column 2 in this table and Table II.A-6, help identify the differences in effects among Sales 186, 195, and 202. Table IV-Summary provides a comparison of effects for all resources for all alternatives and sales. In evaluating the alternatives, an analyst may identify different effects between alternatives, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered. However, if economic oil and gas resources are discovered in the remaining area, the level of development activity and the amount of production (460 million barrels) will be the same. This assumption reflects the real-world situation that only larger economic fields can and will be developed. Small, noneconomic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based upon the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis “conditional” number assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, the MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based upon location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analysis provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analysis.

Water Quality (Section IV.C.1)

Lower Trophic-Level Organisms (Section IV.C.2)

Fishes (Section IV.C.3)

Essential Fish Habitat (Section IV.C.4)

Endangered and Threatened Species (Section IV.C.5)

Bowhead Whales (Section IV.C.5.a)

Steller’s Eiders (Section IV.C.5.b)

Spectacled Eiders (Section IV.C.5.c)

Marine and Coastal Birds (Section IV.C.6)

Marine Mammals (Section IV.C.7)

Terrestrial Mammals (Section IV.C.8)

Vegetation and Wetlands (Section IV.C.9)

Economy (Section IV.C.10)

Subsistence-Harvest Patterns (Section IV.C.11)

Sociocultural Systems (Section IV.C.12)

Archaeological Resources (Section IV.C.13)

Land Use Plans and Coastal Management Programs (Section IV.C.14)

Air Quality (Section IV.C.15)

Environmental Justice (Section IV.C.16)

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. Increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).
Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas, and even small spills of refined petroleum in relatively shallow water could affect benthic organisms, including kelp communities.. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Fishes	
Effects Common to Alternatives I, III, IV, V, and VI	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). A few fish could be harmed or killed, but most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.

Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could effect smolting salmon. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.
Endangered and Threatened Species - Bowhead Whales	
Effects Common to Alternatives I, III, IV, V, and VI	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowheads prey species likely would be negligible. Whales exposed to spilled oil would likely experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration. The differences in noise and oil-spill effects to bowhead whales from these deferrals would likely be difficult to measure. Overall, leasing, exploration, and production activities associated with Sale 195 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.

Endangered and Threatened Species – Steller's Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.
Endangered and Threatened Species -- Spectacled Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from normal activities associated with oil and gas exploration and development in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a non-significant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.
Alternatives I, III, V, and VI	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. **Disturbance of eiders in the Near Zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is expected to take place there.** In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by eiders that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur while the species is in a declining status; however, determination of status may be obscured by natural variation in population numbers. **Effects are likely to be somewhat less than those that could occur as a result of Sale 186.**
Alternative IV	The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I.

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI	The adverse effects on marine and coastal birds from normal exploration and development/production activities in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred-use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a non-significant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternative I	The effects from normal activities include non-significant disturbance and the potential loss of small numbers of birds from collisions with structures. Disturbance of birds in the Near zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is likely to occur there, while lease activity in the Midrange zone is somewhat greater but the number of development projects is the same. In the event a large oil spill occurs, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by several bird species that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil spill mortality is not likely to occur for any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects are likely to be somewhat less than those that could occur as a result of Sale 186 but still could result in significant effects for long-tailed duck and king and common eider.
Alternatives III, V and VI	Because Alternatives III, V, and VI defer areas well removed from primary support facilities in the central Beaufort, where most leasing and development is likely to occur, effects from activities and any oil spill on marine and coastal birds are likely to be the same as under Alternative I.
Alternatives IV	The effects from activities associated with Alternatives IV on several bird species are likely to be somewhat less than under Alternative I; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.
Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10 % chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.

<table>
<tr><th colspan="2">Terrestrial Mammals</th></tr>
<tr><td>Effects Common to Alternatives I, III, IV, V, and VI</td><td>The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.</td></tr>
<tr><th colspan="2">Vegetation and Wetlands</th></tr>
<tr><td>Effects Common to Alternatives I, III, IV, V, and VI</td><td>Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed.

The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs. There is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.</td></tr>
<tr><th colspan="2">Economy</th></tr>
<tr><td>Effects Common to Alternatives I, III, IV, V, and VI</td><td>Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale.

For purposes of analysis, we assume that the exploration and development scenario for Sale 195, will be the same as for each deferral alternative; that is, the OCS activity will occur in a different area and be the same for each deferral alternative.</td></tr>
</table>

Subsistence-Harvest Patterns	
Effects Common to Alternatives I, III, IV,V, and VI	For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik. Overall, oil spills could affect subsistence *resources* periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.
Alternative IV	Even though effects on subsistence would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.

Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I, III, V, and VI	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternative IV	The effects to subsistence-harvest patterns are expected to be reduced under this alternative, Subsequent effects reductions to sociocultural systems also would be expected.

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. • Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks • Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks • Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks • Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI	The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives**, except that activities may be farther away from existing onshore infrastructure. Exploration activities probably would be conducted from offshore facilities, which reduces the potential impact on onshore archaeological resources. Marine archaeological surveys in areas where offshore archaeological resources may exist would identify likely resources, which would be avoided or effects mitigated. In the development phase, the potential for effects to archaeological resources increases with distance from existing infrastructure, primarily because of onshore pipeline distances and associated construction and right-of-way access and the increased possibility for oil-spill-cleanup activities. Onshore archaeological surveys would identify any potential resources, which will be avoided or possible effects mitigated.**
Alternative III	Alternatives III would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.
Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.
Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

Table II.A-6 Summary of Effects for Sale 202

Beaufort Sea Multiple Lease Sale Environmental Impact Statement

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

The information in this summary provides summary information by alternative and resource for Sale 202. For each resource, this table first summarizes the effects that are common to all alternatives, except Alternative II, No Lease Sale. See Section IV.C for information about the effects of Alternative II. This table then summarizes the effects of the Proposal (Alternative I) and Alternatives III-VI having the same effects. When applicable, this table identifies the other alternative combinations that have different effects. Tables II.A-4 and II.A-5 provide similar summaries of effects by resource and alternative for Sales 186 and 195. The bold text in column 2 of this table and Table II.A-5, help identify the differences in effects among Sale 186, 195, and 202. Table IV-Summary provides a comparison of effects for all resources, for all alternatives and sales. In evaluating the alternatives, an analyst may identify different effects between alternatives, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered. However, if economic oil and gas resources are discovered in the remaining area, the level of development activity and the amount of production (460 million barrels) will be the same. This assumption is necessary and realistic and reflects the real-world assumption that only larger economic fields can and will be developed. Small, non-economic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based upon the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis “conditional” number assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based upon location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analysis provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analysis.

Water Quality (Section IV.C.1)

Lower Trophic-Level Organisms (Section IV.C.2)

Fishes (Section IV.C.3)

Essential Fish Habitat (Section IV.C.4)

Endangered and Threatened Species (Section IV.C.5)

Bowhead Whales (Section IV.C.5.a)

Steller’s Eiders (Section IV.C.5.b)

Spectacled Eiders (Section IV.C.5.c)

Marine and Coastal Birds (Section IV.C.6)

Marine Mammals (Section IV.C.7)

Terrestrial Mammals (Section IV.C.8)

Vegetation and Wetlands (Section IV.C.9)

Economy (Section IV.C.10)

Subsistence-Harvest Patterns (Section IV.C.11)

Sociocultural Systems (Section IV.C.12)

Archaeological Resources (Section IV.C.13)

Land Use Plans and Coastal Management Programs (Section IV.C.14)

Air Quality (Section IV.C.15)

Environmental Justice (Section IV.C.16)

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).
Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas, and even small spills of refined petroleum in relatively shallow water could affect benthic organisms, including kelp communities. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternatives I, III, IV, and V	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the planktonic organisms and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Also, a large spill of refined fuel oil likely would have lethal and sublethal effects on less than 1% of the benthic invertebrates in shallow areas. Recovery likely would occur within a month (within a year where water circulation is significantly reduced).
Alternative VI	**The deferral would reduce the risk that hydrocarbons from a large oil spill would contaminate (Section IV.C.1.b) the bowhead-feeding area near Kaktovik for several days. Other effects would be similar to those described for Sale 202 without a deferral (Alternative I). Permitted drilling discharges likely would adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. The Aurora Prospect in this area was explored during 1988, with no noticeable effects of discharges on lower trophic-level organisms. Platform and pipeline construction likely would adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unintentional construction effects on unusual kelp communities could be avoided by required benthic surveys (Stipulation No. 1).**

Fishes	
Effects Common to Alternatives I, III, IV, V, and VI	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.
Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could effect smolting salmon. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.

Endangered and Threatened Species - Bowhead Whales	
Effects Common to Alternatives I, III, IV, V, and VI	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowheads prey species likely would be negligible. Whales exposed to spilled oil would likely experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration. The differences in noise and oil-spill effects to bowhead whales from these deferrals would likely be difficult to measure. Overall, leasing, exploration, and production activities associated with Sale 202 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.
Endangered and Threatened Species – Steller's Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	**Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.**
Endangered and Threatened Species -- Spectacled Eiders	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from normal activities associated with oil and gas exploration and development in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a non-significant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.
Alternatives I, III, V, and VI	The effects from normal activities include a small amount of nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is low, because only one development is likely, probably located where spectacled eiders are relatively scarce. **Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.**
Alternative IV	**The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I.**

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI	The adverse effects on marine and coastal birds from normal exploration and development/production activities in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred/-use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a non-significant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternative I, III, V and VI	The effects from normal activities include a small amount of nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures**.** In the unlikely event a large oil spill occurs, the risk of contact is low, because only one development is likely, probably located where spectacled eiders are relatively scarce. **Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.**
Alternatives IV	The effects from activities associated with Alternatives IV on several bird species are likely to be somewhat less than under Alternative I; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.
Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10 % chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.
Alternative VI	Effects could be reduced from about Barter Island east to Demarcation Bay. Potential conditional risks of oil contact to pinniped, polar bear, and beluga whale offshore habitats from about Barter Island east to Herschel Island (ERA's 36-37 assuming contact occurs within 30 days during the summer) would be reduced somewhat, if oil exploration and development were deferred under this alternative (Table A.2-21: LA18). However, potential oil-spill risks to habitats west of the Beaufort Lagoon area (Table A.2-21, ERA's 29-35 Ice/Sea Segments 1-6) would be the same as described under Effects Common to All Alternatives.

Terrestrial Mammals	
Effects Common to Alternatives I, III, IV, V, and VI	The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.
Alternative VI	Potential noise and disturbance and habitat effects could be reduced from about Barter Island to Demarcation Bay. The chance of contact to terrestrial mammal coastal habitats from about the Barter Island east to Herschel Island (Land Segments 49-55), within 30 days during summer, would be reduced (0-16%) if oil exploration and development were deferred under this alternative (Table A.2-27: LA18 and P7). However, the chance of contact to coastal habitats west of west of Barter (Table A.2-27, Land Segments 25-42) would be about the same as described in Section IV.C.8.b. The overall effects on caribou, muskoxen, grizzly bears, and arctic foxes likely would be about the same as described under Alternative I, for 202.
Vegetation and Wetlands	
Effects Common to Alternatives I, III, IV, V, and VI	Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed. The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs. There is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.
Alternative VI	Under Alternative VI for Sale 202, potential onshore habitat effects could be avoided from about Barter Island east to Demarcation Bay and potential onshore habitat effects from gravel mining, gravel pads and onshore pipeline installation in this area. The chance of contact to vegetation-wetland coastal habitats from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55 within 30 days during the summer) would be reduced (2-11%), if oil exploration and development were deferred under this alternative (Table A.2-27: LA18). However, the chance of contact to coastal habitats west of Beaufort Lagoon (Table A.2-27, Land Segments 25-48) would be about the same as described under general effects.
Economy	
Effects Common to Alternatives I, III, IV, V, and VI	Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale. For purposes of analysis, we assume that the exploration and development scenario for Sale 202, will be the same as for each deferral alternative; that is, the OCS activity will occur in a different area and be the same for each deferral alternative.

Subsistence-Harvest Patterns	
Effects Common to Alternatives I, III, IV, V, and VI	For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik. Overall, oil spills could affect subsistence *resources* periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.
Alternative III	**Because no exploration or production activities would occur in this deferral area, potential oil-spill, chronic noise, and disturbance effects on subsistence whaling and on Barrow's traditional subsistence-whaling area would be reduced.**
Alternative IV	Although effects on subsistence resources would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns in Nuiqsut are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.
Alternative V	**Although effects on subsistence resources would be essentially the same as described for Alternative I, effects on subsistence-harvest patterns in Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling and the western half of Kaktovik's traditional subsistence-whaling area.**
Alternative VI	**Potential reductions in oil-spill contact to seals, polar bears, gray and beluga whales, caribou, muskoxen, grizzly bears, and arctic foxes from about Barter Island east to Demarcation Bay would reduce effects on these important subsistence resources and on important Kaktovik subsistence-harvest areas.**

Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives III, V, and VI	**Because no exploration or production activities would take place in these deferral areas, potential oil spill, chronic noise, and disturbance effects under Alternative IV for Sale 202 on subsistence whaling and on Barrow's traditional subsistence-whaling area would be reduced.**
Alternative IV	The effects to subsistence-harvest patterns are expected to be reduced under this alternative, Subsequent effects reductions to sociocultural systems also would be expected.

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. • Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks • Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks • Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks • Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI	**The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities would be more dispersed. In the exploration phase, some drilling could take place in deeper water, using floating drilling platforms or ships. These drilling units would use anchors and would probably have their blowout preventer buried, which could disturb potential archaeological resources in the immediate area. No impact is expected to prehistoric archaeological resources from activities in water depths greater than 50 meters. In the development phase, floating drilling and production platforms and possibly subsea production well-head assemblies would have the same disturbance effect to the seafloor as in the exploration phase: anchor dragging and digging the glory hole. The effect of gravel islands or bottom-founded production systems would be the same as discussed under effects common to all alternatives, compression and skirt penetration of sediments. The effect of oil-spill cleanup activities depend on the size of the spill and would probably be limited to the Near Zone, but the response area would be larger and more difficult for response personnel to access, potentially exposing unknown archaeological resources to risk of damage. Onshore and offshore archeological surveys and analyses would be conducted and would identify potential archaeological resources, which will be avoided or possible effects would be mitigated.**
Alternative III	Alternatives III would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.

Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.
Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI.	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

Table III.A-1
Climatic Conditions Onshore

Arctic Coast	
Distance to the ocean (km)	<20
Elevation (m)	<50
Air Temperature (C)	
Mean diurnal amplitude	4 to 8
Range (extreme low-high)	-50 to +26
Mean annual	-12.4 ±0.4
Annual amplitude	17.5 ± 1.2
Degree-Day (C-day)	
Freeze	4930 ± 150
Thaw	420 ± 120
Precipitation (mm)[1]	
Snow	113
Rain	85
Annual total	198
Seasonal Snow Cover	
Average starting date	27 Sept.
Range	4 Sept. to 14 Oct.
Average duration (days)	259
Range (extreme)	212 to 288
Average maximum thickness (cm)	32
Range (extreme)	10 to 83
Thaw Season	
Average starting time	6 Jun.
Range (extreme)	26 May to 19 Jun.
Average length (days)	106
Range (extreme)	77 to 153

Note:
[1] From Natural Resources Conservation Service (1994).
Source:
Zhang, Osterkamp, and Stamnes (1996).

Table III.A-2
Wind Speed and Air Temperature at Tern Island from February to May 1987

Month	Average Wind Speed		Median Wind Speed		Average Air Temperature		Median Air Temperature	
	kts	m/s	kts	m/s	□F	□C	□F	□C
February	9.0	4.6	7.5	3.9	-21.6	-29.8	-21.5	-29.7
March	9.4	4.8	6.0	3.1	-17.6	-27.6	-14.0	-25.6
April	9.1	4.7	9.0	4.6	-4.5	-20.3	-6.0	-21.1
May	12.4	6.4	12.0	6.2	17.0	-8.3	13.0	-10.6

Notes:
C = Carboniferous
F = Fluorine
kts = Knots
m/s = Mass Spectrometry
Source:
USDOI, MMS (1998). Calculated from meteorological data collected at Tern Island in 1987.

Table III.A-3
Summary of Hydrologic Data for Alaska North Slope Streams Adjacent to the Beaufort Sea Multiple-Sale Area

Stream Location (lat., long.)	Headwaters	Drainage Area (mi^2)	Avg. Runoff (cfm)	Peak Runoff (cfsm)	Record Year
Miguakiuk River					
70°40'13", 154°19'20"	Coastal Plain	1,460	0.12	1.1	1
Fish Creek					
70°19"00", 151°28'36"	Coastal Plain	1,699	0.12*	7.0**	<1
Ikpikpuk River					
70°08'12",154°38'30"	Foothills	3,980	0.29*	58.6**	<1
Colville River (nr. Nuiqsut)					
70°09'56",150°55'00"	Brooks Range	20,670	0.70	29.0	7.***

Source:
Arnborg, Walker, and Peippo (1966); Childers et al. (1979); Shannon and Wilson Consultants (1996); U.S. Geological Survey (1978).
Notes:
*Calculated from regional regression.
**Field estimate of maximum evident flood-peak discharge.
***Some years' data are incomplete.

Table III.A-4
Summary of Long-Term Stream-Gauging Data for North Slope Streams Adjacent to the Beaufort Sea Multiple-Sale Area

Stream Location (lat., long.)	Headwaters	Drainage Area (mi^2)	Avg. Runoff (cfm)	Peak Runoff (cfsm)	Record Year
Nunavak Creek					
71°15'35", 156°46'57"	Coastal Plain	2.8	0.37	47.0	25
Putuligayuk River					
70°16"04", 148°37'36"	Coastal Plain	176	0.24	28.3	15
Kuparuk River					
70°16'54",148°57'50"	Foothills	3,130	0.43	37.7	25
Sagavanirktok River					
69°05'24",148°45'34"	Brooks Range	2,208	0.75	28.1	9

Source:
U.S. Geological Survey (1979, 1987, 1996).

Table III.A-5
Ambient Air Quality Standards Relevant to the Beaufort Sea Planning Area (measured in micrograms per cubic meters; an asterisk [*] indicates that no standards have been established)

Pollutant[1]	Averaging Time Criteria					
	Annual	24 hr	8 hr	3 hr	1 hr	30 min
Total Suspended Particulates [2]	60 [3]	150	—	—	—	—
Class II [4]	19 [3]	37	—	—	—	—
Carbon Monoxide	—	—	10,000	—	40,000	—
Ozone [5]	—	—	—	—	235 [6]	—
Nitrogen Dioxide	100 [7]	—	—	—	—	—
Class II [4]	25 [7]	—	—	—	—	—
Inhalable Particulate Matter (PM_{10})	50 [9]	150 [10]	—	—	—	—
Class II [4]	17	30	—	—	—	—
Lead	1.5[11]	—	—	—	—	—
Sulfur Dioxide	80 [7]	365	—	1,300	—	—
Class II [4]	20 [7]	91	—	512	—	—
Reduced Sulfur Compounds [2]	—	—	—	—	—	50

Source: State of Alaska, Dept. of Environmental Conservation (1982), 80, 18, AAC 50.010, 18 AAC 50.020; 40 CFR 52.21 (43 *FR* 26388); 40 CFR 50.6 (52 *FR* 24663); 40 CFR 51.166 (53 *FR* 40671).
Footnotes: [1]All-year averaging times not to be exceeded more than once each year, except that annual means may not be exceeded. [2]State of Alaska air quality standard (not national standard). [3]Annual geometric mean. [4]Class II standards refer to the PSD Program. The standards are the maximum increments in pollutants allowable above previously established baseline concentrations. [5]The State ozone standard compares with national standards for photochemical oxidants, which are measured as ozone. [6]The 1-hour standard for ozone is based on a statistical, rather than a deterministic, allowance for an "expected exceedance during a year." [7]Annual arithmetic mean. [8]PM_{10} is the particulate matter less than 10 micrometers in aerodynamic diameter. [9]Attained when the expected annual arithmetic mean concentration, as determined in accordance with 40 CFR 50 subpart K, is equal to or less than 50 µg/m³. [10]Attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m³, as determined in accordance with 40 CFR 50, subpart K, is equal to or less than 1. [11]Maximum arithmetic mean averaged over a calendar quarter.

Table III.A-6
Measured Air Pollutant Concentrations at Prudhoe Bay, Alaska 1986-1996 (measured in micrograms per cubic meter; absence of data is indicated by asterisks [**])

Pollutant[1]	Monitor Sites					
	A[2]	B[3]	C[4]	D[5]	National Standards[6]	Class II Increments[7]
Ozone						
Annual Max. 1 hr	115.8	180.3	115.6	100.0	235	—
Nitrogen Dioxide						
Annual	26.3	11.9	16.0	4.9	100	25
Inhalable Particulate Matter (PM_{10})						
Annual	—	—	10.5	—	50	17
Annual Max. 24 hr	29.3	—	25.0 [8]	—	150	30
Sulfur Dioxide						
Annual	2.6	—	5.2	2.6	80	20
Annual Max. 24 hr	10.5	—	26.2[8]	13.1	365	91
Annual Max. 3 hr	13.1	—	44.5	55.0	1,300	512
Carbon Monoxide						
Annual Max. 8 hr	—	—	1,400	—	10,000	—
Annual Max. 1 hr	—	—	2,500 [8]	—	40,000	—

Sources: ERT Company, Inc. (1987); Environmental Science and Engineering (1987); ENSR, (1996), as cited in U.S. Army Corps of Engineers (1999).
Footnotes: [1]Lead was not monitored. [2]Site CCP (Central Compressor Plant), Prudhoe Bay monitoring program, selected for maximum pollutant concentrations. All data are for years 1992-1996. [3]Site Pad A (Drill Pad A), Prudhoe Bay monitoring program, site of previous monitoring, selected to be more representative of the general area or neighborhood. All data are for years 1992-1996. [4]Site CPF-1 (Central Processing Facility), Kuparuk monitoring program, selected for maximum pollutant concentrations. Ozone, nitrogen dioxide, and sulfur dioxide are for years 1990-1992; PM_{10} and carbon monoxide data are for 1986-1987. [5]Site DS-1F, Kuparuk monitoring program site selected to be representative of the general area or neighborhood. All data are for years 1990-1992. [6]Applicable National Ambient Air Quality Standards. Please refer to Table III.A-5 for more specific definitions of air-quality standards. [7]Class II PSD Standard Increments. [8]Second highest observed value (in accordance with approved procedures for determining ambient-air quality).

Table III.B-1
Salmon Essential Fish Habitat Components, Seasons, and Areas in the Beaufort Sea

Habitat	Lifestage	Season*	Characteristics	EFH Area in Sale
Freshwater	Eggs and larvae	July to May	substrate	**~314 kilometers**
	Juveniles	year-round	water column, prey, prey habitat	
	Adult	June x Dec.	substrate, water column	
Estuarine	Juveniles	March-Aug.	water column, prey, prey habitat	**~713,000 hectares**
	Adult migrants	June x Sept.	water column, prey, prey habitat	
Marine	Immature	Year-round	water column, prey, prey habitat	**~4,027,000 hectares**
	Adult migrants	June x Sept.	water column, prey, prey habitat	

*** Source:** North Pacific Fisheries Management Council (1997).

Table III.C-1
North Slope Borough Employment by Industry 1990-1998 (nonagricultural wage and salary employment)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Industries	9,185	9,208	8,400	8,823	9,570	9,114	9,149	9,102	9,404
Mining	5,126	5,018	4,411	4,213	4,617	4,436	4,431	4,158	4,753
Construction	373	484	387	361	623	415	344	354	371
Manufacturing	0	0	0	0	0	2	3	7	8
Trans., Comm., & Util.	362	364	241	238	378	403	428	440	435
Wholesale Trade	0	0	0	0	0	0	0	0	0
Retail Trade	252	205	213	487	522	481	524	540	567
Finance, Ins., R.E.	183	177	167	166	166	145	143	175	177
Services	976	1,031	1,008	1,308	949	804	890	1,046	1,035
Government	1,901	1,929	1,964	2,040	2,315	2,428	2,385	2,293	2,068
Federal	107	98	78	57	70	78	43	38	28
State	32	64	60	59	58	58	57	52	56
Local	1,762	1,767	1,827	1,925	2,187	2,293	2,286	2,204	1,983
Miscellaneous	0	0	5	0	0	0	1	1	1
Total Less Mining	4,059	4,190	3,989	4,610	4,953	4,678	4,718	4,854	4,651

* Mining in the North Slope Borough's is completely oil and gas industry employment.
Note: 1999 and 2000 data are not available as of November 2001.
Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section.

Table III.C-2
1998 Employment by Employer, North Slope Borough, Nuiqsut, Kaktovik, and Barrow

	NSB		Nuiqsut		Kaktovik		Barrow	
Employer	**Employment**	**Percent**	**Employment**	**Percent**	**Employment**	**Percent**	**Employment**	**Percent**
Village Corporation	413**	17	33	27	15	20	81	5
NSB School District	296	12	8	6	7	9	176	11
NSB Government	998	41	38	31	35	46	671	44
City Government	59	2	7	7	4	5	30	2
State and Federal Government	74	3	3	2	3	4	53	3
All Other Employees	606	25	35	28	12	16	530	34
Total Less Mining	2,476	100	124	100	76	100	1,541	100

* Results represent only those individuals participating on the census survey.
** Include Arctic Slope Regional Corporation.
Note: Percentage may not total 100 due to rounding.
Source: North Slope Borough (1999).

Table III.C-3
1998 Employment by Employer, Employees by Ethnicity*

	North Slope Borough			
Employer	**Inupiat**	**Caucasian**	**Other Minorities**	**Grand Total**
Federal Government	17	11	11	39
State Government	9	19	7	35
City Government	43	8	6	57
NSB Government	509	217	151	877
NSB School District	134	108	47	289
NSB CIP	82	23	7	112
Oil Industry	10	4	2	16
Private Construction	44	14	8	66
ASRC or Subsidiary	90	26	16	132
Village Corporations	225	33	17	275
Financial/Insurance	0	1	0	1
Transportation	14	17	12	43
Communications	0	4	1	5
Trade	14	9	12	35
Service	28	36	19	83
Ilisagvik College	21	36	12	69
Other	171	68	45	285
Total	1,411	634	373	2,418

***Results include only those individuals responding to the census survey**

NSB = North Slope Borough
CIP = Capital Improvement Program
ASRC =Arctic Slope Regional Corporation
Source: North Slope Borough (1999)

Table III.C-4
1998 Labor Force Summary North Slope Borough, Nuiqsut, Kaktovik, and Barrow

	NSB	**Nuiqsut**	**Kaktovik**	**Barrow**
Labor Force	3,823	176	141	2,508
Permanent/Full Time	2,114	85	62	1,565
Temporary/Seasonal	523	56	19	287
Part Time	222	13	9	91

Source: North Slope Borough (1999).

Table III.C-5
1998 Unemployment and Underemployment in Percent of Total Labor Force

	NSB	Nuiqsut	Kaktovik	Barrow
Unemployment	16	10	15	10
Underemployment (The number of people who indicated that they believe themselves to be underemployed)	13	27	14	12
Underemployment (Those who worked less than 40 weeks in 1998)	27	62	41	24

Note: The percentage of the total labor force.
Source: North Slope Borough (1999).

Table III.C-6
Employment Estimates (in thousands) (nonagricultural wage and salary employment)

	1995	1996	1997	1998	1999	2000
Anchorage – Mat-Su Region	131	132	135	141	144	148
Kenai Peninsula Borough	16	16	16	17	17	n.a.
Fairbanks North Star Borough	31	31	32	33	33	34
Total for 3 areas	178	179	183	191	194	199*
Alaska Total	261	264	269	275	278	284

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section.
n.a. Not available as of November 2001.
* Assumes 17,000 for Kenai Peninsula Borough.

Table III.C-7
1998 Annual Household Subsistence Expenditure By Ethnicity*

	North Slope Borough (NSB)			
Amount	**Inupiat**	**Caucasian**	**Other Minorities**	**Total**
$0	90	11	7	108
$1 to $500	139	20	11	170
$501 to $1,000	103	12	10	125
$1,001 to $2,000	82	6	7	95
$2,001 to $4,000	97	9	1	107
$4,001 to $6,000	97	10	2	109
$6,001 to $8,000	78	3	0	81
$8,001 to $10,000	43	2	1	46
$10,001 or More	112	6	1	119
Total	**841**	**79**	**40**	**960**

Source: North Slope Borough (1999).

* Results include only those households responding to the census surveys and to the question "…during the recent calendar year, what is your best estimate of the money you spend for subsistence activities?"

Table III.C-8
Resources Used in Barrow, Kaktovik, and Nuiqsut

Species	Inupiaq Name	Scientific Name	Location B[1]	K[2]	N[3]
Marine Mammals					
Bearded seal	*Ugruk*	Erignathus barbatus	√	√	√
Ringed seal	*Natchiq*	Phoca hispida	√	√	√
Spotted seal	*Qasigiaq*	Phoca largha	√	√	√
Ribbon seal	*Qaigulik*	Phoca fasciata	√	—	—
Beluga whale	*Quilalugaq*	Delphinapterus leucas	√	√	—
Bowhead whale	*Agviq*	Balaena mysticetus	√	√	√
Polar bear	*Nanuq*	Ursus maritimus	√	√	√
Walrus	*Aiviq*	Odobenus rosmarus	√	√	—
Terrestrial Mammals					
Caribou	*Tuttu*	Rangifer tarandus	√	√	√
Moose	*Tuttuvak*	Alces alces	√	√	√
Brown bear	*Aklaq*	Ursus arctos	√	√	√
Dall sheep	*Imnaiq*	Ovis dalli	√	√	√
Muskox	*Uminmaq*	Ovibus moschatus	—	√	√
Arctic fox (Blue)	*Tigiganniaq*	Alopex lagopus	√	√	√
Red fox [4]	*Kayuqtuq*	Vulpes fulva	√	√	√
Porcupine	*Qinagluk*	Erethizon dorsatum	√	—	—
Ground squirrel	*Siksrik*	Spermophilus parryii	√	√	√
Wolverine	*Qavvik*	Gulo gulo	√	√	√
Weasel	*Itigiaq*	Mustela erminea	—	√	√
Wolf	*Amaguk*	Canis lupus	√	√	√
Marmot	*Siksrikpak*	Marmota broweri	—	√	√
Fish					
Salmon (ns)	—	—	√	√	√
Chum	*Iqalugruaq*	Oncorhynchus keta	√	—	√
Pink (humpback)	*Amaqtuuq*	Oncorhynchus gorbuscha	√	√	√
Silver (coho)	*Iqalugruaq*	Oncorhynchus kisutch	—	[5]	—
King (chinook)	—	O. tshawytscha	—	—	—
Sockeye (red)	—	Oncorhynchus nerka	—	—	—
Whitefish (ns)	*Aanaakliq*	Coregonus sp.	√	√	—
Round w.f.	*Aanaakliq*	Prosopium cylindraceum	√	—	—
Broad w.f.	*Aanaakliq*	Coregonus nasus	√	√	√
Humpback w.f.	*Pikuktuuq*	Coregonus clupeaformis	√	—	√
Least cisco	*Iqalusaaq*	Coregonus sardinella	√	√	√
Bering,Arctic cisco	*Qaaktaq*	Coregonus autumnalis	√	√	√
Other Freshwater Fish					
Arctic grayling	*Sulukpaugaq*	Thymallus arcticus	√	√	√
Arctic char	*Iqalukpik*	Salvelinus alpinus	√	√	√
Burbot (Ling cod)	*Tittaaliq*	Lota lota	√	√	√
Lake trout	*Iqaluaqpak*	Salvelinus narnaycush	√	√	√
Northern pike	*Siulik*	Esox lucius	√	—	—
—	—	—	—	—	—
—	—	—	—	—	—

Species	Inupiaq Name	Scientific Name	Location B[1]	K[2]	N[3]
Fish (continued)					
Other Coast. Fish	—	—	—	—	—
Capelin	*Pagmaksraq*	Mallotus villosus	√	—	—
Rainbow smelt	*Ilhuagniq*	Osmerus mordax	√	—	√
Arctic cod	*Iqalugaq*	Boreogadus saida	√	√	√
Tomcod	*Uugaq*	Eleginus gracilis	√	√	—
Flounder (ns)	*Nataagnaq*	Liopsetta glacialis	—	√	—
Birds					
Snowy owl	*Ukpik*	Nyctea scandiaca	—	—	√
Red-throated loon	*Qaqsraupiagruk*	Gavia stellata	√	—	—
Tundra swan	*Qugruk*	Cygnus columbianus	—	√	√
Eider	—	—	—	—	—
Common eider	*Amauligruaq*	Somateria mollissima	√	√	√
King eider	*Qinalik*	Somateria spectabilis	√	√	√
Spectacled eider	*Tuutalluk*	Somateria fischeri	√	—	—
Steller's eider	*Igniqauqtuq*	Polysticta stelleri	√	—	—
Other ducks (ns)	*Qaugak*	—	√	√	—
Pintail	*Kurugaq*	Anas acuta	—	√	—
Long-tailed duck	*Aaqhaaliq*	Clangula hyemalis	√	√	—
Surf scoter	*Aviluktuq*	Melanitta perspicillata	√	—	—
Goose	—	—	—	—	—
Brant	*Niglingaq*	Branta bernicla n.	√	√	√
White-fronted g.	*Niglivialuk*	Anser albifrons	√	√	√
Snow goose	*Kanuq*	Chen caerulescens	√	√	√
Canada goose	*Iqsragutilik*	Branta canadensis	√	√	√
Ptarmigan (ns)	*Aqargiq*	Lagopus sp.	√	√	√
Willow ptarmigan	*Nasaullik*	Lagopus lagopus	√	—	—
Other Resources					
Berries (ns)	—	—	√	√	√
Blueberry	*Asiaq*	Vaccinium uliginosum	√	—	—
Cranberry	*Kimminnaq*	Vaccinium vitis-idaea	√	—	—
Salmonberry	*Aqpik*	Rubus spectabilis	√	—	—
Bird Eggs (ns)	*Mannik*	—	√	√	—
Gull eggs	—	—	—	√	—
Goose eggs	—	—	—	√	—
Eider eggs	—	—	√	√	—
Greens/Roots (ns)	—	—	√	√	√
Wild rhubarb	*Qunulliq*	Oxyric digyna	√	—	—
Wild chives	*Quagaq*	Allium schoenoprasum	√	—	—
Clams	*Imaniq*	—	√	—	—
Wood	—	—		√	√
Freshwater	*Imiq*	—	√	—	—
Freshwater ice	*Sikutaq*	—	√	—	—
Sea ice	*Siku*	—	√	—	—

Sources: S.R. Braund and Assocs. and UAA, ISER (1993); Pedersen (1995a,b); S. R. Braund and Assocs. (1996).
Footnotes: [1] B, Barrow, resources used 1987–1990. [2]K, Kaktovik, resources used 1992–1993. [3]N, Nuiqsut, resources used 1993. [4]Red fox (Cross, Silver) [5]Harvest of silver, king, and sockeye salmon is rare.
Note: An unchecked box may mean a resource was not used or, especially in the case of "Other Resources," the resource might have been used but use was reported as "berries" rather than "blueberries," for example.
Abbreviations: ns, nonspecified**; w.f.,** whitefish; coast., coastal.

Table III.C-9
Proportion of Inupiat Household Food Obtained from Subsistence Activities, 1977, 1988, and 1993 (proportion is measured in percent)

	All Communities of the North Slope Borough		
Proportion	**1977**	**1988**	**1993**
None	13	20	18
Less Than Half	42	31	25
Half	15	14	15
More Than Half	30	35	42

Source:
Harcharek (1995).

Table III.C-10
Participation in Successful Harvests of Selected Resources (percentage of households per resource)

	Barrow[1]	Nuiqsut[2]	Kaktovik[3]
Total	87 %	90 %	89 %
Marine mammals	76	37	40
Terrestrial mammals	77	76	68
Fish	60	81	81
Birds	65	76	64
Marine Mammals			
Bowhead whale	75 %	5 %	6 %
Walrus	29	0	2
Bearded seals	46	7	28
Ringed seals	19	31	26
Spotted seals	1	2	4
Polar bear	7	2	4
Terrestrial Mammals			
Caribou	77 %	74 %	55 %
Moose	7	10	6
Brown bear	0	8	0
Dall sheep	3	0	28
Wolverine	1	16	13
Arctic Fox	5	13	15
Red Fox	*	23	11
Fish			
Whitefish (all species)	54 %	74 %	70 %
Grayling	21	65	15
Arctic Char	5	31	79
Salmon (all species)	16	36	9
Burbot	10	57	0
Birds			
Geese	40 %	73 %	47 %
Eiders	52	36	38
Ptarmigan	26	45	57

Notes: Dates resources used: [1]1987–1990. [2]1993. [3]1992–1993.
*Represents less than 0.1%.
All numbers are percentages.
Sources: S.R. Braund and Assocs. and University of Alaska, Anchorage, Institute of Social and Economic Research (1993); Pedersen (1995a,b); S.R. Braund and Assocs. (1996).

Table III.C-11
Percent of Total Subsistence Resources Consumed and Total/Per Capita Harvests

Resource	Barrow (%)		Nuiqsut (%)		Kaktovik (%)	
	1962-82[1]	1989	1993	1994-95	1962-82	1992
Bowhead Whale	21.3	38.7	28.7	0	27.5	63.2
Caribou	58.2	22.2	30.6	58	16.2	11.1
Walrus	4.6	8.9	0	—	3.2	*
Bearded Seal	2.9	2.1	0.3	—	7.4	2.4
Hair Seals	4.3	1.6	2.7	2 [2]	4.1	1.0
Beluga Whale	0.5	0.	0	—	6.2	0.
Polar Bear	0.3	2.2	0.	—	2.8	0.7
Moose	0.3	2.2	1.6	5	3.5	1.1
Dall Sheep	0	0.1	0	—	3.8	2.5
Muskox	—	—	0	—	—	1.8
Small Land Mammals	0.1	*	— [3]	— [3]	0.4	*
Birds[4]	0.9	3.3	1.5	5	0.4	1.9
Fishes	6.6	7.8	33.7	30	21.7	13.4
Vegetation	—	0.1	1.4	*	—	0.1
Total Harvest (lb)	928,205	872,092	160,035	267,818	32,408	170,939
Per Capita Harvest (lb)	540	289.16	399.19	741.75	219	885.60

Notes:
[1] Averaged for the period.
[2] Represents all marine mammals harvested in 1994-95: 1 polar bear and 35 ringed seals.
[3] Not harvested for food.
[4] Birds and eggs.
[5] Not calculated in report**.**
*Represents less than 0.1%.
Source: Stoker, 1983, as cited by ACI/Braund (1984); S.R. Braund and Assocs. (1989); State of Alaska, Dept. of Fish and Game (1995a).

Table III.C-12
Number of Animals Harvested, Barrow 1987-1990 (weighted)

	Year 1	Year 2	Year 3	3-Year Average
Bowhead whale	7	11	10	9
Walrus	84	61	101	81
Bearded Seal	236	179	109	174
Ringed Seal	466	388	328	394
Spotted Seal	2	4	4	3
Polar Bear	12	11	39	21
Belukha Whale	0	0	0	0
Caribou	1,595	1,533	1,656	1,595
Moose	52	53	40	48
Dall Sheep	12	12	9	11
Brown Bear	1	1	0	1
Porcupine	5	0	0	2
Ground Squirrel	24	0	17	14
Wolverine	4	2	1	2
Arctic Fox	192	146	48	129
Red Fox	8	4	2	5
Wolf	0	0	0	0
Ermine	0	0	0	0
Whitefish	27,366	20,628	38,053	28,683
Nonspecified	5,108	173	0	1,760
Round	2,122	721	16	953
Broad--riv.&lake	10,579	11,431	30,047	17,352
Humpback	1,225	647	3,648	1,840
Least Cisco	7,024	7,505	2,929	5,819
Arctic Cisco	1,309	151	1,413	958
Grayling	12,664	8,684	8,392	9,914
Arctic Char	38	76	135	83
Burbot	1,086	392	550	676
Lake Trout	153	72	216	147
Northern Pike	2	0	10	4
Salmon	196	80	2,089	788
Nonspecified	66	3	439	169
Chum	11	5	529	182
Pink	12	1	261	92
Silver	103	70	828	334
King	4	1	31	12
Capelin	3,960	0	346	1,435
Rainbow Smelt	97	0	1,480	526
Arctic Cod	0	7,945	17,018	8,321
Arctic Flounder	0	0	0	0
Tomcod	0	194	0	65
Sculpin	0	11	0	4
Geese	2,873	3,334	3,943	3,384
Nonspecified	329	69	34	144
Brant	127	221	973	440
White-Fronted	2,417	3,035	2,932	2,795
Snow	0	8	4	4
Canada	0	1	1	1
Eiders	5,173	4,499	8,590	6,087
Ptarmigan	2,454	1,350	329	1,378
Other Birds	79	0	9	30

Source: Adapted from S.R. Braund & Assocs. (1993).

Table III.C-13
Barrow 1989 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds

	Edible Pounds Harvested				
	Total Number Harvested	Total	Household Harvest Mean	Per capita	Household Percent Participation
Marine Mammals					
Total Marine Mammals	591	508, 181	542.35	168.5	45.0
Bowhead Whale	10	377,647	403.04	125.21	45.0
Belukha Whale	0	0	0.00	0.00	0.0
Walrus	101	77,987	83.23	25.86	13.0
Polar Bear	39	19,471	20.78	6.46	4.0
Bearded Seal	109	19,152	20.44	6.35	11.0
Ringed Seal	328	13,774	14.70	4.57	11.0
Spotted Seal	4	151	0.16	0.05	x
Terrestrial Mammals					
Large Land Mammals	1,705	214,676	229.11	71.18	39.0
Brown Bear	0	0	0.00	0.00	0.0
Caribou	1,656	193,744	206.77	64.24	39.0
Moose	40	20,014	21.36	6.64	6.0
Muskox	0	0	0.00	0.00	0.0
Dall Sheep	9	918	0.98	0.30	2.0
Small Land Mammals/Furbearers	68	7	0.01	0.00	2.0
Arctic Fox	48*	0	0.00	0.00	x
Red Fox	2*	0	0.0	0.00	x
Marmot	0	0	0.00	0.00	0.0
Mink	0	0	0.00	0.00	0.0
Parka Squirrel	17	7	0.01	0.00	x
Weasel	0	0	0.00	0.00	0.0
Wolf	0	0	0.00	0.00	0.0
Wolverine	1	0	0.00	0.00	x
Fish					
Total Fish	68,287	118,471	126.44	39.28	61.0
Total Salmon	2,088	12,244	13.07	4.06	10.0
Total Nonsalmon	66,199	106,226	113.37	35.22	13.0
Smelt	1,825	247	0.26	0.08	2.0
Cod	17,018	3,404	3.63	1.13	5.0
Burbot	550	2,202	2.35	0.73	7.0
Char	350	1,239	1.32	0.41	5.0
Grayling	8,393	6,714	7.17	2.23	9.0
Total Whitefish	38,054	92,399	98.61	30.64	18.0
Broad Whitefish	30,047	78,921	84.23	26.17	--
Cisco	2,929	2,929	3.13	0.97	3.0
Humpback Whitefish	3,648	9,119	9.73	3.02	10.0
Birds					
Total Birds and Eggs	12,869	29,446	31.43	9.76	41.0
Migratory Birds	12,539	29,215	31.18	9.69	37.0
Ducks	8,589	12,883	13.75	4.27	37.0
Eider	8,585	12,877	13.74	4.27	37.0
Oldsquaw	2	4	0.00	0.00	0.0
Geese	3,944	16,289	17.38	5.40	13.0
Brant	973	2,920	3.12	0.97	4.0
Snow Geese	4	19	0.02	0.01	0.0
White Fronted	2,932	13,193	14.08	4.37	12.0
Seabirds and Loons	3	9	0.01	0.00	x
Ptarmigan	329	231	0.25	0.08	5.0
Bird Eggs	--	--	--	--	--

Notes: Number of households in the sample =101; number of households in the community = 937.
Footnotes: *not eaten. [S] Some not eaten. [x] Percent harvesting less than 0.1%.
Source: State of Alaska, Dept. of Fish and Game (1995b) Community Profile Database.

Table III.C-14
Annual Harvest of Polar Bears for the Harvest Years 1983-1995 for the Communities of Barrow, Nuiqsut, and Kaktovik

		Number of Bears	
Harvest Season[1]	Barrow	Nuiqsut	Kaktovik
1983/84	27	0	1
1984/85	31	1	0
1985/86	13	4	5
1986/87	21	5	3
1987/88	12	3	6
1988/89	31[2]	2	8
1989/90	14	0	0
1990/91	14	0	0
1991/92	22	0	0
1992/93	24	0	3
1993/94	28	3	5
1994/95	8	1	1

Source: Schliebe (1995)
[1]Harvest year runs from 1 July to 30 June.
[2]Atqasuk harvested two bears during the 1988/89 season.

Table III.C-15
Nuiqsut 1993 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds

	Edible Pounds Harvested			
	Total Number Harvested	Total	Household Harvest Mean	Per capita
Marine Mammals				
Total Marine Mammals	113	85,216	936.44	236.01
Bowhead Whale	3	76,906	845.12	213.00
Polar Bear	1 *	0	0.00	0.00
Bearded Seal	6	1,033	11.35	2.86
Ringed Seal	98	7,277	79.96	20.15
Spotted Seal	4 *	0	0.00	0.00
Terrestrial Mammals				
Large Land Mammals	691	87,306	959.40	241.80
Brown Bear	10 *	734	8.06	2.03
Caribou	672	82,169	902.95	227.57
Moose	9	4,403	48.38	12.19
Muskox	0	0	0.00	0.00
Dall Sheep	0	0	0.00	0.00
Small Land Mammals/Furbearers	599 §	84	0.92	0.23
Arctic Fox	203	0	0.00	0.00
Red Fox	63	0	0.00	0.00
Marmot	0	0	0.00	0.00
Mink	0	0	0.00	0.00
Parka Squirrel	336	84	0.92	0.23
Weasel	10	0	0.00	0.00
Wolf	31	0	0.00	0.00
Wolverine	19	0	0.00	0.00
Fishes				
Total Fish	71,897	90,490	994.39	250.62
Total Salmon	272	1,009	11.08	2.79
Total Nonsalmon	71,626	89,481	983.30	247.83
Smelt	304	42	0.46	0.12
Cod	62	7	0.07	0.02
Burbot	1,416	5,949	65.37	16.48
Char	618	1,748	19.20	4.84
Grayling	4,515	4,063	44.65	11.25
Total Whitefish	64,711	77,671	853.53	215.12
Cisco	51,791	34,943	383.98	96.78
Arctic Cisco	45,237	31,666	347.97	87.70
Least Cisco	6,553	3,277	36.00	9.08
Birds				
Total Birds and Eggs	3,558	4,325	47.53	11.98
Migratory Birds	2,238	3,540	38.90	9.80
Ducks	772	1,152	12.66	3.19
Eiders	662	1,059	11.63	2.93
Geese	1,459	2,314	25.43	6.41
Brant	296	356	3.91	0.99
Canada Goose	691	830	9.11	2.30
White-Fronted	455	1,092	12.00	3.02
Swan	7	73	0.80	0.20
Ptarmigan	973	681	7.48	1.89

Number of households in the sample = 62; number of households in the community = 91.
Source: State of Alaska, Dept. of Fish and Game (1995b) Community Profile Database.
Footnotes: *Not eaten. §Some not eaten.

Table III.C-16
Subsistence-Harvest by Month for Nuiqsut, July 1, 1994 to June 30, 1995

	1994						1995						Total	Est. Total
Item	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	71 HH's	83 HH's
Arctic Char	0	8	0	0	0	0	0	0	0	0	0	0	8	8
Arctic Cisco[1]	0	0	37	5,737	2,400	1,050	262	0	0	0	0	0	9,486	9,842
Broad Whitefish	1,535	25	75	855	500	0	0	0	0	0	0	130	3,120	3,237
Burbot	0	0	0	9	76	3	0	0	0	0	0	0	88	91
Fish Unidentified	0	0	0	0	0	0	0	0	0	0	0	75	75	78
Grayling	0	24	225	110	84	0	0	0	0	0	0	2	445	462
Humpback Salmon	10	0	0	0	0	0	0	0	0	0	0	0	10	10
Humpback Whitefish[1]	0	0	0	150	25	0	0	0	0	0	0	0	175	182
Least Cisco	0	0	0	0	0	750	0	0	0	0	0	0	750	778
Northern Pike	0	0	0	0	0	0	0	0	0	0	0	18	18	19
Whitefish Unidentified	0	0	0	50	425	0	0	0	0	0	0	0	475	493
Caribou	63	32	6	80	13	4	9	5	13	7	2	15	249	258
Moose	1	1	1	1	0	0	1	0	0	0	0	0	5	5
Wolf	0	0	0	0	1	1	3	0	12	1	0	0	18	19
Wolverine	0	0	0	0	1	1	2	1	1	2	0	0	8	8
Arctic Fox	0	0	0	0	0	1	1	1	3	0	0	0	6	6
Fox Unidentified	0	0	0	0	4	0	0	0	0	0	0	0	4	4
Red Fox	0	0	0	0	0	1	1	1	1	1	0	0	5	5
Polar Bear	0	0	0	0	1	0	0	0	0	0	0	0	1	1
Tundra Swan	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Geese Unidentified	0	0	0	0	0	0	0	0	0	0	409	48	457	474
Eider Unidentified	0	0	0	0	0	0	0	0	0	0	50	40	90	93
Ptarmigan	0	0	0	0	0	0	0	0	0	33	23	0	56	58
Sandhill Crane	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Ringed Seal	2	10	0	0	0	0	0	0	0	6	0	5	23	24
Salmonberries (gal)	0	9	0	0	0	0	0	0	0	0	0	0	9	9
Cranberries (gal)	0	0.5		0	0	0	0	0	0	0	0	0	0.5	1
Blueberries (gal)	0	2.5		0	0	0	0	0	0	0	0	0	2.5	3
Blackberries (gal)	0	0.5		0	0	0	0	0	0	0	0	0	0.5	1

Source: Brower and Opie (1997); Brower and Hepa (1998).
Notes: HH=Households. [1]The harvest of arctic cisco and humpback whitefish is under represented: one household provided evidence of a significant but unquantifiable harvest by saying that "sled loads" were harvested "every couple of days during October and November."

Table III.C-17
Kaktovik 1992 Subsistence-Harvest Summary for Marine Mammals, Terrestrial Mammals, Fish, and Birds

	Edible Pounds Harvested			
	Total Number Harvested	Total	Household Harvest Mean	Per capita
Marine Mammals				
Total Marine Mammals	—	115,645	1,835.64	599.13
Bowhead Whale	—	108,160	1,716.82	560.35
Beluga Whale	0	0	0.00	0.00
Walrus	47 §	52	0.81	0.27
Polar Bear	3	1,330	21.10	6.89
Bearded Seal	24 §	4,246	67.40	22.00
Ringed Seal	42	1,689	26.80	8.75
Spotted Seal	4 §	169	2.68	0.88
Terrestrial Mammals				
Large Land Mammals	212	28,705	455.63	148.71
Brown Bear	0	0	0.00	0.00
Caribou	158	19,136	303.74	99.14
Moose	4	2,011	31.91	10.42
Muskox	5	3,179	50.46	16.47
Dall Sheep	44	4,379	69.51	22.69
Small Land Mammals/Furbearers	213	162	2.56	0.84
Arctic Fox	36 *	0	0.00	0.00
Red Fox	11 *	0	0.00	0.00
Marmot	21	107	1.70	0.55
Mink	0	0	0.00	0.00
Parka Squirrel	133	54	0.86	0.28
Weasel	0	0	0.00	0.00
Wolf	3 *	0	0.00	0.00
Wolverine	9 *	0	0.00	0.00
Fish				
Total Fish	18,468	22,952	364.32	118.91
Total Salmon	50	105	1.66	0.54
Total Non-Salmon	18,415	22,847	362.65	118.37
Smelt	—	—	—	—
Cod	3,673	300	4.76	1.55
Burbot	—	—	—	—
Char	5,741	16,337	259.31	84.64
Grayling	176	158	2.50	0.82
Total Whitefish	8,823	6,051	96.04	31.35
Cisco	8,809	6,027	95.66	31.22
Bering Cisco	8,103	5,672	90.03	29.39
Least Cisco	697	349	5.53	1.81
Birds				
Total Birds and Eggs	1,796	3,249	51.56	16.83
Migratory Birds	970	2,702	42.88	14.00
Ducks	369	553	8.77	2.86
Eiders	248	372	5.90	1.93
Oldsquaw	106	159	2.52	0.82
Geese	601	2,135	33.89	11.06
Brant	378	1,134	18.00	5.87
Canada Goose	164	736	11.68	3.81
White-Fronted	50	223	3.54	1.16
Swan	1	13	0.21	0.07
Ptarmigan	769	539	8.54	2.79
Bird Eggs	56	8	0.13	0.04

Notes: Number of households in the sample = 62; number of households in the community = 91.
Source: State of Alaska, Department of fish and Game (1995b), Community Profile Database.
Footnotes: *Not eaten. §Some not eaten.

Table III.C-18
The Number of Surveyed Households in Each of the Four Survey Seasons (December 1, 1994 to November 30, 1995) in Kaktovik that Reported a Given Activity Code

Activity Code*Reported	Number of Surveyed Households in Each Surveyed Season			Fall
	Winter	Spring	Summer	
	December 1, 1994 to March 31, 1995	April 1 to June 30, 1995	July 1 to September 30, 1995	October 1 to November 30, 1995
1	17	22	42	13
2	7	3	2	13
3	48	40	24	41
4	0	0	1	0
5	1	7	2	3
6	0	0	1	0
7	0	0	0	0
8	0	1	1	0
Total	73	73	73	70

Notes:
Activity Code:
1=harvest
2=attempted—harvest but not successful
3=did not attempt to harvest
4=out hunting
5=out of town
6=could not contact
7=did not want to be interviewed
8=other (any other activity not mentioned above

Harvest Items	Table III.C-19 Reported Subsistence-Harvest by Month for Kaktovik, Alaska December 1, 1994 to November 30, 1995*												Reported for all Survey Seasons
		1995											
	1994	Winter			Spring			Summer			Fall		
	Dec.	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Unk**	
Dolly Varden	100	0	0	2	160	0	16	708	748	0	7	124	10	1,875
Arctic Cisco	0	0	0	0	0	0	0	1,128	1,230	0	0	0	0	2,358
Arctic Cod	0	0	0	0	0	0	0	40	0	0	0	0	0	40
Arctic Flounder	0	0	0	0	0	0	0	13	0	0	0	0	0	13
Chum Salmon	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Grayling	2	0	0	0	1	0	0	0	0	0	0	1	0	4
Sculpin	0	0	0	0	0	0	0	60	75	0	0	0	0	135
Bowhead Whale	0	0	0	0	0	0	0	0	0	3	0	0	0	3
Beluga Whale	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Polar Bear	1	0	0	0	0	1	0	0	0	0	0	0	0	2
Bearded Seal	0	0	0	0	0	0	0	18	3	0	0	0	0	21
Ringed Seal	0	0	0	0	0	5	3	5	1	2	0	0	0	16
Spotted Seal	0	0	0	0	0	0	0	0	2	1	0	0	0	3
Brown Bear	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Moose	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Muskox	0	0	0	4	0	0	0	0	0	0	4	1	0	9
Caribou	9	5	1	0	2	0	0	50	5	3	3	0	0	78
Dall Sheep	7	0	5	3	0	0	0	0	0	0	4	11	0	30
Wolf	1	1	1	2	2	0	0	0	0	0	0	1	0	8
Wolverine	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Arctic Fox	0	0	0	0	0	0	0	0	0	0	0	0	5	5
Ground Squirrel	0	0	0	0	30	0	0	0	0	0	0	0	15	45
Goose Unidentified	0	0	0	0	0	1	8	0	4	0	0	0	0	13
Canada Goose	0	0	0	0	0	0	18	0	0	1	0	0	0	19
Snow Goose	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Brant	0	0	0	0	0	0	207	3	29	0	0	0	0	239
King Eider	0	0	0	0	0	0	39	2	6	0	0	0	0	47
Common Eider	0	0	0	0	0	6	21	27	10	0	0	0	0	64
Common Loon	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Long-Tailed Duck	0	0	0	0	0	0	10	2	13	0	0	0	0	25
Ptarmigan	25	25	0	0	20	0	15	0	0	10	14	10	0	119
Grand Total	146	31	8	11	216	13	339	2,058	2,127	21	32	148	30	5,180

*During this 12 month period, 31 different harvest items were taken.

**Unk = Unknown month (included in total).

Table III.C-20
Cultural/Archaeological Resources Near the Beaufort Sea Multiple-Sale Area

AHRS Site Number	Location	Resource
No reported AHRS sites	Point Barrow to Dease Inlet	—
BAR-0093	Dease Inlet to Cape Simpson	(H) Structure, house ruin
BAR-0023	—	(P) Site, paleontological
BAR-0045	—	(H) Reburial
TES-0031	—	(P) Site, paleontological
TES-0027	—	(H) Test well site
TES-0030	Cape Simpson to Pitt Point	(P) Site, paleontological
TES-0028	—	(H) Site
TES-0048	—	(H) POW-1 DEW Line site
HAR-0019	Pitt Point to Cape Halkett	(H) Site, trading post
No number	—	(H) Site, house (NSB TLUI)
No number	Cape Halkett to Atigaru Point	(H) Site, reindeer corral (NSB TLUI)
No number	—	(H) Site, DEW Line landing strip
HAR-0012	—	(H) Site
HAR-0013	—	(H) Site
HAR-0022	—	(H) Site
HAR-0025	—	(H) Site
HAR-0002	—	(P) Site, lithic remains
HAR-0014	—	(H) Structure
HAR-0018	—	(H) Site
HAR-0040	—	(P) Site, paleontological
HAR-0026	—	(H) Site
HAR-0024	Atigaru Point to Colville River Delta	(H) Site
HAR-0046	—	(H) Site, campsite, tent area, old whaling boat
HAR-0045	—	(H) Site, campsite, drying racks
HAR-0027	—	(H) Site, sod house, ice cellar
HAR-0029	—	(H) Site, sod house, ruins
No number	—	(H) Site, house (NSB TLUI)
HAR-0051	—	(H) Site, remains in dune
HAR-0030	—	(H) Site, settlement, sod houses
No number	—	(H) Site, reindeer herding (NSB TLUI)
HAR-0028	—	(H) Site
HAR-0044	—	(H) Site, recently tended grave
HAR-0169	—	(P)(H) Site, trading, settlement, burials
HAR-0054	—	(H) Structure, lifeboat
HAR-0056	—	(H) Site
HAR-0052	—	(H) Site, historic remains
HAR-0162	—	(H) Site
HAR-0001	—	(P) Site, settlement, houses, artifacts (likely destroyed by a storm)
HAR-0015	—	(H) Site
HAR-0160	—	(H) Site
HAR-0016	—	(H) Site, burials
HAR-0159	—	(H) Site
XBP-0002	Colville River Delta to Milne Point	(H) Site, hunting camp
XBP-0039	—	(H) POW-2 DEW Line site
XBP-0036	—	(H) Site, sod houses, ice cellars, burials
XBP-0044	—	(P?) Site
XBP-0037	—	(P)(H) Site, camp, lithic remains, historic remains
XBP-0008	—	(P)(H) Site, lithic remains from Arctic Small Tool Tradition, historic remains
XBP-0009	—	(H) Site, cabins, house depressions, present-day whaling camp
XBP-0047	—	(P) Site, activity area, lithic remains
XBP-0010	Milne Point to Prudhoe Bay	(H) Site, residential, hunting camp, sod houses and other structures
XBP-0011	—	(H) Site, Naval Arctic Research Laboratory station
XBP-0012	—	(H) Site, old village dating from 1500 AD
XBP-0013	—	(H) Site, sod houses, by 1983 site almost entirely destroyed by natural forces
XBP-0014	—	(H) Site, driftwood structures, whalebone
XBP-0066	—	(H) Site, camp, meat cellar, cache, drying rack
XBP-0003	—	(H) Site, Ahvakana home
XBP-0004	—	(H) Site, sod houses
XBP-0065	—	(H) Site, depression, meat cellar
XBP-0063	—	(H) Site, cemetery, burials
XBP-0064	—	(H) Site, cemetery, burials
XBP-0015	—	(H) Site, sod houses, scattered graves
XBP-0016	—	(H) Site, house ruin
XBP-0043	—	(P) Site, Arctic Small Tool Tradition

Table III.C-20
Cultural/Archaeological Resources Near the Beaufort Sea Multiple-Sale Area (continued)

AHRS Site Number	Location	Resource
XBP-0017	—	(H) Site, sod houses
XBP-0045	—	(P) Site, short-term camp, hearth, lithic artifacts, fire-cracked rock
XBP-0048	—	(P) Site, activity area, hearth, lithic remains
XBP-0049	—	(P) Site, activity area, hearth, lithic remains
XBP-0071	—	(P) Site
XBP-0018	—	(H) Structure, whaling boat
XBP-0040	—	(H) POW-C DEW Line site
XBP-0019	—	(H) Site, sod house ruins, driftwood, milled wood
XBP-0056	—	(H) Discovery well, Prudhoe Bay State No. 1
XBP-0007	—	(P) Site, fire hearth and lithic scatters from Arctic Small Tool, Archaic, and Paleoarctic Traditions
XBP-0005	—	(H) Site, Prudhoe Bay #1, semi-subterranean houses, driftwood cabin
XBP-0006	**Prudhoe Bay to Tigvariak Island**	(H) Site, settlement, tent rings, destroyed by Niakuk oilfield development
XBP-0001	—	(H) Site
XBP-0022	—	(H) Site
XBP-0061	—	(P)(H) Site, depression, house pit
XBP-0023	—	(H) Site
XBP-0024	—	(H) Site, settlement, sod houses
XBP-0025	—	(H) Site
XBP-0020	—	(H) Site, sod and wooden houses, cellars
XBP-0030	—	(H) Site, grave
XBP-0034	—	(P)(H) Site, houses
XBP-0035	—	(H) Site, sod houses, graves
XBP-0038	—	(P)(H) Site, artifacts
XBP-0042	—	(P) Site, fire-cracked rock
XBP-0043	—	(P) Site, artifacts from Arctic Small Tool Tradition
XBP-0062	—	(P)(H) Site, depression, house pit
XBP-0026	—	(H) Site
XBP-0060	—	(H) Site, burial
XBP-0067	—	(H) Site, tent ring, cobbles
XBP-0068	—	(P)(H) Site, cache pit, meat cellar?
XBP-0027	—	(H) Site, sod structure, remains
XBP-0031	**Tigvariak Island to Bullen Point**	(H) Site, camp, dwellings, burials
XBP-0069	—	(H) Site, burials
XBP-0032	—	(H) Site
XBP-0028	—	(H) Site, settlement, habitation, ice cellar
XFI-0021	**Flaxman Island to Bullen Point**	(H) POW-3 DEW Line site
XFI-0024	—	—
XFI-0001	—	—
XFI-0025	—	—
XFI-0023	—	—
XFI-0026	—	—
XFI-0004	**Bullen Point to Brownlow Point**	(H) Site, single dwelling, sod house, settlement
XFI-0005	—	(H) Site, settlement, sod houses
XFI-0006	—	(H) Site, settlement, sod houses
XFI-0002	—	(H) Site, governmental camp, research, permafrost
XFI-0007	—	(H) Site, burials (eroded away)
XFI-0008	—	(H) Site, settlement, sod houses
XFI-0009	—	(H) POW-D DEW Line site
XFI-0020	**Brownlow Point to Collinson Point**	(H) Site, single dwelling, sod house
XFI-0019	—	(H) Site, single dwelling, sod house
XFI-0018	—	(H) Site, single dwelling, sod house
XFI-0017	—	(H) Site, burials
XMM-0018	—	(H) Site
XMM-0019	—	(H) Site
XMM-0004	—	(H) Site
XMM-0114	—	(H) Camden Bay DEW line Station
XMM-0013	—	(P) Site
XMM-0014	—	(P) Site
XMM-0015	—	(P) Site
XMM-0016	—	(P) Site
XMM-0017	—	(P) Site
XMM-0005	—	(H) Site
XMM-0009	—	(P) Site
XMM-0007	—	(P) Site
XMM-0010	—	(P) Site

Table III.C-20
Cultural/Archaeological Resources Near the Beaufort Sea Multiple-Sale Area (continued)

AHRS Site Number	Location	Resource
XMM-0008	—	(P) Site
XMM-0011	—	(P) Site
XMM-0012	—	(P) Site
No number	—	(P?)(H?) Site
XMM-0042	—	(H) Site
XMM-0043	—	(H) Site
XMM-0045	—	(H) Site, cemetery
XMM-0001	—	(P) Site
XMM-0046	—	(H) Site
XMM-0041	—	(H) Site
XFI-0013	—	(H) Site, ice cellar
XFI-0015	—	(H) Site, single dwelling, sod house
XFI-0014	—	(H) Structure, lookout tower
XFI-0003	—	(P) Site
XFI-0016	—	(H) Site, settlement, sod houses, sod quarry
XFI-0011	—	(H) Site, cabin, ice cellar, camp
XFI-0012	—	(H) Site, single dwelling, sod house
XFI-0010	—	(H) Site, settlement, sod houses
BRL-0007	—	(P) Site
BRL-0001	**Barter Island to Canadian Border**	(P) Site
BRL-0004	—	(H) Site
BRL-0023	—	(H) BAR-M DEW Line site
BRL-0046	—	(H) Site, village
BRL-0002	—	(H) Site
BRL-0009	—	(H) Site, burial
BRL-0006	—	(H) Site
BRL-0014	—	(H) Site
BRL-0015	—	(H) Site
BRL-0016	—	(P) Site
BRL-0008	—	(H) Site
BRL-0010	—	(H) Site, ice cellar
BRL-0012	—	(H) Site
BRL-0013	—	(H) Site
BRL-0003	—	(H) Site, ice cellar
BRL-0011	—	(H) Site, burial
BRL-0017	—	(H) Site, burial
BRL-0005	—	(H) Site
No number	—	(H) Site, DEW Line staging site
BRL-0021	—	(H) Site
BRL-0019	—	(H) Site, (cabins?)
XDP-0004	—	(H) Site
XDP-0026	—	(H) Site
XDP-0027	—	(H) Site
XDP-0028	—	(H) Site
XDP-0001	—	(H) Site
XDP-0045	—	(H) Beaufort Lagoon DEW Line Station
XDP-0029	—	(H) Site
XDP-0024	—	(H) Site
XDP-0023	—	(P)(H) Site
XDP-0025	—	(P)(H) Site
XDP-0003	—	(H) Site
XDP-0016	—	(H) Site
XDP-0013	—	(H) Site
XDP-0011	—	(H) Site
XDP-0012	—	(H) Site
XDP-0010	—	(H) Site
XDP-0009	—	(H) Site
XDP-0008	—	(H) Site
XDP-0002	—	(H) Site, Gordon (trading post) and Demarcation Point DEW Line Station
XDP-0005	—	(H) Site, Cemetery
XDP-0006	—	(H) Site
XDP-0007	—	(H) Site
XDP-0014	—	(P)(H) Site
XDP-0015	—	(H) Site
XDP-0044	—	(H) Structure, caribou fence, tent ring

Table III.C-21
Shipwrecks Potentially Within the Beaufort Sea Multiple-Sale Area

Vessel Name	Type	Tons	Date Wrecked	Location	Cause of Wreck
St. George	Whaling Ship	392	8/27/1876	Between Pt. Barrow and Pt. Tangent	Caught in ice and abandoned.
Acors Barnes	Whaling Bark	296	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned; later, burned by Inupiaq Eskimos.
Camilla	Whaling Bark	328	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Cornelius Howland	Whaling Ship	333	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Desmond	Whaling Bark	301	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Java 2nd	Whaling Bark	290	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Josephine	Whaling Bark	363	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Marengo	Whaling Ship	478	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
Onward	Whaling Bark	339	9/5/1876	20-30 mi N of Cape Simpson	Caught in ice and abandoned.
James Allen	Whaling ship	349	9/5/1876	20-30 mi N of Cape Simpson	Trapped in ice and abandoned
Young Phoenix	Whaling Bark	355	8/3/1888	30 mi E of Point Barrow	Lost in ice and gale; crew picked up by steam bark Beluga and rescued later by steamer Bear, Mar. 9, 1888. Still drifting in ice 1 year later.
Reindeer	Whaling Bark	340	8/4/1894	On Reindeer Island, Midway Islands	Ice came in very quickly and ship was forced ashore. Reindeer Island (western most of Midway Islands) was named after this vessel. All hands saved.
Duchess of Bedford	Expedition Schooner	60	4/11/1907	Off Flaxman Island	Caught in ice and crushed.
Elvira	Gas schooner	109	9/23/1913	5 mi offshore of Humphrey Point, E of Barter Island, off Icy Reef	Crushed in ice then lost in an autumn gale. Crew wintered aboard the whaler *Belvedere*. Captain Pedersen walked 400 mi to Fairbanks, then traveled to San Francisco to take charge of the *Herman* for the 1914-whaling season.
Duxbury	Gas trading schooner	38	6/5/1925	1/2 mi NE of Cape Halkett	Caught in ice floe and crushed.
Baychimo	Trading/ Supply steamer	1,322	11/24/1931	Just S of Point Barrow	Caught in ice and abandoned. Vessel drifted for years in Arctic ice, was sighted and even boarded a number of times, but finally disappeared. It was officially listed as lost in 1934. After a number of years, the cargo of furs was recovered by Leslie Melvin who sighted the hulk while travelling by dog sled. Sightings in the Beaufort Sea as late as the 1960's were reported by local Inupiat.
Unnamed	Native whaling boat	?	9/11/1988	30 mi off Point Barrow	Boat lost while whaling. Seventy people began searching. The two whalers, Burton Rexford and his son Mike, managed to make their way to a barge underway off Barrow.
Unnamed	Native whaling boat	?	9/13/1988	Off Kaktovik	Aluminum whaling boat struck ice while whaling off the village of Kaktovik in the Beaufort Sea. One crewman, Simon Tagarook, Jr., suffered head injuries and died; 2 others were injured.
Unnamed	Native whaling boat	?	9/28/1991	30 mi N of Cross Island	Nuiqsut whaling captain Eli Nukapigak and his 4 crew lost their whaling boat after a bowhead whale they had struck pulled their 18-foot boat under water. The men were hauled aboard the whaling boat of Nuiqsut whaling captain Frank Long, which was following close behind. No one was lost.
Unnamed	Native whaling boat	?	9/28/1991	25 mi NE of Cross Island	Captain Archie Ahkiviana and crew lost a whale and their whaling boat in rough seas while towing the whale back to Cross Island. Ahkiviana and his crew were rescued by another whaling boat in the vicinity. No one was lost.

Table IV Summary and Comparisons of Impacts and Cumulative Effects among Alternatives in the Beaufort Sea Multiple EIS

Note to Reader: Please keep the following information in mind as you read the summaries in this table.

The information in this summary provides and compares information among the alternatives and sales. For each resource, this table first summarizes the effects that are common to all alternatives and sales, except for Alternative II, No Lease Sale. See Section IV.B for the analysis of effects for Alternative II. This table summarizes the effects of the Proposal (Alternative I) for the first sale (Sale 186) and Alternatives III-VI and sales (Sales 195 and 202) having the same effects. When applicable, this table identifies the other alternative and sale combinations that have different effects. Tables II.A-4, II.A-5, and II.A-6 provide similar summaries of effects by resource and Alternatives I and III-VI for Sales 186, 195, and 202. In evaluating the alternatives, an analyst may identify different effects between alternatives and sales, but those differences do not translate to changes in the overall effect. For this EIS, we assume that removing areas (deferral alternatives) will decrease the opportunity that an economic resource will be found in the remainder of the area being offered; however, if economic oil and gas resources are discovered in the remaining area, the level of development activity and the amount of production (460 million barrels) will be the same. This assumption is necessary and realistic and reflects the real-world assumption that only larger economic fields can and will be developed. Small, noneconomic fields, when discovered, do not result in development activity.

This EIS uses the comparative term “the same as” to indicate that an impact is essentially identical to or as similar as can be determined to that noted for another alternative. Within the EIS analysis, we use the phrase “the same as” to indicate to the reader that two impacts are considered to be equal. We do not intend this in the pure or mathematical sense. We are not saying that two alternatives are exactly the same in all aspects. Rather, we use the phrase to indicate that two impacts are so close that finding a difference between them is beyond our analytical ability to measure or analyze.

The effects associated with potential oil spills are based upon the assumption, for purposes of analysis, that a spill occurs and no spill-response activities are conducted. Most of the numbers presented in the oil-spill-risk analysis “conditional” number assume that the oil spill occurs and provides information about the likelihood of such a spill contacting a resource. The reader should keep in mind that the probability of a large oil spill (greater than or equal to 1,000 barrels of oil) is less than 10%. The chance of an oil spill occurring and reaching a resource is much less than 10%. Furthermore, the MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Because we cannot predict a specific level of cleanup, which would vary based upon location, weather conditions, time of year, etc., we make a very conservative assumption of zero cleanup and containment.

The summaries presented in this table are based on the comprehensive analysis provided in Section IV.C and Section V. Readers are encouraged to go to the appropriate Sections in IV.C and V for the full analysis.

Water Quality	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Hydrocarbons from small spills could result in local, chronic hydrocarbon contamination; and hydrocarbons from a large oil spill could exceed the 1.5 parts per million acute toxic criterion during the first day of a spill and the 0.015 parts per million chronic criterion for up to a month in an area the size of a small bay. Other effects of the lease sales would not affect regional water quality, including the following three permitted activities. The increased turbidity from permitted construction activities would be local and short term. Trace metals from permitted discharges of drilling muds and cuttings over the life of the field could exceed sublethal levels over only a few square kilometers. If produced waters were discharged, the effect on water quality would be local but would last over the life of the field(s).
Cumulative Effects of Alternative I for Sale 186.	Based on the total number of projects or the number of offshore projects, the contribution from Alternative I for Sale 186 could range up to one-tenth of the foreseeable cumulative effects. A spill could affect water quality for 10 or more days in a local area. The effects of discharges and offshore construction activities are expected to be short term, lasting as long as the individual activity, and have the greatest impact in the immediate vicinity of the activity. The contribution from Alternative I for Sale 186 to the total number of offshore projects (11) is about 9% and it would contribute about one-tenth of the cumulative effects described in the paragraph above.

Lower-Trophic-Level Organisms	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the plankton in the coastal band of high concentration and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Spills of crude oil would probably not affect benthic organisms, but spills of refined petroleum in relatively shallow water could affect them, including kelp communities. The benthic organisms would probably recover within a few years even though small amounts of spilled oil would probably persist in shoreline sediments for more than a decade in spite of cleanup responses.
Alternatives I, III, IV, V, and VI for Sales 186 and 195, and Alternatives I, III, IV, and V for Sale 202.	Permitted drilling discharges are estimated to adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. Platform and pipeline construction is estimated to adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unusual kelp communities could be protected from construction effects by required benthic surveys. The communities likely would colonize and benefit slowly from some new gravel islands. In the unlikely event that a large oil spill occurs, it is estimated to have lethal and sublethal effects on less than 1% of the plankton in the coastal band of high concentration and (assuming a winter spill) less than 5% of the epontic organisms in the sale area. Recovery of plankton likely would occur within a week (2 weeks in embayments). Spills of crude oil would probably not affect benthic organisms, but spills of refined petroleum in relatively shallow water could affect them, including kelp communities. The benthic organisms would probably recovery within a few years even though small amounts of spilled oil would probably persist in shoreline sediments for more than a decade in spite of cleanup responses.
Alternative VI for 202.	The deferral would reduce the risk that hydrocarbons from a large oil spill would contaminate (Section IV.C.1.b) the bowhead-feeding area near Kaktovik for several days. Other effects would be similar to those described for Sale 202 without a deferral (Alternative I). Permitted drilling discharges likely would adversely affect less than 1% of the benthic organisms in the sale area. The organisms likely would recover within a year. The Aurora Prospect in this area was explored during 1988, with no noticeable effects of discharges on lower trophic-level organisms. Platform and pipeline construction likely would adversely affect less than 1% of the immobile benthic organisms in the sale area. Recovery likely would occur within 3 years. Unintentional construction effects on unusual kelp communities could be avoided by required benthic surveys (Stipulation No. 1).
Cumulative Effects of Alternative I for Sale 186.	One offshore oil spill of about 3,000 barrels is estimated for the past, present, and reasonably foreseeable developments. About half of the reasonably foreseeable developments would be outside of the barrier islands, and the cumulative risk to river deltas and other sensitive portions of the coastline would not increase proportionally. Also, none of the developments other than possibly Liberty would be near the Boulder Patch and, therefore, the cumulative risk to it would be slightly greater with Alternative I for Sale 186. Benthos would be disturbed (buried) during pipeline and island construction for the reasonably foreseeable developments. The total disturbed area would probably be less than 800 acres, and the effect would be moderated by benthic colonization on old exploration islands that were abandoned during the past decade. The contribution of Alternative I for Sale 186 to the cumulative analysis for lower-trophic-level organisms is minimal for disturbance effects and estimated at about 4% of the effects from a large oil spills to the cumulative case. Alternative I for Sale 186 is not expected to make a measurable contribution to the cumulative effect on these organisms.

Fishes	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Noise and discharges from dredging, gravel mining, island construction and reshaping, pipeline trenching, and abandonment are likely to have no measurable effect on fish populations (including incidental anadromous species). While a few fish could be harmed or killed, most in the immediate area would avoid these activities and would be otherwise unaffected. Effects on most overwintering fish are likely to be short term and sublethal, with no measurable effect on overwintering fish populations. In the unlikely event of a large oil or diesel fuel spill, effects on arctic fishes (including incidental anadromous species) would depend primarily on the season and location of the spill; the lifestage of the fishes (adult, juvenile, larval, or egg); and the duration of the oil contact. Because of their very low numbers in the spill area, no measurable effects are likely on fishes in winter. Effects would be more likely to occur from an offshore oil spill moving into nearshore waters during summer, where fishes concentrate to feed and migrate. If an offshore spill did occur and contact the nearshore area, some marine and migratory fish may be harmed or killed. However, it likely would not have a measurable effect on fish populations, and recovery would be likely within 5-10 years. In general, the effects of fuel spills on fishes are likely to be less than those of crude oil spills. In the unlikely event of an onshore pipeline oil spill contacting a small waterbody supporting fish (for example, ninespine stickleback, arctic grayling, and Dolly Varden char) and that had restricted water exchange, it likely would kill or harm most of the fish within the affected area. Recovery would be likely in 5-10 years. However, because of the small amount of oil or diesel fuel likely to enter freshwater habitat, the low diversity and abundance of fish in most of the onshore area, and the unlikelihood of spills blocking fish migrations or occurring in overwintering areas or small waterbodies (containing many fish or fish eggs), an onshore spill of this kind is not likely to have a measurable effect on fish populations on the Arctic Coastal Plain.
Cumulative Effects of Alternative I for Sale 186.	Disturbances associated with Alternative I for Sale 186 are not likely to make a measurable contribution to the overall cumulative effect on fishes. Some fish in the vicinity of a large oil spill may be adversely affected by it. Those that are affected are likely to experience effects ranging from minor and short-term to no effect at all. Large oil spills associated with Alternative I for Sale 186 are not likely to have a measurable additive effect on fish populations. The contribution of Alternative I for Sale 186 to the cumulative effects from disturbances and oil spills are not likely to make a measurable contribution to the overall cumulative effect on fishes.

Essential Fish Habitat	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	The same type and size of disturbance (for example, seismic activity, turbidity from construction, or an oil spill) or size of deferral can be expected to have a slightly greater effect in the western Beaufort than in the eastern Beaufort. Less impact would be expected in the central region. One exception is that freshwater effects would be greatest in the central region. The disturbance effects during the exploratory phase are all limited to the 45-day open-water season, except for the possible 3-year recovery of benthic prey and their habitat around exploratory wells. However, benthic organisms are only a minor prey item. Effects on essential fish habitat from seismic surveys, drilling-mud disposal, turbidity, and pipeline construction (both offshore and onshore), are considered low. The effects of ice-road construction could range from low to moderate because of the uncertainty of withdrawing up to 15% of the free water from lakes during the winter. In most cases, the salmon would recover within one generation. In the unlikely event that a large oil spill occurs, effects on freshwater essential fish habitat would be low. Effects of the spill on estuarine and marine essential fish habitats could be moderate and could effect smolting salmon. These salmon would recover within one generation. Changes in abundance would be limited to a population or portion of a population (populations in one stream or in even or odd years for pink salmon populations) and/or for a short time period.
Cumulative Effects of Alternative I for Sale 186.	The low level of effects from seismic surveys, exploration and drilling activities, and drilling mud are unlikely to increase above the present level of effects. The substantial accumulation of effects on essential fish habitat are more likely to occur from oil spills effects on freshwater and estuarine water than on marine water essential fish habitat. However, because of the low water temperatures, the marine habitat is unlikely to support any salmon, even with a maximum trend of temperature increases each decade. Therefore, no cumulative effect of oil spills on marine essential fish habitat is likely, because the effects likely would dissipate before salmon ever use the habitat. If there are cumulative effects on essential fish habitat, they are a decrease in the theoretical time to extinction of any existing marginal salmon populations using freshwater or estuarine habitat. The contribution of Alternative I for Sale 186 to the cumulative effect level of seismic surveys, exploratory drilling and drilling mud disposal are unlikely to increase above the present low level of effects. If a large oil spill actually occurs as a result of Alternative I for Sale 186, the greatest likelihood of oil reaching the coastal freshwater essential fish habitat is 3-14%.

Endangered and Threatened Species - Bowhead Whales	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Bowhead whales exposed to noise-producing activities such as vessel and aircraft traffic, drilling operations, and seismic surveys most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours. The Industry Site-Specific Bowhead Whale-Monitoring Program should be effective in preventing a delay or blockage of the migration. Any effects from the discharge of muds and cuttings or suspension of sediment in the water column would be very localized around the drill rig because of the rapid dilution/deposition of these materials. Effects on the bowheads prey species likely would be negligible. Whales exposed to spilled oil would likely experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The stipulation on Pre-booming Requirements for Fuel Transfers should ensure that no fuel spills would affect bowhead whales during their migration.
Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	The effects of noise and oil spills on bowhead whales are likely to be essentially the same as described in Sections IV.C.5.a(1) and IV.C.5.a(1)(c)), because the activities expected to occur are likely to be similar. The differences in noise and oil-spill effects to bowhead whales from these deferrals would likely be difficult to measure. Overall, leasing, exploration, and production activities associated with Sales 186, 195, and 202 likely would have minimal effect on bowhead whales. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 kilometers, including the transport of bottom-founded drilling platforms. Most bowhead whales during the fall migration are likely to avoid an area around a seismic vessel operating in nearshore waters by a radius of up to 20 kilometers. Avoidance may persist up to 12 hours after the end of seismic operations. In addition, provisions under the Conflict Avoidance Agreement that are likely to be implemented during the bowhead whale migration place limitations on where and when seismic operations can be conducted. Some bowheads may avoid drilling noise at 20 kilometers or more. Drilling operations from drill ships with icebreaker support during the bowhead whale migration are likely to have a low effect on bowhead whales, causing most whales to avoid the area around a drill site, particularly if an icebreaker is actively managing ice in the area. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. In the unlikely event of a large oil spill, some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals affected likely would be small. Some bowheads could experience skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and/or perhaps temporary displacement from some feeding areas. Exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, although most individuals exposed to spilled oil likely would experience temporary, nonlethal effects.
Cumulative Effects of Alternative I for Sale 186.	Overall, exposure of bowhead whales to noise from oil and gas operations is not expected to kill any bowhead whales, but some could experience temporary, nonlethal effects. Whales exposed to spilled oil likely would experience temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could kill some whales. The incremental contribution of effects from Alternative I for Sale 186 to the overall effects under the cumulative case is not likely to cause an adverse effect on the bowhead whale population.

Endangered and Threatened Species – Steller's Eiders	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Steller's eiders are not likely to experience adverse effects from potentially disturbing routine activities, collisions with structures, foraging habitat reduction, or oil-spill-cleanup activity. The effects of normal activities on Steller's eiders under Alternative I for Sales 186 and 195 are likely to be significantly less than those obtained if leasing and development occurred throughout the planning area with equal intensity. Low Steller's eider mortality is expected in the unlikely event a large oil spill occurs; however, recovery of the Alaska population from spill-related losses is not likely to occur while the regional population is declining.
Cumulative Effects of Alternative I for Sale 186.	Although little Steller's Eider mortality is expected from an oil spill, knowledge regarding their numbers and distribution in this region is insufficient to allow realistic calculation of risk or effects from cumulative adverse factors. Contribution of Alternative I for Sale 186 to the cumulative case is likely to be about 4 % of the local short-term disturbance and habitat alteration effects on eiders. Only in the case of a large offshore oil spill would these projects be expected to increase cumulative adverse effects to potentially significant population-level consequences.

Endangered and Threatened Species -Spectacled Eiders	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	The effects from normal activities associated with oil and gas exploration and development during three sales in the Beaufort Sea are likely to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Although the eider population, which currently is declining at a non-significant rate, may be slower to recover from small losses or declines in fitness or productivity, no significant overall population effect is likely. In the unlikely event a large oil spill occurs, spectacled eider mortality is likely to be fewer than 100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect. Recovery from substantial mortality is not likely to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers.
Alternatives I, III,V, and VI for Sale 186.	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by eiders, that have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur while the spectacled eider is in a declining status; however, determination of status may be obscured by natural variation in population numbers.
Alternatives I, III, V, and VI Sale 195.	The effects from normal activities include nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. Disturbance of eiders in the Near Zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is expected to take place there. In the unlikely event of a large oil spill, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by eiders that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur while the species is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Effects are likely to be somewhat less than those that could occur as a result of Sale 186.
Alternatives I, III, V, and VI for Sale 202.	The effects from normal activities include a small amount of nonsignificant disturbance and the potential loss of small numbers of eiders from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is low, because only one development is likely, probably located where spectacled eiders are relatively scarce. Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.
Alternative IV for Sales 186, 195, and 202.	The effects on spectacled eiders from normal activities and in the unlikely event a large oil spill occurs from Alternative IV are likely to be somewhat less than under Alternative I for Sales 186, 195, and 202.
Cumulative Effects of Alternative I for Sale 186.	The effects from normal activities associated with cumulative exploration and development of oil and gas prospects in the Beaufort Sea are expected to include the loss of a small number of spectacled eiders. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness, survival, or production of young may occur where birds are exposed frequently to various disturbance factors, particularly helicopter support traffic. The frequency of such disturbance is expected to be highest in the vicinity of primary support facilities. Overlap between cumulative project developments could increase disturbance effects. The spectacled eider population, currently declining at a non-significant rate, may be slow to recover from small losses or declines in fitness or productivity. No significant overall population effect is expected to result from small losses. In the event a large oil spill occurs in the marine environment, spectacled eider mortality is expected to be less than 100 individuals; however, any substantial loss (for example, 25+ individuals) would represent a significant effect. Mortality resulting from the cumulative effects of oil and gas projects would be additive to natural mortality and interfere with the recovery of the Arctic Coastal Plain population. Recovery from substantial mortality is not expected to occur while the population exhibits a declining trend, but determination of population status may be obscured by natural variation in population numbers. The contribution of Alternative I for Sale 186 to the cumulative case is likely to be about 4 % of the local short-term disturbance and habitat alteration effects on eiders. Only in the case of a large offshore oil spill would these projects be expected to increase cumulative adverse effects to potentially significant population-level consequences.

Marine and Coastal Birds	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	The adverse effects on marine and coastal birds from normal exploration and development/production activities during three sales in the Beaufort Sea are likely to include the loss of small numbers of marine and coastal birds. This is most likely to occur as a result of collisions with offshore or onshore structures. Declines in fitness or survival of individuals or production of young may occur where birds frequently are exposed to various disturbance factors, particularly helicopter traffic, causing displacement from preferred-use areas, and increased levels of energy use and predation. The frequency of such disturbance is likely to be highest in the vicinity of primary support facilities in the Prudhoe Bay area. Disturbance of local nesting birds probably would have little effect on Arctic Coastal Plain bird populations as a whole. However, populations currently declining at a non-significant rate may be slower to recover from small losses or declines in fitness or productivity, and those declining at a significant rate are likely to require a protracted recovery period. No significant overall population effect is likely to result from small losses for most species. In the unlikely event a large oil spill occurs, mortality is likely to reflect local population size and vulnerability determined by seasonal habitat use and stage of annual cycle at the time of contact (for example, molting versus non-molting). As the most abundant species, long-tailed duck mortality is likely to exceed 1,000 individuals, while that of other common species such as king eider, common eider, and scoters likely would be in the low hundreds, and loon species fewer than 25 individuals each. Mortality at the higher levels predicted by Fish and Wildlife Service data could result in significant effects for the long-tailed duck, king eider, and common eider. The probability of a large oil spill occurring, low throughout the planning area, is likely to decrease from the Near Zone to the Far Zone due to the greater likelihood of oil development in the former area.
Alternative I for Sale 186.	The effects from activities associated with Alternative I for Sale 186 include nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. In the unlikely event a large oil spill occurs, the risk of contact is likely to be somewhat lower than if developments were spread throughout the planning area, which could include some areas used by marine and coastal birds that have higher contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil-spill mortality is not likely to occur in any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects of a unlikely large oil spill could result in significant effects for long-tailed ducks and king and common eiders.
Alternative I, Sale 195	The effects from normal activities associated with Alternative I, Sale 195 include non-significant disturbance and the potential loss of small numbers of birds from collisions with structures. Disturbance of birds in the Near zone is likely to be lower than under Sale 186, because a lower proportion of leasing and exploration is likely to occur there, while lease activity in the Midrange zone is somewhat greater but the number of development projects is the same. In the event a large oil spill occurs, the risk of contact is likely to be somewhat lower under Sale 195 than under Sale 186, which proposes one more development project than Sale 195, or lower than if developments were spread throughout the planning area, which could include some areas used by several bird species that have higher spill-contact probabilities indicated by the MMS oil-spill model. Recovery from substantial oil spill mortality is not likely to occur for any species whose population is in a declining status; however, determination of status may be obscured by natural variation in population numbers. Overall effects are likely to be t less than those that could occur as a result of Sale 186 but still could result in significant effects for long-tailed duck and king and common eider.
Alternative I, Sale 202.	The effects from activities associated with Alternative I, Sale 202 include a small amount of nonsignificant disturbance, and the potential loss of small numbers of birds from collision with structures. The risk of oil-spill contact is relatively low, because only one development is likely, most likely located where most species are relatively scarce. Effects are likely to be considerably less than those that could occur as a result of Sales 186 or 195.
Alternatives III, V, and VI for Sales 186, 195, and 202.	Because Alternatives III, V, and VI defer areas well removed from primary support facilities in the central Beaufort, where most leasing and development is likely to occur, effects from activities and any oil spill associated with any of the three sales on marine and coastal birds are likely to be the same as under Alternative I for Sales 186, 195, and 202.
Alternatives IV and VI forSales 186, 195, and 202.	The effects from activities associated with Alternatives V and VI on several bird species are likely to be somewhat less than under Alternative I for Sales 186, 195, and 202; however, in the unlikely event a large oil spill occurs, effects on regional populations of several species could be lowered substantially.
Cumulative Effects of Alternative I for Sale 186,	Overall cumulative effects of oil-industry activities on marine and coastal birds potentially could be substantial in the case of loon species and king eider, and significant in the case of long-tailed duck and common eiders, primarily as a result of mortality from oil spills. Although the chance of oil-spill occurrence is small, the potential is highest for contact with bird concentrations in the vicinity of primary support facilities in the central Beaufort where most projects assumed in the cumulative case likely will occur. Also, as a result of the apparent decline in populations of some species, and the challenge of recovering spilled oil, particularly in broken-ice conditions, there is uncertainty as to the ultimate effect of any spills on bird populations. Disturbance may cause some small loss of productivity and lowered fitness or survival of birds occupying areas with high levels of industry-activity, but these effects are not expected to be significant. Effects resulting from oil and gas development activities likely would be additive to naturally occurring effects.

Marine Mammals	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	The effects from activities associated with Beaufort Sea oil and gas exploration and development are estimated to include the loss from a large oil spill (8-10 % chance) of small numbers of pinnipeds (perhaps 100-200 ringed seals but probably fewer than 10-20 spotted and 30-50 bearded seals and small numbers [fewer than 100] walruses), polar bears (6-10 bears), and beluga and gray whales (fewer than 10), with populations recovering (recovery meaning the replacement of individuals killed as a consequence of exploration and development) within about 1 year.
Alternatives I, III, IV, V, and VI, for Sales 186 and 202, and Alternatives I, III, IV, and V for Sale 202.	The effects from activities associated with exploration and development are estimated to include the loss of small numbers of pinnipeds, polar bears, and beluga and gray whales (perhaps 100-200 ringed seals, probably fewer than 10-20 spotted and 30-50 bearded seals, fewer than 100 walruses, perhaps 6-10 bears, and fewer than 10 beluga and gray whales), with populations recovering within about 1 year. .
Alternative VI for Sale 202.	Under Alternative VI for Sale 202, effects could be reduced from about Barter Island east to Demarcation Bay. Potential conditional risks of oil contact to pinniped, polar bear, and beluga whale offshore habitats from about Barter Island east to Herschel Island (ERA's 36-37 assuming contact occurs within 30 days during the summer) would be reduced somewhat, if oil exploration and development were deferred under this alternative (Table A.2-21:LA18). However, potential oil-spill risks to habitats west of the Beaufort Lagoon area (Table A.2-21, ERA's 29-35 Ice/Sea Segments 1-6) would be the same as described under Effects Common to All Alternatives.
Cumulative Effects of Alternative I for Sale 186.	The overall effects (mainly from one oil spill assumed for this analysis) is the potential losses of perhaps up to 10 polar bears and a few hundred seals and walruses, and small numbers (probably fewer than 10) of beluga and gray whales. In the likely cumulative case, pinnipeds, polar bear, and beluga and gray whale populations are expected to recover within 1 year, assuming only one large spill (greater than or equal to 1,000 barrels) occurs. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have long-term (more than one generation or perhaps 5-10 years) effect on sea otters and perhaps harbor seals and other marine mammals. Cumulative noise and disturbance in the Beaufort Sea Planning Area is expected to briefly and locally disturb or displace a few seals, walruses, beluga and gray whales, and polar bears. A few polar bears could be temporarily attracted to the production island, with no significant effects on the population's distribution and abundance. The contribution of Alternative I for Sale 186 is expected to be about 2-4% of the local short-term disturbance and habitat effects on pinnipeds, polar bears, and beluga and gray whales (based on 0.46-billion barrel/11.5-billion barrel oil reserves in Table V-12). Alternative I for Sale 186 likely would contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).

Terrestrial Mammals	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	The effects of Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes likely would include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances likely would not affect caribou, muskox, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), probably fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.
Alternatives I, III, IV, V, and VI for Sales 186 and 195, and Alternatives I, III, IV, and V for Sale 202.	The effects of Alternative I for Sale 186 Beaufort Sea oil exploration and development on caribou, muskoxen, grizzly bears, and arctic foxes are expected to include local displacement within about 1-2 kilometers (0.62-1.2 miles) along the onshore pipelines, with this local effect persisting during construction activities. Brief disturbances (a few minutes to a few days) of groups of caribou and muskoxen could occur along the pipeline corridor during periods of high ice-road and air traffic, but these disturbances are not expected to affect caribou, muskoxen, grizzly bear, and arctic fox movements and distribution. If an oil spill occurred in the Beaufort Sea, it likely would result in the loss of no more than a small number of caribou (perhaps 10 to a few hundred), fewer than 10 individual muskoxen, grizzly bears, and arctic foxes, with recovery expected within about 1 year.
Alternative VI for Sale 202.	Potential noise and disturbance and habitat effects could be reduced from about Barter Island to Demarcation Bay. The chance of contact to terrestrial mammal coastal habitats from about the Barter Island east to Herschel Island (Land Segments 49-55), within 30 days during summer, would be reduced (0-16%) if oil exploration and development were deferred under this alternative (Table A.2-27:LA18 and P7). However, the chance of contact to coastal habitats west of west of Barter (Table A.2-27, Land Segments 25-42) would be about the same as described in Section IV.C.8.b. The overall effects on caribou, muskoxen, grizzly bears, and arctic foxes likely would be about the same as described under Alternative I, for 202.
Cumulative Effects of Alternative I for Sale 186	Terrestrial mammals that would be affected include caribou, muskoxen, grizzly bears, and arctic foxes. Oil development in the Prudhoe Bay area could continue to displace some caribou during the calving season within about 4 kilometers (2.48 miles) of some roads with vehicle traffic that crosses calving habitat. The general shift of caribou calving away from the extensive oil fields may persist. Cows and calves of the Central Arctic Herd may, over time, reduce calving and the use of summer habitats near roads with high levels of traffic. If they do, these activities potentially could affect the caribou's productivity and abundance over the long term. However, this potential effect may not be measurable, because the caribou's productivity greatly varies under natural conditions. Some oil-development projects, such as Badami and Alpine, do not include roads constructed to connect to Prudhoe Bay and the Dalton Highway. They are not likely to disturb or displace calving caribou or change caribou movements across the Arctic Slope. Cumulative oil development is likely to have only local effects on the distribution and abundance of caribou, muskoxen, arctic foxes, and grizzly bears on the North Slope of Alaska but not affect overall distribution and abundance. Potential cumulative oil spills along the tanker route to the U.S. West Coast could have short-term (1-3 years) effects on other terrestrial mammals. The contribution from Alternative I for Sale 186 to the cumulative case is expected to be about 4% of the local short-term disturbance and habitat effects on of caribou, muskoxen, grizzly bears, and arctic foxes and zero reduced use of habitat for calving (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). It could attract few if any foxes to facilities and construction sites, with no effects on distribution and abundance. Alternative I for Sale 186 is estimated to contribute about 17% of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65, but the most likely number of offshore spills is zero (Table V-12).

Vegetation and Wetlands	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Disturbances mainly come from building gravel pads and ice roads and installing the onshore pipeline. Gravel pads, the pipeline trench, and the 12- or 50-mile-long onshore pipelines would destroy a few acres of vegetation and affect a few acres of nearby vegetation and have only local effects on the tundra ecosystem. Ice roads would have local effects (compression of tundra under the ice roads) on vegetation, with recovery expected within a few years, and no vegetation would be killed. The mean number of one or more oil spills greater than or equal to 1,000 barrels occurring during exploration and development is 0.11. The most likely number of spills greater than or equal to 1,000 barrels is zero. In the unlikely event that such a spill occurs. There is a less than 0.5-21% conditional chance that an offshore spill will contact coastline habitats in the planning area, which include wetlands and other vegetation cover. An estimated 29-40 kilometers of coastline could be oiled from a 1,500- or 4,600-barrel spill. The shoreline of the planning area contains some habitats with fairly high values (1 being the lowest and 10 being the highest) for oil-spill retention (lagoonal beaches have a value of 5, and peat shores have a value of 6) along river deltas and near the mouths of other streams. Stranded oil on sheltered intertidal areas, especially along peat shorelines, likely would persist for many years.
Alternatives I, III, IV, V, and VI for Sales 186 and 195, and Alternatives I, III, IV, and V for Sale 202.	The effects of exploration and development on vegetation and wetlands likely would include the destruction of some acres of vegetation-wetlands from gravel mining, landfall gravel-pad and onshore pipeline installation, and potential oil-spill effects and spill-cleanup effects, which could persist for 10 years or longer.
Alternative VI for Sale 202.	Under Alternative VI for Sale 202, potential onshore habitat effects could be avoided from about Barter Island east to Demarcation Bay and potential onshore habitat effects from gravel mining, gravel pads and onshore pipeline installation in this area. The chance of contact to vegetation-wetland coastal habitats from about Beaufort Lagoon east to Herschel Island (Land Segments 49-55 within 30 days during the summer) would be reduced (2-11%), if oil exploration and development were deferred under this alternative (Table A.2-27:LA18). However, the chance of contact to coastal habitats west of Beaufort Lagoon (Table A.2-27, Land Segments 25-48) would be about the same as described under general effects.
Cumulative Effects of Alternative I for Sale 186.	Oil-field development on Alaska's North Slope centers on the Arctic Coastal Plain, which covers about 13 million acres. Existing gravel-mine reserve pits, pads, and other facilities cover more than 7,800 acres (Tables V-3 and V-5). About 50 miles of shoreline, including vegetation and wetland habitats, potentially would be affected by cumulative development within the Alternative I for Sale 186 area. (See Section III.B.8 for a description of the distribution of vegetation and wetland in the project area.) All projects in Maps 1 and 2 either have or would destroy vegetation through construction of onshore gravel pads, gravel mines, and roads; burial of pipelines; or installation of vertical support members for elevated pipelines. Sources of past and potential impacts include directly digging up and burying vegetation; changes in snow drifting and water drainage; accumulation of dust, salt, and chemicals along roads and near gravel pads; and damage from oil spills and other accidental chemical spills. In terms of acres of land affected, construction causes more than 99% of the effects, with spills having a very minor role. Rehabilitation of gravel pads can result in the growth of grasses-sedges within 2 years after abandonment of the pads. Natural growth of plant cover on abandoned gravel pads would be very slow. onstruction of existing facilities, past exploration pads, and vehicle tracts across the tundra landscape have affected a small percentage of the total tundra-wetland habitats on the Arctic Coastal Plain. However, local additive effects of gravel pads, roads, mines, and other facilities on tundra wetlands are expected to persist decades long after the oil fields are abandoned. We assume one large offshore oil spill greater than or equal to 1,000 barrels would occur during development over the life of these potential fields. Complete recovery of oiled coastal wetlands from an unlikely large oil spill could take several decades to fully recover from the spill and associated cleanup activities. Alternative I for Sale 186 would contribute about 4% of the cumulative disturbance effects on over 7,800 acres of tundra and wetlands now affected by oil development (based on 0.46-barrel/11.5-barrel oil reserves [Table V-12]). Alternative I for Sale 186 is estimated to contribute about 17% mean number of cumulative offshore spills. The estimated mean number of cumulative offshore spills is 0.65 , but the most likely number of offshore spills is zero (Table V-12).

<table>
<tr><th colspan="2">Economy</th></tr>
<tr><td>Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.</td><td>Each alternative will generate increases in North Slope Borough property taxes that will average about 1% above the level of Borough revenues without the Sales in the early years and taper to less than 0.5% in the latter years. In the early years of production, each alternative will generate increases in revenues to the State of Alaska of less than 0.25% above the level without a sale. The increases will taper to an even smaller percent in the latter years of production. The change in total employment and personal income is less than 3% over the 1999 baseline for the North Slope Borough and the rest of Alaska for each of the three major phases of OCS activity: exploration, development, and production. The employment and personal income increase includes workers to cleanup possible large oil spills of 1,500-barrels or 4,600 barrels. These increases will occur for each alternative and sale.

For purposes of analysis, we assume that the exploration and development scenario for Alternative I for Sale 186, will be the same as for each deferral alternative and sale; that is, the OCS activity will occur in a different area and be the same for each deferral alternative as for Alternative I for Sale 186.</td></tr>
<tr><td>Cumulative Effects of Alternative I for Sale 186.</td><td>In total, the cumulative case would generate the following additive annual revenues:
$15 million to the North Slope Borough
$90 million to the State
$125 to the Federal Government
This cumulative case is projected to generate additive employment and personal income increases as follows:
160 jobs annual average for North Slope Borough residents during development, declining to 40 during production.
$10 million in total average annual personal income for workers residing in the North Slope Borough during development, declining to $2.8 million during production.
5,800 jobs annual average during development, declining to 3,300 during production. $367 million in total average annual personal income for workers residing in Southcentral Alaska and Fairbanks during development, declining to $211 million during production.
$367 million in total average annual personal income for workers residing in residing in the rest of the U.S. during development, declining to $211 million during production.
60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea.
The contribution Alternative I for Sale 186 to the cumulative effect would be as follows:
$1 million revenue average annually to the North Slope Borough annually for 22 years of production
$27 million revenue average annually to the State for 22 years of production
$57 million revenue average annually to the Federal Government for 22 years of production
40 jobs annual average for North Slope Borough residents during development declining to 9 during production.
$3.4 million in total average annual personal income for workers residing in the North Slope Borough development and declining to $0.7 million during production.
600 jobs annual average during development, declining to 390 during production.
$38 million in total average annual personal income for production workers, declining to $25 million during production for these workers.
60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea
10,000 jobs for 6 months for cleanup of an unlikely tanker spill in the Gulf of Alaska</td></tr>
</table>

Subsistence-Harvest Patterns	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	For the communities of Barrow, Nuiqsut and Kaktovik, disturbances periodically could affect subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt. The chance of an oil spill occurring and entering offshore waters is estimated to be low. Based on the assumption that a spill has occurred, the chance of an oil spill during summer from a platform or a pipeline contacting important traditional bowhead whale- and seal-harvest areas over a 360-day period would be 75% or less for the Barrow whaling area, 41% or less for the Nuiqsut whaling area, and 34% or less for the Kaktovik whaling area. A spill also could affect other subsistence resources and harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik. Overall, oil spills could affect subsistence *resources* periodically in the communities of Barrow, Nuiqsut, and Kaktovik. In the unlikely event of a large oil spill, many harvest areas and some subsistence resources could be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads and threaten a pivotal element of Inupiat culture. There also is concern that the International Whaling Commission, which sets the quota for the Inupiat subsistence harvest of bowhead whales, would reduce the harvest quota following a major oil spill or, as a precaution, as the migration corridor becomes increasingly developed to ensure that overall population mortality did not increase. Such a move would have a profound cultural and nutritional impact on Inupiat whaling communities. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree these resources were contaminated. In the case of extreme contamination, harvests could cease until such time as resources were perceived as safe by local subsistence hunters. Overall, such effects are not expected from routine activities and operations. Tainting concerns also would apply to polar bears, seals, beluga whales, walruses, fish, and birds. Additionally, effects from a large oil spill likely would produce potential short-term but serious adverse effects to long-tailed duck and king and common eider populations. All areas directly oiled, areas to some extent surrounding them, and areas used for staging and transportation corridors for spill response would not be used by subsistence hunters for some time following a spill. Oil contamination of beaches would have a profound impact on whaling because even if bowhead whales were not contaminated, Inupiat subsistence whalers would not be able to bring them ashore and butcher them on a contaminated shoreline. The duration of avoidance by subsistence users would vary depending on the volume of the spill, the persistence of oil in the environment, the degree of impact on resources, the time necessary for recovery, and the confidence in assurances that resources were safe to eat. Such oil-spill effects would be considered significant.
Alternatives I, III, V, and VI for Sale 186; Alternatives I, III, V, and VI for Sale 195; and Alternative I for Sale 202.	Based on the sale-specific effects on subsistence resources mentioned above from noise, disturbance, and oil spills, the consequent effects on subsistence-harvest patterns are expected to be similar to those discussed in effects common to all alternatives above. Disturbance and noise could affect subsistence species that include bowhead whales, seals, polar bears, caribou, fishes, and birds. For the communities of Barrow, Nuiqsut, and Kaktovik, disturbances periodically could affect these subsistence resources, but no resource or harvest area would become unavailable and no resource population would experience an overall decrease. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Oil-spill cleanup would increase these effects. Cleanup disturbances could displace subsistence species, alter or reduce subsistence-hunter access to these species and, therefore, alter or extend the normal subsistence hunt.
Alternative IV for Sales 186 and 195.	Even though effects on subsistence would be essentially the same as described for Alternative I for Sale 186, effects on subsistence-harvest patterns are expected to be reduced because no exploration or production activities would occur in these deferral areas, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.
Alternative III for Sale 202.	Because no exploration or production activities would occur in this deferral area under Alternative III for Sale 202, potential oil-spill, chronic noise, and disturbance effects under Alternative III for Sale 202 on subsistence whaling and on Barrow's traditional subsistence-whaling area would be reduced.
Alternative IV	Although effects on subsistence resources under Alternative IV for Sale 202 would be essentially the

Subsistence-Harvest Patterns	
for Sale 202.	same as described for Alternative I for Sale 202, effects on subsistence-harvest patterns in Nuiqsut are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished.
Alternative V for Sale 202.	Although effects on subsistence resources would be essentially the same as described for Alternative I for Sale 202, effects on subsistence-harvest patterns in Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling and the western half of Kaktovik's traditional subsistence-whaling area.
Alternative VI for Sale 202.	Potential reductions in oil-spill contact to seals, polar bears, gray and beluga whales, caribou, muskoxen, grizzly bears, and arctic foxes from about Barter Island east to Demarcation Bay would reduce effects on these important subsistence resources and on important Kaktovik subsistence-harvest areas.
Cumulative Effects of Alternative I for Sale 186.	Cumulative effects on subsistence-harvest patterns include effects from Alternative I for Sale 186 exploration and development and other past, present, and reasonably foreseeable projects on the North Slope with one or more important subsistence resources becoming unavailable or undesirable for use for 1-2 years, a significant adverse effect. Sources that could affect subsistence resources include potential oil spills, noise and traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. The communities of Barrow, Nuiqsut, and Kaktovik potentially would be most affected. Nuiqsut potentially would be the most affected community, because it is within an expanding area of oil exploration and development both onshore (Alpine and the Northeast National Petroleum Reserve-Alaska) and offshore (Northstar and McCovey). In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive (but not synergistic) significant effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Because a large oil spill is unlikely, attaining a level of significant effect also is unlikely. The contribution of Alternative I for Sale 186 is about 4% of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. While the most likely number of oil spills greater than or equal to 500 barrels from all past, present, and future activities onshore is estimated to be 5, the most likely number of offshore spills is estimated to be 0. Alternative I for Sale 186 is estimated to contribute about 17% of the estimated mean number of cumulative offshore spills, with a most likely number of spills of 0 (Table V-12). In the unlikely event of a spill from Alternative I for Sale 186, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Tainting concerns in communities nearest the spill event could seriously curtail traditional practices for harvesting, sharing, and processing bowheads, threatening a critical underpinning of Inupiat culture. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated.

Sociocultural Systems	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from industrial activities, from changes in population and employment, and from periodic interference with subsistence-harvest patterns from oil spills and oil-spill cleanup. Altogether, effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternatives I, III, V, and VI for Sales 186 and 195, and Alternative I for Sale 202.	The consequential effects on sociocultural systems are expected to be similar to those discussed under Effects Common to All Alternatives. Altogether, effects periodically could disrupt but not displace ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. However, in the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered significant.
Alternative IV for Sales 186, 195, and 202.	The effects to subsistence-harvest patterns are expected to be reduced under this alternative, Subsequent effects reductions to sociocultural systems also would be expected.
Alternatives III, V, and VI for Sale 202.	Because no exploration or production activities would take place in these deferral areas for Sale 202, potential oil spill, chronic noise, and disturbance effects under Alternatives III, V, and VI for Sale 202 on subsistence whaling and on Barrow's, Nuiqsut's, and Kaktovik's,traditional subsistence-whaling area would be reduced.
Cumulative Effects of Alternative I for Sale 186.	The contribution from Alternative I for Sale 186 to cumulative effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from oil-spill-cleanup activities, small changes in population and employment, and disruption of subsistence-harvest patterns from oil spills and oil-spill cleanup. Disturbance effects periodically could disrupt but not displace ongoing social systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. Community activities and traditional practices for harvesting, sharing, and processing subsistence resources could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill.

Archaeological Resources	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Potential effects on archaeological resources would be from exploration and development activities on both onshore and offshore resources, including historic and prehistoric. Onshore resources are more at risk for effects from disturbance caused by construction or oil-spill-cleanup operations. Potential offshore resources are at greater risk for effects from bottom-disturbing activities, notably anchor dragging and pipeline trenching. Generally, potential effects from activities increase with the level of activities, from the exploration phase to the development phase. For onshore archaeological resources, the potential for effects increases with the distance from existing pipeline infrastructure and from oil-spill size and associated cleanup operations. Archaeological surveys and analyses are required in areas where potential archaeological resources are at risk from offshore operations. These requirements are specified in the MMS Handbook 620.1H, Archaeological Resource Protection; in regulations (30 CFR 250.194; 30 CFR 250.126; 30 CFR 250.201; 30 CFR 250.203; 30 CFR 250.204; 30 CFR 250.414; 30 CFR 250.1007(a)(5); and 30 CFR 250.1009); and in law through the National Historic Preservation Act. Any archaeological resources, either onshore or offshore, will be identified before any activities are permitted, and they will be avoided or potential effects will be mitigated. Each of the alternatives would provide some level of protection to archaeological resources by removing areas from leasing and potential exploration and development activities. The MMS has identified 502 whole or partial blocks in the program area that may contain prehistoric or historic resources (see Section III.C). The following indicates the number of blocks with archaeological potential within each alternative, their relative percent of the total number of blocks with archaeological resource potential, and the blocks with archaeological resource potential remaining in the sale area. • Alternative III would remove 9 (1.8%), leaving 493 blocks or partial blocks • Alternative IV would remove 17 (3.4%), leaving 485 blocks or partial blocks • Alternative V would remove 20 (4%), leaving 482 blocks or partial blocks • Alternative VI would remove 48 (9.6%), leaving 454 blocks or partial blocks
Alternatives I, IV, V, and VI for Sale 186.	The potential effects on archaeological resources are essentially the same as discussed for general effects, with activity concentrated in the Near Zone, close to existing infrastructure. If extended-reach drilling techniques are used instead of offshore platforms or islands, possible offshore effects would be minimized. More potential effects could occur onshore as opposed to offshore, and in the development phase rather than the exploration phase, because of possible oil-spill-cleanup activities. Although all the projected development for Sale 186 is in the Near and Midrange zones where there is a higher potential for archaeological resources to occur, prehistoric and historic resources both onshore and offshore will be identified by archaeological surveys and avoided or mitigated.
Alternatives I, IV, V, and VI, for Sale 195.	The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities may be farther away from existing onshore infrastructure. Exploration activities probably would be conducted from offshore facilities, which reduces the potential impact on onshore archaeological resources. Marine archaeological surveys in areas where offshore archaeological resources may exist would identify likely resources, which would be avoided or effects mitigated. In the development phase, the potential for effects to archaeological resources increases with distance from existing infrastructure, primarily because of onshore pipeline distances and associated construction and right-of-way access and the increased possibility for oil-spill-cleanup activities. Onshore archaeological surveys would identify any potential resources, which will be avoided or possible effects mitigated.

Archaeological Resources	
Alternatives I, IV, V and VI, for Sale 202.	The effect of exploration and development activities on possible archaeological resources would be essentially the same as discussed under effects common to all alternatives, except that activities would be more dispersed. In the exploration phase, some drilling could take place in deeper water, using floating drilling platforms or ships. These drilling units would use anchors and would probably have their blowout preventer buried, which could disturb potential archaeological resources in the immediate area. No impact is expected to prehistoric archaeological resources from activities in water depths greater than 50 meters. In the development phase, floating drilling and production platforms and possibly subsea production well-head assemblies would have the same disturbance effect to the seafloor as in the exploration phase: anchor dragging and digging the glory hole. The effect of gravel islands or bottom-founded production systems would be the same as discussed under effects common to all alternatives, compression and skirt penetration of sediments. The effect of oil-spill cleanup activities depend on the size of the spill and would probably be limited to the Near Zone, but the response area would be larger and more difficult for response personnel to access, potentially exposing unknown archaeological resources to risk of damage. Onshore and offshore archeological surveys and analyses would be conducted and would identify potential archaeological resources, which will be avoided or possible effects would be mitigated.
Alternative III for Sales 186, 195, and 202.	Alternatives III and IV for Sales 186, 195, and 202 would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.
Cumulative Effects of Alternative I for Sale 186.	In addition to Alternative I for Sale 186, other activities associated with this cumulative analysis that may affect archaeological resources in the Beaufort Sea include lease sales and activity in the National Petroleum Reserve-Alaska and State lands, State oil and gas fields, oil and gas transportation, noncrude carriers, and any Federal activities. Cumulatively, these proposed projects likely would disturb the seafloor more often, but remote-sensing surveys made before approval of any Federal or State lease actions should keep these effects low. Federal laws would preclude effects to most archaeological resources from these planned activities. The contribution of Alternative I for Sale 186 to the cumulative case is expected to be minimal for archaeological resources, because any surface-disturbing activities that could damage archaeological sites would be mitigated by current State and Federal procedures, which require identification and mitigation of archaeological resources in the proposed project areas. Overall effects of the Alternative I for Sale 186 would be additive to effects anticipated for other future projects and, in the case of oil spills, is uncertain. However, data from the *Exxon Valdez* oil spill indicate that less than 3% of the resources within a spill area would be significantly affected.

Land Use Plans and Coastal Management Programs	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Conflicts with the Statewide standards of the ACMP and the NSB CMP policies are not expected. Through the use of mitigating measures and regulatory oversight, it should be possible to comply with all of the standards and policies. Most of these policies will be more precisely addressed if and when specific proposals are brought forward by lessees. All Exploration and Development and Production plans must be accompanied by a consistency certification for State review and concurrence. The State will review OCS plans and concur or object with the lessee's consistency certification. The MMS cannot issue a permit for any activities described in the plans in the absence of the State's concurrence unless the Secretary of Commerce overrides the State's objection.
Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSB CMP are anticipated.
Cumulative Effects of Alternative I for Sale 186.	The potential for conflicts arising from the cumulative case is the same as those discussed in Section IV.C Effects Common to All Alternatives. Conflicts with Statewide standards of the ACMP and the policies of the NSB CMP are not inherent in the hypothetical scenarios presented in the cumulative case. Alternative I for Sale 186, represents a small proportion (4%) of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea area. No conflicts are anticipated for activities associated with Alternative I for Sale 186 and its contribution to the cumulative case does not alter the conclusion for the cumulative case. This conclusion is based partly on the small contribution of Alternative 1 for Sale 186, but predominantly on the conclusion that exploration and development and production can proceed consistent with the enforceable policies of the ACMP and the NSB CMP. The MMS regulatory oversight and lease stipulations address many of the concerns applicable to the enforceable standards. In addition, the consistency review of these activities will address the applicable policies at the time that specific plans are submitted.
Air Quality	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Effects on onshore air quality from air emissions likely would be only a very small percent of the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, there likely would be only a minimal effect on air quality with respect to standards. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires. The air-quality analysis is based on the specific emission controls and emission limitations that the operators would apply to meet the appropriate Environmental Protection Agency regulations and permit requirements for any development and production activities. The effects of all these activities would cause only small, local, temporary increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards. Therefore, effects from the proposed sales would be low. Individual air masses move constantly with atmospheric circulation, we expect that the major differences in effects of the different alternatives on air quality would be in which specific geographic areas could be affected by air emissions. Because these emissions should not be significant other than in extremely localized areas, we conclude that none of the alternatives to the proposed sales (186, 195, and 202) would result in significant effects different from or other than those discussed in Section IV.C.15.a. Air quality effects of all activities under all sales and all alternatives would cause only small increases in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Ambient Air Quality Standards.
Cumulative Effects of Alternative I for Sale 186.	The cumulative effects of all projects affecting the North Slope of Alaska in the past and occurring now have caused generally little deterioration in air quality, which remains better than required by national standards. All reasonably foreseeable North Slope projects (see Table V-1a) would not change this situation. Considering that predicted discoveries and development from Alternative I for Sale 186 would represent only a few percent of the existing North Slope activity, air emissions from Alternative I, Sale 186 would have no significant contribution to cumulative effects for air quality.

Environmental Justice	
Effects Common to Alternatives I, III, IV, V, and VI for Sales 186, 195, and 202.	Sale-specific environmental justice effects would derive from potential noise, disturbance, and oil spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential environmental justice-related effects to Native villages from the Beaufort Sea multiple sales and the range of alternatives would occur in the unlikely event of a large oil spill, which could affect subsistence resources. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.
Cumulative Effects of Alternative I for Sale 186.	Potential effects would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the North Slope Borough; however, effects are not expected from routine activities and operations. If a large spill assumed in the cumulative case occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives, because oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health. Any potential effects to subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated. Only in the event of a large spill, which is a low likelihood event, would disproportionate high adverse effects be expected on Alaska Natives from Alternative I for Sale 186.

Table IV.A-1
Representative Development Schedule for Sale 186

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (miles)	New Shore Bases	Oil Production (MMbbl)	Oil Production (MMbbl)	Oil Production (MMbbl)	Combined Oil Production (MMbbl)	Cumulative Oil Production (MMbbl)
2003	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2004	1	—	1	—	—	—	—	—	—	—	—	—	—	—
2005	1	—	1	—	—	—	—	—	—	—	—	—	—	—
2006	1	2	2	—	—	—	—	—	—	—	—	—	—	—
2007	1	—	1	—	—	—	—	—	—	—	—	—	—	—
2008	1	2	2	—	—	—	—	—	—	—	—	—	—	—
2009	1	—	1	1	3	3	1	10	—	—	—	—	—	—
2010	—	2	1	—	10	4	1	—	—	7.9	—	—	7.9	7.9
2011	—	—	—	1	13	7	2	10	—	15.7	—	—	15.7	23.6
2012	—	—	—	—	10	4	1	—	—	15.7	7.9	—	23.6	47.2
2013	—	—	—	—	10	4	1	—	—	15.7	15.7	—	31.5	78.7
2014	—	—	—	1	3	3	1	20	—	13.0	15.7	—	28.7	107.4
2015	—	—	—	—	10	4	1	—	—	10.7	15.7	13.2	39.6	147.0
2016	—	—	—	—	10	4	1	—	—	8.8	13.0	22.0	43.8	190.8
2017	—	—	—	—	—	—	—	—	—	7.3	10.7	22.0	40.0	230.8
2018	—	—	—	—	—	—	—	—	—	6.0	8.8	22.0	36.8	267.6
2019	—	—	—	—	—	—	—	—	—	5.0	7.3	22.0	34.2	301.9
2020	—	—	—	—	—	—	—	—	—	4.1	6.0	18.9	29.0	330.9
2021	—	—	—	—	—	—	—	—	—	3.4	5.0	16.3	24.6	355.5
2022	—	—	—	—	—	—	—	—	—	2.8	4.1	14.0	20.9	376.4
2023	—	—	—	—	—	—	—	—	—	2.3	3.4	12.0	17.7	394.1
2024	—	—	—	—	—	—	—	—	—	1.9	2.8	10.3	15.0	409.1
2025	—	—	—	—	—	—	—	—	—	—	2.3	8.9	11.2	420.3
2026	—	—	—	—	—	—	—	—	—	—	1.9	7.7	9.5	429.9
2027	—	—	—	—	—	—	—	—	—	—	—	6.6	6.6	436.5
2028	—	—	—	—	—	—	—	—	—	—	—	5.7	5.7	442.1
2029	—	—	—	—	—	—	—	—	—	—	—	4.9	4.9	447.0
2030	—	—	—	—	—	—	—	—	—	—	—	4.2	4.2	451.2
2031	—	—	—	—	—	—	—	—	—	—	—	3.6	3.6	454.8
2032	—	—	—	—	—	—	—	—	—	—	—	3.1	3.1	457.9
2033	—	—	—	—	—	—	—	—	—	—	—	2.7	2.7	460.5
—	**6**	**6**	**—**	**3**	**69**	**33**	**—**	**40**	**—**	**120**	**120**	**220**	**460.5**	—

Notes:
Each oil-production column represents annual production from a single field. There are three fields assumed for this sale. A combined production stream and cumulative production stream also are provided. All other activities represent a sum of activities associated with these three fields.
Source:
USDOI, MMS, Alaska OCS Region.

Table IV.A-2
Representative Development Schedule for Sale 195

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (miles)	New Shore Bases	Field #1 Oil Production (MMbbl)	Field #2 Oil Production (MMbbl))	Combined Oil Production (MMbbl)	Cumulative Oil Production (MMbbl)
2003	—	—	—	—	—	—	—	—	—	—	—	—	—
2004	—	—	—	—	—	—	—	—	—	—	—	—	—
2005	—	—	—	—	—	—	—	—	—	—	—	—	—
2006	—	—	—	—	—	—	—	—	——	—	—	—	—
2007	1	—	1	—	—	—	—	—	—	`—	—	—	—
2008	1	—	1	—	—	—	—	—	—	—	—	—	—
2009	—	2	1	—	—	—	—	—	—	—	—	—	—
2010	1	—	1	—	—	—	—	—	—	—	—	—	—
2011	—	—		—	—	—	—	—	—	—	—	—	—
2012	2	—	2	1	3	3	1	10	—	—	—	—	—
2013	1	2	2	—	10	4	1	—	—	7.9	—	7.9	7.9
2014	—	2	1	—	10	4	1	—	—	15.7	—	15.7	23.6
2015	—	—	—	—	—	—	—	—	—	15.7	—	15.7	39.3
2016	—	—	—	1	3	3	1	30	—	15.7	—	15.7	55.1
2017	—	—	—	1	13	7	2	—	—	13.0	21.5	34.5	89.5
2018	—	—	—	—	20	8	2	—	—	10.7	28.6	39.4	128.9
2019	—	—	—	—	10	4	1	—	—	8.8	28.6	37.5	166.3
2020	—	—	—	—	—	—	—	—	—	7.3	28.6	35.9	202.3
2021	—	—	—	—	—	—	—	—	—	6.0	28.6	34.7	236.9
2022	—	—	—	—	—	—	—	—	—	5.0	28.6	33.6	270.5
2023	—	—	—	—	—	—	—	—	—	4.1	25.2	29.3	299.8
2024	—	—	—	—	—	—	—	—	—	3.4	22.2	25.6	325.4
2025	—	—	—	—	—	—	—	—	—	2.8	19.5	22.3	347.7
2026	—	—	—	—	—	—	—	—	—	2.3	17.2	19.5	367.2
2027	—	—	—	—	—	—	—	—	—	1.9	15.1	17.0	384.2
2028	—	—	—	—	—	—	—	—	—	—	13.3	13.3	397.5
2029	—	—	—	—	—	—	—	—	—	—	11.7	11.7	409.2
2030	—	—	—	—	—	—	—	—	—	—	10.3	10.3	419.5
2031	—	—	—	—	—	—	—	—	—	—	9.1	9.1	428.6
2032	—	—	—	—	—	—	—	—	—	—	8.0	8.0	436.5
2033	—	—	—	—	—	—	—	—	—	—	7.0	7.0	443.6
2034	—	—	—	—	—	—	—	—	—	—	6.2	6.2	449.7
2035	—	—	—	—	—	—	—	—	—	—	5.4	5.4	455.2
2036	—	—	—	—	—	—	—	—	—	—	4.8	4.8	460.0
2037	—	—	—	—	—	—	—	—	—	—	—	—	—
—	**6**	**6**	—	**3**	**69**	**33**	—	**40**	—	**120**	**340**	**460**	—

Source: USDOI, MMS, Alaska OCS Region.
Notes: Each oil-production column represents annual production from a single field. There are two fields assumed for this sale. A combined production stream and cumulative production stream are also provided. All other activities represent a sum of activities associated with these two fields.

Table IV.A-3
Representative Development Schedule for Sale 202

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (miles)	New Shorebases	Field #1 Oil Production (MMbbl)	Cumulative Oil Production (MMbbl)
2003	—	—	—	—	—	—	—	—	—	—	—
2004	—	—	—	—	—	—	—	—	—	—	—
2005	—	—	—	—	—	—	—	—	—	—	—
2006	—	—	—	—	—	—	—	—	—	—	—
2007	—	—	—	—	—	—	—	—	—	—	—
2008	—	—	—	—	—	—	—	—	—	—	—
2009	—	—	—	—	—	—	—	—	—	—	—
2010	1	—	1	—	—	—	—	—	—	—	—
2011	—	—	—	—	—	—	—	—	—	—	—
2012	1	—	1	—	—	—	—	—	—	—	—
2013	1	1	1	—	—	—	—	—	—	—	—
2014		2	1	—	—	—	—	—	—	—	—
2015	1	2	1	—	—	—	—	—	1	—	—
2016	—	—	—	—	—	—	—	—	—	—	—
2017	1	—	1	—	—	—	—	—	—	—	—
2018	1	—	1	1	4	4	1	35	—	—	—
2019	—	—	—	1	14	8	2	—	—	30.8	30.8
2020	—	—	—	—	20	8	2	—	—	38.6	69.4
2021	—	—	—	—	20	9	2	—	—	38.6	108.0
2022	—	—	—	—	10	5	1	—	—	38.6	146.6
2023	—	—	—	—	—	—	—	—	—	38.6	185.2
2024	—	—	—	—	—	—	—	—	—	38.6	223.8
2025	—	—	—	—	—	—	—	—	—	34.0	257.8
2026	—	—	—	—	—	—	—	—	—	29.9	287.7
2027	—	—	—	—	—	—	—	—	—	26.3	314.0
2028	—	—	—	—	—	—	—	—	—	23.2	337.2
2029	—	—	—	—	—	—	—	—	—	20.4	357.6
2030	—	—	—	—	—	—	—	—	—	17.9	375.5
2031	—	—	—	—	—	—	—	—	—	15.8	391.3
2032	—	—	—	—	—	—	—	—	—	13.9	405.2
2033	—	—	—	—	—	—	—	—	—	12.2	417.4
2034	—	—	—	—	—	—	—	—	—	10.8	428.2
2035	—	—	—	—	—	—	—	—	—	9.5	437.7
2036	—	—	—	—	—	—	—	—	—	8.3	446.0
2037	—	—	—	—	—	—	—	—	—	7.3	453.3
2038	—	—	—	—	—	—	—	—	—	6.7	460.0
2039	—	—	—	—	—	—	—	—	—	—	—
—	**6**	**5**	—	**2**	**68**	**34**	—	**35**	**1**	**460.0**	—

Table IV.A-4
Summary of Basic Exploration Development, Production, and Transportation Assumptions for All Alternatives[1]

Phase Activity/Event	Sale 186 Timeframe and Assumed Number	Sale 195 Timeframe and Assumed Number	Sale 202 Timeframe and Assumed Number
Exploration			
Well Drilling	**2004-2010**	**2007-2014**	**2010-2018**
Exploration Rigs	1-2	1-2	1
Exploration Wells	6	6	6
Delineation Wells	6	6	5
Drilling Discharges			
Drilling Muds (short tons, dry)	1,040	1,040	935
Cuttings (short tons, dry)	6,300	6,300	5,775
Support Activities (Annual)			
Helicopter Flights [2]	155	155	140
Supply-Boat Trips	0-14	0-14	0-7
Surface Transport[3]	see footnote [3]	see footnote [3]	see footnote [3]
Shallow-Hazards Site Surveys			
Blocks Surveyed	6	6	6
Total Area Covered[4] (mi^2)	54	54	54
Development And Production			
Platforms Installed	**2009-2014**	**2012-2017**	**2018-2019**
—	3	3	2
Production and Injection Service Wells	2009-2016	2012-2019	2018-2022
—	102	102	102
Number of Fields	3	2	1
Oil Production	2010-2033	2013-2036	2019-2038
Total (MMbbl)	460	460	460
Peak Yearly (MMbbl)	2016	2018	2020-2024
—	43.8	39.4	38.6
Monthly Support Activities			
Helicopter Flights: Construction[5]	300-600	300-600	600
Helicopter Flights: Development	28-56	28-56	56
Helicopter Flights: Production	12-28	12-28	28
Supply-Boat Trips	see Footnote[6]	see Footnote[6]	see Footnote[6]
Surface Transport[7]			
Construction Phase	12,000	6,000	N/A
Operation Phase	30-60	25-30	N/A
Drilling Discharges			
Drilling Muds (short tons, dry)	13,300	13,300	13,300
Cuttings (short tons, dry)	84,000	84,000	84,000
Shallow-Hazard Surveys [8]	—	—	—
Total Area Covered (mi^2)	105	105	70
Transportation			
Oil Pipeline Installation	2008-2014	2012-2016	2018
Offshore Length (miles)	40	40	35
Onshore Length (miles)	—	—	85[9]
Tanker Transport			
Peak Years of Production	2016	2018	2020-2024
Number of Loadings [10]	63	56	55
Oil Spills	**See Table IV.A-5**		

Most of the information in this table may be found in Appendix B of this EIS.
[1] The figures presented in this table forecast activities beginning and ending in discrete time periods. This is done for the purpose of a consistent and methodical and based on a situational average. [2] Helicopter trips are expressed in an annual average. [3] Surface transport estimates vary according to the location of the exploration platform. Even if the exploration platform is located in the landfast-ice zone, surface transport volumes by ice road to the drill site will be less than half on the volumes forecast for a postfind construction phase. During the operations phase, vehicle trips could decline 100-200 per season. [4]An OCS block is 8.9 mi^2. [5]Helicopter support trips will decline sharply after the construction phase; however, Far Zone structures will consistently require greater levels of air support. [6] Marine support traffic for the construction phase will vary from 150-200 per open-water season for each nearshore platform to as many as 250 for structures beyond the landfast-ice zone. Vessel traffic will decline into the production phase, with 4-6 trips per season for nearshore platforms. [7]Based on a 90 day ice-road season. Estimates for Sale 195 are based on one platform in landfast ice zone. The platform assumed for Sale 202 will be beyond the landfast-ice zone. [8] The MMS's site-clearance seismic-survey requirements specify a minimum of 35 mi^2 (92 km^2) for a block-wide survey. Three days would be required for a 54 mi^2 site-clearance survey and 7 days for a 105 mi^2 survey. [9]The portrayed mileage is a rough estimate of a pipeline route from Smith Bay to the Kuparuk mainline. Should the pipeline landfall occur at Point Thomson, it would connect at the Badami field 12 miles distance. [10]Assuming 100,000 deadweight-ton tankers. Please note that all vessel trips inherently round trips. In reality, these periods may blend with and overlap each other. Estimates made in this table are speculative.

Table IV.A-5
Large, Small, and Very Large Spill Sizes We Assume for Analysis in this EIS by Section

EIS Section	Source of Spill	Type of Oil	Size of Spill(s) (Barrels)	Receiving Environment
Large Spills (≥1,000 barrels)				
—	**Offshore**	—	—	—
IV.C	Pipeline	Crude	4,600	Open Water
—	Platform/Gravel Island	Crude	1.500	Under Ice
—	Storage Tank	—	—	On Top of Sea Ice
—	—	—	—	Broken Ice
Small Spills (< 1000 barrels)				
—	**Offshore and Onshore**	—	147-184 spills <1 barrel[1]	Gravel Island
IV.C	Operational Spills	Diesel or	48-59 spills ≥1 barrel but <25 barrels	Open Water
—	from All Sources	Crude	3 spills >25 and <500 bbl	On Top of Sea Ice
—	—	Crude	0 spills >500 and <1,000 bbl	—
—	**Onshore and Offshore**	—	—	Broken Sea Ice
—	—	Refined	157-202 spills of 0.7 barrels each	Snow/Ice
—	—			Tundra
Very Large Spills (≥150,000 barrels)				
—	—	—	—	Open Water
IV.I	**Blowout from the Gravel Island**	Crude	180,000	On Top of Sea Ice
—	—	—	—	Broken Sea Ice

Source: USDOI, MMS, Alaska OCS Region (2002)
Note: Tables A1-6a through A1-6e in Appendix A1 show the distribution of small crude and refined spills by alternative.

Table IV.A-6a
Fate and Behavior of a Hypothetical 1,500-Barrel Oil Spill from a Platform in the Beaufort Sea

	Summer Spill[1]				Meltout Spill[2]			
Time After Spill in Days	1	3	10	30	1	3	10	30
Oil Remaining (%)	81	73	58	28	84	78	73	65
Oil Dispersed (%)	2	5	16	43	0.2	0.6	2	6
Oil Evaporated (%)	17	22	26	29	16	21	25	29
Thickness (mm)	3.5	2.1	1.2	1	7.6	2.8	1.7	1
Discontinuous Area (km^2)[3, 4]	2	9	44	181	2	7	18	143
Estimated Coastline Oiled (km)[5]	29				32			

Note: For the Alternative I Sales 186, 195, and 202 and their alternatives, the median platform spill is assumed to be 1,500 barrels.

Table IV.A-6b
Fate and Behavior of a Hypothetical 4,600-Barrel Oil Spill from a Pipeline in the Beaufort Sea

	Summer Spill[1]				Meltout Spill[2]			
Time After Spill in Days	1	3	10	30	1	3	10	30
Oil Remaining (%)	83	77	65	40	85	81	71	69
Oil Dispersed (%)	1	3	10	32	0.1	0.4	3	4
Oil Evaporated (%)	16	20	25	28	15	19	26	27
Thickness (mm)	3.5	2.1	1.2	1	7.7	4.9	2.9	1.7
Discontinuous Area (km^2)[3, 4]	4	16	77	320	3	13	61	252
Estimated Coastline Oiled (km)[5]	49				54			

Source: USDOI, MMS, Alaska OCS Region (2001).
Notes:
Calculated with the Sintef oil-weathering model Version 1.8 of Reed et al. (2000) and assuming an Alaska North Slope crude type. For the Alternative I Sales 186, 195, and 202 and their alternatives, the median pipeline spill is assumed to be 4,600 barrels.

1 Summer (July through September), 12-knot wind speed, 2 degrees Celsius, 0.4-meter wave height.

2 Meltout Spill. Spill is assumed to occur in May into first-year pack ice, pools 2-centimeter thick on ice surface for 2 days at 0 degrees Celsius prior to meltout into 50% ice cover, 11-knot wind speed, and 0.1 meter wave heights.

3 This is the area of oiled surface.

4 Calculated from Equation 6 of Table 2 in Ford (1985) and is the discontinuous area of a continuing spill or the area swept by an instantaneous spill of a given volume. Note that ice dispersion occurs for about 30 days before meltout.

5 Calculated from Equation 17 of Table 4 in Ford (1985) and is the results of stepwise multiple regression for length of historical coastline affected.

Table IV.B-1
Essential Fish Habitat Ranking for Alternatives

	Freshwater Rank	Estuary Rank	Marine Rank	Composite Rank	Composite if Freshwater Weighted
No Lease Sale (II)*	1	1	1	1	1
Barrow Subsistence Whaling Deferral (III)	5	4	4	5	5
Nuiqsut Subsistence Whaling Deferral (IV)	2	3	3	3	2
Kaktovik Subsistence Whaling Deferral (V)	4	5	5	4	4
Eastern (VI)	3	2	2	2	3
Full Sale, No Deferral	6	6	6	6	6

*****While Alternative II would lower potential effects in the Beaufort Sea, those effects would be transferred to another location (see Section IV.C.2).

Table IV.C-1
Number of Pacific Salmon Collected by Fyke Net in the Prudhoe Bay/Sagavanirktok River Region of Alaska, 1981-1997

Year	Effort					
	Net Days	**Pink**	**Chum**	**Chinook**	**Sockeye**	**Coho**
1981	193	0	0	0	0	0
1982	249	41*	0	0	0	0
1983	625	0	0	0	0	0
1984	1,603	15	2	1	0	0
1985	1,239	27	0	0	0	0
1986	1,289	74	6	0	0	0
1987	863	8	1	0	0	0
1988	572	0	0	0	0	0
1989	678	13	5	0	0	0
1990	371	19	1	0	0	0
1991	613	20	1	0	0	0
1992	627	21	1	0	0	0
1993	620	16	9	0	0	0
1994	403	5	0	0	0	0
1995	463	0	1	0	0	0
1996	360	17	4	0	0	0
1997	84	0	0	0	0	0
Total	**11,477**	**276**	**31**	**1**	**0**	**0**

Source:
Griffiths and Gallaway (1982); Griffiths et al. (1983); Woodward-Clyde Consultants (1983); Biosonics (1984); Moulton et al. (1986); Cannon et al. (1987); Glass et al. (1990); LGL Ecological Research Assocs., Inc. (1990, 1991, 1992, 1993, 1994a); Reub et al. (1991); Griffiths et al. (1995, 1996, 1997).
*Includes 11 fish caught upstream in the Sagavanirktok River.

Table IV.C-2
Sale 186 Employment and Personal Income Effects

Area of Residence/ Phase of OCS Activity	Employment Annual Average Jobs			Total Personal Income Annual Average in Millions of Constant 1999 $		
	Direct	Indirect and Induced	Total	For Direct Workers	For Indirect and Induced Workers	Total
NSB (a)						
Exploration	3	1	4	0.3	0.1	0.4
Development	30	10	40	2.4	1.0	3.4
Production	7	2	9	0.5	.2	0.7
Southcentral Alaska and Fairbanks (b)						
Exploration	40	20	60	3.2	0.6	3.8
Development	400	200	600	32.0	6.0	38.0
Production	260	130	390	21.0	4.0	25.0

Source:
USDOI, MMS, "Arctic IMPAK: 1st Step Model" and "Arctic IMPAK: 2nd Step Model"
(a) NSB: North Slope Borough for place of residence meaning villages in the NSB but not in the OCS worker enclave or enclaves.
(b) Southcentral includes Municipality of Anchorage, Matanuska-Susitna Borough, and Kenai Peninsula Borough. Fairbanks means the Fairbanks Northstar Borough.

Table IV.I-1
Discharge Conditions for a Well Blowout to Open Water or Solid Ice

Discharge Category	Volume of Oil (Barrels)				
	Day 1	Day 2	Day 3	Day 15	15-Day Totals
Well's Discharge Volume	15,000	15,000	15,000	15,000	225,000
Evaporation (20%)	-3,000	-3,000	-3,000	-3,000	-45,000
Fall out to Gravel Island	6000	6,000	6,000	6,000	90,000
Oil Remaining on Gravel Island	-3,400	0 [1]	0 [1]	0 [1]	-3,400
Oil Draining to the Sea from Gravel Island	2,600	6000	6,000	6,000	86,600
Oil Falling to the Sea or Solid Ice	6,000	6,000	6,000	6,000	90,000
Total Oil to the Sea or Solid Ice	8,600	12,000	12,000	12,000	176,600

Notes: Assumes Alaska North Slope crude; constant wind speed of 20 knots; winds change from west-southwest to east-northeast; current speed of 0.6 knots; wave height of 1-5 feet; and air temperature of 45 °F.
[1] After hour 14, the gravel island is saturated with oil. All oil falling on the gravel island drains to the sea.
Source:
S.L. Ross Environmental Research Ltd., D.F. Dickins and Assocs., and Vaudrey and Associates (1998); BPXA (2000b).

Table IV.I-2
Discharge Conditions for a Well Blowout to Broken Ice

Discharge Category	Volume of Oil (Barrels)				
	Day 1	Day 2	Day 3	Day 15	15-Day Totals
Well's Discharge Volume	15,000	15,000	15,000	15,000	225,000
Evaporation (20%)	-3,000	-3,000	-3,000	-3,000	-45,000
Fall out to Gravel Island	6000	6,000	6,000	6,000	90,000
Oil Remaining on Gravel Island	-3,400	0 [1]	0 [1]	0 [1]	-3,4000
Oil Draining to the Sea from Gravel Island	2,600	6,000	6,000	6,000	86,600
Oil Falling to the Open Water	3,000	3,000	3,000	3,000	45,000
Oil Falling to Ice Floes	3,000	3,000	3,000	3,000	45,000
Total Oil to the Environment	8,600	12,000	12,000	12,000	176,600
Oil Thickness on Floe	0.0004 to 0.9 mm	—	—	—	—

Notes:
Assumes Alaska North Slope crude; wind speed averages 19 knots; air temperature 8–18 °F; 5/10th's icefloes; ice is 0.6-0.8 feet thick and covered by 2-4 inches of snow; floes are hundreds of thousands of feet in size; 50% of the oil spray lands on the ice, 50% lands on the water.
[1] After 14 hours, the gravel island is saturated with oil; all oil falling on the gravel island drains to the sea.
Source:
S.L. Ross Environmental Research Ltd., D.F. Dickins and Assocs., and Vaudrey and Associates (1998); BPXA (2000b).

Table IV.I-3
General Mass Balance of Oil from a 180,000-Barrel Solid-Ice Spill

Day[1]	Oil Remaining (bbl)	Evaporated (bbl)
0	180,000	45,000 [2]
3	178,000	47,100
10	170,000	56,000
30	168,000	59,000

Notes:
Based on a 225,000-barrel spill size with 20% evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of 11 knots, and water temperature 0 °C.
Footnotes:
[1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels f oil is in the water.
Source:
USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al. (2000) weathering model assuming an Alaska North Slope Crude

Table IV.I-4
General Mass Balance of Oil from a 180,000-Barrel Fall Broken-Ice Spill

Day[1]	Oil Remaining (bbl)	Evaporated (bbl)	Dispersed (bbl)	Sedimented (bbl)	Onshore (bbl)
0	180,000	45,000 [2]	—	—	—
3	153,800	47,100	1,500	1,000	21,600
10	139,400	56,000	3,000	2,600	26,000
30	120,900	59,000	5,000	4,100	36,000

Notes:
Based on a 225,000-barrel spill size with 20% evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of 11 knots, and water temperature 0 °C.
Footnotes:
[1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels of oil is in the water.
Source:
USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al. (2000) weathering model assuming an Alaska North Slope Crude.

Table IV.I-5
Areas of Discontinuous and Thick Slicks from a 180,000-Barrel Fall or Winter Spill Melting Out in Spring

	Discontinuous Slick Area (km^2)[1]	Area of Thick Slick (km^2)[2]
Initial Spill Area	—	125
Area During Oil Pooling on Ice Surface	—	12
Days after Spill Reaches Water Surface[2]—		
3	160	5
10	770	8
30	3,200	16
60	7,900	22

Footnotes:
[1] Calculated from Ford (1985) and Kirstein and Redding (1987).
[2] Based on ocean-ice weathering model of Kirstein and Redding 1987).
Source:
USDOI, MMS, Alaska OCS Region (1998).

Table IV.I-6a
General Mass Balance of Oil from a 180,000-Barrel Spring Broken-Ice Spill

Day[1]	Oil Remaining in Slick (bbl)	Evaporated (bbl)	Dispersed (bbl)	Sedimented (bbl)	Onshore (bbl)
0	180,000	45,000 [2]	—	—	—
3	142,800	49,000	10,800	1,000	21,600
10	116,500	56,000	25,000	2,600	26,000
30	71,900	73,900	53,000	4,100	36,000

Notes:
Based on a 225,000-barrel spill size with 20% evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of 11 knots, and water temperature 2 °F.
Footnotes:
[1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels of oil is in the water.
Source:
USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al. (2000) weathering model assuming an Alaska North Slope Crude.

Table IV.I-6b
Length of Coastline a 180,000-Barrel Spill Might Contact Without Oil-Spill Response

Days	Amount of Coastline Contacted (in Kilometers)[1]	
	Winter-Ice Conditions	**Summer Open Water**
3	0	50 –140
10	50	155 – 170
30	100-130	275 – 300
360	350 – 425	485 –575

Source:
USDOI, MMS, Alaska OCS Region (2002).
Footnotes:
Estimated from oil-spill-risk analysis conditional probabilities. We add the length of land segments with chance of contact >0.5% to estimate the amount of coastline contacted. This calculation assumes no oil-spill response and includes land segments that had any chance of contact.

Table IV.I-7
General Mass Balance of Oil from a Spill of 180,000 Barrels in Open Water

Day[1]	Oil Remaining in Slick (bbl)	Evaporated (bbl)	Dispersed (bbl)	Sedimented (bbl)	Onshore (bbl)
0	180,000	45,000	—	—	—
3	142,600	49,000	10,800	1,000	21,600
10	116,500	58,900	25,000	2,600	26,000
30	71,900	73,900	53,000	4,100	36,000

Notes:
Based on a 225,000-barrel spill size with 20% evaporated during the blowout. Assumes Alaska North Slope crude, constant wind speed of 12 knots, and water temperature 2 °F.
Footnotes:
[1] We assume day zero is 15 days after the start of the spill, when 180,000 barrels of oil is in the water. USDOI, MMS, Alaska OCS Region (2002); Calculated with the Reed et al. (2000) weathering model assuming an Alaska North Slope Crude.

Table IV.I-8
Areas of Discontinuous and Thick Oil Slicks from a Spill of 180,000 Barrels in Open Water

Days After Spill Reaches Water Surface	Discontinuous Slick Area (km^2)[1]	Area of Thick Slick (km^2)[2]
3	290	7
10	1,370	12
30	5,700	19
60	14,000	24

Footnotes:
[1] Calculated from Ford (1985) and Kirstein and Redding (1987).
[2] Based on ocean-ice weathering model of Kirstein and Redding (1987).
Source:
USDOI, MMS, Alaska OCS Region (1995).

Table IV.I-9a Summary of the Conditional Probabilities (expressed as percent chance) that an Oil Spill Starting during Summer in the Near Zone (L10 or LA12) Will Contact a Certain Environmental Resource Area Within 1, 3, 10, 30, or 360 Days

Environmental Resource Area	Summer Spill From LA10 (Time in Days)					Summer Spill from LA12 (Time in Days)				
	1	3	10	30	360	1	3	10	30	360
Land	—	3	17	41	71	—	6	17	34	75
Kasegaluk Lagoon	—	n	n	n	n	—	n	n	n	n
Point Barrow, Plover Islands	—	n	n	1	4	—	n	n	n	3
Thetis and Jones Islands	—	7	16	23	26	—	1	5	13	18
Cottle and Return Islands, West Dock	—	3	7	10	13	—	2	8	13	16
Midway Islands	—	1	3	4	5	—	2	4	6	7
Cross and No Name Islands	—	n	2	4	4	—	4	7	9	10
Endicott Causeway	—	n	1	1	2	—	1	2	3	4
McClure Islands	—	n	1	1	2	—	3	6	7	8
Stockton Islands	—	n	n	1	1	—	2	4	5	6
Tigvariak Island	—	n	n	n	n	—	n	1	1	1
Maguire Islands	—	n	n	n	1	—	1	3	4	4
Flaxman Island	—	n	n	1	1	—	n	2	3	4
Barrier Islands	—	n	n	n	1	—	n	n	1	2
Anderson Point Barrier Islands	—	n	n	n	n	—	n	n	n	n
Arey and Barter Islands, Bernard Spit	—	n	n	n	n	—	n	n	1	1
Jago and Tapkaurak Spits	—	n	n	n	1	—	n	n	1	2
Angun and Beaufort Lagoons	—	n	n	n	n	—	n	n	n	1
Icy Reef	—	n	n	n	1	—	n	n	n	2
Chukchi Spring Lead 1	—	n	n	n	n	—	n	n	n	n
Chukchi Spring Lead 2	—	n	n	n	n	—	n	n	n	n
Chukchi Spring Lead 3	—	n	n	n	n	—	n	n	n	n
Chukchi Spring Lead 4	—	n	n	n	n	—	n	n	n	n
Chukchi Spring Lead 5	—	n	n	n	n	—	n	n	n	n
Beaufort Spring Lead 6	—	n	n	n	n	—	n	n	n	n
Beaufort Spring Lead 7	—	n	n	n	n	—	n	n	n	n
Beaufort Spring Lead 8	—	n	n	n	n	—	n	n	n	n
Beaufort Spring Lead 9	—	n	n	n	1	—	n	n	n	1
Beaufort Spring Lead 10	—	n	n	n	2	—	n	n	n	2
Ice/Sea Segment 1	—	n	n	1	2	—	n	n	n	1
Ice/Sea Segment 2	—	n	1	4	7	—	n	n	1	4
Ice/Sea Segment 3	—	3	10	18	21	—	n	1	6	9
Ice/Sea Segment 4	—	24	29	35	37	—	7	12	21	25
Ice/Sea Segment 5	—	2	5	8	10	—	21	26	30	31
Ice/Sea Segment 6	—	n	n	2	2	—	2	6	9	10
Ice/Sea Segment 7	—	n	n	n	1	—	n	n	2	5
Ice/Sea Segment 8	—	n	n	n	1	—	n	n	1	4
Ice/Sea Segment 9	—	n	n	n	1	—	n	n	n	3
Point Hope Subsistence Are	—	n	n	n	n	—	n	n	n	n
Point Lay Subsistence Area	—	n	n	n	n	—	n	n	n	n
Wainwright Subsistence Area	—	n	n	n	n	—	n	n	n	n
Barrow Subsistence Area 1	—	n	n	n	n	—	n	n	n	n
Barrow Subsistence Area 2	—	n	n	3	5	—	n	n	n	2
Nuiqsut Subsistence Area	—	1	5	9	10	—	32	37	40	41
Kaktovik Subsistence Area	—	n	n	n	1	—	n	n	2	3

Environmental Resource Area	Summer Spill From LA10 (Time in Days)					Summer Spill from LA12 (Time in Days)				
	1	3	10	30	360	1	3	10	30	360
Whale Concentration Area	n	n	n	n	n	—	n	n	n	1
Herald Shoal Polynya	n	n	n	n	n	—	n	n	n	n
Ice/Sea Segment 10	n	n	n	n	n	—	n	n	n	n
Ice/Sea Segment 11	n	n	n	n	n	—	n	n	n	1
Hanna's Shoal Polynya	n	n	n	n	1	—	n	n	n	1
Ice/Sea Segment 12	n	n	n	n	n	—	n	n	n	n
Ice/Sea Segment 13	n	n	n	n	n	—	n	n	n	n
Ice/Sea Segment 14	n	n	n	n	1	—	n	n	n	1
Ice/Sea Segment 15	n	n	1	6	11	—	n	n	2	7
Ice/Sea Segment 16a	4	3	16	33	38	—	n	2	12	19
Ice/Sea Segment 17	—	34	47	55	57	—	10	24	35	39
Ice/Sea Segment 18a	5	1	6	11	12	—	41	55	59	59
Ice/Sea Segment 19	1	n	n	2	3	—	1	5	9	12
Ice/Sea Segment 20a	n	n	n	1	8	—	n	1	4	15
Ice/Sea Segment 21	n	n	n	n	7	—	n	n	1	12
Ice/Sea Segment 22	n	n	n	n	7	—	n	n	n	11
Ice/Sea Segment 22	n	n	n	n	4	—	n	n	n	6
Ice/Sea Segment 24a	n	n	n	n	3	—	n	n	n	4
Ledyard Bay	n	n	n	n	n	—	n	n	n	n
Peard Bay	—	n	n	n	n	—	n	n	n	n
ERA 1	—	n	n	2	3	—	n	n	n	1
ERA 2	—	n	3	8	11	—	n	n	2	6
Ice/Sea Segment 16b	—	3	16	33	37	—	n	2	11	17
Harrison Bay	—	n	2	6	7	—	n	n	2	3
Harrison Bay/Colville Delta	—	2	8	16	19	—	n	1	5	10
ERA 3	—	27	43	53	55	—	n	5	15	19
Simpson Lagoon	—	4	12	17	20	—	1	5	12	17
Gwyder Bay	—	n	2	2	3	—	1	2	4	4
Prudhoe Bay	—	n	1	1	1	—	n	1	1	2
Cross Island ERA	—	2	6	10	11	—	44	50	53	54
Water over Boulder Patch 1	—	n	2	2	4	—	6	9	11	13
Water over Boulder Patch 2	—	n	1	2	4	—	6	8	10	12
Foggy Island Bay	—	n	n	1	2	—	3	4	5	6
Mikkelsen Bay	—	n	n	n	n	—	3	3	3	3
ERA 4	—	n	2	4	5	—	25	32	34	35
Ice/Sea Segment 18b	—	1	6	11	12	—	41	55	59	59
Simpson Cove	—	n	n	n	n	—	n	n	n	1
ERA 5	—	n	n	n	1	—	n	1	3	4
Kaktovik ERA	—	n	n	n	1	—	n	n	2	5
Ice/Sea Segment 20b	—	n	n	1	6	—	n	1	4	10
ERA 6	—	n	n	n	1	—	n	n	n	4
ERA 7	—	n	n	n	2	—	n	n	n	4
ERA 8	—	n	n	n	2	—	n	n	n	3
Ice Sea Segment 24b	—	n	n	n	n	—	n	n	n	1
—	—	—	—	—	—	—	—	—	—	—

Note:
For Environmental Resource Areas, see Maps A-2a through A-2d; for Land Segments, see Maps A-3a and A-3b;; and for Spill Areas LA1D and LA12, see Maps A-4a and A-4b.
n = less than 0.5%.
Source:
Johnson, Marshall, and Lear (2002).

Table IV.I-9b Summary of the Conditional Probabilities (expressed as percent chance) that an Oil Spill Starting during Winter in the Near Zone (L10 or LA12) Will Contact a Certain Environmental Resource Area Within 1, 3, 10, 30, or 360 Days

Environmental Resource Area	Winter Spill From LA10 (Time in Days)					Winter Spill from LA12 (Time in Days)					Environmental Resource Area	Winter Spill From LA10 (Time in Days)					Winter Spill From LA12 (Time in Days)				
	1	3	10	30	360	1	3	10	30	360		1	3	10	30	360	1	3	10	30	360
Land	—	n	3	7	52	—	1	3	6	55	Whale Concentration Area	n	n	n	n	n	—	n	n	n	1
Kasegaluk Lagoon	—	n	n	n	n	—	n	n	n	n	Herald Shoal Polynya	n	n	n	n	n	—	n	n	n	n
Point Barrow, Plover Islands	—	n	n	n	3	—	n	n	n	3	Ice/Sea Segment 10	n	n	n	n	n	—	n	n	n	n
Thetis and Jones Islands	—	1	3	3	20	—	n	1	2	12	Ice/Sea Segment 11	n	n	n	n	1	—	n	n	n	1
Cottle and Return Islands, West Dock	—	n	1	2	8	—	n	2	2	11	Hanna's Shoal Polynya	n	n	n	n	3	—	n	n	n	2
Midway Islands	—	n	n	n	2	—	n	1	1	5	Ice/Sea Segment 12	n	n	n	n	1	—	n	n	n	1
Cross and No Name Islands	—	n	n	n	2	—	1	1	2	6	Ice/Sea Segment 13	n	n	n	n	1	—	n	n	n	1
Endicott Causeway	—	n	n	n	1	—	n	n	1	3	Ice/Sea Segment 14	n	n	n	n	3	—	n	n	n	2
McClure Islands	—	n	n	n	n	—	n	1	1	4	Ice/Sea Segment 15	n	n	1	6	15	—	n	n	2	9
Stockton Islands	—	n	n	n	n	—	n	n	1	2	Ice/Sea Segment 16a	4	3	15	27	42	—	n	2	9	24
Tigvariak Island	—	n	n	n	n	—	n	n	n	1	Ice/Sea Segment 17	—	32	46	51	61	—	10	25	33	44
Maguire Islands	—	n	n	n	n	—	n	n	n	1	Ice/Sea Segment 18a	5	1	2	4	8	—	40	50	52	59
Flaxman Island	—	n	n	n	n	—	n	n	n	1	Ice/Sea Segment 19	1	n	n	n	2	—	n	2	3	8
Barrier Islands	—	n	n	n	n	—	n	n	n	n	Ice/Sea Segment 20a	n	n	n	n	2	—	n	n	2	7
Anderson Point Barrier Islands	—	n	n	n	n	—	n	n	n	n	Ice/Sea Segment 21	n	n	n	n	1	—	n	n	n	3
Arey and Barter Islands, Bernard Spit	—	n	n	n	n	—	n	n	n	1	Ice/Sea Segment 22	n	n	n	n	2	—	n	n	n	5
Jago and Tapkaurak Spits	—	n	n	n	1	—	n	n	n	2	Ice/Sea Segment 22	n	n	n	n	4	—	n	n	n	7
Angun and Beaufort Lagoons	—	n	n	n	n	—	n	n	n	n	Ice/Sea Segment 24a	n	n	n	n	3	—	n	n	n	5
Icy Reef	—	n	n	n	n	—	n	n	n	n	Ledyard Bay	n	n	n	n	n	—	n	n	n	n
Chukchi Spring Lead 1	—	n	n	n	n	—	n	n	n	n	Peard Bay	—	n	n	n	n	—	n	n	n	n
Chukchi Spring Lead 2	—	n	n	n	n	—	n	n	n	n	ERA 1	—	n	n	1	5	—	n	n	n	3
Chukchi Spring Lead 3	—	n	n	n	n	—	n	n	n	n	ERA 2	—	n	1	4	19	—	n	n	1	11
Chukchi Spring Lead 4	—	n	n	n	n	—	n	n	n	n	Ice/Sea Segment 16b	—	1	6	11	27	—	n	1	4	16
Chukchi Spring Lead 5	—	n	n	n	n	—	n	n	n	n	Harrison Bay	—	n	1	1	6	—	n	n	n	5
Beaufort Spring Lead 6	—	n	n	1	3	—	n	n	n	2	Harrison Bay/Colville Delta	—	n	1	2	15	—	n	n	1	6
Beaufort Spring Lead 7	—	n	n	1	3	—	n	n	n	2	ERA 3	—	9	15	17	36	—	n	2	5	20
Beaufort Spring Lead 8	—	n	n	2	5	—	n	n	1	3	Simpson Lagoon	—	1	2	3	17	—	n	1	2	12
Beaufort Spring Lead 9	—	n	n	2	6	—	n	n	1	4	Gwyder Bay	—	n	n	n	1	—	n	n	1	3
Beaufort Spring Lead 10	—	n	4	8	14	—	n	n	3	8	Prudhoe Bay	—	n	n	n	n	—	n	n	n	1
Ice/Sea Segment 1	—	n	n	n	n	—	n	n	n	n	Cross Island ERA	—	n	1	1	5	—	14	15	15	26
Ice/Sea Segment 2	—	n	n	n	1	—	n	n	n	n	Water over Boulder Patch 1	—	n	n	n	1	—	3	4	4	8
Ice/Sea Segment 3	—	1	2	2	3	—	n	n	1	1	Water over Boulder Patch 2	—	n	n	n	1	—	3	3	4	8
Ice/Sea Segment 4	—	6	7	7	7	—	1	2	2	3	Foggy Island Bay	—	n	n	n	1	—	1	1	1	4
Ice/Sea Segment 5	—	n	n	1	1	—	5	6	6	6	Mikkelsen Bay	—	n	n	n	n	—	1	1	1	3
Ice/Sea Segment 6	—	n	n	n	n	—	n	1	1	1	ERA 4	—	n	n	n	2	—	7	8	8	14
Ice/Sea Segment 7	—	n	n	n	n	—	n	n	n	n	Ice/Sea Segment 18b	—	n	1	1	5	—	14	17	18	28
Ice/Sea Segment 8	—	n	n	n	n	—	n	n	n	n	Simpson Cove	—	n	n	n	n	—	n	n	n	n
Ice/Sea Segment 9	—	n	n	n	n	—	n	n	n	1	ERA 5	—	n	n	n	n	—	n	n	n	1
Point Hope Subsistence Are	—	n	n	n	n	—	n	n	n	n	Kaktovik ERA	—	n	n	n	1	—	n	n	n	4
Point Lay Subsistence Area	—	n	n	n	n	—	n	n	n	n	Ice/Sea Segment 20b	—	n	n	n	1	—	n	n	1	4
Wainwright Subsistence Area	—	n	n	n	1	—	n	n	n	n	ERA 6	—	n	n	n	n	—	n	n	n	1
Barrow Subsistence Area 1	—	n	n	n	n	—	n	n	n	n	ERA 7	—	n	n	n	n	—	n	n	n	2
Barrow Subsistence Area 2	—	n	n	n	2	—	n	n	n	2	ERA 8	—	n	n	n	n	—	n	n	n	2
Nuiqsut Subsistence Area	—	n	n	n	1	—	4	5	5	5	Ice Sea Segment 24b	—	n	n	n	1	—	n	n	n	3
Kaktovik Subsistence Area	—	n	n	n	n	—	n	n	n	n	—	—	—	—	—	—	—	—	—	—	—

Note: n = less than 0.5%.
For Environmental Resource Areas, see Maps A-2a through A-2d; for Land Segments, see Maps A-3a and A-3b;; and for Spill Areas LA1D and LA12, see Maps A-4a and A-4b.
Source: Johnson, Marshall, and Lear (2002).

Table IV.I-9c Summary of the Conditional Probabilities (expressed as percent chance) that an Oil Spill Starting during Summer or Winter in the Near Zone (L10 or LA12) Will Contact a Certain Land Segment Within 1, 3, 10, 30, or 360 Days

Land Segment Number	Land Segment Area	Summer Spill from LA10 (Time in Days)					Summer Spill from LA12 (Time in Days)					Winter Spill from LA10 (Time in Days)					Winter Spill from LA12 (Time in Days)				
		1	3	10	30	360	1	3	10	30	360	1	3	10	30	360	1	3	10	30	360
20	Asiniak Point, Kugrua Bay, Kugrua River	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n
22	Skull Cliff	—	—	—	n	n	—	—	—	n	n	—	—	—	—	n	—	—	—	—	n
23	Nulavik	—	—	—	n	n	—	—	—	n	n	—	—	—	—	n	—	—	—	—	n
24	Walakpa Bay, Walakpa River	—	—	—	n	1	—	—	—	n	1	—	—	—	n	1	—	—	—	n	1
25	Barrow, Elson Lagoon	—	n	n	1	2	—	n	n	n	2	—	—	n	n	2	—		n	n	3
26	Dease Inlet	—	n	n	n	2	—	n	n	n	1	—	n	n	n	1	—	n	n	n	1
27	Kurgorak Bay	—	n	n	n	n	—	n	n	n	n	—	n	n	n	n	—	n	n	n	n
28	Cape Simpson	—	n	n	1	1	—	n	n	n	1	—	n	n	n	2	—	n	n	n	1
29	Ikpikpuk River, Smith Bay	—	n	n	n	1	—	n	n	n	n	—	n	n	n	1	—	n	n	n	1
30	Drew Point, McLeod Point	—	n	n	1	3	—	n	n	n	1	—	n	n	n	2	—	n	n	n	2
31	Lonely AFS Airport, Pitt Point, Pogik Bay	—	n	n	2	4	—	n	n	1	3	—	n	n	1	8	—	n	n	n	5
32	Cape Halkett	—	n	2	5	7	—	n	n	2	4	—	n	n	1	9	—	n	n	n	6
33	Atigaru Point, Kogru River	—	n	1	3	4	—	n	n	1	1	—	n	n	n	2	—	n	n	n	2
34	Fish Creek	—	n	1	4	5	—	n	n	1	2	—	n	n	n	2	—	n	n	n	1
35	Colville River	—	n	3	5	7	—	n	n	1	3	—	n	n	1	6	—	n	n	n	3
36	Oliktok Point	—	1	4	6	8	—	n	n	3	5	—	1	1	1	5	—	n	n	n	2
37	Milne Point, Simpson Lagoon	—	1	4	7	8	—	1	3	6	8	—	1	1	1	6	—	n	1	1	6
38	Kuparuk River	—	n	2	2	3	—	1	3	4	5	—	n	n	n	1	—	n	n	1	2
39	Point Brower, Prudhoe Bay	—	n	1	2	3	—	2	3	4	5	—	n	n	n	1	—	n	1	1	4
40	Foggy Island Bay, Kadleroshilik River	—	n	n	1	2	—	1	2	2	3	—	n	n	n	1	—	n	n	n	1
41	Bullen Point, Point Gordon, Reliance Point	—	n	n	n	1	—	1	3	3	3	—	n	n	n	n	—	n	n	1	3
42	Point Hopson, and Sweeney, Staines River	—	n	n	1	1	—	1	2	3	4	—	n	n	n	n	—	n	n	n	1
43	Brownlow Point, Canning River	—	n	n	n	1	—	n	1	1	2	—	n	n	n	n	—	n	n	n	n
44	Collinson Point, Konganevik Point	—	n	n	n	n	—	n	n	n	1	—	—	n	n	n	—	—	n	n	n
45	Anderson Point, Sadlerochit River	—	n	n	n	n	—	n	n	n	1	—	—	n	n	n	—	—	n	n	n
46	Arey Island, Barter Island	—	n	n	n	n	—	n	n	n	1	—	—	n	n	n	—	—	n	n	n
47	Kaktovik	—	n	n	n	1	—	n	n	n	2	—	—	n	n	1	—	—	n	n	2
48	Griffin Point, Oruktalik Lagoon	—	n	n	n	n	—	n	n	n	1	—	—	n	n	n	—	—	n	n	n
49	Angun Point, Beaufort Lagoon	—	n	n	n	n	—	n	n	n	1	—	—	n	n	n	—	—	n	n	n
50	Icy Reef, Kongakut River, Siku Lagoon	—	n	n	n	n	—	n	n	n	1	—	—	n	n	n	—	—	n	n	n
51	Demarcation Bay, Demarcation Point	—	n	n	n	n	—	n	n	n	2	—	—	n	n	n	—	—	n	n	n
52	Clarence Lagoon, Backhouse River	—	n	n	n	n	—	—	n	n	1	—	—	n	n	n	—	—	n	n	1
53	Komakuk Beach, Fish Creek	—	—	n	n	1	—	—	n	n	1	—	—	—	n	n	—	—	—	n	1
54	Nunaluk Spit	—	—	—	n	n	—	—	—	n	1	—	—	—	—	n	—	—	—	—	n
55	Herschel Island	—	—	—	n	1	—	—	—	n	2	—	—	—	—	1	—	—	—	—	1
56	Ptarmigan Bay	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n	—	—	—	—	1
57	Roland and Phillips Bay, Kay Point	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n	—	—	—	—	2
58	Sabine Point	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n
59	Shingle Point	—	—	—	—	4	—	—	—	—	3	—	—	—	—	n	—	—	—	—	n
60	Trent and Shoalwater Bays	—	—	—	—	n	—	—	—	—	1	—	—	—	—	n	—	—	—	—	n
62	Shallow Bay, West Channel	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n
63	Outer Shallow Bay, Olivier Islands	—	—	—	—	1	—	—	—	—	1	—	—	—	—	n	—	—	—	—	n
64	Middle Channel, Gary Island	—	—	—	—	1	—	—	—	—	1	—	—	—	—	n	—	—	—	—	1
65	Kendall Island	1	—	—	—	n	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n
66	North Point, Pullen Island	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n	—	—	—	—	n

Source: Johnson, Marshall, and Lear (2002). **Note:** **n =** less than 0.5%. For Environmental Resource Areas, seeMaps A-2a through A-2d for Land Segments, see Maps A-3a and A-3b; and for Spill Areas LA1D and LA12, see Maps A-4a and A-4b.

Table V-1a
Alaska North Slope Oil and Gas Discoveries as of July 1, 2002

	Name	Location of Field or Pool	Production Oil, Gas	Location of Production Facility	Discovery	Production Began	Category	Ranking Criteria
Past Development And Production								
1	South Barrow	Onshore	Gas	Onshore	1949	1950	Field	—
2	Prudhoe Bay	Onshore	Oil	Onshore	1967	1977	Field	—
3	Lisburne	Onshore	Oil	Onshore	1967	1981	Field	—
4	Kuparuk	Onshore	Oil	Onshore	1969	1981	Field	—
5	East Barrow	Onshore	Gas	Onshore	1974	1981	Field	—
6	Milne Point	Onshore	Oil	Onshore	1969	1985	Field	—
7	Endicott	Offshore	Oil	Offshore	1978	1986	Field	—
8	Sag Delta	Offshore	Oil	Onshore	1976	1989	Field	—
9	Sag Delta North	Offshore	Oil	Offshore	1982	1989	Satellite[1]	—
10	Schrader Bluff	Onshore	Oil	Onshore	1969	1991	Satellite[2]	**When**
11	Walakpa	Onshore	Gas	Onshore	1980	1992	Field	**Production**
12	Point McIntyre	Offshore	Oil	Onshore	1988	1993	Field	**Began**
13	North Prudhoe Bay	Onshore	Oil	Onshore	1970	1993	Field	—
14	Niakuk	Offshore	Oil	Onshore	1985	1994	Field	—
15	Sag River	Onshore	Oil	Onshore	1969	1994	Satellite[3]	—
16	West Beach	Onshore	Oil	Onshore	1976	1994	Field	—
17	Cascade	Onshore	Oil	Onshore	1993	1996	Field	—
18	West Sak	Onshore	Oil	Onshore	1969	1997	Satellite[2]	—
19	Badami	Offshore	Oil	Onshore	1990	1998	Field	—
20	Eider	Offshore	Oil	Offshore	1998	1998	Satellite[1]	—
21	Tarn	Onshore	Oil	Onshore	1991	1998	Field	—
22	Tabasco	Onshore	Oil	Onshore	1992	1998	Satellite[2]	—
23	Midnight Sun	Onshore	Oil	Onshore	1998	1999	Satellite[4]	—
24	Alpine	Onshore	Oil	Onshore	1994	2000	Field	—
25	Northstar	Offshore	Oil	Offshore	1984	2001	Field	—
26	Aurora	Onshore	Oil	Onshore	1999	2001	Satellite[4]	—
27	NW Eileen/Borealis	Onshore	Oil	Onshore	1999	2001	Field	—
28	Polaris	Onshore	Oil	Onshore	1999	2001	Satellite	—
29	Meltwater	Onshore	Oil	Onshore	2000	2001	Pool	—
30	Nanuk	Onshore	Oil	Onshore	—	2001	Pool	—
31	Palm	Onshore	Oil	Onshore	2001	2002	Pool	—
Present Development								
32	CD South	Onshore	Oil	Onshore	1996	2003	Pool	**When**
33	CD North (Fjord)	Onshore	Oil	Onshore	1992	(2006)	Pool	**Production**
34	Orion	Onshore	Oil	Onshore	2000	—	Satellite	**Is Estimated**
Reasonably Foreseeable Future Development And Production								
35	Spark/Rendezvous	Onshore	Gas & Oil	Onshore	2000	—	Prospect	—
36	Liberty	Offshore	Oil	Offshore	1983	—	Pool	—
37	Kalubik	Offshore	Oil	Onshore	1992	—	Prospect	—
38	Pete's Wicked	Onshore	Oil	Onshore	1997	—	Prospect	—
39	Sikulik	Onshore	Gas	Onshore	1988	—	Pool	—
40	Thetis Island	Offshore	Oil	Offshore	1993	—	Prospect	**When We Estimate**
41	Gwydyr Bay	Offshore	Oil	Onshore	1969	—	Pool	**Chance and**
42	Point Thomson	Onshore	Gas & Oil	Onshore	1977	—	Pools	**Timing of**
43	Mikkelson	Onshore	Oil	Onshore	1978	—	Prospect	**Development**
44	Sourdough	Onshore	Oil	Onshore	1994	—	Pool	**(highest/first to**
45	Yukon Gold	Onshore	Oil	Onshore	1994	—	Prospect	**lowest/last)**
46	Flaxman Island	Offshore	Oil	Offshore	1975	—	Prospect	—
47	Sandpiper	Offshore	Gas & Oil	Offshore	1986	—	Pool	—
48	Stinson	Offshore	Oil	Offshore	1990	—	Prospect	—
49	Hammerhead	Offshore	Oil	Offshore	1985	—	Pool	—
50	Kuvlum	Offshore	Oil	Offshore	1987	—	Prospect	—

Table V-1a
Alaska North Slope Oil and Gas Discoveries as of July 1, 2002 (continued)

	Name	Location of Field or Pool	Production Oil, Gas	Location of Production Facility	Discovery	Production Began	Category	Ranking Criteria
Speculative Future Development								
51	Hemi Springs	Onshore	Oil	Onshore	1984	—	Prospect	—
52	Ugnu	Onshore	Oil	Onshore	1984	—	Pool	—
53	Umiat	Onshore	Oil	Onshore	1946	—	Pool	—
54	Fish Creek	Onshore	Oil	Onshore	1949	—	Prospect	—
55	Simpson	Onshore	Oil	Onshore	1950	—	Pool	—
56	East Kurupa	Onshore	Gas	Onshore	1976	—	Show	**Insufficient**
57	Meade	Onshore	Gas	Onshore	1950	—	Show	**Information to**
58	Wolf Creek	Onshore	Gas	Onshore	1951	—	Show	**Estimate Chance**
59	Gubik	Onshore	Gas	Onshore	1951	—	Pool	**of Development**
60	Square Lake	Onshore	Gas	Onshore	1952	—	Show	—
51	East Umiat	Onshore	Gas	Onshore	1964	—	Prospect	—
62	Kavik	Onshore	Gas	Onshore	1969	—	Show	—
63	Kemik	Onshore	Gas	Onshore	1972	—	Show	—

Notes:
Field information is taken from State of Alaska, Dept. of Natural Resources (2000).
Footnotes for Satellites identify the associated production unit:
[1]Duck Island Unit;
[2]Kuparuk River Unit;
[3]Milne Point Unit;
[4]Prudhoe Bay Unit.
Parentheses indicate when production startup is expected.
Definitions: Field—infrastructure (pads/wells/facilities) installed to produce one or more pools.
Satellite—a pool developed from an existing pad.
Pool—petroleum accumulation with defined limits.
Prospect—a discovery tested by several wells.
Show—a one-well discovery with poorly defined limits and production capacity.

Table V-1b
Trans-Alaska Pipeline System and Future Natural Gas Projects

Name	Estimated Pipeline Length (miles)	Project Description and Route
		Active Project
Trans-Alaska Pipeline (TAPS)	800	The TAPS is the key transportation link for all North Slope oil fields. It has been in operation since 1977 and to date, has carried nearly 13 billion barrels of oil. Approximately 16.3 square miles are contained in the pipeline corridor that runs between Prudhoe Bay and Valdez. The Dalton Highway (or Haul Road) was constructed parallel to the pipeline between Prudhoe Bay and Fairbanks. The pipeline design capacity is 2 million barrels per day, and it reached near peak capacity in 1988. Presently, the TAPS is running at about 1.0 million barrels per day. The lower operational limit generally is thought to be between 200,000 and 400,000 barrels per day. If oil production from northern Alaska cannot be sustained above this minimum rate, the TAPS will become nonoperational, and all oil production is likely to be shut in.
		Future Natural Gas Projects
Trans-Alaska Gas System (TAGS)	800	The TAGS plan consists of a gas-conditioning plant on the North Slope; an 800-mile, 42-inch, pipeline; a liquefied natural gas (LNG) plant and marine terminal at Valdez; and a fleet of new LNG carriers. LNG would be transported to Japan and other Pacific Rim countries. The Yukon Pacific Corporation has obtained permits for construction of the TAGS and export of Alaska North Slope gas to Asia. The LNG facility and marine terminal in Valdez has received the final EIS prepared by the Federal Energy Regulatory Commission. Yukon Pacific believes the large scale of the project (2.05 billion cubic feet per day to yield 14 million metric tons of LNG annually) will make this project competitive with other new LNG projects. The project currently is stalled by the lack of commitments from the North Slope gas producers, delivery contracts to Asian buyers, and high construction costs.
Alaska Natural Gas Transportation System (ANGTS)[1]	2,102	The ANGTS plan is a pipeline system connecting Alaska North Slope gas production through Canada to the lower 48. The new pipeline would run parallel to the TAPS from the North Slope to interior Alaska and then cross the Yukon Territory to connect to existing pipelines in Alberta. The primary market would be consumers in the U.S. Numerous permits, rights-of-way, and approvals have been obtained for the proposed pipeline route through Alaska and Canada. Downward revisions to construction costs and the recent increase in gas prices into the $3-$4-million/cubic-foot range make this project more appealing today. Currently, several variations to routes are being considered for the overland gas-pipeline system.
Arctic Resources, Northern Gas Pipeline Project	326 offshore 874 onshore	This project involves a 52-inch, high-pressure gas pipeline running offshore from Prudhoe Bay in Alaska to the Mackenzie Delta in Northwest Territory and then south through the Mackenzie River Valley to the existing gas pipeline network in northern Alberta. The 326-mile offshore portion would be trenched in 30-60 feet of water. The 874-mile onshore portion also would be buried. It is expected to deliver 2.5 billion cubic feet per day to markets primarily in the U.S. The project would involve a consortium of gas producers, pipeline companies, and Native Corporations in both Alaska and Canada. Commitments of gas producers and gas buyers have not yet been obtained; right-of-way permits also have not been issued.
Natural Gas to Liquids Conversion[2]	Will use existing TAPS pipeline	Atlantic Richfield Co. (ARCO) and Syntroleum Corp constructed a pilot-scale, natural gas to liquids (GTL) conversion facility in Puget Sound, Washington. More recently, BP-Amoco has begun design work on a GTL pilot project on the Kenai Peninsula in Alaska. As a result of the BP-Amoco-ARCO merger, BP-Amoco now holds an equal interest in the gas reserves in the Prudhoe Bay field. All of the major North Slope gas owners (BP-Amoco, Exxon-Mobil, and Phillips-Alaska) are studying the feasibility of various gas-commercialization projects. GTL is an attractive option because it will use the existing TAPS pipeline (extending its life and lowering future tariffs) and produce clean-burning fuels to meet more stringent Environmental Protection Agency emission standards for vehicles. At the present time, the overall cost of a full-scale gas to liquids project is comparable to a similar sized LNG project. As an emerging technology, new cost-reduction breakthroughs are expected for gas to liquids processing, improving the economic potential for future gas to liquid projects.

Notes:
[1] Thomas et al. (1996).
[2] Alaska Report (1997).

Table V-1c
Future Lease Sales

Sale	Proposed Sale Date(s)	Area/Description	Resources or *Hydrocarbon Potential*
Federal Ocs			
5-Year Program – 186, 195, 202	2003, 2005, 2007	As much as 9.9 million acres from the Canadian border on the east to Barrow on the west in the Beaufort Sea (*Federal Register,* 2001c).	1.02-1.71 Bbbl Oil (Estimated)
Northeast NPR-A	June 2002	As much as 3 million acres of the Northeast NPR-A Planning Area (USDOI, BLM, 2001).	0.50-2.2 Bbbl Oil (Estimated)
Northwest NPR-A	To Be Determined	As much as 9.98 million acres of the Northwest NPR-A Planning Area (*Federal Register*, 2001d).	To Be Determined
State Of Alaska			
North Slope Areawide	Oct. 2002, Oct. 2003, Oct. 2004, Oct. 2005	As much as 5,100,000 acres of State-owned lands between the Canning and Colville rivers and north of the Umiat Baseline (about 69° 20' N.).	*Moderate to High*
Beaufort Sea Areawide	Oct. 2002, Oct. 2003, Oct. 2004, Oct. 2005	Unleased State-owned tide- and submerged lands between the Canadian border and Point Barrow and some coastal uplands acreage located along the Beaufort Sea between the Staines and Colville rivers. The gross proposed sale area is in excess of 2,000,000 acres. The State of Alaska was scheduled to hold its first areawide sale in the Beaufort Sea on October 13, 1999. This sale was delayed pending the outcome of the British Petroleum-Amoco and ARCO merger and related uncertainties in future lease holdings.	*Moderate to High*
North Slope Foothills Areawide	May 2002	State-owned lands lying between the National Petroleum Reserve-Alaska and the Arctic National Wildlife Refuge south of the Umiat Baseline and north of the Gates of the Arctic National Park and Preserve. The gross proposed sale area is in excess of 7,000,000 acres.	*Moderate*

Note:
Bbbl = billion barrels.
Source:
USDOI, MMS, Alaska OCS Region (2001).

Table V-2
Past Development: 2001 Production and Reserve Data

				Production[1]				Reserves[2]	
Unit or *Area*	**Field**	**Type (Oil or Gas)**	**Discovery**	**Began**	**Gas (Bcf)**	**2001 Oil (MMbbl)[1]**	**Production to**	**Oil (MMbbl)[1]**	**Gas (Bcf)**
Duck Island	Endicott	O	1973	1987	–	11.622	Endicott	177[3]	–
—	Sag Delta North[2]	O	1989	1989	–	–[3]	Endicott	–	–
—	Sag Delta[2]	O	1976	1989	–	–[3]	Endicott	–	–
—	Eider	O	1998	1998	–	0.148	Endicott	4	–
—	Ivishak	O	–	–	–	0.248	Endicott	–	
Prudhoe Bay	Prudhoe Bay	O	1967	1977	–	187.056	Prudhoe	2,454	–
—	P. Bay Satellites	O	–	–	–	–	Prudhoe	144	–
—	Lisburne	O	1968	1981	–	3.202	Lisburne	33	–
—	Niakuk	O	1985	1994	–	7.336	Lisburne	49	–
—	West Beach	O	1976	1994	–	0.401	Lisburne	5	–
—	N. Prudhoe Bay	O	1970	1993	–	–	Lisburne	1	–
—	Point McIntyre	O	1988	1993	–	23.737	Lisburne	208	–
—	Midnight Sun	O	1998	1999	–	1.441	Prudhoe	11	–
—	Aurora	O	1999	2001	–	–	Prudhoe	38	–
—	NW Eileen/Borealis	O	1999	2001	–	–	Prudhoe	53	–
—	Polaris	O	1999	2001	–	–	Prudhoe	49	-
Kuparuk River	Kuparuk River	O	1969	1981	–	74.133	Kuparuk	814	–
—	Tabasco	O	1992	1998	–	1.911	Kuparuk	24	–
—	Tarn	O	1992	1998	–	8.767	Kuparuk	46	–
—	West Sak	O	1969	1998	–	1.520	Kuparuk	100	–
	Meltwater	O	—	2001	–	0.148855	Kuparuk	52	–
	Palm	O	—	2002		–	Kuparuk	35	–
Milne Point	Milne Point	O	1969	1985	–	–	Milne Point	260	–
—	Cascade[4]	O	1993	1996	–	–	Milne Point	–[4]	–
—	Schrader Bluff	O	1969	1991	–	2.498	Milne Point	99	–
—	Sag River	O	1968	1994	–	–	Milne Point	7	–
Badami	Badami	O&G	1990	1998	–	0.930	TAPS	8	–
Colville River	Alpine	O	1994	2000	–	28.6880.13	Kuparuk	398	–
	Nanuq	O	—	2001	--	0.019312	Kuparuk	40	–
Northstar	Northstar	O	1984	2001	-	1.265552	TAPS	175	–
***NPR-A*[1]**	East Barrow	G	1974	1981	0.085	–	Barrow	–	5
—	South Barrow	G	1949	1950	0.421	–	Barrow	–	4
—	Walakpa	G	1980	1993	1.341	–	Barrow	–	25
All Units or Areas Total		—	—	—	—	—	—	**5,284**	**33**

Notes:

[1] Production information is from State of Alaska, Oil and Gas Conservation Commission (2002)
[2] Reserves were estimated by subtracting 2000 production from State of Alaska, Oil and Gas Conservation Commission (2001) from the Reserve Data in State of Alaska, Dept. of Natural Resources (2001,2002). Reserve estimates for Aurora, Borealis, Meltwater, and Polaris are from *PI/Dwight's Drilling Wire* (2001a, 2002, 2001b, and 2001c), respectively.
[3]Endicott includes Endicott, Sag Delta and Sag Delta North.
[4] Cascade is included in Milne Point.

Table V-3
Past Development: Infrastructure and Facilities

UNIT OR *AREA* Field	Gravel Roads, Pads, & Airstrips (acres)	Pipelines: Gathering, Comm. Carr., Unspecified (miles)			Gravel Num.	Mines Acres	[5]Wells	Pads	Reserve Num.	Pits Acres	Prod Centers	Camps Base and Const.	Facilities Plants: Power Topping Gas Seawater	Docks and Cause-ways	Airports and Airstrips	Roads (miles)	River Crossings
		G	C	U													
Duck Island																	
Endicott	392[2]	3	26	–	1[2]	179[2]	129	2[1]	0[2]	0[2]	0	0[1]	3[1]	2[1]	0[1]	15[1]	1[1]
Prudhoe Bay																	
Prudhoe Bay	4,590[2]			145	6[2]	726[2]	1,764	38	106[2]	560[2]	6[1]	4[1]	4[1]	2[1]	2[1]	200[1]	3[1]
Lisburne	213[2]	50	–	–	0[2]	0[2]	80	5[1]	10[2]	16[2]	1[1]	1[1]	1[1]	0[1]	0[1]	18[1]	–
Niakuk	22[2]	5		–	0[2]	0[2]	19		0[2]	0[2]	–	–	–	–	–	–	–
West Beach	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
N. Prudhoe Bay	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Pt. McIntyre	33[2]	12	–	–	0[2]	0[2]	84	–	0[2]	0[2]	–	–	–	–	–	–	–
Aurora	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
Kuparuk Riv.																	
Kuparuk River	1,435[2]	97	37		5[2]	564[2]	996	34[1]	126[2]	161[2]	3[1]	2[1]	4[1]	1[1]	1[1]	94[1]	5
West Sak	–	–	–	–	0	0	17		0	0	0	0	0	0	0	–	0
Milne Point																	
Milne Point	205[2]	30	10		1[2]	43[2]	182	4[1]	20[2]	19[2]	1[1]	0[1]	2[1]	0[1]	0[1]	19[1]	1[1]
Cascade	31[2]	–	–	–	0[2]	0[2]	–	–	0[2]	0[2]	–	–	–	–	–	–	–
Schrader Bluff	–	–	–	–	–	–	52	–	–	–	–	–	–	–	–	–	–
Sag River	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–
Badami	85[2]	–	26	35	1[2]	89[2]	10	2	0[2]	0[2]	1	1	0	1	1	4.5	5
Alpine	97	–	–	34	0	0	150	2	0	0	1	2	–	0	1	3	5
West Of Kuparuk																	
Tarn[3]	72.8	–	–	10	0-1[4]	–	16	2	0	0	0	0	0	0	0	10	2
Northstar	18	26	26	0	0	0	23	1	0	0	1	1	0	0	0	0	0
Totals	**7,126**	**197**	**99**	**224**	**14-15**	**1,601**	**3,537**	**89**	**262**	**756**	**13**	**110**	**14**	**6**	**5**	**364**	**22**
NPR-A																	
East Barrow	–	–	–	–	–	–	**4**	–	–	–	–	–	–	–	–	–	–
South Barrow	–	–	–	–	–	–	**19**	–	–	–	–	–	–	–	–	–	–
Walakpa	–	–	–	–	–	–	**9**	–	–	–	–	–	–	–	–	–	–

Notes:
[1] Eg&G Idaho, Inc. (1991).
[2] BPXA (1996).
[3] U.S. Army Corps of Engineers, Public Notice of Application for Permit Reference Number 4-970705.
[4] The gravel would come from Mine Site F and should be sufficient. However, a future aliquot to the north has already been permitted for expansion necessary, this aliquot may need to be opened to support the project.
[5] Alaska Oil and Gas Conservation Commission 1998 Annual Report.

Table V-4
Present Development: Estimated Reserve Data

Unit or Area	Field	Type (Oil, Gas)	Discovery	Status	Oil Reserves (MMbbl)
Colville River	CD North (Fjord)	Oil	1992	Present Development	50
Colville River	CD South (Nanuq)	Oil	1996	Present Development	38
Prudhoe	Orion (NW Eileen)	Oil	–	Present Development	50
Total for All Units or Areas			–	–	138

Table V-5
Present Development: Proposed Infrastructure and Facilities

Unit or Area/Field	Gravel Roads, Pads, & Airstrips (acres)	Pipelines (miles)	Gravel Mines		Wells	Pads	Reserve Pits		Facilities					Roads (miles)	River Crossings
			Num.	Acres			Num.	Acres	Prod. Centers	Camps Base and Const.	Plants: Power Topping Gas Seawater	Docks and Cause-ways	Airports and Airstrips		
Colville River/Fiord CD North	40	7	1	45	40	1	0	0	0	0	0	0	1	0	0
Colville River/ CD South/Nanuq	40	4	0	0	40	1	0	0	0	0	0	0	0	3.8	0
Prudhoe/NW Eileen/Orion		5	0	0	60	1	0	0	0	0	0	0	0	–	0

Note:
Fiord (*Petroleum News Bulletin*, 2001a), Nanuq (*Petroleum News Bulletin*, 2001b), and Palm wells estimated using a 2-million-barrel recovery typical of Kuparuk reservoir satellites.

Table V-6a
Reasonably Foreseeable Future Development: Estimated Resources for Purposes of Analysis

Area/Group	Pool	Type (Oil and Gas)	Discovery	Facility Location	Oil Resource (MMbbl)
NPR-A	Spark/Rendezvous	Gas and Oil	2000	Onshore	To Be Determined
Western Group	Kalubik	O	1992	Offshore	—
—	Thetis Island	O	1993	Offshore	250
Central Group (Northstar)	Gwyder Bay	O	1969	Offshore	—
—	Pete's Wicked	O	1997	Onshore	—
—	Sandpiper	Gas and Oil	1986	Offshore	200
Eastern Group (Badami)	Mikkelson	O	1978	Onshore	—
—	Sourdough	O	1994	Onshore	—
—	Liberty	O	1983	Offshore	120
—	Yukon Gold	—	1994	Onshore	—
—	Point Thompson	Gas and Oil	1977	Onshore	—
—	Flaxman Island	O	1975	Offshore	—
—	Stinson	O	1990	Offshore	—
—	Hammerhead	O	1985	Offshore	—
—	Kuvlum	O	1987	Offshore	1,000
Total	—	—	—	—	1,570

Source: USDOI, MMS, Alaska OCS Region.

Notes:
Resource estimates are assumed for purposes of cumulative-effects analysis only. Accurate oil volumes for individual fields generally are unavailable, as these discoveries have not been adequately delineated or studied for their development potential. Most of these discoveries presently are noncommercial and will require new technology or higher oil prices to be economic. It is possible that many of these pools will remain undeveloped. Future development likely would occur in conjunction with the infrastructure for the fields shown in parentheses.

Resource estimates for Hemi Springs and Ugnu are not included in the above table, but they are included in the 2.0 billion barrels expected to be produced from satellites, pools, and enhanced recovery in existing fields. Gas resources are not listed because commercial production from the North Slope will require a new gas-transportation system to reach outside markets.

The oil volume including the Point Thompson pool is largely condensate recovered with associated gas-production wells. We assume that produced gas will be used for field operations (fuel) or be reinjected into reservoirs in nearby oil fields to optimize oil production. Reinjected gas could be recovered at some later date, when a transportation system for North Slope gas is constructed.

Table V-6b
Reasonably Foreseeable Future Development: Estimated New Infrastructure for Purposes of Analysis

Area/Group	Pads	Footprint (Acres)	Wells	Production Facilities	Base Camps	Docks	Airstrips	Roads	Pipeline (Miles)
NPR-A									
Western	4	120	131	1	1	1	0	0	38
Central	3	60	87	0	0	0	0	0	22
Eastern	10	316	343	6	4	2	3	12	131
Southern	1	25	20	0	0	0	0	12	12

Source: USDOI, MMS, Alaska OCS Region.

Notes:
Development Assumptions: (1) Industry will minimize permanent (gravel) roads by using ice roads; (2) new pipelines from satellite fields will tie into pipelines from main fields (Alpine, Northstar, Badami, Kuparuk River); (3) number of pads and wells are estimated from resource volumes; (4) production pad footprints are estimated from pad number, connecting roads, landfall/docks, and airstrips. Hemi Springs and Ugnu are considered to be examples of satellites and enhanced oil recovery, respectively, and will be developed using existing infrastructure of the Prudhoe Bay and Kuparuk River fields.

Table V-7a
Oil and Gas Production 1969 to December 2001 on the North Slope of Alaska

Production To Date	Oil (billions of barrels)	Gas (billions of cubic feet)	Reference
Onshore	13.256	342.24[1,2]	State of Alaska, AOGCC (2002)
Offshore	0.429	0	
Total	**13.625**	**40.24**	

Source:
USDOI, MMS, Alaska OCS Region.

Table V-7b
Summary of Reserve and Resource Estimates We Use for Analytical Purposes in the Cumulative Analysis

Production Activity	Oil (billions of barrels)	Contribution of Sale 186 by Volume of Oil (%)	Reference Table
Low End of the Range (Past and Present)	6	7.66	Table V.B-7c
Middle Portion (Past, Present, and Reasonably Foreseeable)	12	3.80	Table V.B-7c
High End (Past, Present, Reasonably Foreseeable, and Speculative)	15	3.07	Table V.B-7c

Source:
USDOI, MMS, Alaska OCS Region.
Sales 195 and 202 with similar resource estimates of 0.460 billion barrels would each contribute 3.80% by volume of oil.

Table V-7c
Detailed Reserve and Resource Estimates We Use for Analytical Purposes in the Cumulative Analysis

Activity	Oil (billions of barrels)	Gas (billions of cubic feet)	Reference Table
Past and Present Production (total)	5.432	33[1]	Table V.B-2
Onshore–past (Prudhoe Bay, Kuparuk River, Milne Point, Badami, Colville River & NPR-A)	4.938	33[1]	Table V.B-4
Offshore–past (Duck Island Unit and Northstar)	0.356	—	—
Onshore–present (CD North, CD South, Orion)	0.138	—	—
Reasonably Foreseeable Future Production (total)	5.620	–[2]	Table V.B-6a
Discovered Onshore	0.500	—	—
Discovered Offshore	1.070	—	—
Undiscovered Onshore	2.670[4]	—	—
Undiscovered Offshore (Sale 186)	0.46	—	—
Undiscovered Offshore (Sales 195 and 202)	0.92[5a]	—	—
Speculative Production (total)	3.59	32,800[3]	See notes below
Onshore	2.67[4]	—	—
Offshore	0.92[5b]	—	—
Total	**14.642**	**32,833**	Tables V.B-1a to 7b

Source:
USDOI, MMS, Alaska OCS Region.
Notes: Production and Reserve Data as of December 2000.
[1]Gas production to date is from Barrow gas fields supplied for local use to the village of Barrow. [2]Currently, all gas production from existing oilfields is consumed by facilities or reinjected for reservoir pressure maintenance. No gas production is transported and marketed outside of the North Slope. [3]Future production of natural gas assumes that a transportation system eventually will be constructed to move North Slope gas resources to outside markets. All proposed systems are uneconomic under current conditions. [4]Includes 2.0 billion barrels in unnamed satellite fields and from enhanced oil recovery from existing oil fields. Also, 0.300 and 0.370 billion barrels estimated for NE and NW NPR-A multiple sales respectively. [5a] Includes 60% of the mid-point undiscovered resources between the base case ($18.00) and high case ($30.00) of MMS's 2000 Assessment of Beaufort Sea. [5b]Includes the remaining portion (40%) of the mid-point undiscovered offshore resources recoverable between $18.00 and $30.00 per barrel.

Table V-7d
Estimates for Speculative Oil and Gas Resources

Area	Oil (billions of barrels)	Gas (trillions of cubic feet)	Study/Source
Beaufort Shelf	1.8–3.2	—	USDOI, MMS (2000)[1]
Northern Alaska	0.6–3.3	—	U.S. Geological Survey (1995)[2]
Beaufort-MacKenzie River Delta	1.0	9.0	National Energy Board (1998)[3]
Northeast NPR-A	0.5–2.2	—	USDOI ,BLM and MMS (1997)[4]
Arctic National Wildlife Refuge	2.4–6.3	—	U.S. Geological Survey (1998)[5]
North Slope-State lands	4.0	32.8	Industry[6]; MMS[7]
Chukchi Shelf	1.0–6.1	—	USDOI, MMS (2000)[1]

Notes:
The resource estimates for the Beaufort Shelf (USDOI, MMS, 2000)[1] and Northern Alaska (U.S. Geological Survey, 1995)[2] are mean undiscovered volumes that are economically recoverable at oil prices between $18 and $30 per barrel. Economic resources represent a small fraction of the total recoverable petroleum endowment, much of which is in pools too small or too remote to be economic under modeling assumptions. It is impossible to accurately predict the timing of commercial discoveries or future production volumes for speculative resources. Resource estimates often change with new information or modeling assumptions. For example, a new Geological Survey assessment (1998)[5] reports that more economic oil may occur in the small coastal plain of the Arctic National Wildlife Refuge than previously estimated (U.S. Geological Survey, 1995) for all of Northern Alaska. The economic analysis in Section III.D.5, including Table III.D-5, uses $16 per barrel price for the Proposal. The estimates shown use $18-$30 as reference prices. Assuming different price ranges are reasonable given the volatility of oil prices, a more optimistic assumption, that is a higher price, is reasonable for the cumulative case.
For the Liberty Proposal, exploration/appraisal is completed and the field is ready for development. For the cumulative case, regional exploration in Arctic Alaska is not complete and development may be delayed long into the undetermined future. The hope for giant oil fields will continue to draw leasing and exploration activities in the future. However, it is unreasonable to speculate on the timing and infrastructure needed to produce resources that have not been discovered. More than 30 trillion cubic feet of gas has been discovered on the North Slope and remains undeveloped due to the lack of a regional transportation infrastructure and market. This huge proven resource base undoubtedly will be produced before major exploration efforts are focused on undiscovered gas resources in other onshore areas or the Beaufort Sea off Alaska.
Sources:
[1] USDOI, MMS (2000)
[2] U.S. Geological Survey (1995)
[3] National Energy Board, Canada (1998)
[4] USDOI, BLM and MMS (1998)
[5] U.S. Geological Survey (1998)
[6] Informal industry estimates of oil recoverable from enhanced recovery technology and from new small satellite fields near existing North Slope infrastructure
[7] Discovered but undeveloped gas reserves, mainly associated with existing oil fields (Sherwood and Craig, 2000)

Table V-8
Seasonal Transportation Access for Projects off the Road System

	Construction Period			Operation/Production Period		
Project	**Summer**	**Breakup**	**Winter**	**Summer**	**Breakup**	**Winter**
Alpine[1]						
Aircraft[2]	4-7 round trips daily	N/A	3-6 round trips weekly	4 round trips monthly or as needed	N/A	4 round trips monthly or as needed
Surface	Frequent	N/A	Frequent	Daily	N/A	Daily
Marine	N/A	N/A	N/A	N/A	N/A	N/A
Northstar[3]						
Aircraft[4]	See footnote [4]	N/A	2,480 round trips	See footnote [4]	N/A	7 round trips per month
Surface	See footnote [5]	N/A	35,013 [5] round trips	See footnote [5]	N/A	190 round trips Yearly
Marine	132 round trips	N/A	None	5-6 round trips Yearly	N/A	None
Badami[6]						
Aircraft	See footnote [6]	See footnote [6]	See footnote [6]	36 round trips weekly during drilling[7]	40 round trips weekly during drilling[7]	2 round trips weekly during drilling [7]
Surface	See footnote [6]	See footnote [6]	See footnote [6]	1 round trip yearly[8]	N/A	30 round trips daily during drilling [9]
Marine	See footnote [6]	See footnote [6]	See footnote [6]	10[10]	N/A	N/A

Notes:
[1]For the Alpine Project, summer is defined as April 20 to November 30; the rest of the year is winter. Alpine construction and development drilling phase may last from the present to approximately 2005, with the field life estimated at another 15-20 years.
[2]Aircraft operations calculated for the Alpine Project by Arco contractors were made on the basis of an amalgamation of three aircraft types: Hercules cargo plane, Twin Otter, and Boeing 737.
[3]The Northstar project should be completed (island construction and development drilling) within 4 years of initiation. The life of the field is projected at 15-20 years. The transportation requirements indicated here are the construction of the Northstar island in a single season.
[4]Data presented in the Northstar Final EIS (U.S. Army Corps of Engineers, 1999) for helicopter transport is not separated out by season.
[5]Data presented in the Northstar Final EIS for surface transport is not separated out by season. However, of the presented figure of 35,013 surface transport round trips, 2,775 round trips are bus trips and would be involved primarily with the movement of personnel to construction sites. The balance of the surface transport trips are by truck.
[6]The Badami project has proceeded beyond the construction phase and is now in developmental drilling.
[7]For all three periods, 6 aircraft operations will occur weekly after drilling.
[8]Planned pipeline inspection via rolligon; emergency use of rolligons not estimated.
[9]After drilling, 3 yearly round trips planned for pipeline inspection via rolligons; emergency use not estimated.
[10]An additional 10 round trips are planned in summer of 1998 to support drilling operations.

Table V-9a
Tundra-Ice Road Water-Volume Requirements (in gallons)

Road Length	Road Width (feet)			
(Miles)	30	50	100	200
0.5	213,270	355,450	710,899	1,421,798
1.0	426,540	710,899	1,421,798	2,843,597
1.5	639,809	1,066,349	2,132,698	4,265,395
2.0	853,079	1,421,798	2,843,597	5,687,194
2.5	1,066,349	1,777,248	3,554,496	7,108,992
3.0	1,279,619	2,132,698	4,265,395	8,530,790
3.5	1,492,888	2,488,147	4,976,294	9,952,589
4.0	1,706,158	2,843,597	5,687,194	11,374,387
4.5	1,919,428	3,199,046	6,398,093	12,796,186
5.0	2,132,698	3,554,496	7,108,992	14,217,984
5.5	2,345,967	3,909,946	7,819,891	15,639,782
6.0	2,559,237	4,265,395	8,530,790	17,061,581
6.5	2,772,507	4,620,845	9,241,690	18,483,379
7.0	2,985,777	4,976,294	9,952,589	19,905,178
7.5	3,199,046	5,331,744	10,663,488	21,326,976
8.0	3,412,316	5,687,194	11,374,387	22,748,774
8.5	3,625,586	6,042,643	12,085,286	24,170,573
9.0	3,838,856	6,398,093	12,796,186	25,592,371
9.5	4,052,125	6,753,542	13,507,085	27,014,170
10.0	4,265,395	7,108,992	14,217,984	28,435,968

Notes:
Assumptions:
– 6-inch total road thickness.
– 2/3 of thickness is fresh water.
– 1/3 of thickness is snow.
– Typical tundra topography.
– 20% contingency for topographic feature correction, (i.e., stream ramps, etc.).
– Water volumes are calculated for construction only.
– No additional water included for ice road maintenance.
Source: Alaska Interstate Construction, LLC.

Table V-9b
Sea-Ice Road Water-Volume Requirements (in gallons)

Road Length		Road Width (feet)		
(Miles)	**100**	**200**	**300**	**400**
0.5	888,624	1,777,248	2,665,872	3,554,496
1.0	1,777,248	3,884,496	5,331,744	7,108,992
1.5	2,665,872	5,331,744	7,997,616	10,663,488
2.0	3,554,496	7,108,992	10,663,488	14,217,984
2.5	4,443,120	8,886,240	13,329,360	17,772,480
3.0	5,331,744	10,663,488	15,995,232	21,326,976
3.5	6,220,368	12,440,736	18,661,104	24,881,472
4.0	7,108,992	14,217,984	21,326,976	28,435,968
4.5	7,997,616	15,995,232	23,992,848	31,990,464
5.0	8,886,240	17,772,480	26,658,720	35,544,960
5.5	9,774,664	19,549,728	29,324,592	39,099,456
6.0	10,663,488	21,326,976	31,990,464	42,653,952
6.5	11,552,112	23,104,224	34,656,336	46,208,448
7.0	12,440,736	24,881,472	37,322,208	49,762,944
7.5	13,329,360	26,658,720	39,988,080	53,317,440
8.0	14,217,984	28,435,968	42,653,952	56,871,936
8.5	15,106,608	30,213,216	45,319,824	60,426,432
9.0	15,995,232	31,990,464	47,985,696	63,980,928
9.5	16,883,856	33,767,712	50,651,568	67,535,424
10.0	17,772,480	34,544,960	53,417,440	71,089,920

Notes:
Assumptions:
— 6-inch freshwater cap on top of brine ice.
— Water volumes are calculated for construction only.
— No additional water included for ice-road maintenance.
— No contingency for rough ice surfaces.
Source:
Alaska Interstate Construction, LLC.

Table V-10
Some Characteristics of North Slope Oil Fields

Oil Field[1] (Year Production Began)	**Unit Area (hectare)**[2]	**Number of Production Facility Pads**	**Mine Sites and Gravel Placement**	
			Area Disturbed (hectare)	**Percent of Unit Disturbed (%)**
Prudhoe Bay (1977)	99,103.2	50	2,592.5	2.62
Kuparuk River (1981)	104,514.2	49	1,033.8	0.99
Milne Point (1985)	22,002.8	11	182.0	0.83
Lisburne (1986)	32,359.5	8	100.7	0.31
Endicott (1987)	7,099.1	2	207.1	2.92
Point McIntyre (1993)	4,384.1	2	12.7	0.29
Niakuk (1994)	2,623.7	1	9.8	0.37
Badami (1998)	15,139.6	1	74.4	0.49
Alpine (2000[3])	32,576.5	2	56.5	0.17
Northstar (2001[3])	12,491.8	1	1.8	0.01
Pt. Thomson/Sourdough	33,896.8	4	112.0	0.33
TAPS and Dalton Highway (North Slope)	NA	NA	4,412.9	NA

Note:
TAPS = Trans-Alaska Pipeline System
[1]Oil field refers to both units and participating areas.
[2]Unit areas cannot be totaled because of overlap that exists among the units and participating areas.
[3]Table V.B-1a.

Source: Gilders and Cronin (2000).

Table V-11
Summary of Cumulative Effects

Resources	Summary of Effects
a. Water Quality	A large crude or refined oil spill (greater than or equal to 500 barrels) would have a significant effect on water quality by increasing the concentration of hydrocarbons in the water column to levels that greatly exceed background concentrations; however, the chance of a large spill occurring is low. Also, regional (more than 1,000 square kilometers – 386 square miles), long-term (more than 1 year) degradation of water quality to levels above State and Federal criteria because of hydrocarbon contamination is very unlikely. Resuspended sediments from construction activities are not expected to exceed acute water-quality criteria and permitted discharges will be designed to ensure rapid mixing and dilution of the discharge. The effects from Sale 186 from construction activities are expected to be short term, lasting as long as the individual activity, and have the greatest impact in the immediate vicinity of the activity.
b. Lower Trophic Organisms	Effects of additional drilling discharges, construction-related activities and oil spills are not expected to substantially affect organisms in the Sale 186 area. Sale 186 is not expected to make a measurable contribution to the cumulative effects on these organisms.
c. Fishes	Small numbers of fish in the immediate area of an offshore or onshore oil spill may be killed or harmed, but this would not have a measurable effect on fish populations. Marine and migratory fishes are widely distributed in the Beaufort Sea and are not likely to be affected by the Sale 186. Oil is not expected to contact overwintering areas during winter. Hence, the Sale 186 is not expected to contribute measurably to the overall cumulative effect on fishes.
d. Essential Fish Habitat	Effects on essential fish habitat could result in a decrease in the time to extinction of any marginal salmon populations using freshwater or estuarine habitat.
e. Endangered Species: **Bowhead Whale** **Spectacled Eider** **Steller's Eider**	Bowhead whales may avoid noise-producing activities temporarily. Contact with spilled oil could cause temporary, nonlethal effects in bowheads, and a few could die from prolonged exposure to freshly spilled oil. The Sale 186 contribution to cumulative effects is expected to be limited to temporary avoidance behavior by a few bowhead whales in response to vessel traffic. Disturbance from support activities could cause displacement of spectacled eiders to less favorable areas. Frequent cumulative disturbance effects may cause declines in fitness, survival, or productivity. Collision of eiders with structures is expected to result in the loss of some individuals. Currently declining trend may slow recovery of the regional eider population from cumulative small losses or decline in fitness or productivity. Sale 186 effects would be additive to effects from all projects, but only in the case of substantial mortality from a large offshore oil spill would it be expected to raise cumulative effects to a significant level. Recovery from substantial oil spill mortality is not expected to occur while the population exhibits a declining trend. Oil transport through the Gulf of Alaska is expected to contribute little to cumulative effects on wintering Steller's eiders.
f. Marine and Coastal Birds	Disturbance from support activities could cause displacement of loons, waterfowl, and shorebirds to less favorable foraging areas. Frequent cumulative disturbance effects may cause declines in fitness, survival, or productivity. Collision of birds with structures is expected to result in the loss of some individuals. Currently declining trends in long-tailed duck and common eider populations may slow their recovery from cumulative small losses or decline in fitness or productivity. Sale 186 effects all bird species would be additive to effects from all projects, but only in the case of substantial mortality on regional long-tailed duck and common eider populations from a large offshore oil spill would it be expected to raise cumulative effects to a significant level. Any tanker spill in the Gulf of Alaska could cause substantial losses of migrating shorebirds and waterfowl that use Beaufort Sea habitats, or of overwintering loons, sea ducks, and gulls.
g. Maine Mammals (Pinnipeds, Polar Bears, Beluga and Gray Whales)	Ongoing activities that may effect pinnipeds, polar bears beluga, and gray whales include noise and disturbance, habitat alteration, and potential oil spills. Overall effects (mainly from oil) should last one year. Noise and disturbance, and habitat alteration could briefly and locally disturb or displace a few seals, walruses, polar bears, beluga and gray whales. A few polar bears could be temporarily attracted to the production island with no significant effects on the population's distribution and abundance.
h. Terrestrial Mammals	Oil development in the Prudhoe Bay area is likely to continue to displace some caribou during the calving season within about 4 kilometers of roads with vehicle traffic. Sale 186 is expected to contribute less than 4% of the local short-term disturbance of caribou. Cumulative development could briefly and locally disturb or displace a few muskoxen, grizzly bears and arctic foxes.
i.. Vegetation-Wetland Habitats	Construction causes more than 99% of the effects, with spills having a very minor role. Rehabilitation of gravel pads can result in the growth of grasses-sedges within 2 years after abandonment of the pads. Natural growth of plant cover would be very slow. Sale 186 would contribute less than 4% of the cumulative disturbance effects on 9,000 acres now affected by oil development.

Table V-11:
Summary of Cumulative Effects (continued)

Resources	Summary of Effects
j. Economy	This cumulative case likely would generate the following additive annual revenues: • $15 million to the North Slope Borough • $90 million to the State • $125 to the Federal Government This cumulative case likely would generate additive employment and personal income increases as follows: • 160 jobs annual average for North Slope Borough residents during development declining to 40 during production. These include direct oil industry employment, indirect and induced employment. • $10 million in total average annual personal income for workers residing in the North Slope Borough during development and declining to $2.8 million during production. • 5,800 jobs annual average during development declining to 3,300 during production. These jobs are for workers on the North Slope who reside in Southcentral Alaska and the Fairbanks. These include direct oil industry employment and indirect and induced employment. • $367 million in total average annual personal income for workers residing in Southcentral Alaska and Fairbanks during development declining to $211 million during production. • 5,800 jobs annual average during development declining to 3,300 during production. These jobs are for workers who reside in the rest of the U.S. These include indirect and induced employment generated by expenditure for goods and services used on the North Slope and spending by direct employees. • $367 million in total average annual personal income for workers residing in residing in the rest of the U.S. during development declining to $211 million during production. This income is for indirect and induced workers generated by expenditure for goods and services used on the North Slope and spending by direct employees. • 60-190 jobs for 6 months for cleanup of unlikely oil spills in the Beaufort Sea. • 10,000 jobs and 25% price inflation for 6 months for cleanup of an unlikely tanker oil spill in the Gulf of Alaska.
k. Subsistence-Harvest Patterns	In the past, drilling and seismic activity near the bowhead whale migration route has made subsistence whaling more difficult, and if a large oil spill occurred, subsistence harvests in Barrow, Nuiqsut, and Kaktovik could be affected with one or more important subsistence resources becoming unavailable or undesirable for use for 1-2 years, a significant adverse effect. Sale 186 is expected to have periodic effects on subsistence resources, but no harvest areas would become unavailable for use and no resource population would experience an overall decrease.
l. Sociocultural Systems	Past and present development of oil and gas and other projects have had negative effects on North Slope communities by producing conflicts to traditional lifestyles and straining social and health service providers. At the same time, tax revenues from past oil and gas development have also produced positive effects that include increased funding for infrastructure, higher incomes (that can be used to purchase better tools for subsistence), better health care, and improved educational facilities. Sale 186 development could produce periodic disturbance effects to communities but would not displace any sociocultural systems, community activities, or traditional practices.
m. Archaeological Resources	Sale 186's contribution to cumulative effects and the cumulative effects overall are expected to be minimal for archaeological resources, because any surface-disturbing activities that could damage archaeological sites would be mitigated by current State and Federal procedures.
n. Land Use Plans/CMP	Exploration and development and production can proceed consistent with the enforceable policies of the Alaska CMP and the North Slope Borough CMP. Requirements of the enforceable policies and standards can be effectively addressed through MMS regulatory oversight and the use of lease stipulations.
o. Air Quality	Projects in the past and present now have caused essentially no deterioration in air quality or contribute measurably to global climate change. Air emissions from the Sale 186 essentially would have no effects on air quality.
p. Environmental Justice	Alaska Inupiat Natives are a recognized minority and are potentially the most affected by Sale 186. Effects could occur to the communities of Nuiqsut and possibly Kaktovik. Effects are not expected from routine activities, but could occur from a large oil spill, although not from Sale 186. Oil-spill contamination of the essential whaling area and subsistence foods are the main concerns. Any potential effects to subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated.

Table V-12
Cumulative Oil-Spill-Occurrence Estimates ≥500 Barrels or ≥1,000 Barrels Resulting from Oil Development over the Assumed 15-20 Year Production Life of Sale 186

Category	Crude-Oil Spills					
	Reserves and Resources (Bbbl)	Spill Rate (Spills/Bbbl)	Size Category (bbl)	Assumed Size (Barrels)	Most Likely Number of Spills	Estimated Mean Number of Spills
Offshore						
Past, Present, and Reasonably Foreseeable	2.34	0.23	≥1000		0	0.54
Alternative I for Sale 186	0.46	0.23	≥1000		0	0.11
Total	**2.80**	**0.23**	**≥1000**		**0**	**0.65**
Onshore						
Past, Present, and Reasonably Foreseeable	8.66	0.64	≥500	500–925	5	5.54
Alternative I for Sale 186	0.46	0.11	≥500	720–1,142	0	0.05
Total	**9.12**	**0.11**	**≥500**	**500–1,142**	**5**	**5.59**
TAPS Pipeline						
Past, Present, and Reasonably Foreseeable	11.04	0.11	≥500	500–999	1	1.21
Alternative I for Sale 186	0.46	0.11	≥500	500–999	0	0.05
Total	**11.50**	**0.11**	**≥500**	**500–999**	**1**	**1.24**
TAPS Tanker						
Past, Present, and Reasonably Foreseeable	11.04	0.88	≥1,000	Table V-15	9	9.66
Alternative I for Sale 186	0.46	0.88	≥1,000	Table V-15	0	0.41
Total	**11.50**	**0.88**	**≥1,000**	**Table V-15**	**10**	**10.07**

Notes:
The Alaska Dept. of Environmental Conservation database has no significant crude oil spills on the North Slope resulting from well blowouts and no facility or onshore pipeline spills greater than 1,000 barrels for the years 1985-2000.
Source:
USDOI, MMS, Alaska OCS Region (2001).

Table V-13
Contribution by Mean Number and Most Likely Number of Spills Resulting from Oil Development over the Assumed 15-20-Year Production Life of Sale 186

Spill Category	Percent of Mean Number of Spills	Most Likely Number of Spills over 15-20-Year Production Life
Offshore	17%	0
Onshore	0.8%	5
TAPS Pipeline	4%	1
TAPS Tanker	1.5%	10

Table V-14
Trans-Alaska Pipeline System Tanker Spills ≥1,000 Barrels, 1977 through 1998

Date	Vessel	Location	Destination	No. of Barrels
8/29/78	*Overseas Joyce*	Balboa Channel	Perth Amboy, New Jersey	1,816
6/7/80	*Texaco Connecticut*	Panama Canal Zone	Port Neches, Texas	4,047
12/12/81	*Stuyvesant*	Gulf of Tehuantepec	Panama	3,600
12/21/85	*ARCO Anchorage*	Puget Sound	Cherry Point, Washington	5,690
1/9/87	*Stuyvesant*	Gulf of Alaska, British Columbia	Puerto Armuelles, Panama	15,000
7/2/87	*Glacier Bay*	Cook Inlet, Alaska	Nikiski, Alaska	4,900
10/4/87	*Stuyvesant*	Gulf of Alaska, British Columbia	Puerto Armuelles, Panama	14,286
1/3/89	*Thompson Pass*	Port of Valdez	Panama	1,700
3/24/89	*Exxon Valdez*	Prince William Sound, Alaska	Long Beach, California	240,500
2/7/90	*American Trader*	Huntington Beach, California	Long Beach, California	9,929
2/22/91	*Exxon San Francisco*	Fidalgo Bay, Washington	Anacortes, Washington	5,000

Source:
Anderson and Lear (1994); Anderson (2000).

Table V-15
Sizes of Tanker Spills We Assume from the Trans-Alaska Pipeline System in the Cumulative Analysis

Size Category	Number of Spills	Average Size (Barrels)	Total Volume (Barrels)
≤6,000	7	4,000	28,000
>6,001-≤15,000	2	13,000	26,000
>200,000	1	250,000	250,000
Total	10	—	298,000

Notes:
The distribution of the number of spills is based on the percentage of the number of spills in a size category from actual Trans-Alaska Pipeline System tanker spills listed in Table V-12. Table V-12 shows that 64% are ≤6,000, 27% are >6,001-≤15,000, and 8% are ≥ 200,000.
Source:
USDOI, MMS, Alaska OCS Region (2002).

Table VII.B-1
Summary Information: Origin of the E-Mail Comments to the Draft EIS

State	No.	State	No.	State	No.
Alabama	9	Louisiana	10	Oklahoma	31
Alaska	81	Maine	18	Ohio	166
Arizona	87	Maryland	118	Oregon	127
Arkansas	18	Massachusetts	68	Pennsylvania	196
California	921	Michigan	177	Rhode Island	8
Colorado	139	Minnesota	87	South Carolina	42
Connecticut	34	Mississippi	8	South Dakota	9
Delaware	18	Missouri	89	Tennessee	55
Florida	180	Montana	17	Texas	81
Georgia	92	Nebraska	8	Utah	20
Hawaii	39	Nevada	28	Vermont	26
Idaho	23	New Hampshire	10	Virginia	118
Illinois	178	New Jersey	179	Washington	186
Indiana	77	New Mexico	48	Washington, D.C.	17
Iowa	24	New York	409	West Virginia	19
Kansas	35	North Carolina	151	Wisconsin	110
Kentucky	41	North Dakota	4	Wyoming	5
Country / Territory	**No.**	**Country / Territory**	**No.**	**Country / Territory**	**No.**
Argentina	2	Hungry	1	Puerto Rico	13
Austria	1	Japan	1	Romania	2
Australia	13	India	6	Scotland	1
Belgium	1	Indonesia	1	Singapore	5
Brazil	4	Ireland	2	South Africa	9
Canada	49	Israel	2	South Korea	1
Chile	1	Lebanon	1	Spain	5
Columbia	3	Malaysia	3	Sweden	4
Cypress	1	Mexico	7	Switzerland	2
Denmark	4	Netherlands	7	Taiwan	1
Finland	3	New Zealand	4	Trinidad	1
France	1	Norway	2	Turkey	1
Germany	4	Pakistan	1	United Arab Emirates	1
Ghana	1	Panama	2	United Kingdom	40
Greece	1	Peru	1	Virgin Islands	3
Guam	1	Philippines	2	Yugoslavia	2
Hong Kong	2	Portugal	3	Unknown	1

Alaska Outer Continental Shelf

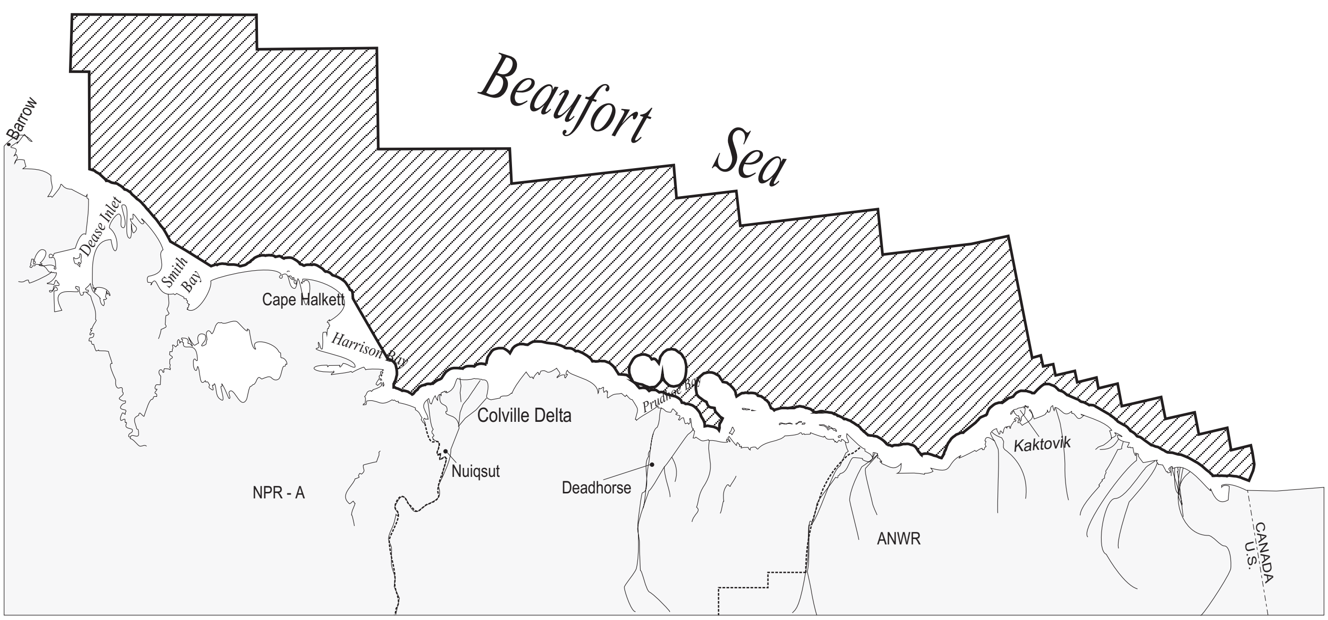
OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area

Oil and Gas Lease Sales
186, 195, and 202

Final Environmental
Impact Statement

Volume IV
(Appendices)



MMS
U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

BEAUFORT SEA PLANNING AREA OIL AND GAS LEASE SALES 186, 195, AND 202
Final Environmental Impact Statement
OCS EIS/EA, MMS 2003-001, in 4 volumes:
Volume I, Executive Summary, Sections I through VI
Volume II, Section VII, Bibliography, Index
Volume III, Tables, Figures, and Maps for Volumes I and II
Volume IV, Appendices

The summary is also available as a separate document:
Executive Summary, **MMS 2003-002.**

The complete EIS is available on CD-ROM (**MMS 2003-001 CD**) and on the Internet (**http://www.mms.gov/alaska/cproject/Beafort Sea/**).

This Environmental Impact Statement (EIS) is not intended, nor should it be used, as a local planning document by potentially affected communities. The exploration, development and production, and transportation scenarios described in this EIS represent best-estimate assumptions that serve as a basis for identifying characteristic activities and any resulting environmental effects. Several years will elapse before enough is known about potential local details of development to permit estimates suitable for local planning. These assumptions do not represent a Minerals Management Service recommendation, preference, or endorsement of any facility, site, or development plan. Local control of events may be exercised through planning, zoning, land ownership, and applicable State and local laws and regulations.

With reference to the extent of the Federal Government's jurisdiction of the offshore regions, the United States has not yet resolved some of its offshore boundaries with neighboring jurisdictions. For the purposes of the EIS, certain assumptions were made about the extent of areas believed subject to United States' jurisdiction. The offshore-boundary lines shown in the figures and graphics of this EIS are for purposes of illustration only; they do not necessarily reflect the position or views of the United States with respect to the location of international boundaries, convention lines, or the offshore boundaries between the United States and coastal states concerned. The United States expressly reserves its rights, and those of its nationals, in all areas in which the offshore-boundary dispute has not been resolved; and these illustrative lines are used without prejudice to such rights.

Alaska Outer Continental Shelf

OCS EIS/EA
MMS 2003-001

Beaufort Sea Planning Area
Oil and Gas Lease Sales
186, 195, and 202

Final Environmental
Impact Statement

Volume IV
(Appendices)

Author
Minerals Management Service
Alaska OCS Region

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

February 2003

APPENDICES

APPENDIX A-1

INFORMATION,
MODELS AND ASSUMPTIONS
WE USE TO ANALYZE
THE EFFECTS OF AN OIL SPILL
IN THIS EIS

Contents for Appendix A-1

APPENDIX A-1

Figures

The Information, Models and Assumptions We Use to Analyze the Effects of Oil Spills in this EIS

We analyze oil spills and their relative impact to environmental, economic, and sociocultural resource areas and the coastline, which could result from offshore oil exploration and development in the Beaufort Sea Planning Area. Predicting an oil spill is an exercise in probability. Uncertainty exists regarding the location, number, and size of oil spills and the wind, ice and current conditions at the time of a spill. Although some of the uncertainty reflects incomplete or imperfect data, a considerable amount of uncertainty exists simply because it is difficult to predict events 15-40 years into the future.

We make assumptions to analyze the effects of oil spills. To judge the effect of an oil spill, we estimate information regarding the type of oil, the source of an oil spill, the location and size of a spill, the chemistry of the oil, how the oil will weather, how long it will remain, and where it will go. We describe the rationale for these assumptions in the following subsections. The rationale for these assumptions is a mixture of project-specific information, modeling results, statistical analysis, and professional judgment. Based on these assumptions, we assume a spill occurs and then analyze its effects. After we analyze the effects of an oil spill, we consider the chance of an oil spill ever occurring.

A. Estimates of the Source, Type, and Size of Oil Spills

Table IV.A-5 show the source of a spill(s), type of oil, size of spill(s) in barrels, and the receiving environment we assume in our analysis of the effects of oil spills in this EIS for the Proposal and Alternatives and other analyses. The sources of spills are generically divided into platform or pipeline. The type of oil used in this analysis is Alaska North Slope crude. We divide spills into three sizes- small, large, and very large spills. Small spills are those less than 1,000 barrels. Large spills are greater than or equal to 1,000 barrels, and very large spills are greater than or equal to 150,000 barrels. Table IV.A-5 shows the EIS section where we analyze the effects of a large, small, and very large spill.

A.1. Source and Spill-Size Assumptions

The spill assumptions we use for large spills are based on the historic spill sizes from production in the Gulf of Mexico outer continental shelf (OCS) and what we believe is likely to occur. We estimate the likely large spill size based on the median spill size in the Gulf of Mexico. Small spills are based on the historic spill sizes from production on the onshore Alaska North Slope. Very large spill sizes are based on BPXA's estimates of the greatest possible discharge that could occur from a blowout in the Oil Discharge

Prevention and Contingency Plans for the Liberty Development Area and Northstar (BPXA, 2001, 2002). The State of Alaska requires this estimate for a response planning standard under 18 AAC.75.430.

A.1.a. Historical Crude Oil Spills Greater Than or Equal to 1,000 Barrels on the Outer Continental Shelf

The Gulf of Mexico OCS data show that the most likely location of a spill is from a pipeline or a platform. The median size of a crude oil spill greater than or equal to 1,000 barrels from a pipeline from 1985-1999 on the outer continental shelf is 4,600 barrels, and the average is 6,700 barrels (Anderson and LaBelle, 2000). The median spill size for a platform on the outer continental shelf over the entire record from 1964-1999 based on trend analysis is 1,500 barrels, and the average is 3,300 barrels (Anderson and LaBelle, 2000). For purposes of analysis we use the median spill size as the likely large spill size.

A.1.b. Historical Crude Oil Spills From Blowouts

We consider blowouts to be unlikely events. Blowout events are often equated with catastrophic spills; however, in actuality very few blowout events have resulted in spilled oil, and the volumes spilled are often small. All five of the blowout events greater than or equal to 1,000 barrels in the OCS database occurred between 1964 and 1970 (Table A.1-1a). Following the Santa Barbara blowout in 1969, amendments to the OCS Lands Act and implementing regulations significantly strengthened safety and pollution-prevention requirements for offshore activities. Well-control training, redundant pollution-prevention equipment, and subsurface safety devices are among the provisions that have been adopted in the regulatory program. From 1971-2000, 199 blowouts occurred on the OCS while drilling approximately 29,000 wells and producing 11.4 billion barrels of oil. Twenty eight of those 199 blowouts resulted in oil spills of crude or condensate with the amount of oil spilled ranging from less than 1 barrel to 200 barrels. The total volume spilled from those 28 blowouts is approximately 1,200 barrels. The volume spilled from blowouts was approximately 0.00001% of the volume produced. There were no spills greater than or equal to 1,000 barrels from blowouts in the last 30 years on the OCS.

The record for Alaska North Slope blowouts is not validated, but is presented as the best available information. There are two written reports regarding blowouts on the Alaska North Slope, Mallory (1998) and Fairweather (2000). Fairweather (2000) found 10 blowouts, 6 that Mallory had identified and 4 prior to 1974. Of the 10 blowouts, 9 were gas and 1 was oil. The blowout of oil in 1950 was unspectacular and could not have been avoided, because there were no casings of blowout preventors available (Fairweather, 2000). These drilling practices from 1950 would not be relevant today. A third study confirmed that no crude oil spills greater than or equal to 100 barrels from blowouts occurred from 1985-1999 (Hart Crowser, Inc., 2000). A recent report titled Blowout Frequency Assessment of Northstar (Scandpower, 2001) uses statistical blowout frequencies modified to reflect specific field conditions and operative systems at Northstar. This report concludes that the blowout frequency for drilling the oil-bearing zone is 1.5×10^{-5} per well drilled. This compares to a statistical blowout frequency of 7.4×10^{-5} per well (for an average development well). This same report estimates that the frequency of oil quantities per well drilled for Northstar for a spill greater than 130,000 barrels is 9.4×10^{-7} per well.

However unlikely a blowout may be, because it is a significant concern to the public, we analyze the effects of an 180,000-barrel spill in Section IV.I Low Probability, Very Large Oil Spill.

B. Behavior and Fate of Crude Oils

There is scientific and historical information about the behavior and fate of crude oil. We also make several assumptions about oil weathering to perform modeling simulations of oil weathering.

B.1. Processes Affecting the Fate and Behavior of Oil

Several processes alter the chemical and physical characteristics and toxicity of spilled oil. Collectively, these processes are referred to as weathering or aging of the oil and, along with the physical oceanography and meteorology, the weathering processes determine the oil's fate. The major oil-weathering processes are spreading, evaporation, dispersion, dissolution, emulsification, microbial degradation, photochemical oxidation, and sedimentation to the seafloor or stranding on the shoreline (Payne et al., 1987; Boehm, 1987; Lehr, 2001) (Appendix A-1, Figures A-1 and A-2).

The physical properties of a crude oil spill, the environment it occurs in, and the source and rate of the spill will affect how an oil spill behaves and weathers. Table A.1-1b shows the properties of Alaska North Slope crude oil.

The environment in which a spill occurs, such as the water surface or subsurface, spring ice-overflow, summer open-water, winter under ice, or winter broken ice, will affect how the spill behaves. In ice-covered waters, many of the same weathering processes are in effect; however, the sea ice changes the rates and relative importance of these processes (Payne, McNabb, and Clayton, 1991).

After a spill occurs, spreading and advection begin. The slick spreads horizontally in an elongated pattern oriented in the direction of wind and currents and nonuniformly into thin sheens (0.5-10 micrometers) and thick patches (0.1-10 millimeters) (Elliott, 1986; Elliott, Hurford, and Penn, 1986; Galt et al., 1991). In the cooler arctic waters, oil spills spread less and remain thicker than in temperate waters because of differences in the viscosity of oil due to temperature. This property will reduce spreading. An oil spill in broken ice would spread less and would spread between icefloes into any gaps greater than about 8-15 centimeters (Free, Cox, and Shultz, 1982).

The presence of broken ice tends to slow the rate of spreading (S.L. Ross Environmental Research Ltd. and D.F. Dickens Assocs. Ltd., 1987). Oil spilled beneath a wind-agitated field of pancake ice would be pumped up onto the surface of the ice or, if currents are slow enough, bound up in or below the ice (Payne et al., 1987). Once oil is encapsulated in ice, it has the potential to move distances from the spill site with the moving ice.

Evaporation results in a preferential loss of the lighter, more volatile hydrocarbons, increasing density and viscosity and reducing vapor pressure and toxicity (Mackay, 1985). Evaporation of volatile components accounts for 30-40% of crude loss, with approximately 25% occurring in the first 24 hours (Fingas, Duval, and Stevenson, 1979; National Academy of Sciences, 1985). The initial evaporation rate increases with increasing wind speeds, temperatures, and sea state. Evaporative processes occur on spills in ice-covered waters, although at a lower rate (Jordan and Payne, 1980). Fuel oils (diesel) evaporate more rapidly than crude, on the order of 13% within 40 hours at 23° Celsius, a larger overall percentage of diesel eventually will evaporate. Evaporation decreases in the presence of broken ice and stops if the oil is under or encapsulated in the ice (Payne et al., 1987). The lower the temperature, the less crude oil evaporates. Both Prudhoe Bay and Endicott crudes have experimentally followed this pattern (Fingas, 1996). Oil between or on icefloes is subject to normal evaporation. Oil that is frozen into the underside of ice is unlikely to undergo any evaporation until its release in spring. In spring as the ice sheet deteriorates, the encapsulated oil will rise to the surface through brine channels in the ice. As oil is released to the surface, evaporation will occur.

Dispersion of oil spills occurs from wind, waves, currents, or ice. Dispersion is an important breakup process that results in the transport of small oil particles (0.5 micrometers-several millimeters) or oil-in-water emulsions into the water column (Jordan and Payne, 1980; National Research Council, 1985). Droplets less than 0.5 millimeter rise slowly enough to remain dispersed in the water column (Payne and McNabb, 1985). The dispersion rate is directly influenced by sea state; the higher the sea state and breaking waves, the more rapid the dispersion rate (Mackay, 1985). The presence of broken ice promotes dispersion (Payne et al., 1987). Any waves within the ice pack tend to pump oil onto the ice. Some additional oil dispersion occurs in dense, broken ice through floe-grinding action. More viscous and/or weathered crudes may adhere to porous icefloes, essentially concentrating oil within the floe field and limiting the oil dispersion.

Dissolution results in the loss of soluble, low-molecular-weight aromatics such as benzene, toluene, and xylenes (National Research Council, 1985). The low-molecular weight aromatics, which are acutely toxic, rapidly dissolve into the water column. Dissolution, however, is very slow compared with evaporation; most volatiles usually evaporate rather than dissolve. Dissolved-hydrocarbon concentrations underneath a slick, therefore, tend to remain less than 1 part per million (Malins and Hodgins, 1981). Dissolved-hydrocarbon concentration can increase due to the promotion of dispersion by broken ice (Payne et al., 1987).

Emulsified oil results from oil incorporating water droplets in the oil phase and generally is referred to as mousse (Mackay, 1982). The measurable increases in viscosity and specific gravity observed for mousse change its behavior, including spreading, dispersion, evaporation, and dissolution (Payne and Jordan, 1988). The formation of mousse slows the subsequent weathering of oil. The presence of slush ice and turbulence promotes oil-in-water emulsions (Payne et al., 1987).

Most of the oil droplets suspended in the water column eventually will be degraded by bacteria in the water column or deposited on the seafloor. The rate of sedimentation depends on the suspended load of the water, the water depth, turbulence, oil density, and incorporation into zooplankton fecal pellets.

Subsurface blowouts or gathering-pipeline spills disperse small oil droplets and entrained gas into the water column. With sufficient gas, turbulence, and the necessary precursors in the oils, mousse forms by the time the oil reaches the surface (Payne, 1982; Thomas and McDonagh, 1991). For subsurface spills, oil rises rapidly to the water surface to form a slick. Droplets less than 50 microns in size, generally 1% of the blowout volume, could be carried several kilometers downcurrent before reaching the water surface (Environmental Sciences Limited, 1982). Blowout simulations show that convective cells set up by the rising oil and gas plume result in concentric rings of waves around the central plume. Surface currents within the ring should move outward, and surface currents outside the ring should move inward, resulting in a natural containment of some oil.

The subsurface release of oil droplets increases slightly the dissolution of oil, but the rapid rise of most oil to the surface suggests that the increase in dissolution—as a percentage of total spill volume—is fairly small. The resulting oil concentration, however, could be substantial, particularly for dispersed oil in subsurface plumes.

An oil spill under ice would follow this sequence: (1) The oil will rise to the under-ice surface and spread laterally, accumulating in the under ice cavities (Glaeser and Vance 1971; NORCOR, 1975; Martin, 1979; Comfort et al., 1983). (2) For spills that occur when the ice sheet is still growing, the pooled oil will be encapsulated in the growing ice sheet (NORCOR, 1975; Keevisl and Ramseier, 1975; Buist and Dickens, 1983; Comfort et al., 1983). (3) In the spring as the ice begins to deteriorate, the encapsulated oil will rise to the surface through brine channels in the ice (NORCOR, 1975; Purves, 1978; Martin, 1979; Kisil, 1981; Dickins and Buist, 1981; Comfort et al., 1983). The spread of oil under the landfast ice may be affected by the presence of currents, if the magnitude of those currents is large enough. A field study near Cape Parry in the Northwest Territories reported that currents up to 10 centimeters per second were present. This current was insufficient to strip oil from under the ice sheet after the oil had ceased to spread (NORCOR, 1975). Laboratory tests have shown that currents in excess of 15-25 centimeters per second are required to strip oil from under-ice depressions (Cammaert, 1980; Cox et al., 1980). Current speeds in the nearshore Beaufort generally are less than 10 centimeters per second during the winter (Weingartner and Okkonen 2001). The area of contamination for oil under ice could increase if the ice were to move. Because the nearshore Beaufort is in the landfast ice area, the spread of oil due to ice movement would not be anticipated until spring breakup.

Alaska North Slope crude oil will readily emulsify to form stable emulsions. Emulsification of some crude oils is increased in the presence of ice. With floe grinding, Prudhoe Bay crude forms a mousse within a few hours, an order of magnitude more rapidly than in open water.

B.2. Shoreline Type

The shoreline habitats and the estimation of the behavior and persistence of oil on intertidal habitats is based on an understanding of the dynamics of the coastal environments, not just the substrate type and grain size. The sensitivity of a particular intertidal habitat is an integration of the following factors: 1) shoreline type (substrate, grain size, tidal elevation, origin); 2) exposure to wave and tidal energy; 3) biological productivity and sensitivity; and 4) ease of cleanup. All of these factors are used to determine the relative sensitivity of intertidal habitats. Key to the sensitivity ranking is an understanding of the relationships between physical processes; substrate; shoreline type; product type; fate and effect; and sediment-transport patterns. The intensity of energy expended on a shoreline by wave action, tidal currents, and river currents directly affects the persistence of stranded oil. The need for shoreline cleanup activities is determined, in part, by the slowness of natural processes in removal of oil stranded on the shoreline. These concepts have been used in the development of the ESI, which ranks shoreline environments as to their relative sensitivity to oil spills, potential biological injury, and ease of cleanup. Generally speaking, areas exposed to high levels of physical energy, such as wave action and tidal currents, and low biological activity rank low on the scale, whereas sheltered areas with associated high biological activity rank highest. A comprehensive shoreline habitat ranking system has been developed for the entire United States. The shoreline habitats delineated on the North Slope of Alaska are listed in order of increasing sensitivity to spilled oil:
3A) Fine- to Medium-grained Sand Beaches
3C) Tundra Cliffs
5) Mixed Sand and Gravel Beaches
6A) Gravel Beaches
7) Exposed Tidal Flats
8B) Sheltered, Solid Man-made Structures
8E) Peat Shorelines
9A) Sheltered Tidal Flats
10A) Salt- and Brackish-Water Marshes
10E) Inundated Low-lying Tundra
U) Unranked

The ESI rankings progress from low to high susceptibility to oil spills. In many cases, the shorelines also are ranked with multiple codes such as 10E/7. The first number is the most landward shoreline type, saltmarsh, with exposed tidal flats being the shoreline type closest to the water. Table A.1-1c shows the percentage of each ESI ranking for the most seaward shoreline type for each land segment.

B.3. Assumptions about Oil Weathering

- The crude oil properties will be similar to Alaska North Slope crude (Table A.1-1b).
- The size of the spill is 1,500 or 4,600 barrels.
- The wind, wave, and temperature conditions are as described.
- Meltout spills occur into 50% ice cover.
- The properties predicted by the model are those of the thick part of the slick.
- The spill occurs as an instantaneous spill over a short period of time.

Uncertainties exist, such as:
- the actual size of the oil spill or spills, should they occur;
- whether the spill is instantaneous or chronic
- wind, current, wave, and ice conditions at the time of a possible oil spill; and
- the crude oil properties at the time of a possible spill.

B.4. Modeling Simulations of Oil Weathering

To judge the effect of an oil spill, we estimate information regarding how much oil evaporates, how much oil is dispersed and how much oil remains after a certain time period. We derive the weathering estimates of Alaska North Slope crude oil and arctic diesel from modeling results from the SINTEF Oil Weathering Model (OWM) Version 2.0 (Reed et al., 2000) for up to 30 days.

Tables IV.A-6a and 6b show the results for Alaska North Slope crude oil spills using the SINTEF model. The SINTEF OWM changes both oil properties and physical properties of the oil. The oil properties include density, viscosity, pour point, flash point, and water content. The physical processes include spreading, evaporation, oil-in-water dispersion, and water uptake. The SINTEF OWM Version 2.0 performs a 30-day time horizon on the model-weathering calculations, but with a warning that the model is not verified against experimental field data for more than 4-5 days. The SINTEF OWM has been tested extensively with results from three full-scale field trials of experimental oil spills (Daling and Strom, 1999).

The SINTEF OWM does not incorporate the effects of the following:

- currents;
- beaching;
- containment;
- photo-oxidation;
- microbiological degradation;
- adsorption to particles; and
- encapsulation by ice.

The Alaska North Slope crude oil spill sizes are 1,500 or 4,600 barrels. We simulate two general scenarios: one in which the oil spills into open water and one in which the oil freezes into the ice and melts out into 50% ice cover. We assume open water is July through September, and a winter spill melts out in July. For open water, we model the weathering of the 1,500 or 4,200-barrel spills as if they are instantaneous spills. For the meltout spill scenario, we model the entire spill volume as an instantaneous spill. Although different amounts of oil could melt out at different times, the MMS took the conservative approach, which was to assume all the oil was released at the same time. We report the results at the end of 1, 3, 10, and 30 days.

Tables IV A.6a and 6b summarize the results we assume for the fate and behavior of Alaska North Slope crude oil and diesel oil in our analysis of the effects of oil on environmental and social resources.

C. Estimates of Where an Offshore Oil Spill May Go

We study how and where large offshore spills move by using a computer model called the Oil-Spill-Risk Analysis model (Smith et al., 1982). By large, we mean spills greater than or equal to 1,000 barrels. This model analyzes the likely paths of oil spills in relation to biological, physical, and social resources. The model uses information about the physical environment, including files of wind, ice, and current data. It also uses the locations of environmental resource areas, barrier islands, and the coast that might be contacted by a spill.

C.1. Inputs to the Oil-Spill-Trajectory Model

- study area
- arctic seasons
- location of the coastline
- location of environmental resource areas
- location of land segments
- location of boundary segments
- location of hypothetical launch areas
- location of hypothetical pipelines and transportation assumptions
- current and ice information from two general circulation models
- wind information.

C.1.a. Study Area and Boundary Segments

Map A-1 shows the Beaufort multiple-sale oil-spill-trajectory study area extends from lat. 68º N. to 74º N. and from long. 134° W. to 176° W. The study area is formed by 38 boundary segments and the Chukchi and Beaufort Sea coastline. The boundary segments are vulnerable to spills in both arctic summer and winter. We chose a study area large enough to contain the paths of 2,700 hypothetical oil spills each through as long as 360 days.

C.1.b. Seasons

We define three time periods for the trajectory analysis of oil spills. The first is from July through September and represents open water or arctic summer. We ran 675 trajectories in the arctic summer. The second is from October through June and represents ice cover or arctic winter. We also ran 2,025 trajectories in the arctic winter. The last is annual, which is from January through December, and represents the entire year. We ran 2,700 trajectories.

C.1.c. Locations of Environmental Resource Areas

Maps A-2a, A-2b, A-2c and A-2d show the location of 88 environmental resource areas, which represent concentrations of wildlife, subsistence-hunting areas, and subsurface habitats. Our analysts designate these environmental resource areas. The analysts also designate in which months these environmental resource areas are vulnerable to spills. The names or abbreviations of the environmental resource areas and their months in which they are vulnerable to spills are shown in Table A.1-2a. We also include Land as an additional environmental resource area. Land is the entire study area coastline.

C.1.d. Location of Land Segments

Land was further analyzed by dividing the Beaufort Sea coastline into 66 land segments. Maps A-3a and A-3b show the location of these 66 land segments. Land segments are vulnerable to spills in both summer and winter. The model defines summer as July through September and winter from October through June. The land segment identification numbers (ID) and the geographic place names within the land segment are shown in Table A.1-2b. Some land segments were grouped as follows:

- Arctic National Wildlife Refuge — 43, 44, 45, 46, 47, 48, 49, 50, 51
- Ivvavik National Park — 52, 53, 54, 56, 57
- Hershel Island — 55
- Kendall Island Bird Sanctuary — 64, 65
- Teshekpuk Lake Special Use Area — 29, 30, 31, 32, 33

C.1.e. Location of the Proposed and Alternative Hypothetical Spill Areas and Pipeline Segments

Map A-4a shows the location of the 18 hypothetical launch areas and 13 pipeline segments, the sites where large oil spills would originate, if they were to occur. There are 735 spill points evenly spread over the 18 hypothetical launch areas and 13 pipeline segments. Hypothetical spills were started at the 735 spill points and 13 pipeline segments. With the exception of the Northstar pipeline, landfall locations were chosen based on educated guesses. For example the Liberty pipeline was chosen as a landfall. Since that time, the project has been canceled.

Map A-4b shows the location of the alternatives to indicate where spill areas and pipelines would be removed. It also shows the location of the Near, Midrange, and Far zones. Table A.1-3 shows the transportation assumptions for the spill areas and their associated pipelines.

Table A.1-4 shows how the pipelines and launch areas relate to the Near Zone, Midrange Zone, and Far Zone scenarios and each alternative for each sale. For Sales 186, 195, and 202 Alternative I, we assume no oil large spills occur during exploration activities. Development/production activities for Sale 186 are not expected to occur in the Far Zone, and there would be no spill from launch areas or pipeline segments in this zone (LA1-LA5, LA11, LA13-LA16, LA18, P1, P5, P6, and P8). Development/production activities for Sale 195 are not expected to occur in the Far Zone, and there would be no spill from launch areas or pipeline segments in this zone (LA1-LA5, LA11, LA13-LA16, LA18, P1, P5, P6, and P8). One development/production project is expected to occur in the Far Zone for Sale 202. No development/production projects are expected in the Near Zone or the Midrange Zone, and there would be no spill from launch areas LA8 and LA10.

C.1.f. Current and Ice Information from a General Circulation Model

For the Beaufort multiple-sale, we use two general circulation models to simulate currents ($U_{current}$) or ice (U_{ice}) depending upon whether the location is nearshore or offshore.

C.1.f.(1) Offshore

Offshore of the 10- to 20-meter bathymetry contour, the wind-driven and density-induced ocean-flow fields and the ice-motion fields are simulated using a three-dimensional, coupled, ice-ocean hydrodynamic model (Haidvogel, Hedstrom, and Francis, 2001). The model is based on the ocean model of Haidvogel ,Wilkin, and Young (1991) and the ice models of Hibler (1979) and Mellor and Kantha (1989). This model simulates flow properties and sea-ice evolution in the western Arctic during the years 1982-1996. The coupled system uses the S-Coordinate Rutgers University Model (SCRUM) and Hibler viscous-plastic dynamics and the Mellor and Kantha thermodynamics. It is forced by daily surface geostrophic winds and monthly thermodynamic forces. The model is forced by thermal fields for the years 1982-1996. The thermal fields are interpolated in time from monthly fields. The location of each trajectory at each time interval is used to select the appropriate ice concentration. The pack ice is simulated as it grows and melts. The edge of the pack ice is represented on the model grid. Depending on the ice concentration, either the ice or water velocity with wind drift from the stored results of the Haidvogel, Hedstrom and Francis (2001) coupled ice-ocean model is used. A major assumption used in this analysis is that the ice-motion velocities and the ocean daily flows calculated by the coupled ice-ocean model adequately represent the flow components. Comparisons with data illustrate that the model captures the first-order transport and the dominant flow (Haidvogel, Hedstrom and Francis, 2001).

C.1.f.(2) Nearshore

Inshore of the 10- to 20-meter bathymetry contour, $U_{current}$ is simulated using a two-dimensional hydrodynamic model developed by the National Oceanic and Atmospheric Administration (NOAA) (Galt, 1980, Galt and Payton, 1981). This model does not have an ice component. In this model, we added an ice mask within the 0-meter and 10- to 20-meter water-depth contours to simulate the observed shorefast-ice zone. We apply the mask from November 1-June 15 in the Beaufort and December 1 to May 1 in selected areas of the Chukchi. U_{ice} is zero for the months November through June or January to May. The two-dimensional model incorporated the barrier islands in addition to the coastline. The model of the shallow water is based on the wind forcing and the continuity equation. The model was originally developed to simulate wind-driven, shallow-water dynamics in lagoons and shallow coastal areas with a complex shoreline. The solutions are determined by a finite element model where the primary balance is between the wind forcing friction, the pressure gradients, coriolis accelerations, and the bottom friction. The time dependencies are considered small, and the solution is determined by iteration of the velocity and sea level equations, until the balanced solution is calculated. The wind is the primary forcing function, and a sea level boundary condition of no anomaly produced by the particular wind stress is applied far offshore, at the northern boundary of the oil-spill-trajectory analysis domain. An example of the currents simulated by this model for a 10-meter-per-second wind is shown in Appendix A-1,Figure A-3.

The results of the model were compared to current meter data from the Endicott Environmental Monitoring Program to determine if the model was simulating the first order transport and the dominant flow. The model simulation was similar to the current meter velocities during summer. Example time series from 1985 show the current flow at Endicott Station ED1 for the U (east-west) and V (north-south) components plotted on the same axis with the current derived from the NOAA model for U and V (Der-U and Der-V). The series show many events that coincide in time, and that the currents derived from the NOAA model generally are in good correspondence with the measured currents. Some of the events in the measured currents are not particularly well represented, and that probably is due to forcing of the current by something other than wind, such as low frequency alongshore wave motions.

C.1.g. Wind Information

We use 15 of the 17-year re-analysis of the wind fields provided to us by Rutgers. The TIROS Operational Vertical Sounder (TOVS) has flown on NOAA polar-orbiting satellites since 1978. Available from July 7, 1979, through December 31, 1996, and stored in Hierarchical Data Format, the TOVS Pathfinder (Path-P) dataset provides observations of areas poleward of lat. 60° N. at a resolution of approximately 100 x 100 kilometers. The TOVS Path-P data were obtained using a modified version of the Improved Initialization Inversion Algorithm (3I) (Chedin et al., 1985), a physical-statistical retrieval method improved for use in identifying geophysical variables in snow- and ice-covered areas (Francis, 1994). Designed to address the particular needs of the polar-research community, the dataset is centered on the North Pole and has been gridded using an equal-area azimuthal projection, a version of the Equal-Area Scalable Earth-Grid (EASE-Grid) (Armstrong and Brodzik, 1995).

Preparation of a basinwide set of surface-forcing fields for the years 1980 through 1996 has been completed (Francis, 1999). Improved atmospheric forcing fields were obtained by using the bulk boundary-layer stratification derived from the TOVS temperature profiles to correct the 10-meter level geostrophic winds computed from the National Center for Environmental Prediction Reanalysis surface pressure fields. These winds are compared to observations from field experiments and coastal stations in the Arctic Basin and have an accuracy of approximately 10% in magnitude and 20 degrees in direction.

C.1.h. Oil-Spill Scenario

For purposes of this trajectory simulation, all spills occur instantaneously. For each trajectory simulation, the start time for the first trajectory was the first day of the season (summer or winter) of the first year of wind data (1982) at 6 a.m. Greenwich Mean Time. We launch particles every 2 days (on average) for each of the 15 years of wind.

C.2. Oil-Spill-Trajectory Model Assumptions

- Oil spills occur in the hypothetical spill areas or along pipeline segments.
- Companies transport the produced oil through pipelines.
- An oil spill reaches the water.
- An oil spill encapsulated in the fast ice does not move until the ice moves or it melts out.
- Oil spills occur and move without consideration of weathering. The oil spills are simulated each as a point with no mass or volume. The weathering of the oil is estimated in the stand alone SINTEF OWM model.

- Oil spills occur and move without any cleanup. The model does not simulate cleanup scenarios. The oil-spill trajectories move as though no booms, skimmers, or any other response action is taken.
- Oil spills stop when they contact the mainland coastline, but not the barrier islands in Stefansson Sound.

Uncertainties exist, such as:
- the actual size of the oil spill or spills, should they occur;
- whether the spill reaches the water;
- whether the spill is instantaneous or a long-term leak;
- the wind, current, and ice conditions at the time of a possible oil spill;
- how effective cleanup is;
- the characteristics of crude oil at the time of the spill;
- how Alaska North Slope crude oil will spread; and
- whether or not production occurs.

C.3. Oil-Spill-Trajectory Simulation

The trajectory simulation portion of the model consists of many hypothetical oil-spill trajectories that collectively represent the mean surface transport and the variability of the surface transport as a function of time and space. The trajectories represent the Lagrangian motion that a particle on the surface might take under given wind, ice, and ocean-current conditions. Multiple trajectories are simulated to give a statistical representation, over time and space, of possible transport under the range of wind, ice, and ocean-current conditions that exist in the area.

Trajectories are constructed from simulations of wind-driven and density-induced ocean flow fields and the ice-motion field. The basic approach is to simulate these time- and spatially dependent currents separately, then combine them through linear superposition to produce an oil-transport vector. This vector is then used to create a trajectory. Simulations are performed for three seasons: winter (October-June), summer (July-September), and annual (January-December). The choice of this seasonal division was based on meteorological, climatological, and biological cycles and consultation with Alaska Region analysts.

For cases where the ice concentration is below 80%, each trajectory is constructed using vector addition of the ocean current field and 3.5% of the instantaneous wind field—a method based on work done by Huang and Monastero (1982), Smith et al. (1982), and Stolzenbach et al. (1977). For cases where the ice concentration is 80% or greater, the model ice velocity is used to transport the oil. Equations 1 and 2 show the components of motion that are simulated and used to describe the oil transport for each spillete:

1 $U_{oil} = U_{current} + 0.035\ U_{wind}$

or

2 $U_{oil} = U_{ice}$

where:

U_{oil} = oil drift vector

$U_{current}$ = current vector (when ice concentration is less than 80%)

U_{wind} = wind speed at 10 meters above the sea surface

U_{ice} = ice vector (when ice concentration is greater than or equal to 80%)

The wind-drift factor was estimated to be 0.035, with a variable drift angle ranging from 0º to 25º clockwise. The drift angle was computed as a function of wind speed according to the formula in Samuels, Huang, and Amstutz (1982). (The drift angle is inversely related to wind speed.)

The trajectories age while they are in the water and/or on the ice. For each day that the hypothetical spill is in the water, the spill ages—up to a total of 360 days. While the spill is in the ice (greater than or equal to 80% concentration), the aging process is suspended. The maximum time allowed for the transport of oil in the ice is 360 days, after which the trajectory is terminated. After coming out of the ice into open water, the trajectory ages to a maximum of 30 days.

C.4. Results of the Oil-Spill-Trajectory Model

C.4.a. Conditional Probabilities: Definition and Application

The chance that an oil spill will contact a specific environmental resource area or land or boundary segment within a given time of travel from a certain location or spill site is termed a conditional probability. The condition is that we assume a spill occurs. Conditional probabilities assume a spill has occurred and the transport of the spilled oil depends only on the winds, ice, and ocean currents in the study area.

For the Beaufort multiple-sales, we estimate conditional probabilities of contact within 1, 3, 10, 30, 60, 180, or 360 days during summer. Summer spills are spills that begin in July through September. Therefore, if any contact to an environmental resource area or land segment is made by a trajectory that began before the end of September, it is considered a summer contact and is counted along with the rest of the contacts from spills launched in the summer. We also estimate the conditional probability of contact from spills that start in winter, freeze into the landfast ice and meltout in the spring. We estimate contacts from these spills for 1, 3, 10, 30, 60, 180, or 360 days. Winter spills are spills that begin in October through June, melt out of the ice, and contact during the open-water period. Therefore, if any contact to an environmental resource area or land segment is made by a trajectory that began by the end of June, it is considered a winter contact and is counted along with the rest of the contacts from spills launched in the winter.

C.4.a.(1) Conditional Probabilities: Results

The chance of a spill contacting is taken from the oil-spill trajectory model results summarized below and listed in Tables A2-1 through A2-54 and A2-73 through A2-90.

C.4.a.(1)(a) Comparisons between Spill Location and Season

The primary differences of contact between spill locations are geographic in the perspective of west to east and nearshore versus offshore. Offshore spill locations take longer to contact the coast and nearshore environmental resource area, if contact occurs at all. Winter spill contact to nearshore and coastal resources is less often and to a lesser extent due to the landfast ice in place from October to June.

C.4.a.(1)(b) Generalities Through Time

3 Days: During summer, offshore launch areas 1, 7, 9, 11, 13, 14, and 16 have less than a 0.5% chance of contacting individual land segments within 3 days. Nearshore launch areas have a less than 0.5-6% chance of contacting individual land segments. Pipeline segments have a less than 0.5-14% chance of contacting individual land segments. Contacts to land segments from pipeline spills are highest where the pipeline comes ashore.

During summer, offshore launch areas 1 through 18 have a less than 0.5-46% chance of contacting individual environmental resource areas. Launch areas adjacent to or on top of environmental resource areas have the highest percent chance of contact. Pipeline segments 1 through 13 have a less than 0.5% to a greater than 99.5% chance of contact to individual environmental resource areas.

During winter, launch areas 1, 3, 5, 7, and 9 through 17 have a less than 0.5% chance of contacting individual land segments within 3 days. Nearshore launch areas 2, 4, 6, 8, and 18 have a less than 0.5-1% chance of contacting individual land segments. Pipeline segments have a less than 0.5-5% chance of contacting individual land segments.

During winter, offshore launch areas 1 through 18 have a less than 0.5-46% chance of contacting individual environmental resource areas. Launch areas adjacent to or on top of environmental resource areas have the highest percent chance of contact. Pipeline segments 1 through 13 have a less than 0.5% to greater than 99.5% chance of contact to individual environmental resource areas.

10 Days: During summer, offshore spill box 14 has less than a 0.5% chance and launch areas 9, 11, and 13 have a less than 0.5-1% chance of contacting individual land segments within 10 days. The other launch areas have a less than 0.5-13% chance of contacting individual land segments. Pipeline segments have a less than 0.5-18% chance of contacting individual land segments. Contacts to land segments from pipeline spills are highest where the pipeline comes ashore.

During summer, offshore spill boxes 1 through 18 have a less than 0.5-60% chance of contacting individual environmental resource areas. Launch areas adjacent to or on top of environmental resource areas have the highest percent chance of contact. Pipeline segments 1 through 13 have a less than 0.5% to greater than 99.5% chance of contact to individual environmental resource areas.

During winter, offshore launch areas 3, 9, 11, 13, 14, 15, and 16 have less than a 0.5% chance of contacting individual land segments within 10 days. Other launch areas have a less than 0.5-2% chance of contacting individual land segments. Pipeline segments have a less than 0.5-6% chance of contacting individual land segments.

During winter, offshore launch areas 1 through 18 have a less than 0.5% to greater than 59% chance of contacting individual environmental resource areas. Launch areas adjacent to or on top of environmental resource areas have the highest percent chance of contact. Pipeline segments 1 through 13 have a less than 0.5% to greater than 99.5% chance of contact to individual environmental resource areas.

30 Days: During summer, launch areas have a less than 0.5-17% chance of contacting individual land segments within 30 days. Pipeline segments have a less than 0.5-21% chance of contacting individual land segments. Contacts to land segments from pipeline spills are highest where the pipeline comes ashore.

During summer, offshore launch areas 1 through 18 have a less than 0.5-66% chance of contacting individual environmental resource areas. Launch areas adjacent to or on top of environmental resource areas have the highest percent chance of contact. Pipeline segments 1 through 13 have a less than 0.5% to greater than 99.5% chance of contact to individual environmental resource areas.

During winter, offshore launch areas 11, 13, and 14 have less than a 0.5% chance of contacting individual land segments within 30 days. Other launch areas have a less than 0.5-4% chance of contacting individual land segments. Pipeline segments have a less than 0.5-6% chance of contacting individual land segments.

During winter, offshore launch areas 1 through 18 have a less than 0.5% to greater than 62% chance of contacting individual environmental resource areas. Launch areas adjacent to or on top of environmental resource areas have the highest percent chance of contact. Pipeline segments 1 through 13 have a less than 0.5% to greater than 99.5% chance of contact to individual environmental resource areas.

D. Oil-Spill-Risk-Analysis

A measure of oil-spill impact is determined by looking at the chance of a spill occurring and then contacting a resource of concern. This analysis helps determine the relative spill occurrence and contact associated with oil and gas production in different regions of the proposed area. Combined probabilities are estimated using the conditional probabilities, the historical oil-spill rates, the resource estimates, and the assumed transportation scenarios. These are combined through matrix multiplication to estimate the mean number of spills occurring and contacting.

D.1. Chance of a Spill Occurring

The chance of a spill occurring is derived from two components: (1) the spill rate and (2) the resource volume estimates.

D.1.a. Spill Rates

We derive the spill rates from a modeling study done by the Bercha Group, Inc. (2002). This study examined alternative oil-spill-occurrence estimators for the Beaufort and Chukchi seas using a fault-tree method. During preparation of the Liberty Development final EIS, stakeholders expressed concern regarding the application of historical data from the Gulf of Mexico to the Beaufort OCS. For the Liberty Development final EIS, historical oil-spill data were gathered from a multitude of sources. Various causes of spills were looked at in relation to their relevance to arctic conditions. A preliminary assessment was made regarding the contribution of arctic versus non-arctic conditions. Because sufficient historical data on offshore oil spills for these regions do not exist for the Arctic on oil-spill occurrence, a model based on fault-tree methodology was developed and applied for this Beaufort multiple-sale EIS (Bercha Group, Inc., 2002). Using fault trees, oil-spill data from the Gulf of Mexico were modified and incremented to represent expected Arctic performance.

D.1.a.(1) Limitations of Input data

The Arctic effects include modifications in causes associated with the historical data set in addition to additions of spill causes unique to the arctic environment. Quantification of existing causes for the Arctic was done in a relatively cursory way restricted to engineering judgment. A reproducible but relatively elementary analysis of gouging and scour effects was carried out. Upheaval-buckling and thaw-settlement effect assessments were included on the basis of professional judgment; no engineering analysis was carried out for the assessment of frequencies to be expected for these effects. No Arctic effects were estimated for the wells, which were considered to blow out with frequencies the same as those for the Gulf of Mexico. The existing MMS databases on pipeline mileage were used as they stand with all their inherent inaccuracies.

D.1.a.(2) Results for Spill Rates

Based on the Bercha Group, Inc. (2002) fault-tree analysis for Sale 186, the MMS calculates the spill rates as follows:

Platforms	0.13 spills per billion barrels produced
Pipelines	0.10 spills per billion barrels produced

D.1.b. Source-Volume Estimates

The resource volume estimates are discussed in terms of an opportunity index in Appendix B.

D.1.c. Transportation Assumptions

Appendix A.1 Section C - Estimates of Where an Oil Spill May Go discusses the transportation assumptions for the launch areas and their associated pipelines.

D.1.d. Results for the Chance of a Spill Occurring

Using the above spill rates, Table A.1-5 shows the chance of one or more spills occurring for the Proposal and alternatives. For the Proposal alternatives, we estimate 0.04-0.05 pipeline spills and 0.05-0.06 platform (and well) spills. The chance of one or more pipeline spills is 4-5%, and the chance of one or more platform spills is 5-6%. The chance of one or more spills total is 8-10 % for each sale.

D.2. Chance of a Spill Contacting

The chance of a spill contacting is taken from the oil-spill-trajectory model results summarized in Section C.4.a(1) and listed in Tables A2-1 through A2-54.

D.3. Results of the Oil-Spill-Risk Analysis: Combined Probabilities

Tables A2-55 through A2-72 show the annual combined probabilities for the Proposal and the alternatives. For the most part, the chance of one or more spills occurring and contacting resources and land segments is less than 0.5%. The relative risk from the Proposal and alternatives is low, because we do not expect oil spills to occur and contact resources or coastline. Because the combined probabilities are so low it is difficult to distinguish differences between the Proposal and alternatives based on combined probabilities.

E. Small Oil Spills

Small spills are spills that are less than 1,000 barrels. We analyze the effects of small spills in Section C.4.a.(1) We consider two types of small spills–crude oil and refined oil.

We use the Alaska North Slope record of small spills, because the spill rate is significantly less than the Gulf of Mexico OCS small spill rate. The OCS rate of crude and refined small spills is approximately 3,460 spills per billion barrels, and the North Slope rate is approximately 618 spills per billion barrels. We expect the same companies and regulators to participate offshore in the Beaufort Sea as those that are now operating on the onshore Alaska North Slope. We believe it is reasonable to assume that the rate in the Beaufort Sea will be similar to the rate on the Alaska North Slope.

The analysis of operational small oil spills uses historical oil-spill databases and simple statistical methods to derive general information about small crude and refined oil spills that occur on the Alaska North Slope. This information includes estimates of how often a spill occurs for every billion barrels of oil produced (oil-spill rates), the mean (average) number of oil spills, and the mean and median size of oil spills from facilities, pipelines, and flowlines combined. We then use this information to estimate the number, size, and distribution of operational small spills that may occur from Beaufort Sea Sales 186, 195, and 202. The analysis of operational small oil spills considers the entire production life of the Beaufort Sea sales and assumes the following:

- commercial quantities of hydrocarbons are present in the multiple-sale Program Area, and
- these hydrocarbons will be developed and produced at the estimated resource levels.

Uncertainties exist, such as

- the estimates required for the assumed resource levels, or
- the actual size of a crude- or refined-oil spill.

We use the history of crude and refined oil spills reported to the State of Alaska, Department of Environmental Conservation and the Joint Pipeline Office to determine crude- and refined-oil-spill rates and patterns from Alaska North Slope oil and gas exploration and development activities for spills greater than or equal to 1gallon and less than 1,000 barrels. Refined oil includes aviation fuel, diesel fuel, engine lube, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil. The Alaska North Slope oil-spill analysis includes onshore oil and gas exploration and development spills from the Point Thompson Unit, Badami Unit, Kuparuk River Unit, Milne Point Unit, Prudhoe Bay West Operating Area, Prudhoe Bay East Operating Area, and Duck Island Unit.

The Alaska North Slope oil-spill database of all spills greater than or equal to 1 gallon is from the State of Alaska, Department of Environmental Conservation. Oil-spill information is provided to the State of

Alaska, Department of Environmental Conservation by private industry according to the State of Alaska Regulations 18 AAC 75. The totals are based on initial spill reports and may not contain updated information. The State of Alaska, Department of Environmental Conservation database integrity is most reliable for the period 1989 and after due to increased scrutiny after the Exxon Valdez oil spill (Volt, 1997, pers. commun.). For this analysis, the database integrity cannot be validated thoroughly. However, we use this information, because it is the only information available to us about small spills. For this analysis, the State of Alaska, Department of Environmental Conservation database is spot-checked against spill records from ARCO Alaska, Inc. and British Petroleum, Inc. All spills greater than or equal to1 gallon are included in the data set. We use the time period January 1989-December 2000 in this analysis of small oil spills for the Beaufort Sea multiple-sales.

A simple analysis of operational small oil-spills is performed. Alaska North Slope oil-spill rates are estimated without regard to differentiating operation processes. The State of Alaska, Department of Environmental Conservation database base structure does not facilitate quantitative analysis of Alaska North Slope oil-spill rates separately for platforms, pipelines, or flowlines.

E.1. Results for Small Operational Crude Oil Spills

The analysis of Alaska North Slope crude oil spills is performed collectively for all facilities, pipelines, and flowlines. The pattern of crude oil spills on the Alaska North Slope is one of numerous small spills. Of the crude oil spills that occurred between 1989 and 2000, 31% were less than or equal to 2 gallons; 55% were less than or equal to 5 gallons. Ninety-eight percent of the crude oil spills were less than 25 barrels, and 99% were less than 60 barrels. The spill sizes in the database range from less than 1 gallon to 925 barrels. The average crude oil-spill size on the Alaska North Slope is 2.7 barrels, and the median spill size is 5 gallons. For purposes of analysis, this EIS assumes an average crude oil-spill size of 3 barrels.

Table A.1-6a shows the estimated crude oil-spill rate for the Alaska North Slope is 178 spills per billion barrels produced. Table A.1-6b shows the assumed number, size, and total volume of small spills for the proposal and alternative. Table A.1-6c shows the assumed size distribution of those spills for the Proposal and alternatives.

The causes of Alaska North Slope crude oil spills, in decreasing order of occurrence by frequency, are leaks, faulty valve/gauges, vent discharges, faulty connections, ruptured lines, seal failures, human error, and explosions. The cause of approximately 30% of the spills is unknown.

E.2. Results for Small Operational Refined Oil Spills

The typical refined products spilled are aviation fuel, diesel fuel, engine lube, fuel oil, gasoline, grease, hydraulic oil, transformer oil, and transmission oil. Diesel spills are 58% of refined oil spills by frequency and 83% by volume. Engine lube oil spills are 10% by frequency and 3% by volume. Hydraulic oil is 26% by frequency and 10% by volume. All other categories are less than 1% by frequency and volume. Refined oil spills occur in conjunction with oil exploration and production. The refined oil spills correlate to the volume of Alaska North Slope crude oil produced. As production of crude oil has declined, so has the number of refined oil spills. Table A.1-6d shows that from January 1989-December 2000, the spill rate for refined oil is 440 spills per billion barrels produced. Table A.1-6e shows the assumed refined oil spills during the lifetime of the Proposal and alternatives.

BIBLIOGRAPHY

Anderson, C.M. and R.P. LaBelle. 2000. Update of Comparative Occurrence Rates for Offshore Oil Spill. Spill Science and Technology 65/6:303-321.

Armstong, R.L. and M.J. Brodzik. 1995. An Earth-Gridded SSM/I Data Set for Crysopheric Studies and Global Change Monitoring. Advanced Space Research 16:155-163.

Bercha Group, Inc. 2002. Alternative Oil Spill Occurrence Estimators for the Beaufort and Chukchi Seas - Fault Tree Method. OCS Study MMS 2002-047. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 84 pp. plus appendices.

Boehm, P.D. 1987. Transport and Transformation Processes Regarding Hydrocarbon and Metal Pollutants in Offshore Sedimentary Environments. In: Long-Term Environmental Effects of Offshore Oil and Gas Development, D.F. Boesch and N.N. Rabalais, eds. London: Elsevier Applied Sciences, pp. 233-286.

BPXA. 2001. Oil Discharge Prevention and Contingency Plan, Liberty Development Area, North Slope, Alaska. Liberty Development ODPCP11/01, Rev.0. Anchorage, AK: BPXA.

BPXA. 2002. Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska. Anchorage, AK: BPXA.

Buist, I.A. and D.F. Dickins. 1983. Fate and Behavior of Water-in-Oil Emulsions in Ice. Canadian Offshore Oilspill Research Association Report CS 11. Calgary, Alberta, Canada: Dome Petroleum Ltd.

Cammaert, A.B. 1980. Oil and Gas under Ice Laboratory Study. No. RWC17. Canadian Marine Drilling Ltd. and Canada Environmental Protection Service.

Chedin, A., N.A. Scott, C. Wahiche, and P. Moulineir. 1985. The Improved Initialization Inversion Method: A High Resolution Physical Method for Temperature Retrievals from Satellites of the TIROS-N Series. Journal of Climate and Applied Meteorology 24:128-143.

Comfort, G., T. Roots, L. Chabot, and F. Abbott. 1983. Oil Behavior under Multi-Year Ice at Griper Bay, NWT. Proceedings of the Sixth Arctic and Marine Oilspill Program Technical Seminar. Ottawa, Ont., Canada: Environment Canada.

Cox, C., L.A. Schultz, R.P. Johnson, and R.A. Shelsby. 1980. The Transport and Behavior of Oil Spilled in and under Sea Ice. Boulder, CO: USDOC, NOAA, OCSEAP and USDOI, BLM, Alaska OCS Office.

Daling, P.S. and T. Strom. 1999. Weathering of Oils at Sea: Model/Field Data Comparisons. Spill Science and Technology 51:63-74.

Dickins, D.F. and I.A. Buist. 1981. Oil and Gas under Sea Ice. CV-1, Vols. I-II. Calagary, Alberta, Canada: Dome Petroleum Ltd.

Elliott, A.J. 1986. Shear Diffusion and the Spread of Oil in the Surface Layers of the North Sea. Deutsch Hydrography Zvenya 39:113-137.

Elliott, A.J., N. Hurford, and C.J. Penn. 1986. Shear Diffusion and the Spreading of Oil Slicks. Marine Pollution Bulletin 17:308-313.

Environmental Sciences Limited. 1982. Biological Impacts of Three Oil Spill Scenarios in the Beaufort Sea. Calgary, Alberta, Canada: Dome Petroleum Ltd.

Fairweather. 2000. Historical Blowout Study North Slope, Alaska. Anchorage, AK: BP-Amoco Exploration, Alaska.

Fingas, M.F. 1996. The Evaporation of Oil Spills: Variations with Temperature and Correlations with Distillation Data. In: Nineteenth Arctic and Marine Oilspill Program Technical Seminar, Calgary, Alberta, Canada. Ottawa, Ontario, Canada: Environment Canada, pp. 29-72.

Fingas, M.F., W.S. Duval, and G.B. Stevenson. 1979. Basics of Oil Spill Cleanup. Ottawa, Ontario, Canada: Environment Canada, 155 pp.

Francis, J.A. 1994. Improvements to TOVS Retrievals Over Sea Ice and Applications to Estimating Arctic Energy Fluxes. Journal of Geophysical Research 99(D5):10,395-10,408.

Francis, J.A. 1999. The NASA/NOAA TOVS Polar Pathfiner - 18 Years of Arctic Data. The 5th Conference on Polar Meteorology and Oceanography. Dallas, TX: American Meteorological Society.

Free, A.P., J.C. Cox, and L.A. Schultz. 1982. Laboratory Studies of Oil Spill Behavior in Broken Ice Fields. In: Proceedings of the Fifth Arctic Marine Oil Spill Program Technical Seminar, Edmonton, Alberta, Canada. Ottawa, Ontario, Canada: Environment Canada, pp. 3-14.

Galt, J.A. 1980. A Finite Element Solution Procedure for the Interpolation of Current Data in Complex Regions. Journal of Physical Oceanography 10(12):1984-1997.

Galt, J.A. and D.L. Payton. 1981. Finite-Element Routines for the Analysis and Simulation of Nearshore Currents. In: Commptes Rendus du Colloque, Mechanics of Oil Slicks, Paris. Paris, France: International Association for Hydraulic Research, pp 121-122.

Galt, J.A., G.Y. Watabayshi, D.L. Dalton, and J.C. Pearson. 1991. Trajectory Analysis for the Exxon Valdez: Hindcast Study. In: Proceedings of the 1991 International Oil Spill Conference (Prevention, Behavior, Control, Cleanup), San Diego, Calif., Washington, DC: USCG; API; USEPA, pp. 629-634.

Glaeser, J.L., Lt. J.G. and Lt. Cmdr. G. Vance. 1971. A Study of the Behavior of Oilspills in the Arctic. Report AD 717 142. Washington, DC: U.S. Coast Guard.

Haidvogel, D.B., J.L. Wilkin, and R. Young. 1991. A Semi-spectral Primative Equation Ocean Circulation Model Using Vertical Sigma and Orthogonal Curvilinear Horizontal Coordinates. Journal of Computational Physics 94:151-185.

Haidvogel, D.B., K.S. Hedstrom, and J. Francis. 2001. Numerical Simulations of Atmosphere/Ocean/Sea Ice Interaction in the Arctic Ocean 1982-1996. OCS Study MMS 2001-069. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 62 pp.

Hart Crowser Inc. 2000. Estimation of Oil Spill Risk from Alaska North Slope, Trans Alaska Pipeline and Arctic Canada Oil Spill Data Sets. OCS Study, MMS 2000-007. Anchorage Alaska: USDOI, MMS, Alaska OCS Region.

Hibler, W.D., III. 1979. A Dynamic Thermodynamic Sea Ice Model. Journal of Physical Oceanography 9:815-846.

Huang, J.C. and F.M. Monastero. 1982. Review of the State-of-the-Art of Oilspill Simulation Models. Washington, DC: American Petroleum Institute.

Jordan, R.E. and J.R. Payne. 1980. Fate and Weathering of Petroleum Spills in the Marine Environment: A Literature Review and Synopsis. Ann Arbor, MI: Ann Arbor Science Publishers, Inc., 174 pp.

Keevil, B.E. and R. Ramseier. 1975. Behavior of Oil Spilled Under Floating Ice. 1975 Conference on Prevention and Control of Oil Pollution. Washington, DC: American Petroleum Institute, pp 497-501.

Kisil, C.A. 1981. A Study of Oil and Gas in Fresh and Salt Water-Ice Ssystems. Toronto, Ont., Canada: University of Toronto.

Lehr, W.J. 2001. Review of Modeling Procedures for Oil Spill Weathering. In: Oil Spill Modelling and Processes, C.A. Brebbia, ed. Boston, MA: WIT Press, pp. 51-90.

Mackay, D. 1982. Fate and Behaviour of Oil Spills. In: Oil Dispersants in Canadian Seas - Research Appraisal and Recommendations. Report EPS 3-EC-82-2. Ottawa, Ontario, Canada: Environment Canada, pp. 7-27.

Mackay, D. 1985. The Physical and Chemical Fate of Spilled Oil. In: Petroleum Effects in the Arctic Environment, F.R. Engelhardt, ed. New York: Elsevier Applied Science, pp. 37-59.

Malins, D.C. and H.O. Hodgins. 1981. Petroleum and Marine Fishes: A Review of Uptake, Disportion, and Effects. Environmental Science Technology 1511:1272-1280.

Mallory, C.R. 1998. A Review of Alaska North Slope Blowouts, 1974-1997. Document II-9. In: Preliminary Analysis of Oil Spill Response Capability in Broken Ice to Support Request for Additional Information for Northstar Oil Spill Contingency Plan. Vol. II. Anchorage, AK: State of Alaska, Dept. of Environmental Conservation, multiple pagination.

Martin, S. 1979. A Field Study of Brine Drainage and Oil Entrainment in First-Year Sea Ice. Journal of Glaciology 22:473-502.

Mellor, G.L. and L. Kantha. 1989. An Ice-Ocean Coupled Model. Journal of Geophysical Research 94:10,937-10,954.

National Research Council. 1985. Oil in the Sea: Inputs, Fates, and Effects. Washington, DC: National Academy Press, 601 pp.

NORCOR Engineering and Research. 1975. The Interaction of Crude Oil with Arctic Sea Ice. Beaufort Sea Technical Report No. 27. Victoria, BC: Canada, Department of the Environment, Beaufort Sea Project, 145+ p.

Payne, J.R. 1982. The Chemistry and Formation of Water-in-Oil Emulsions and Tar Balls from the Release of Petroleum in the Marine Environment. Washington, DC: National Academy of Sciences, 142 pp.

Payne, J.R. and S. Jordan. 1985. Petroleum Spills in the Marine Environment; the Chemistry and Formation of Water in Oil Emulsions and Tar Balls. Chelsea, MI: Lewis Publishers.

Payne, J.R. and G.D. McNabb. 1985. Weathering of Petroleum in the Marine Environment. MTS Journal 18(3):24-42.

Payne, J.R., G.D. McNabb, and J.R. Clayton. 1991. Oil Weathering Behavior in Arctic Environments. In: Proceedings from the Pro Mare Symposium on Polar Marine Ecology. Trondheim, Norway pp. 631-662.

Payne, J.R., G.D. McNabb, L.E. Hachmeister, B.E. Kirstein, J.R. Clayton, C.R. Phillips, R.T. Redding, C.L. Clary, G.S. Smith, and G.H. Farmer. 1987. Development of a Predictive Model for Weathering of Oil in the Presence of Sea Ice. OCSEAP Final Reports of Principal Investigators, Vol. 59 (November 1988). OCS Study, MMS 89-0003. Anchorage, AK: USDOC, NOAA, OCSEAP and USOI, MMS, Alaska OCS Region, pp. 147-465.

Purves, F. 1978. The Interaction of Crude Oil and Natural Gas with Laboratory-Grown Saline Ice. Environment Canada, Report No. EPS-4-EC-78-9. ARCTEC Canada LTd.

Reed, M., N. Ekrol, P. Daling, O. Johansen, and M.K. Ditlevsen. 2000. SINTEF Oil Weathering Model User's Manual Version 1.8. Trondheim, Norway: SINTEF Applied Chemistry, 39 pp.

Research Planning Institute. 2002. Environmental Sensitivity Index Classification of the Beaufort Sea and Chukchi Sea. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

S.L. Ross Environmental Research Ltd. 1994. Spill-Related Properties of Fresh and Weathered Alaskan Crude Oils. Anchorage, AK: Alaska Clean Seas.

S.L. Ross Environmental Research Ltd. and D.F. Dickins Associates Ltd. 1987. Field Research Spills to Investigate the Physical and Chemical Fate of Oil in Pack Ice. Report No. 062. Ottawa, Ontario Canada: Environment Canada, Environmental Emergencies Technologies Division.

Scandpower. 2001. Blowout Frequency Assessment of Northstar. 27.83.01/R1. Kjeller, Norway: Scandpower, 40 pp. plus appendices.

Smith, R.A., J.R. Slack, T. Wyant, and K.J. Lanfear. 1982. The Oilspill Risk Analysis Model of the U.S. Geological Survey. Geological Survey Professional Paper 1227. Washington, DC: U.S. Government Printing Office, 40 pp.

Stolzenbach, K.D., S. Madsen, E.E. Adams, A.M. Pollack, and C.K. Cooper. 1977. A Review and Evaluation of Basic Techniques for Predicting the Behavior of Surface Oil Slicks. Report No. MITSG 77- 8. Cambridge, MA: MIT Sea Grant Program, Ralph M. Parsons Laboratory, 322 pp.

Thomas, D. and M. McDonagh. 1991. Underwater Releases of Oil. In: Proceedings of the 1991 International Oil Spill Conference (Prevention, Behavior, Control, Cleanup), San Diego, Calif. Washington, DC: USCG, API, USEPA, pp.724-725.

Volt, G. 1997. Telephone conversation in April 1997 from C. Smith, USDOI, MMS, Alaska OCS Region, to G. Volt, State of Alaska, Dept. of Environmental Conservation, Spill Prevention and Response, Anchorage Office; subject: ADED oil-spill database quality assurance/quality control.

Weingartner, T.J. and S.R. Okkonen. 2001. Beaufort Sea Nearshore Under-Ice Currents: Science, Analysis and Logistics. In: University of Alaska Coastal Marine Institute Final Report. OCS Study, MMS 2001-068. Fairbanks, AK: University of Alaska, Fairbanks, 17 pp.

Table A.1-1a
Number of Blowouts per Year in the Gulf of Mexico and Pacific OCS Regions

		Total Incidents with Condensate/ Oil	Amount of Condensate/ Oil (Barrels)			Production				Drilling				Workover/ Completion	Wells Drilled
Year	Number of Blowouts		Development	Exploration	Total Exploration and Development	Total	Fire	Hurricane	Other	Total	Exploration	Development	Unknown	Total	Total
1956	1	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1957	1	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1958	2	1	Minimal	—	1	1	1	—	—	—	—	—	—	—	—
1959	1	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1960	2	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1961	0	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1962	1	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1963	1	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1964	7	3	10,380	—	10,380	3	1	2	—	—	—	—	—	—	—
1965	5	2	1688	—	1,688	1		1	—	1	—	—	1	—	—
1966	2	2	Minimal	—	1	—	—	—	—	1	—	—	1	—	—
1967	1	1	Minimal	—	1	1	—	—	1	—	—	—	—	—	—
1968	9	0	—	—	0	—	—	—	—	—	—	—	—	—	—
1969	3	3	82500	—	82500	2	—	—	2	1	—	1	—	—	—
1970	23	3	83000	—	83000	2	2	—	—	1	—	1	—	—	—
1971	9	1	450	—	450	1	1	—	—	—	—	—	—	—	851
1972	5	1	Minimal	—	1	—	—	—	—	1	—	—	1	—	845
1973	3	1	Minimal	—	1	—	—	—	—	1	—	1	—	—	820
1974	6	2	275	—	275	2	—	2	—	—	—	—	—	—	802
1975	7	1	Minimal	—	1	—	—	—	—	—	—	—	—	1	842
1976	6	0	—	—	0	—	—	—	—	—	—	—	—	—	1078
1977	10	0	—	—	0	—	—	—	—	—	—	—	—	—	1240
1978	12	1	Minimal	—	1	—	—	—	—	—	—	—	—	1	1164
1979	5	2	Minimal	—	1	—	—	—	—	2	—	2	—	—	1140
1980	8	2	1	—	1	1	—	—	1	1	—	1	—	—	1158
1981	10	4	64	—	64	—	—	—	—	2	—	2	—	2	1208
1982	9	2	Minimal	—	1	—	—	—	—	1	—	1	—	1	1255
1983	12	0	—	—	0	—	—	—	—	—	—	—	—	—	1180
1984	5	0	—	—	0	—	—	—	—	—	—	—	—	—	1352
1985	6	1	40	—	40	1	—	—	1	—	—	—	—	—	1169
1986	2	0	—	—	0	—	—	—	—	—	—	—	—	—	694
1987	13	1	60	—	60	—	—	—	—	1	—	1	—	—	845
1988	3	0	—	—	0	—	—	—	—	—	—	—	—	—	950
1989	12	0	—	—	0	—	—	—	—	—	—	—	—	—	947
1990	7	3	20.5	—	20.5	1	—	—	1	—	—	—	—	2	1018
1991	6	1	—	0.8	0.8	—	—	—	—	1	1	—	—	—	726
1992	1	1	—	100	100	—	—	—	—	1	1	—	—	—	431
1993	2	0	—	—	0	—	—	—	—	—	—	—	—	—	879
1994	0	0	—	—	0	—	—	—	—	—	—	—	—	—	845
1995	1	0	—	—	0	—	—	—	—	—	—	—	—	—	798
1996	4	0	—	—	0	—	—	—	—	—	—	—	—	—	889
1997	5	0	—	—	0	—	—	—	—	—	—	—	—	—	954
1998	7	1	1.5	—	1.5	1	—	—	1	—	—	—	—	—	993
1999	5	0	—	—	0	—	—	—	—	—	—	—	—	—	962
2000	9	3	—	200	200	—	—	—	—	2	2	—	—	1	1315
Total	258	43	178,480	300.8	0	17	—	—	—	17	—	—	—	9	29350

Source:
USDOI, MMS, Alaska OCS Region (2002).

Table A1-1b
Properties of Alaska North Slope Crude Oil (Pump Station 1)

Property		Weathering (Volume %)		
in English Units	**in Metric Units**	**0**	**11.5**	**20.0**
Density (g/cm[3])	**Density (g/m L)**	**—**	—	**—**
34°F	1°C	0.887	0.926	0.943
60°F	15°C	0.876	0.914	0.935
85°F	30°C	—	—	—
Viscosity	**Viscosity**	—		—
Dynamic (cP)	**Dynamic (mPa.s)**			
60°F	15°C	38.9	471.3	9031.3
85°F	30°C	17.6	93.4	665.0
Kinematic (cST)	**Kinematic (mm z/s)**			
60°F	15°C	43.9	509.0	9577.2
85°F	30°C	20.1	102.2	711.2
Interfacial Tensions @ 72°F (dynes/cm)	**Interfacial Tensions @ 22°C (mNm)**	—	—	—
Air/Oil	Air/Oil	31.8	34.2	35.3
Oil/Seawater	Oil/Seawater	24.0	27.0	25.0
Pour Point	**Pour Point**	—	—	—
°F	**—**	<9	9	30
—	**°C**	<-13	-13	-1
Flash Point	**Flash Point**	—		—
°F	**—**	<9	19	252
22	**°C**	<-13	-7	-122
Emulsion Formation @ 72°F	**Emulsion Formation @ 22°C**	—	—	—
Tendency	Tendency	0.40	0.86	1.00
Stability	Stability	0.00	0.006	1.00
—	—			

ASTM Modified Distillation (°C)

Evaporation (% volume)	Liquid Temperature °F	Liquid Temperature °C	Vapor Temperature °F	Vapor Temperature °C
1B.P	171.68	77.6	95.9	35.5
5	297.32	147.4	128.66	53.7
10	359.42	181.9	149.36	65.2
15	416.3	213.5	166.82	74.9
20	478.94	248.3	184.1	84.5
25	543.56	284.2	201.02	93.9
30	596.48	313.6	238.28	114.6
35	645.08	340.6	251.42	121.9

Source:
S.L. Ross Environmental Research Ltd. (1994).

Table A1-1c
Land Segment ID and the Percent Type of Shoreline Closest to the Ocean

ID	Geographic Place Names	1A	1B	3A	3C	4	5	6A	6B	7	8A	8B	8E	9A	9B	10 A	10 E	U
1	Cape Thompson, Akoviknak and Mapsorak Lagoon	4	—	—	—	—	96	—	—	—	—	—	—	—	—	—	—	—
2	Aiautak Lagoon Teshekpak Lake	—	—	—	—	—	100	—	—	—	—	—	—	—	—	—	—	—
3	Ipiutak Lagoon, Marryat Inlet, Point Hope	9	—	—	—	—	86	—	—	—	—	—	—	—	—	—	—	—
4	Angayutak Mountain, Cape Dyer, Kilikralik Point	68	—	—	—	—	27	—	—	—	—	—	—	—	—	—	—	—
5	Alokut Point, Cape Lewis, Cape Lisburne	35	—	—	—	—	56	—	—	—	—	—	—	—	—	—	—	—
6	Ayugatak Lagoon	51	—	—	—	—	46	—	—	—	—	—	—	—	—	—	—	—
7	Cape Sabine, Pitmegea River	51	—	—	9	—	40	—	—	—	—	—	—	—	—	—	—	—
8	Agiak Lagoon, Punuk Lagoon	—	—	—	10	—	86	—	—	—	—	—	—	—	—	—	—	—
9	Cape Beaufort, Omalik Lagoon	—	—	—	45	—	50	—	—	—	—	—	—	—	—	—	—	—
10	Kuchaurak Creek, Kuchiak Creek	—	—	20	3	—	34	—	—	—	—	—	1	12	9	10	10	—
11	Kukpowruk River, Naokok, Sitkok Point	—	—	34	7	—	21	—	—	—	—	—	—	25	7	2	2	3
12	Kokolik River, Point Lay, Siksrikpak Point	—	—	30	3	—	7	—	—	—	—	—	3	19	19	—	5	14
13	Akunik Pass, Tungaich Point, Tungak Creek	—	—	27	14	—	7	—	—	—	—	—	—	19	8	—	3	22
14	Kasegaluk Lagoon, Solivik Island, Utukok River	—	—	21	8	—	1	—	—	—	—	—	—	19	9	—	—	43
15	Akeonik, Icy Cape, Icy Cape Pass	—	—	25	12	—	14	—	—	—	—	—	3	16	18	—	2	10
16	Akoliakatat Pass, Avak Inlet, Tunalik River	—	—	21	21	—	7	—	—	—	—	—	4	10	7	—	10	20
17	Nivat Point, Nokotlek Point, Ongorakvik River	—	—	47	10	—	30	—	—	—	—	—	—	2	9	1	1	1
18	Kuk River, Point Collie, Sigeakruk Point,	—	—	46	13	—	23	—	—	—	—	—	1	3	2	—	9	3
19	Point Belcher, Wainwright, Wainwright Inlet	—	—	26	26	—	37	—	—	—	—	—	—	—	11	—	—	—
20	Eluksingiak Point, Igklo River, Kugrua Bay	—	—	23	42	—	16	—	—	—	—	—	9	4	2	—	5	—
21	Peard Bay, Point Franklin, Seahorse Islands, Tachinisok Inlet	—	—	60	26	—	7	—	—	—	—	—	5	-	2	—	—	—
22	Skull Cliff	5	—	—	78	—	17	—	—	—	—	—	—	—	—	—	—	—
23	Nulavik, Loran Radio Station	1	—	—	91	—	8	—	—	—	—	—	—	—	—	—	—	—
24	Walakpa River, Will Rogers and Wiley Post Memorial	—	—	—	4	—	96	—	—	—	—	—	—	—	—	—	—	—
25	Barrow, Browerville, Elson Lagoon	—	—	—	—	20	38	—	—	2	—	—	28	—	—	—	10	1
26	Dease Inlet, Plover Islands, Sanigaruak Island	—	—	11	—	15	23	—	—	13	—	—	35	—	—	—	3	—
27	Igalik Island, Kulgurak Island, Kurgorak Bay, Tangent Point	—	—	7	—	4	5	—	—	7	—	—	34	27	3	—	13	—
28	Cape Simpson, Piasuk River, Sinclair River, Tulimanik Island	—	—	—	—	4	5	—	—	3	—	—	19	48	2	—	4	15
29	Ikpikpuk River, Point Poleakoon, Smith Bay	—	—	—	—	-	—	—	—	-	—	—	8	73	—	—	—	19
30	Drew Point, Kolovik, McLeod Point,	—	—	—	—	25	—	—	—	15	—	—	60	—	—	—	—	—

Table A1-1c (continued)
Land Segment ID and the Percent Type of Shoreline Closest to the Ocean

ID	Geographic Place Names	1A	1B	3A	3C	4	5	6A	6B	7	8A	8B	8E	9A	9B	10 A	10 E	U
31	Lonely, Pitt Point, Pogik Bay, Smith River	—	—	—	—	9	8	—	—	4	—	—	27	30	—	—	—	22
32	Cape Halkett, Esook Trading Post, Garry Creek	—	—	0	3	16	—	—	—	5	—	—	72	—	—	—	4	—
33	Atigaru Point, Eskimo Islands, Harrison Bay,	—	—	15	27	8	2	—	—	2	—	—	16	—	—	1	22	7
34	Fish Creek, Tingmeachsiovik River	—	—	11	4	—	—	—	—	12	—	—	3	32	—	—	38	—
35	Anachlik Island, Colville River, Colville River Delta	—	—	7	2	—	—	—	—	42	—	—	2	36	—	1	8	—
36	Kalubik Creek, Oliktok Point, Thetis Mound,	—	—	19	0	—	12	1	—	8	—	—	9	1	—	—	25	25
37	Beechey Point, Bertoncini Island, Bodfish Island, Cottle Island, Jones Islands, Milne Point, Simpson Lagoon	—	—	41	5	—	18	—	—	7	—	—	8	0	—	—	10	11
38	Gwydyr Bay, Kuparuk River, Long Island	—	—	10	1	—	23	—	—	6	—	—	3	23	—	—	26	7
39	Duck Island, Foggy Island, Gull Island, Heald Point, Howe Island, Niakuk Islands, Point Brower	—	—	3	4	—	14	1	—	9	—	1	2	51	—	—	10	4
40	Foggy Island Bay, Kadleroshilik River, Lion Point, Shaviovik River, Tigvariak Island	—	—	10	1	—	8	—	—	27	—	—	4	5	—	—	39	5
41	Bullen Point, Point Gordon, Reliance Point	—	—	10	3	—	39	—	—	5	—	—	3	—	—	—	25	15
42	Flaxman Island, Maguire Islands, North Star Island, Point Hopson, Point Sweeney, Point Thomson, Staines River	—	—	11	3	—	37	2	—	8	—	—	7	—	—	—	14	18
43	Brownlow Point, Canning River, Tamayariak River	—	—	—	2	18	6	—	—	12	—	—	7	35	—	—	1	19
44	Camden Bay, Collinson Point, Katakturuk River, Konganevik Point, Simpson Cove	—	—	—	—	8	30	—	—	9	—	—	14	2	2	—	10	26
45	Anderson Point, Carter Creek, Itkilyariak Creek, Kajutakrok Creek, Marsh Creek, Sadlerochit River	—	—	—	—	14	30	—	—	21	—	—	6	5	—	2	—	23
46	Arey Island, Arey Lagoon, Barter Island, Hulahula River, Okpilak River	—	—	—	—	2	7	—	—	23	—	—	14	10	—	—	—	43
47	Bernard Harbor, Jago Lagoon, Kaktovik, Kaktovik Lagoon	—	—	—	—	4	23	—	—	19	—	—	6	15	—	—	—	34
48	Griffin Point, Oruktalik Lagoon, Pokok Lagoon	—	—	—	—	13	24	—	—	20	—	—	15	12	—	1	—	15
49	Angun Lagoon, Beaufort Lagoon, Nuvagapak Lagoon,	—	—	—	—	28	11	—	—	32	—	—	15	0	—	—	1	13
50	Aichilik River, Egaksrak Lagoon, Egaksrak River, Icy Reef, Kongakut River, Siku Lagoon	—	—	—	—	3	12	—	—	7	—	—	3	39	—	—	3	34
51	Demarcation Bay, Demarcation Point, Gordon, Pingokraluk Lagoon	—	—	—	—	9	51	—	—	14	—	—	8	1	—	—	—	17

Key:
ID = identification (number).
3A = Fine- to Medium-grained Sand Beaches.
3C = Tundra Cliffs.
5= Mixed Sand and Gravel Beaches.
6A = Gravel Beaches.
7 = Exposed Tidal Flats.
8B = Sheltered, Solid Man-made Structures.
8E = Peat Shorelines.
9A= Sheltered Tidal Flats
10A = Salt- and Brackish- water Marshes.
10E = Inundated Low-lying Tundra.
U= Unranked.
Source:
Research Planning Institute (2002).

Table A1-2a

Number and Name of Environmental Resource Areas, Their Vulnerable Period in the Oil Spill Trajectory Model and Their Location on Environmental Resource Area Map A-2a, Map A-2b, Map A-2c, or Map A-2d

ID	NAME	NAME 2	VULNERABLE	MAP	ID	NAME	VULNERABLE	MAP
1	Kasegaluk Lagoon	Solivik Island, Icy Cape	May-October	A-2a	45	Whale Concentration Area	May-October	A-2c
2	Point Barrow, Plover Islands	Elson Lagoon, Dease Inlet	May-October	A-2a	46	Herald Shoal Polynya	January-December	A-2d
3	Thetis and Jones Islands	Spy, Pingok, Bertoncini, Bodfish Islands	May-October	A-2c	47	Ice/Sea Segment 10	January-December	A-2d
4	Cottle and Return Islands, West Dock	Long, Egg, and Stump Islands	May-October	A-2c	48	Ice/Sea Segment 11	January-December	A-2d
5	Midway Islands	Reindeer and Argo Islands	May-October	A-2c	49	Hanna's Shoal Polynya	January-December	A-2d
6	Cross and No Name Islands	—	May-October	A-2c	50	Ice/Sea Segment 12	January-December	A-2d
7	Endicott Causeway	—	May-October	A-2c	51	Ice/Sea Segment 13	January-December	A-2d
8	McClure Islands	Narwhal, Jeanette, and Karluk Islands	May-October	A-2c	52	Ice/Sea Segment 14	January-December	A-2d
9	Stockton Islands	Pole and Belvedere Islands	May-October	A-2c	53	Ice/Sea Segment 15	January-December	A-2a
10	Tigvariak Island	—	May-October	A-2c	54	Ice/Sea Segment 16a	January-December	A-2a
11	Maguire Islands	Challenge, Alaska, Dutchess, Northstar	May-October	A-2c	55	Ice/Sea Segment 17	January-December	A-2c
12	Flaxman Island	—	May-October	A-2c	56	Ice/Sea Segment 18a	January-December	A-2c
13	Barrier Islands	Canning River	May-October	A-2c	57	Ice/Sea Segment 19	January-December	A-2c
14	Anderson Point Barrier Islands	—	May-October	A-2c	58	Ice/Sea Segment 20a	January-December	A-2c
15	Arey and Barter Islands, Bernard Spit	—	May-October	A-2c	59	Ice/Sea Segment 21	January-December	A-2c
16	Jago and Tapkaurak Spits	Takaurak and Oruktalik Lagoon	May-October	A-2c	60	Ice/Sea Segment 22	January-December	A-2c
17	Angun and Beaufort Lagoons	Barrier Islands	May-October	A-2c	61	Ice/Sea Segment 22	January-December	A-2c
18	Icy Reef	Demarcation Bay	May-October	A-2c	62	Ice/Sea Segment 24a	January-December	A-2c
19	Chukchi Spring Lead 1	—	April-June	A-2d	63	Ledyard Bay	July-October	A-2a
20	Chukchi Spring Lead 2	—	April-June	A-2a	64	Peard Bay	July-October	A-2a
21	Chukchi Spring Lead 3	—	April-June	A-2a	65	ERA 1	May-October	A-2a
22	Chukchi Spring Lead 4	—	April-June	A-2a	66	ERA 2	May-October	A-2a
23	Chukchi Spring Lead 5	—	April-June	A-2a	67	Ice/Sea Segment 16b	May-October	A-2a
24	Beaufort Spring Lead 6	—	April-June	A-2a	68	Harrison Bay	May-October	A-2a
25	Beaufort Spring Lead 7	—	April-June	A-2a	69	Harrison Bay/Colville Delta	May-October	A-2a
26	Beaufort Spring Lead 8	—	April-June	A-2a	70	ERA 3	May-October	A-2a
27	Beaufort Spring Lead 9	—	April-June	A-2a	71	Simpson Lagoon	May-October	A-2b
28	Beaufort Spring Lead 10	—	April-June	A-2a	72	Gwyder Bay	May-October	A-2b
29	Ice/Sea Segment 1	—	September-October	A-2b	73	Prudhoe Bay	May-October	A-2b
30	Ice/Sea Segment 2	—	September-October	A-2b	74	Cross Island ERA	May-October	A-2c
31	Ice/Sea Segment 3	—	September-October	A-2b	75	Water over Boulder Patch 1	January-December	A-2b
32	Ice/Sea Segment 4	—	September-October	A-2b	76	Water over Boulder Patch 2	January-December	A-2b
33	Ice/Sea Segment 5	—	September-October	A-2b	77	Foggy Island Bay	May-October	A-2b
34	Ice/Sea Segment 6	—	September-October	A-2b	78	Mikkelsen Bay	May-October	A-2b
35	Ice/Sea Segment 7	—	September-October	A-2b	79	ERA 4	May-October	A-2c
36	Ice/Sea Segment 8	—	September-October	A-2b	80	Ice/Sea Segment 18b	May-October	A-2c
37	Ice/Sea Segment 9	—	September-October	A-2b	81	Simpson Cove	May-October	A-2b
38	Point Hope Subsistence Area	—	January-December	A-2d	82	ERA 5	May-October	A-2c
39	Point Lay Subsistence Area	—	January-December	A-2d	83	Kaktovik ERA	May-October	A-2b
40	Wainwright Subsistence Area	—	January-December	A-2d	84	Ice/Sea Segment 20b	May-October	A-2c
41	Barrow Subsistence Area 1	—	April-May	A-2d	85	ERA 6	May-October	A-2b
42	Barrow Subsistence Area 2	—	August-October	A-2d	86	ERA 7	May-October	A-2c
43	Nuiqsut Subsistence Area	—	August-October	A-2c	87	ERA 8	May-October	A-2c
44	Kaktovik Subsistence Area	—	August-October	A-2b	88	Ice Sea Segment 24b	May-October	A-2c

Table A1-2b
Land Segment ID and the Geographic Place Names within the Land Segment

ID	Geographic Place Names	ID	Geographic Place Names
1	Cape Thompson, Akoviknak and Mapsorak Lagoon	34	Fish Creek, Tingmeachsiovik River
2	Aiautak Lagoon Teshekpak Lake	35	Anachlik Island, Colville River, Colville River Delta
3	Ipiutak Lagoon, Marryat Inlet, Point Hope	36	Kalubik Creek, Oliktok Point, Thetis Mound,
4	Angayutak Mountain, Cape Dyer, Kilikralik Point	37	Beechey Point, Bertoncini Island, Bodfish Island, Cottle Island, Jones Islands, Milne Point, Simpson Lagoon
5	Alokut Point, Cape Lewis, Cape Lisburne	38	Gwydyr Bay, Kuparuk River, Long Island
6	Ayugatak Lagoon	39	Duck Island, Foggy Island, Gull Island, Heald Point, Howe Island, Niakuk Islands, Point Brower
7	Cape Sabine, Pitmegea River	40	Foggy Island Bay, Kadleroshilik River, Lion Point, Shaviovik River, Tigvariak Island
8	Agiak Lagoon, Punuk Lagoon	41	Bullen Point, Point Gordon, Reliance Point
9	Cape Beaufort, Omalik Lagoon	42	Flaxman Island, Maguire Islands, North Star Island, Point Hopson, Point Sweeney, Point Thomson, Staines River
10	Kuchaurak Creek, Kuchiak Creek	43	Brownlow Point, Canning River, Tamayariak River
11	Kukpowruk River, Naokok, Naokok Pass, Sitkok Point	44	Camden Bay, Collinson Point, Katakturuk River, Konganevik Point, Simpson Cove
12	Epizetka River, Kokolik River, Point Lay, Siksrikpak Point	45	Anderson Point, Carter Creek, Itkilyariak Creek, Kajutakrok Creek, Marsh Creek, Sadlerochit River
13	Akunik Pass, Tungaich Point, Tungak Creek	46	Arey Island, Arey Lagoon, Barter Island, Hulahula River, Okpilak River
14	Kasegaluk Lagoon, , Solivik Island, Utukok River	47	Bernard Harbor, Jago Lagoon, Kaktovik, Kaktovik Lagoon
15	Akeonik, Icy Cape, Icy Cape Pass	48	Griffin Point, Oruktalik Lagoon, Pokok Lagoon
16	Akoliakatat Pass, Avak Inlet, Tunalik River	49	Angun Lagoon, Beaufort Lagoon, Nuvagapak Lagoon,
17	Mitliktavik, Nivat Point, Nokotlek Point, Ongorakvik River	50	Aichilik River, Egaksrak Lagoon, Egaksrak River, Icy Reef, Kongakut River, Siku Lagoon
18	Kilmantavi, Kuk River, Point Collie, Sigeakruk Point,	51	Demarcation Bay, Demarcation Point, Gordon, Pingokraluk Lagoon
19	Point Belcher, Wainwright, Wainwright Inlet	52	Clarence Lagoon, Backhouse River
20	Eluksingiak Point, Igklo River, Kugrua Bay	53	Komakuk Beach, Fish Creek
21	Peard Bay, Point Franklin, Seahorse Islands, Tachinisok Inlet	54	Nunaluk Spit
22	Skull Cliff	55	Herschel Island
23	Nulavik, Loran Radio Station	56	Ptarmagin Bay
24	Walakpa River, Will Rogers and Wiley Post Memorial	57	Roland & Phillips Bay, Kay Point
25	Barrow, Browerville, Elson Lagoon	58	Sabine Point
26	Dease Inlet, Plover Islands, Sanigaruak Island	59	Shingle Point
27	Igalik Island, Kulgurak Island, Kurgorak Bay, Tangent Point	60	Trent and Shoalwater Bays
28	Cape Simpson, Piasuk River, Sinclair River, Tulimanik Island	61	Shallow Bay, West Channel
29	Ikpikpuk River, Point Poleakoon, Smith Bay	62	**Shallow Bay**
30	Drew Point, Kolovik, McLeod Point,	63	Outer Shallow Bay, Olivier Islands
31	Lonely AFS Airport, Pitt Point, Pogik Bay, Smith River	64	Middle Channel, Gary Island
32	Cape Halkett, Esook Trading Post, Garry Creek	65	Kendall Island
33	Atigaru Point, Eskimo Islands, Harrison Bay, Kalikpik River, Saktuina Point	66	North Point, Pullen Island

Key:
ID = identification (number).

Table A1-3
Assumptions about how Launch Areas are serviced by Pipelines for the Oil-Spill-Trajectory Analysis

Spill Boxes	Serviced by Pipelines
LA01 & LA02	P1 to P8
LA03	P2 to P8
LA04	P8
LA05 & LA06	P2 to P9
LA07	P3 to P10
LA08	P9
LA09	P4 to P10
LA10	P10
LA11	P5 to P11
LA12	P12
LA13	P5 to P12
LA14	P6 to P12
LA15	P13
LA16, LA17 & LA18	P7 to P13

Table A1-4
Launch Area and Pipeline Segment Exclusions by Sale Scenario for Production and Development

Sale 186/195	
Alternative I	LA1-LA6, LA11, LA13, LA14, LA16, LA18, P1, P2, P5, P6, P8, P11
Alternative III	LA1-LA6, LA11, LA13, LA14, LA16, LA18, P1, P2, P5, P6, P8, P11
Alternative IV	LA1-LA6, LA11, LA13, LA14, LA16, LA18, P1, P2, P5, P6, P8, P11
Alternative V	LA1-LA6, LA11, LA13, LA14, LA16, LA18, P1, P2, P5, P6, P8, P11
Alternative VI	LA1-LA6, LA11, LA13, LA14, LA16, LA18, P1, P2, P5, P6, P8, P11
Alternative III, IV, V and VI, are the same as Alternative I	

Note:
Where the majority (≥80%) of the spill points were removed from the spill area based on the scenario the spill area was excluded even if a small portion (<20%) of the spill area could be leased.

Sale 202	
Alternative I	LA8, LA10
Alternative III	LA8, LA10
Alternative IV	LA8, LA10
Alternative V	LA8, LA10
Alternative VI	LA8, LA10
Alternatives IV, V and VI, are the same as Alternative I.	

Table A1-5
Estimated Percent Chance of One or More Platform, Pipeline and Total Spills for Alternative I (Sales 186, 195 and 202) and Their Alternatives

Alternative		Percent Chance of One or More Platform Spills	Percent Chance of One or More Pipeline Spills	Percent Chance of One or More Spills Total
I	Alternative I	6	5	10
II	No Sale	0	0	0
III	Barrow Subsistence Whale Deferral	6	5	10
IV	Nuiqsut Subsistence Whale Deferral	6	4	10
V	Kaktovik Subsistence Whale Deferral	6	5	10
VI	Eastern Deferral	6	5	10

Table A1-6a
Small Spills Greater than or Equal to 1 Gallon and Less than 1,000 Barrels Table A1-6a Small Crude-Oil Spills: Estimated Spill Rates for the Alaska North Slope

Small Crude-Oil Spills ≤500 barrels, 1898-2000		
Total Volume of Spills	135,127 gallons	
—	3,217 barrels	
Total Number of Spills	1,178 spills	**Note:** Oil-spill databases are from the ADEC, Anchorage, Juneau, and Fairbanks. Alaska North Slope production data are derived from the TAPS throughput data from Alyeska Pipeline. **Source:** USDOI, MMS, Alaska OCS Region, 2002.
Average Spill Size	2.7 barrels	
Production (Crude Oil)	6.6 billion barrels	
Spill Rate	178 spills/billion barrels of crude oil produced	
Small Crude-Oil Spills > 500 barrels and <1,000, 1985-2000		
Total Volume of Spills	171,150 gallons	
—	4,075 barrels	
Total Number of Spills	6	**Note:** Oil-spill databases are from the ADEC, Anchorage, Juneau, and Fairbanks. BP Alaska Inc. and Arco. Alaska North Slope production data are derived from the TAPS throughput data from Alyeska Pipeline. **Source:** USDOI, MMS, Alaska OCS Region, 2002.
Average Spill Size	680 barrels	
Production (Crude Oil)	9.36 billion barrels	
Spill Rate	0.64 spills/billion barrels of crude oil produced	

Table A1-6b
Small Crude-Oil Spills: Assumed Spills over the Production Life of the Beaufort Multiple-Sale

Sales 186, 195, and 202 Alternative	Assumed Small Crude-Oil Spills ≤500 barrels				
	Resources (Bbbl)[1]	Spill Rate (Spills/Bbbl)	Assumed Spill Size (bbl)	Estimated Number of Spills	Estimated Total Spill Volume (bbl)
I	0.46	178	3	82	246
II	0	178	3	0	0
III	0.456	178	3	81	243
IV	0.436	178	3	78	234
V	0.447	178	3	80	240
VI	0.446	178	3	79	237
Alternative	**Assumed Small Crude-Oil Spills > 500 and ≤1,000 barrels**				
I	0.46	0.64	680	0.29	0
II	0	0.64	680	0	0
III	0.456	0.64	680	0.29	0
IV	0.436	0.64	680	0.28	0
V	0.447	0.64	680	0.29	0
VI	0.446	0.64	680	0.29	0

Notes:
[1]The estimation of oil spills is based on the estimated resources.
Source:
USDOI, MMS, Alaska OCS Region (2002).

Table A1-6c
Small Crude-Oil Spills: Assumed Size Distribution over the Production Life of the Beaufort Multiple-Sale

Size[2]	Alternative I	Alternative II	Alternative III	Alternative IV	Alternative V	Alternative VI
1 gallon	16	0	15	15	15	15
>1 and ≤5 gallons	29	0	28	27	28	28
>5 gallons and <1 bbl	16	0	17	16	16	16
Total <1 bbl	61	0	60	58	59	59
≥1 bbl and ≤bbl 5	17	0	17	16	17	16
>5 and ≤25 bbl	3	0	3	3	3	3
> 25 and ≤500 bbl	1	0	1	1	1	1
>500 and ≤1,000 bbl	0	0	0	0	0	0
Total >1 and ≤1,000bbl	21	0	21	20	21	20
Total Volume (bbl)	246	0	243	234	240	237

Notes:
[1] Estimated number of spills is rounded to the nearest whole number.
[2] Spill-size distributions are allocated by multiplying the total estimated number of spills by the fraction of spills in that size category from the ADEC database.
Source:
USDOI, MMS, Alaska OCS Region (2002).

Table A1-6d
Small Refined-Oil Spills:

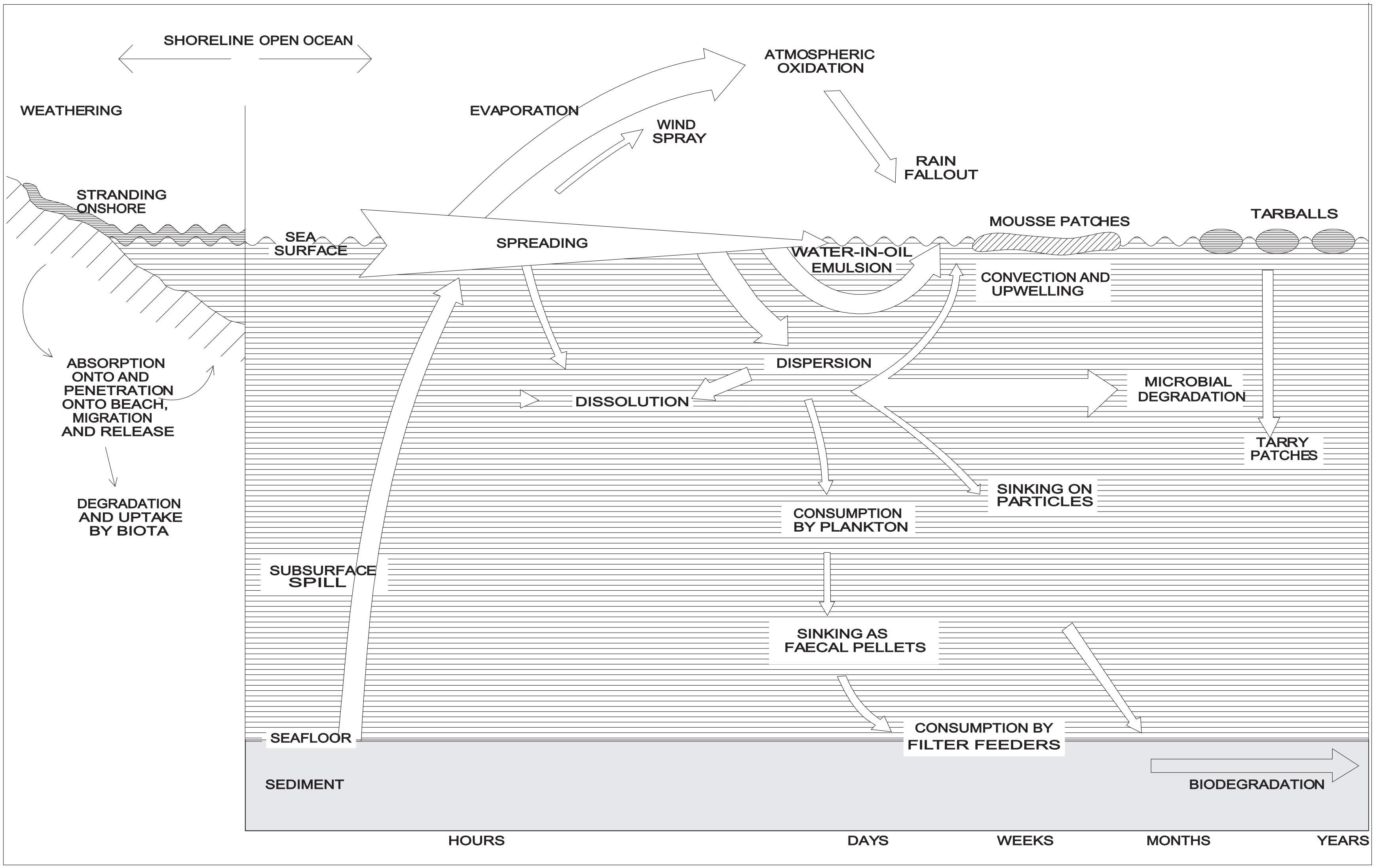
Estimated Spill Rate for the Alaska North Slope, 1989-2000	
Total Volume of Spills	94,195 gallons
	2,243 barrels
Total Number of Spills	2,915 spills
Average Spill Size	0.7 barrels
Production (Crude Oil)	6.6 billion barrels
Spill Rate	440 spills/billion barrels of crude oil produced

Source: USDOI, MMS, Alaska OCS Region (2002).

Table A1-6e
Small Refined-Oil Spills: Assumed Spills over the Production Life of the Beaufort Multiple-Sale

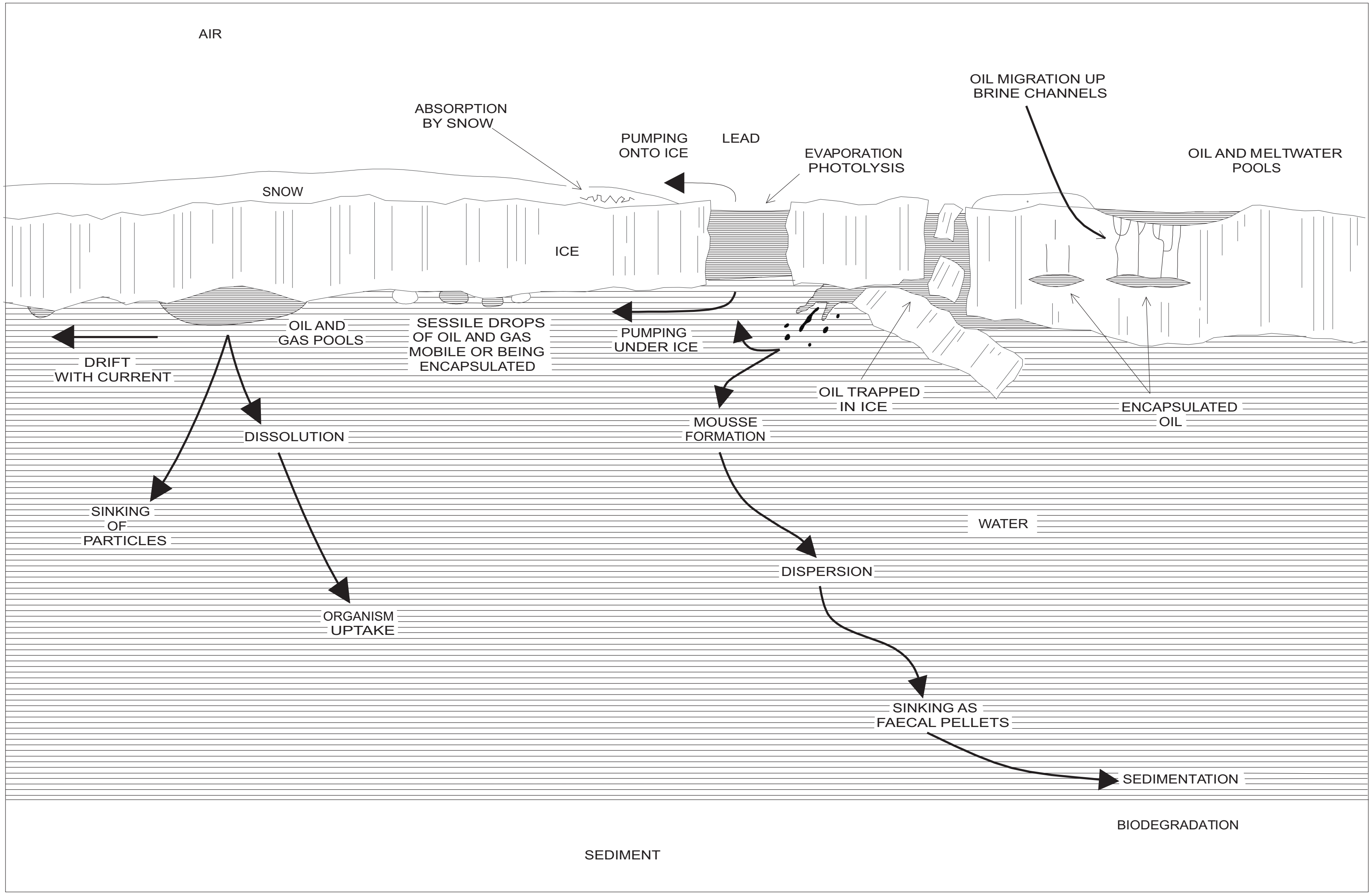
Sales 186, 195, and 202 Alternative	Resource Range (Bbbl)	Spill Rate (Spills/Bbbl)	Average Spill Size (bbl)	Estimated Number of Spills[1]	Estimated Total Spill Volume (bbl)[1]
I	0.46	440	0.7 (29 gal)	202	141
II	0	440	0.7 (29 gal)	0	0
III	0.456	440	0.7 (29 gal)	201	141
IV	0.436	440	0.7 (29 gal)	192	134
V	0.447	440	0.7 (29 gal)	197	138
VI	0.446	440	0.7 (29 gal)	197	138

Note:
[1] The fractional estimated mean spill number and volume is rounded to the nearest whole number.
Bbbl = Billion barrels.
bbl = barrel.
gal = gallon.
Source:
USDOI, MMS, Alaska OCS Region (2002).



Source: After MacKay, 1985, and Rasmussen, (1985).

Figure A-1. Fate of Oil Spills in the Ocean During Arctic Summer



Source: After Hillman and Shafer (1983), and Mackay, (1985).

Figure A-2. Fate of Oil Spills in the Ocean During Arctic Winter

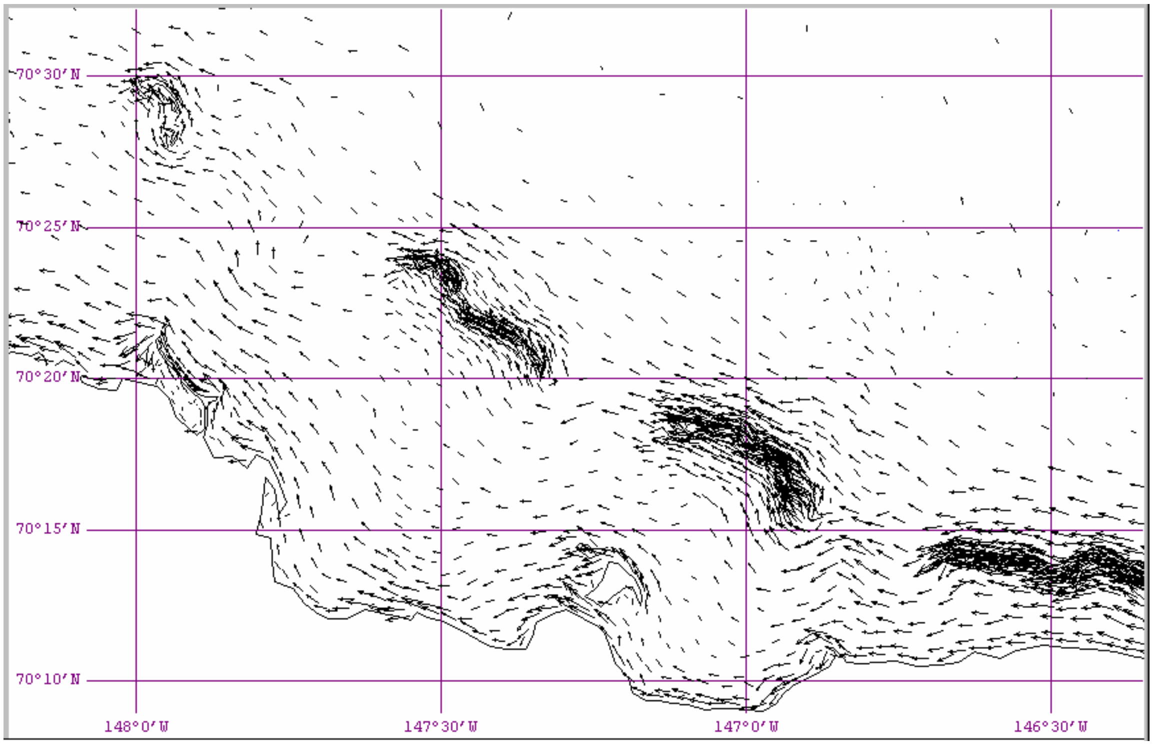


Figure A-3 Nearshore Surface Currents Simulated by the NOAA Model for a Wind from the East at 10 Meters Per Second.

APPENDIX A-2

SUPPORTING TABLES FOR THE OSRA APPENDIX

OIL SPILL RISK ANALYSIS CONDITIONAL AND COMBINED PROBABILITIES TABLE LIST

Table A2-19 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 3 Days, Beaufort Sales 186, 195 and 202

Table A2-20 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 10 Days, Beaufort Sales 186, 195 and 202

Table A2-21 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 30 Days, Beaufort Sales 186, 195 and 202

Table A2-22 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 60 Days, Beaufort Sales 186, 195 and 202

Table A2-23 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 180 Days, Beaufort Sales 186, 195 and 202

Table A2-24 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 360 Days, Beaufort Sales 186, 195 and 202

Table A2-25 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 3 Days, Beaufort Sales 186, 195 and 202

Table A2-26 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 10 Days, Beaufort Sales 186, 195 and 202

Table A2-27 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 30 Days, Beaufort Sales 186, 195 and 202

Table A2-28 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 60 Days, Beaufort Sales 186, 195 and 202

Table A2-29 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 180 Days, Beaufort Sales 186, 195 and 202

Table A2-30 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 360 Days, Beaufort Sales 186, 195 and 202

Table A2-31 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 3 Days, Beaufort Sales 186, 195 and 202

Table A2-32 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 10 Days, Beaufort Sales 186, 195 and 202

Table A2-33 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 30 Days, Beaufort Sales 186, 195 and 202

Table A2-34 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 60 Days, Beaufort Sales 186, 195 and 202

Table A2-35 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 180 Days, Beaufort Sales 186, 195 and 202

Table A2-36 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 360 Days, Beaufort Sales 186, 195 and 202

Table A2-37 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 3 Days, Beaufort Sales 186, 195 and 202

Table A2-76 Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 60 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-77 Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 180 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-78 Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 360 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-79 Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 3 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-80 Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 10 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-81 Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 30 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-82 Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 60 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-83 Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 180 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-84 Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 360 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-85 Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 3 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-86 Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 10 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-87 Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 30 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-88 Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 60 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-89 Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 180 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-90 Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 360 Days, Beaufort Sea Sales 186, 195 and 202

Table A2-1 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	:	5	1	5	1	5	:	4	:	1	:	2	:	:	1	:	3	6	1	1	:	:	:	:	1	12	8	7	6	6	6
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	:	5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	8	1	:	:
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	1	:
5	Midway Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	:	1	:	:	:	:	:	:
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	:	:	1	:	:	:	:	:	:
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	14	5	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	10	1	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Spring Lead 7	6	12	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	20	1	:	:	:	:	:	2	:	:	:	:	:
26	Beaufort Spring Lead 8	1	:	12	1	8	1	:	:	:	:	:	:	:	:	:	:	:	:	2	4	:	:	:	:	:	1	:	:	:	:	:
27	Beaufort Spring Lead 9	1	1	10	4	8	3	:	:	:	:	:	:	:	:	:	:	:	:	3	9	:	:	:	:	:	3	:	:	:	:	:
28	Beaufort Spring Lead 10	:	:	:	:	5	2	12	1	3	:	:	:	:	:	:	:	:	:	:	3	6	:	:	:	:	:	2	:	:	:	:
29	Ice/Sea Segment 1	3	12	1	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:	:	:	:	3	:	:	:	:	:
30	Ice/Sea Segment 2	:	1	2	10	3	8	:	:	:	:	:	:	:	:	:	:	:	:	2	5	:	:	:	:	:	7	1	:	:	:	:
31	Ice/Sea Segment 3	:	:	:	:	1	5	3	11	1	2	:	:	:	:	:	:	:	:	:	2	4	1	:	:	:	:	8	2	:	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	1	1	4	11	3	3	:	:	:	:	:	:	:	:	3	16	7	:	:	:	:	7	8	:	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	1	1	9	4	:	2	:	:	:	:	:	:	:	10	2	:	:	:	:	1	7	:
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	1	1	1	12	:	7	:	:	:	:	:	:	3	1	:	:	:	:	1	10
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	6	3	:	:	:	:	:	:	10	:	:	:	:	:	1
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	5	22	1	6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	10	1	:	:	:	:	:	15	:	:	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	11	1	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	1	8	:
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	7	:	:	:	:	:	:	8	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-1 (continued) Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Ice/Sea Segment 14	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
53	Ice/Sea Segment 15	:	3	14	43	23	37	3	1	:	:	:	:	:	:	:	:	:	:	4	71	3	:	:	:	:	14	5	:	:	:	:
54	Ice/Sea Segment 16a	:	:	:	:	3	15	51	21	20	3	:	:	:	:	:	:	:	:	:	6	60	5	:	:	:	:	35	3	:	:	:
55	Ice/Sea Segment 17	:	:	:	:	:	:	2	1	33	33	41	10	5	:	:	:	:	:	:	:	9	**	41	:	:	:	:	18	27	1	:
56	Ice/Sea Segment 18a	:	:	:	:	:	:	:	:	:	1	2	41	38	14	14	:	:	:	:	:	:	:	44	43	:	:	:	:	2	38	2
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	:	:	1	:	2	52	15	46	1	:	:	:	:	:	19	59	:	:	:	:	:	70
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	28	5	2	:	:	:	:	:	1	9	:	:	:	:	:	1
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	1	5	2	19	:	1	:	:	:	:	:	:	:	:	:	:	:	:	13	4	:	:	:	:	:	26	:	:	:	:	:
66	ERA 2	:	:	:	1	1	17	2	5	:	:	:	:	:	:	:	:	:	:	:	4	2	:	:	:	:	:	8	:	:	:	:
67	Ice/Sea Segment 16b	:	:	:	:	1	7	25	11	10	1	:	:	:	:	:	:	:	:	:	3	30	3	:	:	:	:	17	2	:	:	:
68	Harrison Bay	:	:	:	:	:	1	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	12	:	:	:	:
69	Harrison Bay/Colville Delta	:	:	:	:	:	:	:	3	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	:	:	:
70	ERA 3	:	:	:	:	:	:	3	3	7	14	:	:	:	:	:	:	:	:	:	:	11	10	:	:	:	:	:	24	1	:	:
71	Simpson Lagoon	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	9	2	:	:
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	:	:	:	:	1	:	21	2	:	1	:	:	:	:	:	:	:	3	1	:	:	:	:	2	16	:
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4	:
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	9	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
79	ERA 4	:	:	:	:	:	:	:	:	:	:	:	11	1	:	3	:	:	:	:	:	:	:	1	1	:	:	:	:	:	11	1
80	Ice/Sea Segment 18b	:	:	:	:	:	:	:	:	:	1	1	21	19	7	7	:	:	:	:	:	:	:	22	20	:	:	:	:	1	19	1
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	15	:	:	:	:	:	:	:	1	:	:	:	:	:	2
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	9	14	:	:	:	:	:	:	14	:	:	:	:	:	:
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	15	3	1	:	:	:	:	:	1	6	:	:	:	:	:	1
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:	:	:	:	:	:	:	:	:	:	:
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-2 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	6	15	5	15	4	13	4	13	2	6	1	6	1	:	3	1	9	17	9	7	4	3	2	2	7	22	16	14	10	10	9
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	4	12	2	3	1	1	:	:	:	:	:	:	:	:	:	:	:	:	6	1	:	:	:	:	:	3	:	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	1	2	2	6	1	2	:	:	:	:	:	:	:	:	1	4	1	:	:	:	:	10	4	1	:
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	:	1	3	1	3	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	2	8	2	:
5	Midway Islands	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	1	:	3	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	2	3	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	2	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	7	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	1	:	:	:	:	:	1	3	:	:	:	:	:	1
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	4	:	:	:	:	:	:	3	:	:	:	:	:	:
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	16	10	5	3	2	1	:	:	:	:	:	:	:	:	:	:	:	:	15	4	:	:	:	:	:	3	:	:	:	:	:
25	Beaufort Spring Lead 7	9	15	4	5	1	1	:	:	:	:	:	:	:	:	:	:	:	:	21	4	:	:	:	:	:	5	:	:	:	:	:
26	Beaufort Spring Lead 8	2	2	14	5	11	4	1	1	:	:	:	:	:	:	:	:	:	:	4	8	1	:	:	:	:	3	1	:	:	:	:
27	Beaufort Spring Lead 9	1	2	12	8	11	6	2	1	:	:	:	:	:	:	:	:	:	:	5	13	2	:	:	:	:	6	1	:	:	:	:
28	Beaufort Spring Lead 10	:	:	1	1	7	5	16	5	7	3	1	:	:	:	:	:	:	:	:	5	12	3	1	:	:	:	6	3	1	:	:
29	Ice/Sea Segment 1	6	13	3	4	1	1	:	:	:	:	:	:	:	:	:	:	:	:	9	2	:	:	:	:	:	4	:	:	:	:	:
30	Ice/Sea Segment 2	1	3	4	11	5	9	2	2	1	:	:	:	:	:	:	:	:	:	3	8	2	:	:	:	:	8	1	:	:	:	:
31	Ice/Sea Segment 3	:	:	1	1	2	7	6	13	3	4	1	1	:	:	:	:	:	:	1	3	6	4	1	:	:	:	10	5	2	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	2	2	6	12	6	5	2	:	1	:	:	:	:	:	5	16	8	1	:	:	1	9	11	2	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	2	3	11	6	2	4	:	:	:	:	:	:	1	12	3	:	:	:	:	3	9	1
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	2	1	2	14	1	9	:	:	:	:	:	1	5	3	:	:	:	:	2	11
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	8	4	:	:	:	:	:	1	12	:	:	:	:	:	3
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	5	:	:	:	:	:	:	2	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	10	24	5	10	3	3	:	:	:	:	:	:	:	:	:	:	:	:	14	4	:	:	:	:	:	17	1	:	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	2	1	13	3	1	1	:	:	:	:	:	:	1	5	2	:	:	:	1	3	10	1
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	9	8	:	:	:	:	:	1	11	:	:	:	:	:	2

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-2 (continued) Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Ice/Sea Segment 14	10	4	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:	:	:	:	:	1	:	:	:	:	:
53	Ice/Sea Segment 15	4	7	22	51	33	47	9	7	2	1	:	:	:	:	:	:	:	:	10	73	10	1	:	:	:	20	12	1	:	:	:
54	Ice/Sea Segment 16a	:	:	3	3	9	22	59	37	32	15	6	2	1	:	:	:	:	:	1	11	67	19	4	:	:	1	45	18	7	1	:
55	Ice/Sea Segment 17	:	:	:	:	1	1	7	6	42	46	51	25	16	2	3	:	:	:	:	1	14	**	52	4	:	:	2	27	45	12	1
56	Ice/Sea Segment 18a	:	:	:	:	:	:	:	:	1	3	5	51	42	19	29	1	2	:	:	:	:	2	47	47	1	:	:	1	6	48	10
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	:	:	3	2	6	59	19	56	4	:	:	:	:	1	23	63	:	:	:	:	3	75
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	:	:	5	6	39	18	8	:	:	:	:	:	8	27	:	:	:	:	1	9
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	5	:	:	:	:	:	:	2	:	:	:	:	:	:
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	3	9	6	24	4	5	1	1	:	:	:	:	:	:	:	:	:	:	16	9	1	:	:	:	:	27	1	:	:	:	:
66	ERA 2	:	:	2	3	4	20	5	10	2	2	:	:	:	:	:	:	:	:	1	6	6	2	:	:	:	1	13	3	:	:	:
67	Ice/Sea Segment 16b	:	:	1	2	4	11	29	20	17	9	3	1	1	:	:	:	:	:	:	5	35	11	2	:	:	:	23	11	4	:	:
68	Harrison Bay	:	:	:	:	:	2	1	7	:	1	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	14	1	:	:	:
69	Harrison Bay/Colville Delta	:	:	:	:	:	1	1	6	1	3	:	:	:	:	:	:	:	:	:	:	2	2	:	:	:	:	3	6	2	:	:
70	ERA 3	:	:	:	:	:	1	6	8	13	22	4	3	1	:	:	:	:	:	:	1	15	21	3	:	:	:	3	30	9	1	:
71	Simpson Lagoon	:	:	:	:	:	:	:	1	1	4	1	2	:	:	:	:	:	:	:	:	1	2	1	:	:	:	:	11	5	1	:
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	:	:	:	:	2	2	24	4	1	2	:	:	:	:	:	:	1	7	2	:	:	:	1	5	19	1
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	1	:	5	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	5	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	:	:	5	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	8	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	9	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
79	ERA 4	:	:	:	:	:	:	:	:	:	1	1	14	2	1	5	:	:	:	:	:	:	:	3	2	:	:	:	:	1	14	2
80	Ice/Sea Segment 18b	:	:	:	:	:	:	:	:	1	2	3	27	21	9	14	:	1	:	:	:	:	1	24	22	:	:	:	1	4	25	5
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	1	18	1	:	:	:	:	:	2	4	:	:	:	:	:	5
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	14	17	:	:	:	:	:	1	19	:	:	:	:	:	3
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	:	:	3	4	21	11	5	:	:	:	:	:	4	16	:	:	:	:	:	6
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	10	:	:	:	:	:	:	:	:	:	:	:	:	:
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-3 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	17	26	15	25	14	22	13	22	9	15	6	13	5	3	8	7	16	27	20	17	14	12	7	5	14	29	24	23	17	16	16
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	10	16	5	7	3	3	1	1	:	:	:	:	:	:	:	:	:	:	12	4	1	:	:	:	:	6	1	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	2	3	4	8	4	4	2	1	1	:	:	:	:	:	2	6	4	1	:	:	1	12	7	3	1
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	1	2	4	2	5	2	1	1	:	:	:	:	:	1	3	3	1	:	:	:	3	10	3	1
5	Midway Islands	:	:	:	:	:	:	:	:	:	1	1	3	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	1	2	2	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	1	1	4	1	1	1	:	:	:	:	:	:	1	2	1	:	:	:	1	2	5	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	3	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	3	1	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	1	8	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	2	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	3	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	3
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	1	:	:	:	:	:	:	1	:	:	:	:	:	1	5
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	6	2	:	:	:	:	:	1	5	:	:	:	:	:	2
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	5	:	:	:	:	:	1	6	:	:	:	:	:	2
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	5	:	:	:	:	:	:	1	:	:	:	:	:	1
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	6	:	:	:	:	:	:	1	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	17	12	7	6	4	2	2	1	1	:	:	:	:	:	:	:	:	:	16	6	2	:	:	:	:	5	1	:	:	:	:
25	Beaufort Spring Lead 7	11	16	6	6	4	3	2	1	1	:	:	:	:	:	:	:	:	:	21	7	1	1	:	:	:	6	1	:	:	:	:
26	Beaufort Spring Lead 8	3	3	15	7	12	6	4	2	2	1	1	:	1	:	:	:	:	:	6	10	3	2	1	:	:	5	2	1	1	:	:
27	Beaufort Spring Lead 9	2	3	13	9	12	8	4	2	2	2	1	1	1	:	:	:	:	:	6	15	4	2	1	:	:	7	3	2	1	:	:
28	Beaufort Spring Lead 10	:	:	2	2	8	6	18	8	10	6	5	2	3	1	1	:	:	:	:	6	15	7	4	1	:	1	8	5	4	1	1
29	Ice/Sea Segment 1	7	13	5	5	3	2	1	1	1	:	:	:	:	:	:	:	:	:	10	4	1	:	:	:	:	5	1	:	:	:	:
30	Ice/Sea Segment 2	2	4	6	12	6	10	4	3	2	1	1	:	:	:	:	:	:	:	5	9	3	1	:	:	:	9	2	1	1	:	:
31	Ice/Sea Segment 3	1	1	2	2	3	8	8	14	6	6	3	2	2	:	:	:	:	:	1	4	8	6	3	1	:	1	11	7	4	1	:
32	Ice/Sea Segment 4	:	:	1	:	1	1	3	4	8	14	8	7	5	2	2	:	:	:	:	1	6	18	11	2	:	:	2	10	12	4	1
33	Ice/Sea Segment 5	:	:	:	:	:	:	1	:	1	2	4	12	8	3	5	1	1	:	:	:	:	2	12	4	1	:	:	1	4	10	2
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	1	3	2	3	14	2	9	1	:	:	:	:	1	6	4	:	:	:	1	3	12
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	1	1	2	3	6	9	5	:	:	:	:	:	3	13	:	:	:	:	1	4
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	6	:	:	:	:	:	1	4	:	:	:	:	:	2
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	:	:	:	:	:	:	2	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	3	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
42	Barrow Subsistence Area 2	14	25	9	13	6	6	3	2	1	1	:	:	:	:	:	:	:	:	17	8	2	1	:	:	:	19	3	1	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	1	1	2	2	14	4	2	3	:	:	:	:	:	:	1	6	3	:	:	:	2	4	11	2
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	2	3	5	11	9	:	:	:	:	:	2	13	:	:	:	:	1	5

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-3 (continued) Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	3	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:
52	Ice/Sea Segment 14	18	10	8	5	3	2	1	:	:	:	:	:	:	:	:	:	:	:	12	4	:	:	:	:	:	4	:	:	:	:	:
53	Ice/Sea Segment 15	8	11	27	53	38	51	15	12	8	6	4	2	2	:	:	:	:	:	14	75	15	7	3	1	:	23	17	7	4	1	:
54	Ice/Sea Segment 16a	2	2	7	6	15	27	63	44	42	28	18	10	8	2	3	:	:	:	3	16	71	33	15	3	:	3	48	29	18	6	1
55	Ice/Sea Segment 17	1	:	1	1	3	4	14	12	47	52	56	34	28	10	11	2	2	:	1	3	20	**	59	12	1	:	6	32	50	19	5
56	Ice/Sea Segment 18a	:	:	:	:	:	:	1	1	3	5	8	54	44	23	34	4	5	:	:	:	1	4	49	49	3	:	1	3	9	50	14
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	1	1	5	3	8	61	23	58	6	:	:	:	1	3	25	64	:	:	:	1	5	76
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	2	3	11	15	47	27	15	:	:	:	:	1	16	36	:	:	:	:	3	18
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	3	3	9	7	11	:	:	:	:	:	3	9	:	:	:	:	1	4
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	2	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
65	ERA 1	4	10	8	26	7	9	4	3	2	1	1	:	:	:	:	:	:	:	17	13	4	1	:	:	:	28	4	2	1	:	:
66	ERA 2	1	1	4	5	6	22	9	13	5	5	2	2	1	:	:	:	:	:	2	9	10	5	2	:	:	2	16	6	3	1	:
67	Ice/Sea Segment 16b	1	1	4	4	8	14	32	24	23	17	10	6	5	1	2	:	:	:	2	8	38	19	8	2	:	2	25	17	11	4	1
68	Harrison Bay	:	:	1	1	1	3	3	9	2	3	1	1	1	:	:	:	:	:	:	1	3	2	1	:	:	:	15	3	2	1	:
69	Harrison Bay/Colville Delta	:	:	1	1	1	2	3	8	3	6	2	2	1	:	:	:	:	:	:	1	4	5	2	:	:	:	4	8	3	1	:
70	ERA 3	:	:	1	1	2	3	9	11	17	26	9	7	5	1	2	:	:	:	:	2	17	24	9	2	:	:	6	32	15	5	1
71	Simpson Lagoon	:	:	:	:	:	:	1	2	3	6	3	4	2	1	1	:	:	:	:	:	2	4	3	1	:	:	1	12	8	3	1
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	3	1	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	:	1	1	1	3	3	25	6	2	4	1	1	:	:	:	1	2	8	4	1	:	:	2	6	21	2
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	1	1	6	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	:	2	7	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	1	1	5	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	:	2	10	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	10	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
79	ERA 4	:	:	:	:	:	:	:	:	1	1	1	15	3	2	6	:	1	:	:	:	:	1	4	3	1	:	:	1	2	15	2
80	Ice/Sea Segment 18b	:	:	:	:	:	:	1	1	2	4	5	28	23	11	16	1	2	:	:	:	1	3	25	23	1	:	:	2	7	27	6
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	1	1	1	5	2	19	2	:	:	:	:	:	3	5	:	:	:	:	1	6
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	1	:	2	5	7	17	18	:	:	:	:	:	3	22	:	:	:	:	1	7
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	2	2	6	8	25	16	8	:	:	:	:	1	9	21	:	:	:	:	3	10
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	13	:	:	:	:	:	:	2	:	:	:	:	:	1
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	:	:	:	:	:	:	1	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-4 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	24	33	22	32	20	29	19	28	16	22	12	20	11	10	15	14	22	35	28	23	19	19	15	12	21	35	30	29	25	22	22
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	12	20	8	9	5	4	3	2	2	1	1	1	1	:	:	:	:	:	15	6	2	2	1	:	:	7	2	1	1	:	:
3	Thetis and Jones Islands	:	:	:	:	1	1	3	4	5	10	5	6	3	1	2	:	:	:	:	1	3	7	5	1	:	:	2	15	8	4	1
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	1	1	2	5	3	6	2	1	1	:	:	:	:	:	1	3	3	1	:	:	:	4	12	4	1
5	Midway Islands	:	:	:	:	:	:	:	:	1	2	1	3	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	1	2	3	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	1	1	1	4	1	1	1	:	:	:	:	:	:	1	2	1	:	:	:	1	2	6	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	4	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	1	:	3	1	:	1	:	:	:	:	:	:	:	1	1	:	:	:	:	1	10	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	2	1	:	1	:	:	:	:	:	:	:	1	1	:	:	:	:	1	4	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	1	1	:	:	:	:	:	2	3
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	1	:	1	1	:	1	:	:	:	:	:	:	1	:	:	:	:	:	2	5
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	6	2	:	:	:	:	:	1	6	:	:	:	:	:	3
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	3	5	6	:	:	:	:	1	2	7	:	:	:	:	1	3
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	6	:	:	:	:	:	1	1	:	:	:	:	:	1
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	8	:	:	:	:	:	1	2	:	:	:	:	:	1
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
24	Beaufort Spring Lead 6	17	13	9	7	5	3	3	1	2	1	1	:	1	1	:	:	:	:	17	7	3	1	1	:	:	7	2	1	:	:	:
25	Beaufort Spring Lead 7	12	17	7	7	5	4	3	1	2	1	1	1	1	1	:	:	:	:	22	7	3	1	1	:	:	7	2	1	1	:	:
26	Beaufort Spring Lead 8	3	4	16	8	13	7	5	3	4	3	2	1	2	1	1	1	:	:	7	11	5	3	2	1	:	6	4	2	2	:	1
27	Beaufort Spring Lead 9	2	4	14	10	12	9	6	3	4	3	3	1	2	1	1	1	:	:	7	15	6	3	2	1	:	8	4	3	2	1	1
28	Beaufort Spring Lead 10	:	:	2	2	8	7	19	9	11	7	6	3	4	2	3	1	1	:	:	6	16	7	5	3	1	1	10	6	5	2	2
29	Ice/Sea Segment 1	8	14	5	6	4	3	2	1	1	1	:	:	:	:	:	:	:	:	10	4	1	1	:	:	:	5	1	:	:	:	:
30	Ice/Sea Segment 2	3	4	6	12	7	10	4	3	3	2	2	1	1	:	:	:	:	:	5	9	4	2	1	:	:	9	3	2	1	:	:
31	Ice/Sea Segment 3	2	1	3	2	4	8	8	14	6	7	4	3	2	1	1	:	:	:	2	5	9	7	3	1	:	1	11	7	5	2	:
32	Ice/Sea Segment 4	1	:	1	:	1	1	4	4	8	14	9	8	6	2	2	:	:	:	1	1	6	18	12	2	:	:	2	11	12	5	1
33	Ice/Sea Segment 5	:	:	:	:	:	:	1	1	2	3	4	12	8	4	5	1	1	:	:	:	1	2	13	4	1	:	1	2	5	10	2
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	1	1	3	2	3	15	2	9	1	:	:	:	:	1	6	4	:	:	:	1	4	12
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	6	9	5	:	:	:	:	1	3	13	:	:	:	:	2	4
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	4	4	7	:	:	:	:	:	2	5	:	:	:	:	1	2
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	5	:	:	:	:	:	1	3	:	:	:	:	:	1
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	3	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
42	Barrow Subsistence Area 2	14	25	11	14	8	7	4	3	2	1	1	1	1	:	:	:	:	:	18	9	3	2	1	:	:	20	3	1	1	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	1	1	1	3	3	14	5	2	3	:	:	:	:	:	1	2	7	3	:	:	:	2	4	11	2
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	5	11	9	:	:	:	:	:	3	13	:	:	:	:	1	5

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-4 (continued) Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	3	2	1	1	1	:	1	:	1	:	:	:	:	:	:	:	:	:	2	1	1	1	:	:	:	1	:	:	:	:	:
49	Hanna's Shoal Polynya	8	4	5	3	3	1	1	:	:	:	:	:	:	:	:	:	:	:	6	2	1	1	:	:	:	2	1	:	:	:	:
50	Ice/Sea Segment 12	3	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
51	Ice/Sea Segment 13	4	3	2	2	1	:	1	:	:	:	:	:	:	:	:	:	:	:	4	1	1	:	:	:	:	2	:	:	:	:	:
52	Ice/Sea Segment 14	20	12	11	7	6	3	2	1	1	1	1	:	:	:	:	:	:	:	15	7	2	1	1	:	:	6	1	:	:	:	:
53	Ice/Sea Segment 15	9	12	29	54	39	52	17	14	11	9	8	5	5	3	3	1	1	:	16	75	17	10	8	3	:	25	19	9	7	3	2
54	Ice/Sea Segment 16a	4	3	9	8	17	29	65	46	45	31	22	14	13	6	6	2	2	:	5	18	72	36	19	7	2	5	50	32	22	10	3
55	Ice/Sea Segment 17	2	1	3	2	5	6	17	14	49	54	58	36	31	13	13	4	3	:	1	4	23	**	61	14	3	1	8	34	51	22	8
56	Ice/Sea Segment 18a	:	:	:	:	1	1	2	2	4	7	9	55	45	24	35	5	5	1	:	1	2	6	50	50	3	:	1	4	11	52	15
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	1	1	2	6	4	9	62	24	59	7	:	:	:	1	4	26	65	:	:	1	2	7	77
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	1	1	1	4	5	15	18	50	30	17	:	:	:	1	3	20	39	:	:	:	1	5	22
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	1	1	6	8	15	12	13	:	:	:	:	:	8	15	:	:	:	:	2	9
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	5	4	6	:	:	:	:	:	2	6	:	:	:	:	:	2
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	3	2	1	:	:	:	:	:	2	2	:	:	:	:	:	2
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	:	1	:	:	:	:	:	1
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	2	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
65	ERA 1	5	11	9	27	8	10	5	4	3	2	2	1	1	1	1	:	:	:	18	13	5	3	2	:	:	30	5	2	2	1	:
66	ERA 2	2	2	4	6	7	23	10	15	7	7	4	3	2	1	1	1	1	:	2	9	11	7	4	1	1	3	18	8	4	1	1
67	Ice/Sea Segment 16b	2	2	5	5	9	15	33	25	24	19	12	8	6	3	3	2	2	:	3	9	39	21	10	4	1	3	27	19	13	6	2
68	Harrison Bay	:	:	1	1	1	4	3	10	2	4	2	1	1	:	1	:	:	:	:	1	3	2	2	1	:	:	17	4	3	1	:
69	Harrison Bay/Colville Delta	:	:	1	1	2	3	4	10	5	7	3	3	2	1	1	:	:	:	1	2	5	6	3	1	:	:	5	10	5	2	:
70	ERA 3	1	:	2	1	3	4	10	12	18	27	11	9	7	3	3	1	1	:	:	3	19	25	11	4	1	1	7	34	16	8	2
71	Simpson Lagoon	:	:	:	:	1	1	2	3	4	7	4	5	3	1	1	:	:	:	:	1	3	5	5	1	:	:	2	14	10	4	1
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	4	1	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:
74	Cross Island ERA	:	:	:	:	:	:	1	1	2	4	3	25	6	3	4	1	1	:	:	:	1	3	9	4	1	:	1	2	6	23	3
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	1	1	1	7	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	:	2	9	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	1	1	1	6	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	:	2	13	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	12	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
79	ERA 4	:	:	:	:	:	:	:	:	1	2	2	15	3	2	6	:	1	:	:	:	:	1	4	3	1	:	:	1	3	17	3
80	Ice/Sea Segment 18b	:	:	:	:	:	:	1	1	3	4	5	29	23	11	16	1	2	:	:	:	1	3	26	23	1	:	1	3	7	28	7
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	1	1	2	5	2	20	2	:	:	:	:	:	3	6	:	:	:	:	2	6
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	1	1	3	6	8	18	19	:	:	:	:	1	4	22	:	:	:	:	2	8
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	1	3	3	8	10	25	17	10	:	:	:	:	2	10	21	:	:	:	1	4	12
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	15	:	:	:	:	:	2	4	:	:	:	:	:	2
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	6	:	:	:	:	:	1	2	:	:	:	:	:	1
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	:	:	1	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-5 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	35	49	35	49	34	46	34	48	31	40	27	40	28	30	36	37	47	64	40	39	34	35	32	33	45	55	49	46	44	44	42
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	17	29	13	14	9	8	5	4	3	2	2	1	2	2	1	1	1	:	21	11	5	3	2	1	1	10	4	2	1	1	1
3	Thetis and Jones Islands	:	:	1	1	2	3	6	8	9	17	10	10	7	3	4	1	1	:	:	3	7	13	11	4	1	1	6	24	15	7	1
4	Cottle & Return Islands, West Dock	:	:	:	:	1	1	2	2	4	8	5	10	4	2	2	:	1	:	:	1	2	6	6	2	:	:	1	5	21	5	1
5	Midway Islands	:	:	:	:	:	:	1	:	1	2	1	4	1	1	1	:	:	:	:	:	1	1	1	1	:	:	:	1	3	4	1
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	1	2	1	6	2	1	3	1	1	:	:	:	1	2	3	2	:	:	:	1	3	9	2
7	Endicott Causeway	:	:	:	:	:	:	:	:	1	1	1	3	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	2	7	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	1	1	4	1	1	2	:	:	:	:	:	:	1	1	1	:	:	:	:	1	16	1
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	3	1	1	2	:	1	:	:	:	:	:	1	1	:	:	:	:	1	5	2
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	2	1	1	2	:	1	:	:	:	:	:	1	1	:	:	:	:	:	2	6
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	:	1	:	:	:	:	:	:	1	1	:	:	:	:	2	7
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	1	:	:	:	:	:	1	2	:	:	:	:	:	1
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	1	1	2	4	4	10	4	:	:	:	:	1	2	9	:	:	:	:	2	5
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	1	1	1	1	1	3	3	5	7	10	:	:	:	:	1	2	9	:	:	:	:	1	3
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	9	:	:	:	:	:	1	2	:	:	:	:	:	1
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	1	:	1	1	3	3	13	:	:	:	:	:	2	3	:	:	:	:	1	1
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
24	Beaufort Spring Lead 6	19	15	10	8	6	5	4	2	3	2	2	1	2	2	1	1	1	:	18	9	4	2	2	2	1	8	3	1	1	1	1
25	Beaufort Spring Lead 7	13	20	9	9	6	5	4	2	3	2	3	1	2	2	1	1	1	:	24	9	4	2	2	2	1	9	2	2	1	1	1
26	Beaufort Spring Lead 8	4	6	17	10	14	8	6	4	5	4	4	2	3	3	2	3	1	:	8	12	6	5	3	2	2	7	5	5	2	1	2
27	Beaufort Spring Lead 9	4	6	15	13	14	11	7	5	5	4	4	2	3	3	2	2	1	:	8	16	7	5	3	2	2	12	5	5	3	1	2
28	Beaufort Spring Lead 10	1	1	3	4	10	9	21	12	13	9	8	5	6	4	4	3	2	:	1	8	17	9	6	4	3	3	15	8	8	4	4
29	Ice/Sea Segment 1	8	14	6	6	4	3	2	1	1	1	:	:	:	:	:	:	:	:	11	5	2	1	:	:	:	6	2	1	:	:	:
30	Ice/Sea Segment 2	3	5	7	12	8	11	5	3	3	2	2	1	1	:	:	:	:	:	6	10	5	3	2	:	:	9	3	2	2	:	:
31	Ice/Sea Segment 3	2	1	3	3	4	8	9	14	6	7	5	3	2	1	1	1	1	:	2	5	9	7	4	1	1	2	11	7	5	2	:
32	Ice/Sea Segment 4	1	:	1	1	2	2	4	4	9	15	11	8	7	3	2	1	1	:	1	1	6	19	13	3	1	1	2	11	13	5	1
33	Ice/Sea Segment 5	:	:	:	:	:	:	1	1	2	3	4	12	8	4	5	1	1	:	:	:	1	2	13	5	1	:	1	2	5	10	2
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	1	1	3	3	3	15	2	9	1	:	:	:	:	1	6	4	:	:	:	1	4	12
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	6	10	5	:	:	:	:	1	4	13	:	:	:	:	2	5
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	5	4	7	:	:	:	:	:	3	5	:	:	:	:	2	3
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	1	2	2	3	3	5	4	6	:	:	:	:	1	3	5	:	:	:	:	2	2
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	2	1	1	1	1	:	:	:	:	:	1	:	:	1	:	1	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
41	Barrow Subsistence Area 1	3	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
42	Barrow Subsistence Area 2	16	26	12	15	10	8	6	4	4	2	3	1	2	2	1	1	1	:	18	10	5	3	1	2	1	21	5	4	1	1	1
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	1	1	1	3	3	14	5	2	3	:	:	:	:	:	1	2	7	3	:	:	1	2	4	11	2
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	1	1	3	5	5	11	9	:	:	:	:	1	3	13	:	:	:	:	1	5

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-5 (continued) Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	6	4	4	2	2	1	1	1	2	1	1	1	1	1	:	:	:	:	5	2	1	1	1	:	:	2	:	2	1	1	:
49	Hanna's Shoal Polynya	13	9	9	6	5	4	3	2	2	1	2	1	2	1	1	:	:	:	11	6	3	2	2	1	:	5	2	1	1	1	1
50	Ice/Sea Segment 12	5	4	3	2	2	1	1	:	1	1	1	:	1	1	1	:	:	:	5	1	1	1	1	1	:	3	:	1	1	:	:
51	Ice/Sea Segment 13	6	4	4	3	2	1	1	1	1	1	1	:	1	1	1	1	1	:	5	2	1	1	1	1	1	4	1	1	1	:	:
52	Ice/Sea Segment 14	23	15	14	9	9	5	4	2	3	2	2	1	2	2	1	2	1	:	17	10	4	3	3	1	2	8	3	3	2	1	1
53	Ice/Sea Segment 15	10	14	30	57	41	55	21	17	15	12	12	7	8	6	6	5	4	1	16	76	21	13	11	5	3	30	23	14	9	4	5
54	Ice/Sea Segment 16a	5	5	11	11	19	31	66	51	49	38	28	20	18	10	10	5	4	1	6	19	75	42	26	11	4	7	55	39	27	15	6
55	Ice/Sea Segment 17	3	2	4	4	7	8	20	18	51	58	60	40	34	16	16	6	4	1	2	6	26	**	64	17	3	2	10	40	56	26	10
56	Ice/Sea Segment 18a	:	:	1	1	1	1	3	2	6	8	11	58	46	24	37	5	6	1	:	1	3	8	51	51	4	:	2	5	12	56	16
57	Ice/Sea Segment 19	:	:	:	:	1	:	1	:	1	2	2	8	5	11	63	26	63	8	:	:	:	2	4	27	65	:	1	1	2	11	79
58	Ice/Sea Segment 20a	2	1	2	:	1	:	1	:	2	1	3	6	8	19	22	53	35	21	1	1	1	2	5	23	43	1	:	1	2	9	28
59	Ice/Sea Segment 21	2	1	1	:	1	:	1	:	1	1	2	3	4	11	12	22	17	18	2	1	:	1	2	13	20	:	:	1	1	4	13
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	1	2	3	7	8	13	9	10	:	:	:	:	2	8	11	:	:	:	1	3	8
61	Ice/Sea Segment 22	:	:	:	:	:	:	1	:	1	1	2	3	4	7	7	9	7	4	:	:	1	1	2	6	7	:	:	1	1	4	8
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	1	1	2	2	4	4	5	5	3	:	:	:	1	1	4	5	:	:	:	1	3	5
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	3	2	2	1	1	:	1	:	:	:	:	:	:	1	:	1	1	:	2	1	1	:	:	1	1	1	:	:	:	:	:
65	ERA 1	6	14	11	32	10	12	7	5	4	3	3	2	2	2	2	1	1	:	19	15	7	4	2	1	1	36	8	3	2	1	1
66	ERA 2	2	2	6	8	9	28	15	23	12	14	9	7	6	4	4	3	2	:	3	12	16	13	8	4	3	5	26	14	9	4	4
67	Ice/Sea Segment 16b	3	3	6	7	11	18	37	31	29	25	17	13	10	5	6	3	3	1	3	11	43	27	16	6	3	5	33	27	20	10	4
68	Harrison Bay	:	:	1	1	1	5	4	13	4	5	3	3	2	1	2	:	1	:	:	2	4	4	3	2	1	:	24	5	4	3	1
69	Harrison Bay/Colville Delta	1	1	2	2	3	5	7	16	8	12	7	5	5	2	2	1	1	:	1	4	8	11	6	3	1	1	8	19	9	4	1
70	ERA 3	1	1	3	3	4	6	14	19	23	36	16	15	11	5	7	2	2	:	1	5	23	32	18	7	2	1	10	45	23	13	4
71	Simpson Lagoon	:	:	1	1	2	3	5	7	8	14	8	10	6	3	3	1	1	:	:	3	6	11	10	3	1	1	5	22	19	6	1
72	Gwyder Bay	:	:	:	:	:	:	:	1	1	2	1	2	1	:	:	:	:	:	:	:	1	1	1	:	:	:	:	1	7	1	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:
74	Cross Island ERA	:	:	:	1	:	1	2	1	3	6	5	31	8	4	7	1	1	:	:	:	2	5	11	5	1	:	1	3	8	31	5
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	1	2	1	9	1	1	2	:	1	:	:	:	:	1	2	1	:	:	:	1	3	14	2
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	1	1	1	8	1	1	2	:	:	:	:	:	:	1	2	1	:	:	:	:	3	23	2
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	1	1	4	:	:	1	:	:	:	:	:	:	1	1	:	:	:	:	:	2	18	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
79	ERA 4	:	:	:	:	:	:	1	1	1	2	2	18	4	2	8	1	1	:	:	:	1	2	5	4	1	:	1	1	4	22	4
80	Ice/Sea Segment 18b	:	:	:	1	1	1	2	2	4	6	7	34	25	12	18	2	3	:	:	:	2	5	28	24	1	:	1	4	9	33	8
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	1	1	2	7	3	28	3	:	:	:	:	1	4	8	:	:	:	:	3	8
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	1	1	3	2	5	9	12	28	26	:	:	:	1	2	6	32	:	:	:	1	4	11
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	1	1	2	4	4	9	12	28	22	14	:	:	:	1	3	11	25	:	:	:	1	7	16
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	6	6	25	:	:	:	:	1	4	7	:	:	:	:	1	3
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	4	4	9	:	:	:	:	1	3	5	:	:	:	:	1	2
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	1	1	4	4	5	5	4	:	:	:	:	1	3	4	:	:	:	:	1	4
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	1	2	3	3	5	4	3	:	:	:	:	1	3	5	:	:	:	:	2	4

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-6 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	45	59	48	60	48	59	49	63	48	57	48	60	51	56	60	65	71	83	50	53	49	53	53	57	70	66	63	61	61	64	67
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	20	33	15	17	12	10	7	5	6	4	5	3	4	3	3	2	2	:	24	13	7	5	3	3	1	14	6	3	3	2	2
3	Thetis and Jones Islands	1	1	2	1	4	4	8	10	12	22	14	14	11	5	5	2	1	:	1	4	9	17	16	6	1	1	8	29	20	9	3
4	Cottle & Return Islands, West Dock	:	:	:	:	1	1	2	3	5	9	7	12	6	2	3	1	1	:	:	1	3	7	9	2	1	:	1	6	25	8	2
5	Midway Islands	:	:	:	:	:	:	1	1	1	2	1	5	1	1	2	:	:	:	:	:	1	2	2	1	:	:	:	1	3	4	1
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	1	2	2	7	3	2	3	1	1	:	:	:	1	2	4	3	:	:	:	1	3	10	2
7	Endicott Causeway	:	:	:	:	:	:	:	:	1	1	1	3	:	:	1	:	:	:	:	:	:	1	1	:	:	:	:	1	2	8	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	1	1	5	1	1	3	1	1	:	:	:	:	1	1	1	1	:	:	:	1	18	2
9	Stockton Islands	:	:	:	:	:	:	:	:	:	1	1	3	1	1	3	:	1	:	:	:	:	:	1	1	1	:	:	:	1	5	3
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	2	1	1	2	:	1	:	:	:	:	:	1	1	:	:	:	:	:	2	7
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	1	1	:	:	:	:	:	1	2	1	:	:	:	:	2	9
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	1	5	1	:	:	:	:	:	1	2	:	:	:	:	:	2
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	1	1	1	3	5	5	12	5	:	:	:	:	1	4	10	:	:	:	:	2	6
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	1	1	1	1	2	2	5	5	7	9	12	:	:	:	:	1	5	12	:	:	:	1	2	5
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	2	11	:	:	:	:	:	2	2	:	:	:	:	1	2
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	5	5	16	:	:	:	:	:	3	5	:	:	:	:	1	2
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	2	2	1	1	1	:	1	:	1	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
24	Beaufort Spring Lead 6	19	17	10	9	7	5	4	3	3	2	3	2	2	2	1	2	1	:	19	9	4	3	3	2	1	8	3	2	2	1	1
25	Beaufort Spring Lead 7	14	22	10	10	7	6	5	3	4	3	3	2	2	2	1	2	1	:	25	10	5	3	2	2	1	9	3	2	2	1	1
26	Beaufort Spring Lead 8	5	6	17	11	14	9	6	4	5	4	4	2	3	3	2	3	1	:	8	12	7	5	3	2	2	8	5	5	3	1	2
27	Beaufort Spring Lead 9	4	7	16	14	15	12	8	5	6	5	5	3	3	3	2	2	2	:	9	17	8	5	3	3	2	14	6	6	4	2	2
28	Beaufort Spring Lead 10	1	1	4	4	11	11	22	14	15	11	10	6	8	5	4	3	2	:	1	9	19	12	8	5	3	3	16	10	10	5	4
29	Ice/Sea Segment 1	9	15	7	6	5	4	2	2	1	1	1	:	:	:	:	:	:	:	11	5	2	1	:	:	:	6	2	1	:	:	:
30	Ice/Sea Segment 2	3	5	7	12	8	11	5	4	4	3	3	1	2	1	1	1	1	:	6	10	5	3	2	1	1	9	3	3	2	1	1
31	Ice/Sea Segment 3	2	1	3	3	4	8	9	14	6	7	5	3	2	1	1	1	1	1	2	5	9	7	4	2	2	2	11	7	5	2	1
32	Ice/Sea Segment 4	1	:	1	1	2	2	4	4	9	15	11	8	7	3	3	1	1	1	1	1	6	19	13	3	1	1	2	11	13	6	2
33	Ice/Sea Segment 5	:	:	:	:	:	:	1	1	2	3	4	12	8	4	5	1	1	:	:	:	1	2	13	5	1	:	1	2	5	10	2
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	1	1	3	3	3	15	2	9	1	:	:	:	:	1	6	4	:	:	:	1	4	12
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	7	10	5	:	:	:	:	1	4	13	:	:	:	:	2	5
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	5	5	7	:	:	:	:	:	3	5	:	:	:	:	2	3
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	1	2	2	3	3	5	5	6	:	:	:	:	2	3	5	:	:	:	:	2	3
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	2	2	1	1	1	:	1	:	1	:	1	:	1	1	1	2	1	:	2	1	1	1	1	1	1	2	:	:	1	:	1
41	Barrow Subsistence Area 1	3	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
42	Barrow Subsistence Area 2	17	27	13	15	10	8	6	4	5	3	4	2	3	3	3	3	2	:	19	11	6	4	2	3	2	21	5	5	2	1	2
43	Nuiqsut Subsistence Area	:	:	:	1	:	:	1	1	1	3	3	14	5	2	3	:	:	:	:	:	1	2	7	3	:	:	1	2	5	12	2
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	1	1	3	5	5	11	9	:	:	:	:	1	3	13	:	:	:	:	1	5

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-6 (continued) Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	1	1	:	:	:	:	1	1	2	:	:	:	:	:	1
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	6	4	4	2	3	1	2	1	2	1	1	1	1	1	1	:	:	:	5	2	1	1	1	:	:	3	:	3	1	1	:
49	Hanna's Shoal Polynya	14	9	9	7	6	4	3	2	3	2	2	1	2	1	1	1	:	:	12	7	3	2	2	1	:	5	2	2	1	1	1
50	Ice/Sea Segment 12	6	4	3	2	2	1	1	1	2	1	2	1	1	1	1	1	:	:	5	2	1	1	1	1	1	4	:	1	1	:	1
51	Ice/Sea Segment 13	6	4	4	3	2	1	1	1	1	1	1	:	1	1	1	2	1	:	5	2	1	1	1	1	1	5	1	1	1	:	1
52	Ice/Sea Segment 14	24	16	14	10	10	6	5	3	4	3	3	2	3	3	2	3	1	:	18	10	5	3	4	1	2	9	4	4	2	1	2
53	Ice/Sea Segment 15	11	15	31	59	42	56	22	18	17	14	13	9	11	7	7	6	5	1	17	76	22	15	13	7	5	31	24	16	10	5	6
54	Ice/Sea Segment 16a	6	6	12	12	20	33	67	53	51	41	31	23	21	11	12	7	6	2	7	21	76	45	29	12	6	9	58	42	30	16	7
55	Ice/Sea Segment 17	3	2	4	4	8	8	21	21	52	60	61	43	35	17	18	6	5	1	3	6	27	**	65	18	4	3	11	42	58	28	11
56	Ice/Sea Segment 18a	:	:	1	1	1	2	3	2	6	9	11	59	46	25	38	6	6	1	1	1	3	8	52	51	4	1	2	5	13	58	17
57	Ice/Sea Segment 19	1	1	1	1	2	1	1	1	2	2	3	9	6	12	64	27	65	9	:	1	1	2	5	28	66	1	1	1	3	12	80
58	Ice/Sea Segment 20a	3	2	3	2	4	2	4	2	4	3	6	9	10	21	26	54	39	25	3	3	3	3	7	25	46	1	2	2	4	11	30
59	Ice/Sea Segment 21	2	1	2	1	2	1	2	2	3	2	3	5	7	13	15	25	21	22	2	2	2	2	4	16	23	:	1	2	2	6	16
60	Ice/Sea Segment 22	1	1	2	1	3	1	3	3	3	3	4	6	7	12	13	17	15	12	1	2	3	3	5	12	16	1	1	2	3	8	13
61	Ice/Sea Segment 22	1	1	2	1	2	2	3	2	4	4	5	7	7	11	11	12	11	5	1	2	3	4	5	9	11	1	2	4	4	8	12
62	Ice/Sea Segment 24a	1	1	1	1	1	1	2	1	3	3	4	5	6	7	6	7	8	5	1	1	2	3	4	6	7	:	2	3	3	6	6
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	3	2	2	1	1	:	1	:	:	:	1	:	:	1	:	2	1	:	2	1	1	:	:	1	1	1	:	:	:	:	1
65	ERA 1	7	15	13	35	12	14	8	7	6	5	5	3	4	4	4	3	2	:	20	17	9	6	4	3	1	37	9	4	3	2	3
66	ERA 2	3	3	7	9	10	30	18	27	15	17	12	10	9	7	6	5	4	1	4	13	19	17	11	7	4	5	29	18	13	6	6
67	Ice/Sea Segment 16b	3	4	7	9	12	20	39	35	32	29	21	16	13	7	8	5	4	1	4	13	46	31	19	8	4	7	36	31	23	12	5
68	Harrison Bay	:	:	1	1	2	5	5	15	4	6	3	4	3	2	3	2	1	1	:	2	6	5	4	3	2	:	28	7	5	4	2
69	Harrison Bay/Colville Delta	1	1	3	2	4	6	9	20	11	16	9	7	7	3	3	2	1	:	1	5	10	14	9	4	1	2	11	24	12	5	1
70	ERA 3	2	1	3	3	5	7	16	22	26	40	20	19	14	7	9	4	3	1	2	6	25	37	22	9	3	2	12	50	27	16	6
71	Simpson Lagoon	1	1	2	1	4	4	7	9	10	18	12	13	10	4	5	2	1	:	1	4	7	14	14	4	1	1	7	26	24	8	3
72	Gwyder Bay	:	:	:	:	:	:	1	1	1	2	1	3	1	:	1	:	:	:	:	:	1	2	2	1	:	:	:	1	8	2	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	1	:
74	Cross Island ERA	:	:	:	1	:	1	2	1	3	6	6	33	9	5	9	2	2	:	:	:	2	5	12	7	1	:	1	4	9	34	6
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	1	2	2	10	2	1	3	1	1	:	:	:	:	1	2	1	1	:	:	1	3	16	3
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	1	2	1	9	1	1	3	1	1	:	:	:	:	1	2	2	1	:	:	:	3	26	3
77	Foggy Island Bay	:	:	:	:	:	:	:	:	1	1	1	5	1	:	1	:	:	:	:	:	:	1	1	:	:	:	:	:	2	20	1
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2
79	ERA 4	:	:	:	:	:	1	1	1	2	3	3	20	5	3	9	1	2	:	:	:	1	2	6	5	1	:	1	2	4	24	5
80	Ice/Sea Segment 18b	:	:	:	1	1	1	2	2	4	7	7	36	25	12	20	2	3	:	:	:	2	6	29	25	1	:	2	4	10	35	9
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	1	1
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	2	1	3	9	5	31	4	:	:	:	:	1	6	10	:	:	:	:	3	11
83	Kaktovik ERA	:	:	:	:	:	:	:	:	1	1	2	4	4	9	13	18	35	31	:	:	:	1	3	11	40	:	:	1	1	5	17
84	Ice/Sea Segment 20b	1	:	1	:	1	1	2	1	2	2	3	6	5	10	15	30	27	18	:	1	2	2	4	13	29	:	1	1	2	9	19
85	ERA 6	:	:	:	:	:	:	:	:	:	:	1	2	2	6	7	11	11	31	:	:	:	:	1	7	13	:	:	:	:	2	7
86	ERA 7	:	:	1	:	1	:	1	:	1	1	2	2	3	5	6	9	8	12	:	1	1	1	2	5	10	:	:	:	1	2	6
87	ERA 8	1	1	1	1	2	1	1	1	1	1	2	3	3	7	7	8	9	7	1	1	1	1	2	6	8	1	1	:	1	3	9
88	Ice Sea Segment 24b	:	:	1	:	1	1	1	:	1	1	2	3	4	6	5	6	7	5	:	1	1	1	2	5	7	:	1	1	1	4	6

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-7 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
25	Barrow, Elson Lagoon	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	:	:	:	:	:	1
26	Dease Inlet	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
27	Kurgorak Bay	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Cape Simpson	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	3	:	3	1	1	:
29	Ikpikpuk River, Smith Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	1	:	5	2	2	1	1	1
30	Drew Point, McLeod Point,	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	4	:	1	1	:	1
31	Lonely, Pitt Point, Pogik Bay	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	5	1	1	1	:	1
32	Cape Halkett,	:	:	:	:	:	2	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	3	4	1	2	9	4	4	2	1	2
33	Atigaru Point, Kogru River	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	15	13	7	5	31	24	16	10	5	6
34	Fish Creek	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	45	29	12	6	9	58	42	30	16	7
35	Colville River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	**	65	18	4	3	11	42	58	28	11
36	Oliktok Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	8	52	51	4	1	2	5	13	58	17
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	5	28	66	1	1	1	3	12	80
38	Kuparuk River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	7	25	46	1	2	2	4	11	30
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	2	4	16	23	:	1	2	2	6	16
40	Foggy Island Bay, Kadleroshilik River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	5	12	16	1	1	2	3	8	13
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	4	5	9	11	1	2	4	4	8	12
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	4	6	7	:	2	3	3	6	6
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	1	1	:	:	:	:	1
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	6	4	3	1	37	9	4	3	2	3
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	17	11	7	4	5	29	18	13	6	6
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	31	19	8	4	7	36	31	23	12	5
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	5	4	3	2	:	28	7	5	4	2
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	14	9	4	1	2	11	24	12	5	1
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	37	22	9	3	2	12	50	27	16	6

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-8 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
25	Barrow, Elson Lagoon	3	4	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:
26	Dease Inlet	1	5	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
27	Kurgorak Bay	1	2	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
28	Cape Simpson	:	3	1	3	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	7	:	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	7	:	:	:	:	:
30	Drew Point, McLeod Point,	:	1	1	4	1	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	3	:	:	:	:	:
31	Lonely, Pitt Point, Pogik Bay	:	:	1	2	2	5	1	1	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	1	1	:	:	:	:
32	Cape Halkett,	:	:	:	1	1	4	1	4	:	1	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	6	1	:	:	:
33	Atigaru Point, Kogru River	:	:	:	:	:	1	1	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	1	:	:	:
34	Fish Creek	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	:	:	:	:
35	Colville River	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	2	:	:	:
36	Oliktok Point	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	8	1	:	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	:	2	:	1	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	2	3	1	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	6
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	:
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	:	:	:	:	:	:	4	:	:	:	:	:	:
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	:	:	1	:	:	:	:	:	:
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-9 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
24	Walakpa Bay, Walakpa River	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
25	Barrow, Elson Lagoon	6	7	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	5	1	:	:	:	:	:	2	:	:	:	:	:
26	Dease Inlet	4	7	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	5	2	:	:	:	:	:	3	:	:	:	:	:
27	Kurgorak Bay	2	4	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
28	Cape Simpson	1	4	2	5	1	2	1	1	:	:	:	:	:	:	:	:	:	:	2	3	1	:	:	:	:	9	1	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	1	1	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	8	:	:	:	:	:
30	Drew Point, McLeod Point,	1	1	2	5	2	2	1	1	:	:	:	:	:	:	:	:	:	:	2	3	1	:	:	:	:	4	1	:	:	:	:
31	Lonely, Pitt Point, Pogik Bay	1	1	2	3	3	6	2	2	1	1	1	:	:	:	:	:	:	:	1	3	2	1	:	:	:	1	2	1	:	:	:
32	Cape Halkett	:	:	1	1	2	5	2	6	1	2	1	1	1	:	:	:	:	:	:	2	4	2	1	:	:	:	8	3	1	1	:
33	Atigaru Point, Kogru River	:	:	:	:	1	1	1	5	1	1	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	7	1	1	:	:
34	Fish Creek	:	:	:	:	:	1	1	3	1	1	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	2	1	1	:	:
35	Colville River	:	:	:	:	:	1	1	2	1	2	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	1	3	1	:	:
36	Oliktok Point	:	:	:	:	:	:	1	1	1	2	1	1	1	:	:	:	:	:	:	:	1	2	1	:	:	:	:	9	1	1	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	1	3	1	2	1	:	:	:	:	:	:	:	:	1	1	:	:	:	:	2	5	1	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	4	1	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	1	4	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	6
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	:	:	:	1
44	Collinson Point, Konganevik Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	1
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	1	:	:	:	:	:	1	2	:	:	:	:	:	1
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	4	4	:	:	:	:	:	1	6	:	:	:	:	:	2
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	4	:	:	:	:	:	1	2	:	:	:	:	:	1
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	1
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	5	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4	:	:	:	:	:	:	1	:	:	:	:	:	:
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-10 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
22	Skull Cliff	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Walakpa Bay, Walakpa River	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:
25	Barrow, Elson Lagoon	9	9	4	4	3	2	1	1	1	1	1	:	:	:	:	:	:	:	7	3	1	1	:	:	:	2	1	:	:	:	:
26	Dease Inlet	4	8	3	3	2	2	1	1	1	1	:	:	:	:	:	:	:	:	7	2	1	1	:	:	:	3	1	:	:	:	:
27	Kurgorak Bay	2	4	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	2	:	:	:	:	:
28	Cape Simpson	2	4	2	6	2	3	1	1	1	1	:	:	:	:	:	:	:	:	3	3	1	1	:	:	:	12	2	:	:	:	:
29	Ikpikpuk River, Smith Bay	1	1	1	3	1	1	1	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	9	1	:	:	:	:
30	Drew Point, McLeod Point,	1	1	2	6	2	3	2	1	1	1	1	:	:	:	:	:	:	:	2	3	2	1	1	:	:	4	1	1	1	:	:
31	Lonely, Pitt Point, Pogik Bay	1	1	3	4	4	8	3	3	2	2	1	1	1	:	:	:	:	:	1	4	3	2	1	:	:	2	3	2	1	:	1
32	Cape Halkett	:	:	1	1	2	6	3	7	2	3	2	1	1	:	1	:	:	:	:	2	4	3	2	1	:	:	9	4	2	1	:
33	Atigaru Point, Kogru River	:	:	:	1	1	2	1	4	1	2	1	1	:	:	:	:	:	:	:	1	1	1	1	:	:	:	8	2	1	:	:
34	Fish Creek	:	:	:	:	1	1	2	4	2	2	1	1	1	:	:	:	:	:	:	1	2	1	1	:	:	:	2	2	1	1	:
35	Colville River	:	:	:	:	1	1	1	3	1	2	1	1	1	:	:	:	:	:	:	1	1	2	1	:	:	:	1	4	1	1	:
36	Oliktok Point	:	:	:	:	:	1	1	2	1	3	1	1	1	:	:	:	:	:	:	1	2	2	2	:	:	:	1	9	2	1	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	1	1	3	1	3	1	1	1	:	:	:	:	:	1	2	2	:	:	:	:	3	6	2	1
38	Kuparuk River	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	4	1	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	1	5	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	5	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	2	7
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	3	:	:	:	:	:	:	1	1	:	:	:	:	1	1
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	1
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	1	:	:	:	:	:	1	2	:	:	:	:	:	1
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	3	5	4	:	:	:	:	1	1	7	:	:	:	:	1	2
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	4	:	:	:	:	:	1	2	:	:	:	:	1	1
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	4	:	:	:	:	:	1	1	:	:	:	:	:	1
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	6	:	:	:	:	:	1	1	:	:	:	:	:	1
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	5	:	:	:	:	:	1	2	:	:	:	:	:	1
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	:	:	:	:	:	:	1	:	:	:	:	:	:
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	1	:	:	:	:	:	:
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	1	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-11 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
19	Wainwright, Wainwright Inlet	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
22	Skull Cliff	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
24	Walakpa Bay, Walakpa River	3	3	1	1	1	1	1	:	1	:	:	:	:	:	:	:	:	:	2	1	:	:	1	:	1	1	:	:	:	:	:
25	Barrow, Elson Lagoon	13	14	7	6	5	4	3	2	2	1	2	1	2	1	1	1	:	:	11	6	3	2	1	1	:	5	2	1	1	1	1
26	Dease Inlet	6	11	5	5	3	2	1	1	1	1	1	:	:	:	:	:	:	:	9	3	1	1	1	1	:	4	1	1	1	:	:
27	Kurgorak Bay	3	5	2	3	2	1	1	1	1	:	:	:	:	:	:	:	:	:	4	2	1	:	:	:	:	2	1	:	:	:	:
28	Cape Simpson	2	6	4	11	3	4	2	2	1	1	1	:	1	:	:	:	:	:	4	5	2	1	1	:	:	21	3	1	:	:	:
29	Ikpikpuk River, Smith Bay	1	2	2	4	2	2	1	1	1	1	:	:	:	:	:	:	:	:	1	2	1	1	1	:	:	11	1	:	:	:	:
30	Drew Point, McLeod Point,	1	2	3	7	3	4	3	2	2	1	1	1	1	:	1	:	:	:	2	3	2	1	1	1	:	5	2	2	1	:	1
31	Lonely, Pitt Point, Pogik Bay	2	2	5	6	6	13	6	6	4	5	4	3	3	2	2	1	1	:	2	7	4	5	4	2	1	2	6	4	3	1	2
32	Cape Halkett	:	:	2	1	3	8	5	11	4	6	3	3	3	1	2	1	1	:	1	3	6	5	4	2	1	1	14	7	4	4	1
33	Atigaru Point, Kogru River	:	:	1	1	1	2	2	5	2	2	1	1	1	:	1	:	:	:	:	1	2	2	1	1	:	:	9	2	1	1	:
34	Fish Creek	:	:	1	1	1	1	2	5	2	2	1	1	1	1	:	:	:	:	:	1	2	2	1	1	:	:	3	2	2	1	:
35	Colville River	:	:	1	1	1	1	2	5	3	5	2	2	2	1	1	:	:	:	:	1	2	4	2	1	:	:	1	7	3	1	:
36	Oliktok Point	:	:	1	:	1	1	2	3	3	4	2	2	2	1	1	:	:	:	:	1	3	4	3	1	:	:	3	11	3	2	:
37	Milne Point, Simpson Lagoon	:	:	:	:	1	1	1	2	2	5	3	5	2	1	1	:	:	:	:	:	2	4	4	1	:	:	2	4	13	2	1
38	Kuparuk River	:	:	:	:	:	:	:	:	:	1	1	2	1	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	5	1	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	1	1	1	4	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	2	10	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	1	1	2	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	7	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	2	1	1	2	:	1	:	:	:	:	:	1	1	1	:	:	:	:	2	8
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	2	1	5	1	:	:	:	:	:	1	2	:	:	:	:	1	2
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	5	1	:	:	:	:	:	1	4	:	:	:	:	1	2
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	1	1	1	2	3	4	7	6	:	:	:	:	1	2	9	:	:	:	1	1	3
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	2	7	:	:	:	:	:	1	3	:	:	:	:	1	2
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	6	:	:	:	:	:	1	1	:	:	:	:	:	1
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	9	:	:	:	:	:	1	2	:	:	:	:	:	1
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	8	:	:	:	:	:	1	3	:	:	:	:	1	1
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	2	8	:	:	:	:	:	1	3	:	:	:	:	:	1
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	2	5	:	:	:	:	:	1	2	:	:	:	:	:	1
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	:	:	:	:	:	1	1	:	:	:	:	:	1
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	3	:	:	:	:	:	1	2	:	:	:	:	:	2
56	Ptarmigan Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:	1	:	:	:	:	:	1
57	Roland & Phillips Bay, Kay Point	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	1	1	1	:	:	:	:	:	:	1	:	:	:	:	1	:
60	Trent and Shoalwater Bays	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:
63	Outer Shallow Bay, Olivier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	:	1	:	:	:	:	:	1
64	Middle Channel, Gary Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
65	Kendall Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	:
66	North Point, Pullen Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-12 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
19	Wainwright, Wainwright Inlet	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
21	Peard Bay, Point Franklin	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Skull Cliff	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
24	Walakpa Bay, Walakpa River	3	3	2	1	1	1	1	:	1	1	1	1	1	1	1	1	:	:	3	1	1	1	1	1	1	1	:	:	1	:	1
25	Barrow, Elson Lagoon	15	17	9	8	7	5	4	3	3	2	3	2	3	2	2	2	1	:	13	8	4	3	3	2	1	7	3	1	2	2	1
26	Dease Inlet	7	12	5	5	4	3	2	1	1	1	1	1	1	1	1	1	1	:	10	4	2	1	1	1	:	5	2	1	1	:	:
27	Kurgorak Bay	3	6	3	4	2	2	1	1	1	:	1	:	1	1	:	:	:	:	4	3	1	1	:	1	:	3	1	1	:	:	:
28	Cape Simpson	3	7	5	13	5	5	3	2	2	2	2	1	1	1	1	:	1	:	5	6	3	2	1	1	:	23	3	1	1	:	1
29	Ikpikpuk River, Smith Bay	1	2	2	4	2	3	2	1	1	1	1	:	1	1	1	:	1	:	2	2	1	1	1	:	1	13	2	:	1	:	1
30	Drew Point, McLeod Point,	2	2	4	8	4	5	4	3	3	2	2	1	2	1	2	1	1	:	3	4	4	2	2	1	:	6	2	2	1	1	1
31	Lonely, Pitt Point, Pogik Bay	3	3	6	7	8	15	7	8	6	7	6	5	5	5	4	3	3	:	3	8	6	7	6	4	3	2	7	7	5	3	4
32	Cape Halkett	1	1	2	2	3	9	7	14	6	8	5	5	4	3	3	2	2	1	1	4	8	7	6	4	3	1	16	10	7	5	2
33	Atigaru Point, Kogru River	:	:	1	1	1	2	2	6	2	2	1	2	1	1	1	1	:	:	:	1	2	2	1	1	:	:	10	2	1	1	1
34	Fish Creek	:	:	1	1	1	2	3	7	3	3	2	1	1	1	1	1	:	:	:	2	3	3	2	1	1	1	4	3	2	1	:
35	Colville River	:	1	1	1	1	2	3	6	3	6	4	3	3	1	1	:	:	:	1	2	3	5	3	2	:	:	3	9	5	2	:
36	Oliktok Point	:	:	1	1	1	2	3	4	4	6	3	3	3	1	1	:	:	:	:	2	4	5	4	1	:	1	3	13	4	2	1
37	Milne Point, Simpson Lagoon	:	:	:	:	1	1	2	2	3	7	4	7	4	2	2	1	:	:	:	1	2	4	6	1	:	:	2	4	15	4	1
38	Kuparuk River	:	:	:	:	:	:	:	:	1	1	1	3	1	:	:	:	:	:	:	:	:	1	2	1	:	:	:	1	6	2	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	1	1	2	1	4	1	:	1	:	:	:	:	:	:	1	1	:	:	:	:	1	2	12	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	1	1	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	8	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	3	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	2	1	1	2	1	1	:	:	:	:	:	1	1	1	:	:	:	:	2	9
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	2	6	1	:	:	:	:	:	2	3	:	:	:	:	1	2
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	6	1	:	:	:	:	:	1	4	:	:	:	:	1	2
47	Kaktovik	:	:	:	:	:	:	:	:	1	1	1	2	2	4	5	6	10	8	:	:	:	1	2	4	11	:	:	:	1	2	5
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	3	3	8	:	:	:	:	:	2	4	:	:	:	:	1	3
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	1	7	:	:	:	:	:	1	2	:	:	:	:	:	2
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	11	:	:	:	:	:	2	3	:	:	:	:	:	2
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	4	4	10	:	:	:	:	:	2	4	:	:	:	:	1	2
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	4	4	11	:	:	:	:	1	2	5	:	:	:	:	1	2
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	1	1	1	2	3	4	3	7	:	:	:	:	1	2	4	:	:	:	1	1	3
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	2	:	:	:	:	:	1	2	:	:	:	:	1	1
55	Herschel Island	:	:	:	:	:	:	1	1	1	1	1	1	1	2	3	4	3	4	:	1	1	1	1	3	3	:	1	1	:	1	3
56	Ptarmigan Bay	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	1	1	1	:	:	:	:	1	1	1	:	:	:	:	1	1
57	Roland & Phillips Bay, Kay Point	:	:	:	:	:	:	:	:	:	:	:	2	1	1	1	2	1	1	:	:	:	:	1	1	1	:	:	:	:	3	1
58	Sabine Point	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1
59	Shingle Point	1	:	1	:	1	:	1	1	1	1	1	1	1	1	1	1	1	:	:	1	1	1	1	1	1	:	:	1	1	:	:
60	Trent and Shoalwater Bays	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
62	Shallow Bay, West Channel	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
63	Outer Shallow Bay, Olivier Islands	:	:	1	:	1	:	:	:	:	:	:	:	1	1	1	1	2	1	:	:	:	:	:	1	1	:	:	:	:	:	2
64	Middle Channel, Gary Island	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	2	2	:	:	:	:	:	1	2	:	:	:	:	1	2
65	Kendall Island	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	2	1	:	:	:	:	:	1	1	:	:	:	:	:	1
66	North Point, Pullen Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	:	:	:	:	:	1	1	:	:	:	:	1	2

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-13 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-14 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-15 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
22	Beaufort Sea	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Beaufort Sea	1	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
24	Beaufort Sea	1	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
25	Beaufort Sea	1	1	2	1	2	1	1	1	1	:	:	:	:	:	:	:	:	:	1	2	1	:	:	:	:	1	1	:	:	:	:
26	Beaufort Sea	1	:	1	:	2	1	1	1	1	1	1	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	1	:	:	:	:
27	Beaufort Sea	:	:	1	:	1	1	1	:	1	:	1	:	:	:	:	:	:	:	1	1	:	1	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-16 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
18	Chukchi Sea	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Sea	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Sea	2	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
21	Chukchi Sea	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	1	1	1	1	1	1	1	:	1	:	:	:	:	:	:	:	:	:	1	1	1	:	1	:	:	:	1	:	:	:	:
23	Beaufort Sea	3	2	2	2	2	2	1	1	1	1	1	:	1	:	:	:	:	:	2	2	1	1	1	:	:	1	1	1	:	:	:
24	Beaufort Sea	3	2	2	1	2	1	1	1	1	:	:	:	1	:	:	:	:	:	3	1	1	:	1	:	:	1	1	:	:	:	:
25	Beaufort Sea	3	2	3	2	3	2	3	2	2	1	1	1	1	1	1	1	:	:	2	3	2	1	1	2	1	2	2	1	1	1	:
26	Beaufort Sea	1	1	3	1	3	2	3	2	3	2	3	2	3	2	1	1	1	:	2	2	3	3	3	2	1	1	1	1	2	1	1
27	Beaufort Sea	1	1	2	1	3	2	3	2	3	2	3	2	2	2	1	1	:	:	2	2	2	2	2	2	:	1	1	2	2	1	1
28	Beaufort Sea	1	:	1	:	1	1	1	1	1	1	2	1	1	1	1	1	:	:	1	1	1	1	1	:	1	:	1	:	:	:	1
29	Beaufort Sea	:	:	:	:	:	:	1	:	:	:	1	:	1	1	:	1	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-17 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
18	Chukchi Sea	4	3	3	2	2	2	1	:	1	:	1	:	:	:	:	:	:	:	3	2	1	1	:	:	:	1	1	:	:	:	:
19	Chukchi Sea	5	3	3	2	2	1	1	1	1	:	1	:	1	1	:	:	:	:	4	2	1	:	1	:	:	2	1	:	:	:	:
20	Chukchi Sea	5	3	3	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	4	3	1	:	:	:	:	2	:	:	:	:	:
21	Chukchi Sea	2	2	1	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	2	1	1	1	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	2	1	2	1	2	1	1	:	1	:	1	1	:	:	:	:	:	:	1	1	1	:	1	:	:	1	1	:	1	1	:
23	Beaufort Sea	3	2	3	2	3	2	2	1	1	1	1	1	1	1	1	:	:	:	3	2	2	1	1	1	:	2	2	1	1	1	:
24	Beaufort Sea	3	2	3	2	2	2	2	1	2	1	1	1	1	:	1	:	:	:	3	2	2	1	1	1	:	2	2	1	1	1	:
25	Beaufort Sea	3	2	4	3	4	3	4	3	3	2	3	2	3	2	2	1	1	:	3	4	4	2	2	3	1	2	3	2	2	2	1
26	Beaufort Sea	2	2	3	2	4	3	5	3	5	4	5	3	5	4	4	3	3	1	3	4	5	5	4	4	3	2	3	3	3	2	3
27	Beaufort Sea	2	2	4	3	6	4	7	5	7	6	8	5	7	6	5	3	2	1	2	4	6	7	6	6	1	2	6	5	5	4	4
28	Beaufort Sea	3	2	3	2	4	4	4	2	4	3	5	3	4	4	3	3	3	2	3	4	4	4	4	3	3	2	3	1	2	1	2
29	Beaufort Sea	2	1	2	1	2	1	2	2	2	2	2	2	3	3	2	3	2	1	2	1	2	2	3	3	2	1	1	1	2	1	1
30	Beaufort Sea	:	:	:	:	:	:	1	:	1	1	1	1	1	:	1	1	1	:	:	:	1	1	1	1	:	:	:	1	1	1	1
31	Beaufort Sea	:	:	:	:	:	:	1	1	1	1	1	1	1	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	1	:	:
34	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
35	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	:	1	1	1	1	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:
36	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	:	1	1	:	:	:	:	1	1
37	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	:	1	2	1	2	2	1	:	:	:	:	1	1	2	:	:	:	1	:	1
38	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	1	:	:	:	:	:	1	2	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-18 Annual Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
17	Chukchi Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:
18	Chukchi Sea	4	3	3	2	2	2	1	1	1	1	1	:	:	:	:	:	:	:	3	2	1	1	:	:	:	2	1	:	:	:	:
19	Chukchi Sea	5	3	3	2	2	2	1	1	1	1	1	1	1	1	:	:	:	:	5	2	1	1	1	:	:	2	1	1	:	:	:
20	Chukchi Sea	5	3	3	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	4	3	1	:	:	:	:	2	1	:	:	:	:
21	Chukchi Sea	2	2	1	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	2	1	1	1	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	3	2	2	1	2	1	1	:	1	:	1	1	:	:	:	:	:	:	2	1	1	:	1	:	:	1	1	:	1	1	:
23	Beaufort Sea	3	2	3	2	3	2	2	1	1	1	1	1	1	1	1	:	:	:	3	2	2	1	1	1	:	2	2	1	1	1	:
24	Beaufort Sea	3	2	3	2	2	2	2	1	2	1	1	1	1	:	1	:	:	:	3	2	2	1	1	1	:	2	2	1	1	1	:
25	Beaufort Sea	4	3	4	3	4	3	4	3	3	2	3	2	3	3	2	1	1	:	3	4	4	2	2	3	1	2	3	2	2	2	1
26	Beaufort Sea	2	2	4	3	5	4	6	4	6	4	5	4	5	5	4	4	3	1	3	4	6	5	5	4	3	2	4	3	3	3	4
27	Beaufort Sea	2	2	4	4	6	5	8	7	8	7	9	6	8	7	6	3	2	1	3	5	8	8	7	7	2	3	8	7	7	5	4
28	Beaufort Sea	3	2	4	3	5	5	5	3	5	4	5	4	5	5	3	3	3	2	3	4	5	5	4	3	4	2	3	2	3	3	3
29	Beaufort Sea	2	1	2	1	2	1	2	2	2	2	2	2	3	3	3	3	2	1	2	1	2	2	3	3	2	1	2	1	2	2	2
30	Beaufort Sea	1	:	:	:	1	:	1	:	1	1	1	1	1	1	1	1	1	:	:	:	1	2	1	1	:	:	:	1	1	1	1
31	Beaufort Sea	:	:	:	:	:	:	1	1	1	1	1	1	1	:	:	:	:	:	:	1	1	1	1	1	:	:	:	1	1	:	:
33	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
34	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
35	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	1	:	:	:	:	:	:	1	1	1	:	:	:	:	1	:
36	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	2	2	2	2	2	:	:	:	:	1	1	2	2	:	:	:	1	1	2
37	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	2	3	2	3	3	1	:	:	:	:	1	2	2	:	:	:	1	1	2
38	Beaufort Sea	:	:	1	:	1	:	:	:	:	:	1	1	1	2	1	2	1	1	:	1	:	:	:	1	2	:	1	:	:	1	2

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

A2-19 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	1	13	2	13	2	13	:	9	:	3	:	6	:	:	2	:	8	15	2	2	1	1	:	:	3	29	18	13	11	16	13
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	1	15	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	3	:	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	:	1	1	7	:	1	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	19	3	1	:
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	:	:	3	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	15	1	:
5	Midway Islands	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	14	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	2	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	3
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	9
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	2	:	:	:	:	:	:	2	:	:	:	:	:	:
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	5	:	:	:	:	:	:	2	:	:	:	:	:	:
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Spring Lead 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
26	Beaufort Spring Lead 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
27	Beaufort Spring Lead 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Beaufort Spring Lead 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29	Ice/Sea Segment 1	8	26	2	6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	15	1	:	:	:	:	:	7	:	:	:	:	:
30	Ice/Sea Segment 2	1	3	7	23	7	17	1	1	:	:	:	:	:	:	:	:	:	:	4	13	1	:	:	:	:	16	1	:	:	:	:
31	Ice/Sea Segment 3	:	:	:	1	2	12	7	25	1	3	:	:	:	:	:	:	:	:	:	4	9	2	:	:	:	:	19	6	:	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	2	3	9	24	7	7	1	:	:	:	:	:	:	:	8	35	15	:	:	:	:	16	20	1	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	2	3	21	9	1	5	:	:	:	:	:	:	1	25	4	:	:	:	:	4	18	1
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	2	2	2	28	1	17	:	:	:	:	:	1	6	1	:	:	:	:	4	23
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4	14	6	:	:	:	:	:	1	22	:	:	:	:	:	2
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	7	:	:	:	:	:	:	1	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	15	64	3	16	:	1	:	:	:	:	:	:	:	:	:	:	:	:	30	3	:	:	:	:	:	44	:	:	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	1	1	32	3	:	1	:	:	:	:	:	:	:	8	1	:	:	:	:	3	22	:
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	16	20	:	:	:	:	:	1	24	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-19 (continued) Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Ice/Sea Segment 14	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
53	Ice/Sea Segment 15	1	3	16	41	25	35	3	1	:	:	:	:	:	:	:	:	:	:	6	74	3	:	:	:	:	14	5	:	:	:	:
54	Ice/Sea Segment 16a	:	:	:	:	3	15	51	21	21	3	:	:	:	:	:	:	:	:	:	7	62	5	:	:	:	:	37	3	:	:	:
55	Ice/Sea Segment 17	:	:	:	:	:	:	2	1	35	34	41	10	4	:	:	:	:	:	:	:	9	**	40	:	:	:	:	18	29	1	:
56	Ice/Sea Segment 18a	:	:	:	:	:	:	:	:	:	1	3	41	40	13	12	:	:	:	:	:	:	:	45	41	:	:	:	:	3	39	1
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	:	:	1	1	4	55	15	46	1	:	:	:	:	:	20	58	:	:	:	:	1	72
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	31	6	2	:	:	:	:	:	2	11	:	:	:	:	:	2
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	2	12	5	38	1	1	:	:	:	:	:	:	:	:	:	:	:	:	28	7	:	:	:	:	:	54	:	:	:	:	:
66	ERA 2	:	:	1	2	3	36	3	9	:	:	:	:	:	:	:	:	:	:	:	9	4	:	:	:	:	:	17	:	:	:	:
67	Ice/Sea Segment 16b	:	:	:	:	3	15	51	21	21	3	:	:	:	:	:	:	:	:	:	7	62	5	:	:	:	:	37	3	:	:	:
68	Harrison Bay	:	:	:	:	:	3	:	11	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	29	:	:	:	:
69	Harrison Bay/Colville Delta	:	:	:	:	:	:	:	8	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	6	:	:	:
70	ERA 3	:	:	:	:	:	:	7	8	15	27	:	:	:	:	:	:	:	:	:	:	24	18	1	:	:	:	:	48	2	:	:
71	Simpson Lagoon	:	:	:	:	:	:	:	1	:	4	:	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	20	5	1	:
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	:	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:
74	Cross Island ERA	:	:	:	:	:	:	:	:	:	2	1	44	4	:	1	:	:	:	:	:	:	:	9	1	:	:	:	:	4	32	:
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	11	:
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	16	:
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	20	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
79	ERA 4	:	:	:	:	:	:	:	:	:	:	:	25	2	:	5	:	:	:	:	:	:	:	2	3	:	:	:	:	:	26	2
80	Ice/Sea Segment 18b	:	:	:	:	:	:	:	:	:	1	3	41	40	13	12	:	:	:	:	:	:	:	45	41	:	:	:	:	3	39	1
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	32	:	:	:	:	:	:	1	3	:	:	:	:	:	4
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	22	29	:	:	:	:	:	1	30	:	:	:	:	:	:
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	31	6	2	:	:	:	:	:	2	11	:	:	:	:	:	2
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	13	:	:	:	:	:	:	:	:	:	:	:	:	:
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-20 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
	Land	17	43	14	41	12	35	9	33	4	17	3	17	3	1	10	4	24	43	25	20	11	9	5	6	18	56	41	29	23	27	20
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	13	32	5	9	1	2	:	:	:	:	:	:	:	:	:	:	:	:	17	4	:	:	:	:	:	10	:	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	2	4	5	16	3	5	1	:	1	:	:	:	:	:	4	11	2	1	:	:	1	26	9	3	1
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	1	2	7	2	8	1	:	1	:	:	:	:	:	1	4	3	:	:	:	:	5	19	5	1
5	Midway Islands	:	:	:	:	:	:	:	:	:	3	1	4	1	:	1	:	:	:	:	:	:	2	2	1	:	:	:	1	6	3	1
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	2	1	7	1	:	1	:	:	:	:	:	:	1	3	1	:	:	:	2	4	7	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	1	:	2	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	5	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	1	:	6	1	:	2	:	:	:	:	:	:	:	1	1	:	:	:	:	2	15	1
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	4	:	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1	7	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	3	:	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	:	3	4
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	2	1	:	2	:	1	:	:	:	:	:	:	1	:	:	:	:	:	3	9
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	3	:	:	:	:	:	:	:	:	:	:	:	:	1	2
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	3	:	:	:	:	:	:	:	1	:	:	:	:	:	1
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	11	4	:	:	:	:	:	2	9	:	:	:	:	:	3
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	7	10	:	:	:	:	:	1	10	:	:	:	:	:	2
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	10	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	12	:	:	:	:	:	:	1	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Spring Lead 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
26	Beaufort Spring Lead 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
27	Beaufort Spring Lead 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Beaufort Spring Lead 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29	Ice/Sea Segment 1	15	30	8	10	3	3	1	1	:	:	:	:	:	:	:	:	:	:	22	5	:	:	:	:	:	10	:	:	:	:	:
30	Ice/Sea Segment 2	4	8	13	27	14	21	5	4	2	1	:	:	:	:	:	:	:	:	9	22	5	:	:	:	:	19	3	1	:	:	:
31	Ice/Sea Segment 3	1	1	3	3	5	16	15	29	8	10	3	1	1	:	:	:	:	:	2	8	16	9	2	:	:	2	24	12	5	:	:
32	Ice/Sea Segment 4	:	:	:	:	1	1	6	6	16	29	14	12	5	1	1	:	:	:	:	1	12	38	20	1	:	:	3	20	27	7	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	1	5	7	26	14	4	9	1	1	:	:	:	:	3	29	6	1	:	:	1	9	23	3
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	6	4	5	32	2	20	1	:	:	:	:	2	11	5	:	:	:	1	8	25
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	3	5	10	20	9	:	:	:	:	:	4	28	:	:	:	:	1	8
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	4	13	:	:	:	:	:	:	5	:	:	:	:	:	1
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:	:	:	:	1	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	32	69	16	30	7	8	1	1	:	:	:	:	:	:	:	:	:	:	44	12	1	:	:	:	:	51	2	:	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	1	5	4	37	8	2	4	:	:	:	:	:	:	3	15	3	:	:	:	3	8	28	2
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	2	5	6	26	23	:	:	:	:	:	3	31	:	:	:	:	:	7

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-20 (continued) Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Ice/Sea Segment 14	7	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:
53	Ice/Sea Segment 15	6	10	29	51	38	45	10	7	2	1	:	:	:	:	:	:	:	:	16	78	10	1	:	:	:	23	13	2	:	:	:
54	Ice/Sea Segment 16a	1	1	4	4	11	24	60	39	34	16	6	2	1	:	:	:	:	:	1	13	72	22	4	:	:	1	49	19	7	1	:
55	Ice/Sea Segment 17	:	:	:	:	1	1	8	7	44	47	50	24	13	1	2	:	:	:	:	:	14	**	51	2	:	:	3	29	47	11	:
56	Ice/Sea Segment 18a	:	:	:	:	:	:	:	:	1	6	8	55	46	18	22	1	1	:	:	:	:	3	50	44	:	:	:	2	11	54	6
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	:	:	5	4	9	63	19	56	2	:	:	:	:	2	25	60	:	:	:	1	5	78
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	1	1	7	10	45	24	8	:	:	:	:	:	9	32	:	:	:	:	1	15
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	3	7	:	:	:	:	:	:	4	:	:	:	:	:	1
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	7	21	14	49	7	9	1	1	:	:	:	:	:	:	:	:	:	:	35	17	1	:	:	:	:	57	3	:	:	:	:
66	ERA 2	1	2	5	8	9	43	10	19	3	3	1	:	:	:	:	:	:	:	2	16	11	3	1	:	:	3	27	4	1	:	:
67	Ice/Sea Segment 16b	1	1	4	4	11	24	60	39	34	16	6	2	1	:	:	:	:	:	1	13	72	22	4	:	:	1	49	19	7	1	:
68	Harrison Bay	:	:	:	1	1	7	3	19	1	2	:	:	:	:	:	:	:	:	:	3	4	1	:	:	:	:	35	3	1	:	:
69	Harrison Bay/Colville Delta	:	:	:	:	:	2	4	17	2	8	1	1	:	:	:	:	:	:	:	1	6	5	1	:	:	:	8	14	3	1	:
70	ERA 3	:	:	:	:	1	2	15	19	28	43	7	5	1	:	:	:	:	:	:	2	32	40	6	:	:	:	8	58	17	2	:
71	Simpson Lagoon	:	:	:	:	:	:	1	4	3	12	2	5	1	:	1	:	:	:	:	:	3	5	2	1	:	:	:	27	12	3	1
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	2	:	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	2	4	1	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:
74	Cross Island ERA	:	:	:	:	:	:	:	:	1	6	4	50	9	2	4	:	:	:	:	:	:	3	18	4	:	:	:	4	11	40	2
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	2	1	9	1	:	1	:	:	:	:	:	:	2	:	:	:	:	:	:	4	13	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	1	:	8	1	:	2	:	:	:	:	:	:	1	:	:	:	:	:	:	3	17	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	4	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	21	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	2	1
79	ERA 4	:	:	:	:	:	:	:	:	:	2	2	32	6	2	9	:	1	:	:	:	:	1	8	5	:	:	:	1	4	34	4
80	Ice/Sea Segment 18b	:	:	:	:	:	:	:	:	1	6	8	55	46	18	22	1	1	:	:	:	:	3	50	44	:	:	:	2	11	54	6
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	1
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	1	:	2	9	2	40	2	:	:	:	:	:	6	8	:	:	:	:	1	10
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	:	:	2	5	8	35	32	:	:	:	:	:	3	40	:	:	:	:	:	8
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	1	1	7	10	45	24	8	:	:	:	:	:	9	32	:	:	:	:	1	15
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	21	:	:	:	:	:	:	:	:	:	:	:	:	:
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-21 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	47	66	41	66	39	60	37	55	27	41	19	34	13	9	23	19	42	68	53	49	41	34	21	16	39	73	59	50	39	38	37
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	28	42	15	16	9	7	3	2	1	1	1	:	:	:	:	:	:	:	31	11	4	1	:	:	:	17	3	1	:	:	:
3	Thetis and Jones Islands	1	:	:	:	1	1	5	7	12	23	13	13	7	2	3	:	:	:	1	1	7	18	12	1	:	1	2	30	17	9	2
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	1	2	5	10	7	13	6	2	3	1	1	:	:	:	2	7	8	2	:	:	:	7	22	9	3
5	Midway Islands	:	:	:	:	:	:	1	1	1	4	2	6	2	1	2	:	1	:	:	:	1	2	2	2	1	:	:	3	6	6	1
6	Cross and No Name Islands	:	:	:	:	:	:	:	1	1	4	2	9	3	1	3	:	:	:	:	:	1	1	5	2	:	:	:	3	5	11	1
7	Endicott Causeway	:	:	:	:	:	:	:	:	1	1	1	3	1	:	1	:	:	:	:	:	:	1	1	:	:	:	:	1	4	6	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	1	1	7	2	1	3	:	1	:	:	:	:	1	2	1	1	:	:	1	2	16	1
9	Stockton Islands	:	:	:	:	:	:	:	:	:	1	1	5	1	1	3	:	1	:	:	:	:	:	3	:	1	:	:	1	2	7	2
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	4	1	:	2	:	1	:	:	:	:	:	2	1	1	:	:	:	1	4	4
12	Flaxman Island	:	:	:	:	:	:	:	:	:	1	:	3	1	1	3	:	1	:	:	:	:	:	1	1	1	:	:	1	1	3	10
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	2	1	5	1	:	:	:	:	1	1	2	:	:	:	:	1	3
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	3	:	:	:	:	:	:	1	1	:	:	:	:	:	1
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	1	:	2	5	5	15	5	:	:	:	:	:	4	14	:	:	:	:	1	8
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	1	1	2	5	8	12	13	:	:	:	:	:	3	17	:	:	:	:	1	6
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	13	:	:	:	:	:	1	1	:	:	:	:	:	2
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	3	16	:	:	:	:	:	:	3	:	:	:	:	:	1
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Spring Lead 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
26	Beaufort Spring Lead 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
27	Beaufort Spring Lead 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Beaufort Spring Lead 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29	Ice/Sea Segment 1	21	32	14	15	10	7	4	3	2	1	1	:	:	:	:	:	:	:	26	11	3	2	:	:	:	13	3	1	1	:	:
30	Ice/Sea Segment 2	7	11	17	29	20	24	12	8	7	4	3	1	1	:	:	:	:	:	13	25	11	5	2	:	:	21	6	4	2	:	:
31	Ice/Sea Segment 3	3	3	7	6	11	20	22	33	16	18	10	6	5	1	1	:	:	:	5	13	24	18	8	1	:	4	27	20	12	3	1
32	Ice/Sea Segment 4	2	:	2	1	3	3	10	10	22	35	23	21	17	5	5	:	:	:	1	2	16	44	31	4	:	:	6	26	32	14	3
33	Ice/Sea Segment 5	:	:	:	:	1	1	2	2	5	8	11	30	19	9	13	2	2	:	:	1	2	6	32	10	2	:	2	5	13	26	6
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	1	2	2	9	7	8	34	4	23	2	:	:	:	1	5	14	8	:	:	1	2	10	26
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	2	3	8	10	16	25	11	:	:	:	:	1	10	32	:	:	:	:	4	12
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	1	1	5	5	10	10	18	:	:	:	:	:	5	14	:	:	:	:	1	7
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	3	12	:	:	:	:	:	:	6	:	:	:	:	:	2
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	47	74	32	42	22	19	9	7	4	3	2	:	:	:	:	:	:	:	55	27	9	3	:	:	:	58	9	2	1	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	1	1	2	4	9	8	40	13	6	8	1	1	:	:	:	2	6	19	8	1	:	1	6	13	32	4
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	2	1	6	12	14	33	26	:	:	:	:	:	8	39	:	:	:	:	2	16

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-21 (continued) Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Co:ce:tratio: Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Poly:ya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segme:t 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segme:t 11	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
49	Ha::a's Shoal Poly:ya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segme:t 12	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segme:t 13	4	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	2	:	:	:	:	:
52	Ice/Sea Segme:t 14	16	8	7	3	3	1	:	:	:	:	:	:	:	:	:	:	:	:	10	2	:	:	:	:	:	3	:	:	:	:	:
53	Ice/Sea Segme:t 15	12	15	36	53	46	48	17	12	9	6	4	2	1	:	:	:	:	:	23	79	15	7	3	:	:	25	16	7	4	1	:
54	Ice/Sea Segme:t 16a	4	3	11	8	20	30	66	48	47	33	20	12	8	2	2	:	:	:	6	19	78	39	16	3	:	4	52	35	19	7	1
55	Ice/Sea Segme:t 17	1	:	2	1	4	4	15	14	51	55	57	35	28	7	7	:	1	:	:	3	21	**	62	7	:	1	8	38	56	19	3
56	Ice/Sea Segme:t 18a	:	:	:	:	:	1	2	2	6	11	13	59	49	22	27	3	3	:	:	:	2	7	55	45	2	:	1	7	18	58	9
57	Ice/Sea Segme:t 19	:	:	:	:	:	:	:	:	1	2	2	9	7	13	66	21	59	4	:	:	:	1	5	28	62	:	:	1	3	10	79
58	Ice/Sea Segme:t 20a	:	:	:	:	:	:	:	:	:	1	1	4	4	17	21	54	36	13	:	:	:	:	3	21	42	:	:	1	1	6	27
59	Ice/Sea Segme:t 21	:	:	:	:	:	:	:	:	:	:	:	1	1	5	6	15	12	15	:	:	:	:	:	6	16	:	:	:	:	2	8
60	Ice/Sea Segme:t 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	2	6	:	:	:	:	:	:	3	:	:	:	:	:	1
61	Ice/Sea Segme:t 22	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	:	1	1	:	:	:	:	:	:
62	Ice/Sea Segme:t 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	4	3	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	2	:	:	:	:	:
65	ERA 1	12	24	21	53	16	17	7	6	2	2	1	:	:	:	:	:	:	:	37	25	6	2	:	:	:	58	9	2	:	:	:
66	ERA 2	4	5	9	11	15	46	18	24	9	8	5	2	2	:	:	:	:	:	7	21	21	9	4	:	:	6	32	8	4	:	:
67	Ice/Sea Segme:t 16b	4	3	11	8	20	30	66	48	47	33	20	11	8	2	2	:	:	:	6	19	78	39	16	3	:	4	52	35	19	7	1
68	Harriso: Bay	1	1	2	2	3	10	8	23	5	6	3	2	1	:	:	:	:	:	1	4	9	4	3	:	:	1	38	7	4	1	:
69	Harriso: Bay/Colville Delta	1	1	2	2	3	5	10	22	9	16	5	5	3	1	1	:	:	:	1	4	11	14	5	1	:	1	11	21	9	4	1
70	ERA 3	1	:	3	1	6	6	22	26	38	53	21	15	10	2	2	:	:	:	1	5	37	49	20	2	:	:	13	64	29	9	1
71	Simpso: Lagoo:	:	:	:	:	:	1	4	6	9	17	9	12	7	2	3	:	1	:	:	1	6	13	10	2	:	:	2	31	17	7	3
72	Gwyder Bay	:	:	:	:	:	:	:	:	1	2	1	4	1	1	1	:	:	:	:	:	:	1	2	1	:	:	:	2	4	2	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	1	:
74	Cross Isla:d ERA	:	:	:	:	:	1	1	2	4	10	8	53	14	6	8	1	1	:	:	:	2	6	21	9	1	:	1	7	15	43	4
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	1	1	2	2	11	2	:	2	:	1	:	:	:	:	3	2	1	1	:	:	1	5	16	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	1	1	2	1	10	1	1	3	:	1	:	:	:	:	2	2	1	1	:	:	1	5	19	1
77	Foggy Isla:d Bay	:	:	:	:	:	:	:	:	1	1	1	5	1	:	1	:	:	:	:	:	:	1	:	1	:	:	:	1	3	22	:
78	Mikkelse: Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	2	1
79	ERA 4	:	:	:	:	:	:	:	1	1	4	4	34	9	4	11	1	2	:	:	:	:	3	12	7	1	:	:	3	7	36	5
80	Ice/Sea Segme:t 18b	:	:	:	:	:	1	2	2	6	11	13	59	49	22	27	3	3	:	:	:	2	7	55	45	2	:	1	7	18	58	9
81	Simpso: Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	2
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	3	2	5	14	4	42	3	:	:	:	:	1	10	12	:	:	:	:	4	15
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	2	1	7	13	18	42	34	:	:	:	:	:	9	48	:	:	:	:	2	19
84	Ice/Sea Segme:t 20b	:	:	:	:	:	:	:	:	:	1	1	4	4	17	21	54	36	13	:	:	:	:	3	21	42	:	:	1	1	6	27
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	3	29	:	:	:	:	:	:	5	:	:	:	:	:	1
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	11	:	:	:	:	:	:	3	:	:	:	:	:	1
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segme:t 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-22 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	55	72	53	72	50	68	47	63	41	53	32	47	29	27	40	38	55	78	62	59	50	48	37	32	54	77	64	61	52	49	51
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	30	44	18	18	11	9	5	4	3	2	1	1	:	:	:	:	:	:	33	13	6	3	:	:	:	17	4	2	1	:	:
3	Thetis and Jones Islands	1	:	1	1	2	2	6	8	14	24	15	15	11	3	4	1	1	:	1	3	9	20	15	3	1	1	4	31	19	12	3
4	Cottle & Return Islands, West Dock	:	:	:	:	1	1	2	3	6	11	9	14	8	3	4	1	1	:	:	1	3	8	11	3	1	:	1	8	24	10	3
5	Midway Islands	:	:	:	:	:	:	1	1	2	5	2	7	3	1	2	:	1	:	:	:	1	3	3	2	1	:	:	3	6	7	1
6	Cross and No Name Islands	:	:	:	:	:	:	1	1	2	4	2	10	4	2	3	:	1	:	:	:	2	2	5	3	:	:	:	3	5	11	1
7	Endicott Causeway	:	:	:	:	:	:	:	:	1	2	1	3	1	:	1	:	:	:	:	:	:	2	1	:	:	:	:	1	4	7	:
8	McClure Islands	:	:	:	:	:	:	:	1	1	2	1	8	3	1	3	:	1	:	:	:	:	1	2	1	1	:	:	1	2	18	1
9	Stockton Islands	:	:	:	:	:	:	:	1	:	1	1	6	2	1	3	:	1	:	:	:	:	1	3	1	1	:	:	1	2	9	2
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	1	1	4	1	1	3	:	1	:	:	:	:	:	3	2	1	:	:	:	1	5	4
12	Flaxman Island	:	:	:	:	:	:	:	:	:	1	:	3	2	2	3	:	1	:	:	:	:	:	1	3	1	:	:	1	1	5	10
13	Barrier Islands	:	:	:	:	:	:	:	:	:	1	:	2	1	1	2	1	5	1	:	:	:	:	1	1	2	:	:	:	:	1	3
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	1	1	:	:	:	:	:	1
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	1	1	3	6	6	16	5	:	:	:	:	1	5	15	:	:	:	:	1	9
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	1	2	6	8	10	13	13	:	:	:	:	1	6	18	:	:	:	:	1	9
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	5	4	13	:	:	:	:	:	4	3	:	:	:	:	1	4
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	1	1	2	3	5	6	17	:	:	:	:	:	3	7	:	:	:	:	1	3
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Spring Lead 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
26	Beaufort Spring Lead 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
27	Beaufort Spring Lead 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Beaufort Spring Lead 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29	Ice/Sea Segment 1	22	33	17	16	12	9	5	4	3	2	2	1	:	:	:	:	:	:	27	13	4	3	1	:	:	13	4	2	1	:	:
30	Ice/Sea Segment 2	9	12	20	30	22	26	15	9	10	7	7	3	4	1	1	:	:	:	15	29	13	8	6	:	:	22	7	6	5	2	:
31	Ice/Sea Segment 3	5	5	10	8	13	21	24	35	19	20	13	8	7	3	3	2	2	:	7	15	26	21	11	4	1	5	28	21	15	6	1
32	Ice/Sea Segment 4	4	1	4	2	4	4	12	12	24	36	25	23	20	7	7	1	1	:	3	3	17	45	33	7	1	2	7	27	33	17	4
33	Ice/Sea Segment 5	:	:	1	1	1	1	3	3	7	10	13	31	21	10	14	2	3	:	:	1	3	8	35	12	2	1	3	7	15	27	7
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	1	1	2	2	10	8	9	36	4	23	2	:	:	:	1	5	15	9	:	:	2	3	12	27
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	1	1	4	4	11	13	17	26	11	:	:	:	:	3	12	33	:	:	1	1	6	14
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	3	3	10	10	15	14	19	:	:	:	:	:	10	17	:	:	1	1	4	9
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	1	2	5	5	12	11	16	:	:	:	:	1	5	13	:	:	:	:	2	5
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	2	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	49	75	36	44	25	21	13	9	7	5	3	2	1	:	:	:	:	:	57	29	12	7	1	:	:	58	10	4	3	:	:
43	Nuiqsut Subsistence Area	:	:	1	1	1	1	2	3	5	10	9	41	14	7	9	1	1	:	:	1	3	7	20	9	1	1	2	8	14	32	5
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	1	:	3	3	11	16	17	34	26	:	:	:	:	2	11	39	:	:	1	1	4	18

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-22 (continued) Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	2	2	2	1	2	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
49	Hanna's Shoal Polynya	3	1	3	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	3	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	6	4	3	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	5	1	:	:	:	:	:	3	:	:	:	:	:
52	Ice/Sea Segment 14	18	9	10	5	6	2	1	:	1	:	1	:	:	:	:	:	:	:	11	4	1	1	1	:	:	5	1	:	:	:	:
53	Ice/Sea Segment 15	15	16	39	53	48	48	20	13	13	9	9	4	5	1	1	:	:	:	24	80	16	10	7	1	:	26	17	9	8	3	:
54	Ice/Sea Segment 16a	8	6	15	11	23	31	67	49	49	36	23	14	10	4	4	2	2	:	10	21	78	42	19	6	1	8	53	38	23	9	2
55	Ice/Sea Segment 17	4	1	4	3	6	6	17	16	53	57	60	37	32	10	8	1	1	:	2	5	24	**	64	9	1	2	11	40	57	21	3
56	Ice/Sea Segment 18a	:	:	1	:	1	1	4	4	8	12	15	59	50	23	27	3	4	:	:	:	3	9	57	46	2	:	2	8	19	58	9
57	Ice/Sea Segment 19	:	:	:	:	:	:	1	1	2	3	3	11	8	15	67	22	59	4	:	:	:	2	7	29	63	:	1	2	5	12	79
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	1	2	3	8	8	22	27	57	38	14	:	:	:	1	6	26	43	:	:	1	4	10	31
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	3	3	11	14	24	21	18	:	:	:	:	1	15	24	:	:	:	1	4	16
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	1	1	4	3	9	7	11	:	:	:	:	1	2	10	:	:	:	:	:	4
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	1	1	2	3	5	4	1	:	:	:	:	:	3	4	:	:	:	:	1	3
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	3	1	:	:	:	:	:	:	1	3	:	:	:	:	:	3
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	5	3	3	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	2	:	:	:	:	:
65	ERA 1	13	24	23	54	17	17	8	7	3	2	2	1	1	:	:	:	:	:	37	26	7	3	:	:	:	58	9	3	1	:	:
66	ERA 2	5	5	10	12	16	46	20	25	11	9	7	3	3	2	1	:	:	:	7	22	22	10	5	1	:	7	32	10	6	1	:
67	Ice/Sea Segment 16b	7	6	14	10	22	31	67	49	49	35	22	14	10	4	4	2	2	:	8	21	78	42	18	6	1	7	53	37	22	9	2
68	Harrison Bay	1	1	2	3	3	10	8	24	6	7	4	3	2	1	1	:	:	:	1	4	10	5	5	1	:	1	39	8	5	1	:
69	Harrison Bay/Colville Delta	2	2	4	3	5	8	13	24	14	18	10	7	7	3	3	1	1	:	3	6	14	17	8	5	1	2	13	22	12	7	1
70	ERA 3	3	1	6	3	8	7	23	27	40	54	23	17	13	3	3	:	:	:	1	7	39	51	21	4	1	1	14	64	30	12	1
71	Simpson Lagoon	:	:	1	1	2	2	5	7	11	19	12	15	11	4	4	1	1	:	:	2	7	15	14	3	1	1	3	32	19	10	3
72	Gwyder Bay	:	:	:	:	:	:	:	1	1	3	2	4	2	1	1	:	:	:	:	:	:	2	2	1	:	:	:	3	5	2	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	2	1	:
74	Cross Island ERA	:	:	1	1	1	1	2	3	5	11	9	54	16	7	9	1	1	:	:	1	3	7	23	10	1	1	2	8	16	44	5
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	1	2	4	2	12	3	1	3	:	1	:	:	:	:	4	3	2	1	:	:	2	6	17	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	1	1	2	3	2	11	3	1	3	:	1	:	:	:	:	3	3	2	1	:	:	1	6	21	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	1	2	1	6	1	:	1	:	:	:	:	:	:	2	1	1	:	:	:	1	4	23	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	2	1
79	ERA 4	:	:	:	:	:	:	1	1	2	5	5	35	10	4	12	1	2	:	:	:	:	4	13	8	1	:	:	4	8	37	5
80	Ice/Sea Segment 18b	:	:	1	:	1	1	4	4	8	12	15	59	50	23	27	3	3	:	:	:	3	9	57	46	2	:	2	8	19	58	9
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	:	:	:	2
82	ERA 5	:	:	:	:	:	:	:	:	:	1	:	4	3	6	15	5	43	3	:	:	:	:	1	11	12	:	:	1	1	6	15
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	1	:	3	3	11	17	20	43	35	:	:	:	:	2	12	48	:	:	1	1	4	21
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	1	2	3	7	7	21	26	56	38	14	:	:	:	1	6	25	43	:	:	1	4	9	31
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	8	9	31	:	:	:	:	:	3	12	:	:	:	:	1	5
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	4	4	14	:	:	:	:	:	1	6	:	:	:	:	:	2
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	3	1	:	:	:	:	:	:	1	3	:	:	:	:	:	3

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-23 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	57	73	56	74	53	69	49	64	43	57	37	54	38	38	50	48	65	84	63	61	51	50	45	42	66	78	65	63	58	58	59
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	30	44	18	18	12	9	5	4	3	2	1	1	:	:	:	:	:	:	33	14	6	3	:	:	:	17	4	2	1	:	:
3	Thetis and Jones Islands	1	1	2	1	3	3	7	8	15	25	17	16	12	4	5	1	2	:	1	4	9	21	18	4	1	1	4	32	21	12	3
4	Cottle & Return Islands, West Dock	:	:	1	:	1	1	2	3	7	13	10	15	9	3	4	1	1	:	:	2	4	10	13	3	1	:	1	9	26	10	3
5	Midway Islands	:	:	:	:	:	:	1	1	2	5	2	7	3	1	2	:	1	:	:	:	1	3	3	2	1	:	:	3	6	7	1
6	Cross and No Name Islands	:	:	:	:	:	:	1	1	2	4	2	10	4	2	3	:	1	:	:	:	2	2	5	3	:	:	:	3	5	11	1
7	Endicott Causeway	:	:	:	:	:	:	:	1	2	2	2	4	1	:	1	:	:	:	:	:	:	2	2	:	:	:	:	1	6	7	:
8	McClure Islands	:	:	:	:	:	:	:	1	1	2	1	8	3	1	3	:	1	:	:	:	:	1	2	1	1	:	:	1	2	18	1
9	Stockton Islands	:	:	:	:	:	:	:	1	:	1	1	6	2	1	3	:	1	:	:	:	:	1	3	1	1	:	:	1	2	9	2
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	1	1	4	2	1	3	:	1	:	:	:	:	:	3	2	1	:	:	:	1	5	4
12	Flaxman Island	:	:	:	:	:	:	:	:	:	1	:	4	2	2	3	:	1	:	:	:	:	:	1	4	1	:	:	1	1	5	10
13	Barrier Islands	:	:	:	:	:	:	:	:	:	1	:	2	1	1	2	1	5	1	:	:	:	:	1	1	2	:	:	:	:	1	3
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	1	1	:	:	:	:	:	1
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	1	1	3	6	6	16	5	:	:	:	:	1	5	15	:	:	:	:	1	9
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	1	1	2	7	8	11	13	13	:	:	:	:	1	6	18	:	:	:	:	2	9
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	5	4	13	:	:	:	:	:	4	4	:	:	:	:	1	4
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	2	1	3	4	6	7	17	:	:	:	:	1	5	8	:	:	:	:	3	4
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Spring Lead 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
26	Beaufort Spring Lead 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
27	Beaufort Spring Lead 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Beaufort Spring Lead 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29	Ice/Sea Segment 1	23	33	18	16	12	9	5	4	3	2	2	1	:	:	:	:	:	:	28	13	4	3	1	:	:	13	4	2	1	:	:
30	Ice/Sea Segment 2	9	12	20	30	23	26	15	9	11	7	7	4	4	1	1	:	:	:	15	29	13	8	6	1	:	22	7	7	6	2	:
31	Ice/Sea Segment 3	6	5	10	8	14	22	25	35	19	21	14	9	8	4	4	2	2	:	7	16	26	21	12	4	1	5	28	22	15	6	2
32	Ice/Sea Segment 4	5	2	5	2	5	5	12	12	25	37	28	25	21	8	7	2	2	1	3	4	18	46	36	7	2	2	7	28	36	18	4
33	Ice/Sea Segment 5	:	:	1	1	1	2	3	3	7	10	13	31	21	10	15	2	3	:	:	1	3	8	35	12	2	1	3	7	15	28	7
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	1	1	2	2	10	8	9	36	5	23	2	:	:	:	1	5	15	9	:	1	2	3	12	27
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	1	1	5	5	11	13	18	26	11	:	:	:	:	3	13	33	:	:	1	1	6	14
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	1	:	4	4	12	12	18	16	19	:	:	:	:	1	12	18	:	:	1	1	6	11
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	1	1	3	4	9	9	15	14	18	:	:	:	:	2	9	16	:	:	:	1	5	8
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	3	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	49	75	37	44	26	21	13	9	8	5	4	2	1	:	:	:	:	:	57	30	12	7	2	:	:	58	10	4	4	1	:
43	Nuiqsut Subsistence Area	:	:	1	1	1	1	2	3	5	10	9	41	14	7	9	1	1	:	:	1	3	7	20	9	1	1	2	8	14	32	5
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	1	:	3	3	11	16	17	34	26	:	:	:	:	2	11	39	:	:	1	1	4	18

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-23 (continued) Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	2	2	3	1	2	:	1	:	:	:	1	:	:	:	:	:	:	:	3	1	:	:	1	:	:	1	:	:	:	:	:
49	Hanna's Shoal Polynya	5	3	5	2	3	1	2	1	3	1	2	1	1	:	:	:	:	:	4	3	2	2	2	:	:	1	:	1	1	1	:
50	Ice/Sea Segment 12	3	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
51	Ice/Sea Segment 13	6	4	3	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	6	1	:	:	:	:	:	3	:	:	:	:	:
52	Ice/Sea Segment 14	18	9	11	5	6	2	1	1	1	1	2	1	2	:	:	:	:	:	12	4	1	1	2	:	:	5	1	1	:	2	:
53	Ice/Sea Segment 15	16	16	39	53	49	48	20	13	14	10	10	6	7	2	2	:	:	:	24	80	16	11	9	2	:	26	18	9	9	4	:
54	Ice/Sea Segment 16a	9	7	16	11	24	32	68	49	50	37	26	17	13	7	6	3	3	1	10	23	79	43	24	9	2	8	53	39	24	10	4
55	Ice/Sea Segment 17	4	2	5	3	7	7	18	17	54	57	62	38	34	13	10	4	3	1	2	5	24	**	65	12	2	3	12	40	57	22	5
56	Ice/Sea Segment 18a	:	:	1	1	1	2	4	4	8	12	15	59	51	24	28	4	4	:	:	:	3	9	57	47	3	:	3	8	19	58	10
57	Ice/Sea Segment 19	:	:	:	:	:	:	1	1	2	3	4	12	9	17	68	26	59	6	:	:	:	2	8	31	63	:	1	2	5	13	79
58	Ice/Sea Segment 20a	1	:	1	:	1	:	1	1	2	3	6	11	13	29	32	61	40	14	1	1	1	3	10	31	44	:	:	2	6	12	36
59	Ice/Sea Segment 21	:	:	1	:	1	:	1	1	1	2	2	7	8	18	21	32	26	19	:	1	1	1	4	24	28	:	:	1	2	9	24
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	1	1	3	3	5	11	9	17	14	15	:	:	:	1	3	8	18	:	:	:	1	4	12
61	Ice/Sea Segment 22	:	:	1	:	1	1	1	:	2	1	4	3	4	6	6	11	7	3	:	1	1	1	3	5	10	:	:	1	2	4	9
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	1	2	4	4	7	3	1	:	:	:	:	1	3	5	:	:	:	:	2	6
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	5	3	3	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	2	:	:	:	:	:
65	ERA 1	13	24	23	54	18	18	8	7	3	2	2	1	1	:	:	:	:	:	37	26	7	3	1	:	:	58	9	3	1	1	:
66	ERA 2	5	5	10	12	16	46	20	25	11	9	7	4	4	2	1	:	:	:	7	22	22	10	6	1	:	7	33	10	6	2	:
67	Ice/Sea Segment 16b	8	6	15	10	23	31	67	49	49	36	24	15	11	4	4	2	2	:	8	22	79	42	20	6	1	7	53	38	23	9	2
68	Harrison Bay	1	1	2	3	3	10	9	24	6	7	4	3	2	1	1	:	:	:	1	4	10	5	5	1	:	1	39	8	5	1	:
69	Harrison Bay/Colville Delta	2	2	4	4	6	9	14	24	14	18	11	8	8	4	3	2	2	:	3	7	15	18	9	5	1	2	14	23	13	8	2
70	ERA 3	3	1	6	3	8	8	23	27	40	54	25	17	13	4	4	:	1	:	1	7	39	52	23	4	1	1	15	64	31	12	1
71	Simpson Lagoon	:	:	2	1	3	2	6	7	11	19	14	15	12	4	5	1	2	:	:	4	8	16	15	4	2	1	3	32	20	11	4
72	Gwyder Bay	:	:	:	:	:	:	:	1	1	3	2	4	2	1	1	:	:	:	:	:	1	2	3	1	:	:	:	3	5	2	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	1	1	1	2	1	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	2	1	:
74	Cross Island ERA	:	:	1	1	1	1	2	3	5	11	9	54	16	7	9	1	1	:	:	1	3	7	23	10	1	1	2	8	17	44	5
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	1	2	4	2	13	3	1	3	:	1	:	:	:	:	4	3	2	1	:	:	2	7	18	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	1	1	2	4	2	12	3	1	3	:	1	:	:	:	:	3	3	2	1	:	:	1	6	21	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	1	2	1	6	1	:	1	:	:	:	:	:	:	2	1	1	:	:	:	1	4	23	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	2	1
79	ERA 4	:	:	:	:	:	:	1	1	2	5	5	35	10	4	12	1	2	:	:	:	:	4	13	8	1	:	:	4	8	37	5
80	Ice/Sea Segment 18b	:	:	1	1	1	1	4	4	8	12	15	59	50	23	27	3	3	:	:	:	3	9	57	46	2	:	3	8	19	58	9
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	:	:	:	2
82	ERA 5	:	:	:	:	:	:	:	:	:	1	:	4	3	6	15	5	43	3	:	:	:	:	1	11	12	:	:	1	1	6	15
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	1	:	3	3	12	17	20	43	35	:	:	:	:	2	12	48	:	:	1	1	5	21
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	1	2	3	8	8	22	27	57	38	14	:	:	:	1	6	26	43	:	:	1	4	10	32
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	2	3	6	6	9	11	32	:	:	:	:	1	7	14	:	:	:	:	3	5
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	5	6	15	:	:	:	:	1	2	7	:	:	:	:	1	4
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	2	2	:	:	:	:	:	2	2	:	:	:	:	1	1
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	6	3	1	:	:	:	:	1	2	5	:	:	:	:	1	5

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-24 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	63	77	64	78	62	75	60	72	60	71	61	75	65	69	76	76	83	91	68	71	63	65	68	71	82	81	71	73	74	76	83
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	30	44	19	19	12	10	6	5	4	4	4	3	3	2	1	:	:	:	33	15	6	5	1	1	:	18	4	3	3	1	:
3	Thetis and Jones Islands	1	2	3	2	4	3	8	9	17	26	21	18	15	6	6	3	2	1	2	6	11	22	20	6	2	3	5	33	22	14	4
4	Cottle & Return Islands, West Dock	:	:	1	1	2	1	2	3	8	13	12	16	11	4	5	1	2	:	:	3	4	10	15	4	1	1	2	9	26	11	4
5	Midway Islands	:	:	:	:	:	:	1	1	2	5	2	7	3	2	2	:	1	:	:	:	1	3	4	2	1	:	:	3	6	7	1
6	Cross and No Name Islands	:	:	:	:	:	:	1	1	2	4	2	10	4	2	4	1	1	:	:	:	2	2	6	3	1	:	:	3	5	11	1
7	Endicott Causeway	:	:	:	:	:	:	:	1	2	2	2	4	1	:	1	:	:	:	:	:	:	2	2	:	:	:	:	1	6	7	:
8	McClure Islands	:	:	:	:	:	:	:	1	1	2	1	8	3	2	3	1	1	:	:	:	:	1	2	2	1	:	:	1	2	18	1
9	Stockton Islands	:	:	:	:	:	:	:	1	:	1	1	6	2	1	3	:	1	:	:	:	:	1	3	1	1	:	:	1	2	9	2
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	1	1	4	2	1	3	:	1	:	:	:	:	:	3	2	1	:	:	:	1	5	5
12	Flaxman Island	:	:	:	:	:	:	:	:	:	1	:	4	2	2	4	:	1	:	:	:	:	:	2	4	1	:	:	1	1	5	10
13	Barrier Islands	:	:	:	:	:	:	:	:	:	1	:	2	1	1	3	1	5	1	:	:	:	:	1	2	2	:	:	:	:	1	3
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	1	3	:	:	:	:	:	:	1	1	:	:	:	:	:	1
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	1	1	5	7	7	16	5	:	:	:	:	1	7	15	:	:	:	:	1	9
16	Jago and Tapkaurak Spits	:	:	1	:	:	:	:	1	1	1	1	2	4	11	11	13	14	13	:	:	:	:	2	10	19	:	:	1	1	2	11
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	1	1	4	5	6	5	14	:	:	:	:	:	5	4	:	:	:	1	1	6
18	Icy Reef	:	:	:	:	:	:	:	:	:	1	:	2	2	4	5	8	9	17	:	:	:	:	1	7	9	:	:	:	:	4	6
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Spring Lead 7	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
26	Beaufort Spring Lead 8	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
27	Beaufort Spring Lead 9	1	:	:	:	:	:	:	:	1	1	1	1	1	1	:	:	:	:	:	:	1	1	1	1	:	:	:	1	1	:	:
28	Beaufort Spring Lead 10	1	1	1	:	1	:	1	1	2	2	2	2	3	2	1	:	:	:	:	1	1	4	3	1	:	1	1	2	2	1	1
29	Ice/Sea Segment 1	23	33	18	16	12	9	5	4	3	2	2	1	1	:	:	:	:	:	28	13	4	3	1	:	:	13	4	2	1	:	:
30	Ice/Sea Segment 2	9	12	20	30	23	26	15	9	11	7	7	4	5	1	1	:	:	:	15	29	13	8	6	1	1	22	7	7	6	2	:
31	Ice/Sea Segment 3	6	5	10	8	14	22	25	35	19	21	14	9	8	4	4	2	2	:	7	16	26	21	12	4	1	5	28	22	15	6	2
32	Ice/Sea Segment 4	5	2	5	2	5	5	12	12	25	37	28	25	21	8	7	2	2	1	3	4	18	46	36	7	2	2	7	28	36	18	5
33	Ice/Sea Segment 5	:	:	1	1	1	2	3	3	7	10	13	31	21	10	15	2	3	:	:	1	3	8	35	12	2	1	3	7	15	28	7
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	1	1	2	2	10	8	9	36	5	23	2	:	:	:	1	5	15	9	:	1	2	3	12	27
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	1	1	5	5	11	13	18	26	11	:	:	:	:	3	13	33	:	:	1	1	6	14
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	1	:	4	4	12	12	18	16	19	:	:	:	:	1	12	18	:	:	1	1	6	11
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	1	1	3	4	9	9	15	14	18	:	:	:	:	2	9	16	:	:	:	1	5	8
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	3	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	49	75	37	44	26	21	13	9	8	5	4	2	2	1	1	:	:	:	57	30	12	7	3	:	:	58	10	4	4	1	1
43	Nuiqsut Subsistence Area	:	:	1	1	1	1	2	3	5	10	9	41	14	7	9	1	1	:	:	1	3	7	20	9	1	1	2	8	14	32	5
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	1	:	3	3	11	16	17	34	26	:	:	:	:	2	11	39	:	:	1	1	4	18

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-24 (continued) Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Resource	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	1	1	:	:	:	:	1	:	1	:	:	:	:	:	1
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	3	3	3	2	3	1	1	:	:	:	1	1	1	:	:	:	:	:	4	2	:	:	1	:	:	1	:	:	:	1	:
49	Hanna's Shoal Polynya	5	3	5	2	3	1	2	1	3	1	2	1	1	:	:	:	:	:	5	3	2	2	2	1	:	1	:	1	1	1	:
50	Ice/Sea Segment 12	3	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
51	Ice/Sea Segment 13	6	4	3	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	6	1	:	:	:	:	:	3	:	:	:	:	:
52	Ice/Sea Segment 14	18	9	11	5	6	2	1	1	1	1	2	1	2	1	1	:	:	:	12	4	1	1	2	1	:	5	1	1	:	2	:
53	Ice/Sea Segment 15	16	16	40	53	49	49	21	14	14	11	11	7	8	4	3	2	1	:	24	80	17	12	11	3	1	26	18	11	10	4	2
54	Ice/Sea Segment 16a	9	7	16	11	24	32	68	50	52	38	29	19	15	9	8	5	4	1	10	23	79	45	26	10	3	8	53	40	25	11	5
55	Ice/Sea Segment 17	5	3	5	4	7	7	18	17	55	57	63	39	36	15	12	4	3	1	3	6	25	**	67	13	2	3	12	40	57	23	6
56	Ice/Sea Segment 18a	:	:	1	1	1	2	4	4	8	12	15	59	51	24	28	5	5	:	:	:	3	9	57	47	3	:	3	8	19	58	11
57	Ice/Sea Segment 19	:	:	:	:	:	:	1	1	2	3	5	12	10	20	68	27	59	6	:	:	:	2	9	32	64	:	1	2	5	14	79
58	Ice/Sea Segment 20a	2	:	3	2	4	2	7	5	8	8	11	15	17	32	35	63	42	16	1	4	7	7	14	34	45	:	3	6	9	15	38
59	Ice/Sea Segment 21	2	1	3	1	4	2	6	5	7	7	8	12	15	25	27	38	30	20	1	4	7	6	10	31	31	:	3	4	6	12	27
60	Ice/Sea Segment 22	2	1	3	1	3	2	7	5	8	7	11	11	13	18	16	24	19	16	1	4	7	7	12	17	22	:	3	4	7	9	16
61	Ice/Sea Segment 22	2	1	1	1	1	1	2	2	4	4	6	6	7	9	7	11	8	4	1	1	2	3	6	7	10	:	2	2	7	7	9
62	Ice/Sea Segment 24a	1	:	1	1	1	1	1	1	2	3	3	4	4	6	5	7	4	1	1	1	1	3	3	4	5	:	2	1	4	4	6
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	5	3	3	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	2	:	:	:	:	:
65	ERA 1	14	24	23	54	18	18	8	7	4	3	2	1	2	1	1	:	:	:	37	26	7	3	1	:	:	58	9	3	1	1	:
66	ERA 2	7	6	12	12	17	46	21	26	14	11	10	6	6	5	3	2	1	:	8	23	24	12	8	4	1	8	33	11	8	3	2
67	Ice/Sea Segment 16b	8	6	15	10	24	31	68	50	50	37	27	17	13	6	6	3	3	1	9	23	79	44	23	8	2	7	53	39	24	10	4
68	Harrison Bay	1	1	2	3	4	10	9	24	6	7	4	3	3	1	2	2	1	:	1	5	10	5	5	2	1	1	39	8	5	1	1
69	Harrison Bay/Colville Delta	3	3	5	4	7	9	14	25	15	19	12	10	9	5	4	2	2	:	4	8	16	19	10	6	2	3	15	24	14	9	2
70	ERA 3	4	2	6	4	9	8	24	27	41	55	27	19	15	6	6	2	2	1	3	8	39	52	25	7	2	2	15	65	32	14	4
71	Simpson Lagoon	1	1	2	1	4	3	6	7	12	20	17	17	14	6	6	2	2	1	1	4	8	16	17	6	2	2	4	32	21	12	5
72	Gwyder Bay	:	:	:	:	:	:	:	1	1	3	3	4	3	1	1	:	:	:	:	:	1	2	3	1	:	:	:	3	5	3	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	1	1	1	2	1	:	:	:	:	:	:	1	:	1	1	1	:	:	1	1	2	1	:
74	Cross Island ERA	:	:	1	1	1	1	2	3	6	11	10	54	17	8	10	2	2	:	:	1	3	7	24	11	1	1	2	8	17	44	6
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	1	2	4	3	13	4	2	3	1	1	:	:	:	:	4	3	2	1	:	:	2	7	18	2
76	Water over Boulder Patch 2	:	:	:	:	:	:	1	1	2	4	2	12	3	1	3	:	1	:	:	:	:	3	3	2	1	:	:	1	6	22	2
77	Foggy Island Bay	:	:	:	:	:	:	:	:	1	2	1	6	1	:	1	:	:	:	:	:	:	2	1	1	:	:	:	1	4	23	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	2	1
79	ERA 4	:	:	:	:	:	:	1	1	2	5	6	35	11	6	12	2	2	:	:	:	:	4	14	9	1	:	:	4	9	38	6
80	Ice/Sea Segment 18b	:	:	1	1	1	1	4	4	8	12	15	59	50	23	27	3	4	:	:	:	3	9	57	46	2	:	3	8	19	58	10
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	:	:	:	2
82	ERA 5	:	:	:	:	:	:	:	:	:	1	:	4	4	8	16	5	43	4	:	:	:	:	1	12	12	:	:	1	1	6	16
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	1	1	5	6	18	22	27	46	36	:	1	:	1	3	19	52	:	:	1	2	7	26
84	Ice/Sea Segment 20b	1	:	2	1	2	2	5	4	7	6	7	10	11	25	29	60	40	15	:	3	6	5	9	29	45	:	3	4	6	11	35
85	ERA 6	:	:	:	:	:	:	:	:	:	1	1	4	5	11	11	16	15	33	:	:	:	:	2	11	17	:	:	:	:	6	12
86	ERA 7	:	:	:	:	:	:	2	1	3	2	4	4	5	8	8	13	12	17	:	1	3	2	5	9	13	:	1	1	3	4	9
87	ERA 8	1	:	1	1	2	2	2	2	2	2	3	3	3	4	3	4	3	3	1	2	2	2	1	4	3	:	2	1	3	4	3
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	6	3	1	:	:	:	:	1	2	5	:	:	:	:	2	5

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-25 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
25	Barrow, Elson Lagoon	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
26	Dease Inlet	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
27	Kurgorak Bay	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:
28	Cape Simpson	:	4	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	11	:	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	14	:	:	:	:	:
30	Drew Point, McLeod Point,	:	:	:	6	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	3	:	:	:	:	:
31	Lonely AFS Airport, Pitt Point, Pogik Bay	:	:	1	3	1	6	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:
32	Cape Halkett,	:	:	:	:	:	5	:	3	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	8	:	:	:	:
33	Atigaru Point, Kogru River	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	8	:	:	:	:
34	Fish Creek	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:
35	Colville River	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:
36	Oliktok Point	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	10	:	:	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	4	:	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	5	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	8	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	11
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	1	:	:	:	:	:	:
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	3	:	:	:	:	:	:	2	:	:	:	:	:	:
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent, LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-26 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
25	Barrow, Elson Lagoon	7	9	2	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	1	:	:	:	:	:	2	:	:	:	:	:
26	Dease Inlet	3	12	2	3	:	1	:	:	:	:	:	:	:	:	:	:	:	:	7	2	:	:	:	:	:	4	:	:	:	:	:
27	Kurgorak Bay	2	8	1	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	2	:	:	:	:	:
28	Cape Simpson	2	8	2	8	1	2	:	:	:	:	:	:	:	:	:	:	:	:	4	2	:	:	:	:	:	18	:	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	2	1	4	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	18	1	:	:	:	:
30	Drew Point, McLeod Point,	1	2	3	13	2	4	:	1	:	:	:	:	:	:	:	:	:	:	2	4	:	:	:	:	:	7	:	:	:	:	:
31	Lonely AFS Airport, Pitt Point, Pogik Bay	:	1	4	7	5	13	1	2	:	:	:	:	:	:	:	:	:	:	1	5	1	:	:	:	:	2	3	:	:	:	:
32	Cape Halkett,	:	:	1	1	2	11	3	10	1	2	:	:	:	:	:	:	:	:	:	3	3	1	:	:	:	1	15	3	1	:	:
33	Atigaru Point, Kogru River	:	:	:	:	1	3	1	7	:	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	15	1	:	:	:
34	Fish Creek	:	:	:	:	:	1	1	6	:	1	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	4	1	:	:	:
35	Colville River	:	:	:	:	:	:	1	4	:	3	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	1	5	1	:	:
36	Oliktok Point	:	:	:	:	:	:	1	3	1	4	:	:	:	:	:	:	:	:	:	:	2	2	:	:	:	:	:	13	2	:	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	1	1	4	1	3	1	:	:	:	:	:	:	:	:	1	2	1	:	:	:	4	8	1	1
38	Kuparuk River	:	:	:	:	:	:	:	:	:	2	:	3	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	6	2	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	1	:	3	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	3	7	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	9	:
41	Bullen Point, Point Gordon, Reliance Pt	:	:	:	:	:	:	:	:	:	:	:	3	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	2	1
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	2	1	:	2	:	:	:	:	:	:	:	1	1	:	:	:	:	:	3	11
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	2	:	3	:	:	:	:	:	:	1	:	:	:	:	:	1	2
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	1	:	:	:	:	:	:	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	3	:	:	:	:	:	:	1	:	:	:	:	:	:	1
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	6	1	:	:	:	:	:	1	3	:	:	:	:	:	1
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	7	6	:	:	:	:	:	1	10	:	:	:	:	:	1
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	6	:	:	:	:	:	:	3	:	:	:	:	:	:
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	8	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	7	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent, LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-27 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
22	Skull Cliff	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Walakpa Bay, Walakpa River	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
25	Barrow, Elson Lagoon	15	14	5	5	3	2	1	1	:	1	:	:	:	:	:	:	:	:	11	2	1	:	:	:	:	5	1	:	:	:	:
26	Dease Inlet	10	17	6	6	4	3	1	1	1	:	:	:	:	:	:	:	:	:	13	6	1	:	:	:	:	7	1	:	:	:	:
27	Kurgorak Bay	6	10	3	4	2	1	1	:	:	:	:	:	:	:	:	:	:	:	7	2	1	1	:	:	:	3	:	:	:	:	:
28	Cape Simpson	5	10	5	12	4	4	2	1	1	1	:	:	:	:	:	:	:	:	6	7	2	1	:	:	:	21	2	1	:	:	:
29	Ikpikpuk River, Smith Bay	1	4	3	7	2	2	1	1	:	:	:	:	:	:	:	:	:	:	3	3	1	:	:	:	:	21	1	:	:	:	:
30	Drew Point, McLeod Point,	2	4	6	16	6	7	4	3	1	1	:	:	:	:	:	:	:	:	5	9	3	:	:	:	:	9	3	:	:	:	:
31	Lonely AFS Airport, Pitt Point, Pogik Bay	2	3	7	9	9	17	6	5	3	2	1	1	1	:	:	:	:	:	3	9	5	3	:	:	:	4	6	2	1	:	:
32	Cape Halkett,	1	1	3	3	6	14	7	15	4	5	3	2	2	:	:	:	:	:	1	6	9	4	4	:	:	1	19	7	3	1	:
33	Atigaru Point, Kogru River	:	1	1	2	2	4	4	10	2	3	2	1	1	:	:	:	:	:	1	2	4	2	1	:	:	1	17	3	1	:	:
34	Fish Creek	:	:	:	1	1	2	3	8	3	4	1	1	1	:	:	:	:	:	1	1	5	4	1	:	:	:	5	4	2	1	:
35	Colville River	:	:	1	1	1	2	3	5	2	5	1	1	:	:	:	:	:	:	1	2	3	5	1	:	:	:	1	6	2	1	:
36	Oliktok Point	:	:	:	:	:	:	2	4	4	6	2	3	1	:	:	:	:	:	:	:	4	5	3	:	:	:	1	15	4	2	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	1	1	3	7	4	6	3	1	2	:	:	:	:	:	2	4	4	1	:	:	:	5	11	3	1
38	Kuparuk River	:	:	:	:	:	:	:	:	1	2	1	4	1	1	1	:	:	:	:	:	:	1	2	:	:	:	:	1	6	3	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	1	2	1	4	1	:	1	:	:	:	:	:	:	1	1	:	:	:	:	1	4	8	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	1	:	2	1	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	2	10	:
41	Bullen Point, Point Gordon, Reliance Pt	:	:	:	:	:	:	:	:	:	:	:	3	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	3	2
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	1	:	3	1	:	2	:	1	:	:	:	:	:	1	1	1	:	:	1	1	4	12
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	1	1	:	3	1	5	1	:	:	:	:	1	2	1	:	:	:	:	1	3
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	1	:	:	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	4	:	:	:	:	:	:	1	1	:	:	:	:	:	1
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	8	2	:	:	:	:	:	2	5	:	:	:	:	:	2
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	2	4	6	12	9	:	:	:	:	:	3	16	:	:	:	:	1	6
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	4	9	:	:	:	:	:	2	5	:	:	:	:	:	3
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	1	8	:	:	:	:	:	1	1	:	:	:	:	:	2
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	11	:	:	:	:	:	:	1	:	:	:	:	:	1
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	10	:	:	:	:	:	:	3	:	:	:	:	:	1
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	8	:	:	:	:	:	:	1	:	:	:	:	:	:
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	7	:	:	:	:	:	:	1	:	:	:	:	:	:
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:	:
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent, LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-28 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
20	Asiniak Point, Kugrua Bay, Kugrua River	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Skull Cliff	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
24	Walakpa Bay, Walakpa River	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:
25	Barrow, Elson Lagoon	17	15	6	6	4	3	2	2	1	1	:	:	:	:	:	:	:	:	12	3	2	1	:	:	:	5	2	1	:	:	:
26	Dease Inlet	11	18	7	6	5	4	2	1	2	1	1	:	:	:	:	:	:	:	14	6	2	2	:	:	:	8	1	1	1	:	:
27	Kurgorak Bay	7	11	4	4	3	2	1	1	1	:	:	:	:	:	:	:	:	:	8	3	1	1	:	:	:	4	:	:	:	:	:
28	Cape Simpson	6	11	5	12	4	5	3	1	1	1	1	:	:	:	:	:	:	:	6	7	3	1	:	:	:	21	2	1	:	:	:
29	Ikpikpuk River, Smith Bay	2	4	3	7	2	2	2	1	1	:	:	:	:	:	:	:	:	:	3	3	1	:	:	:	:	21	1	:	:	:	:
30	Drew Point, McLeod Point,	2	4	7	16	7	8	5	3	3	2	2	1	1	:	:	:	:	:	6	9	5	2	1	:	:	9	3	3	2	:	:
31	Lonely AFS Airport, Pitt Point, Pogik Bay	3	3	8	10	11	18	7	5	4	4	3	2	2	:	:	:	:	:	4	11	5	4	2	:	:	4	6	3	2	:	:
32	Cape Halkett,	1	1	3	3	6	14	8	15	5	6	3	3	3	1	1	:	:	:	1	7	10	5	6	:	:	1	19	8	4	1	:
33	Atigaru Point, Kogru River	1	1	1	2	2	5	5	10	3	4	2	1	1	:	:	:	:	:	1	3	4	3	1	:	:	1	18	4	2	:	:
34	Fish Creek	1	1	1	2	2	3	5	9	5	4	3	1	2	1	1	:	:	:	1	2	6	5	2	1	:	1	6	5	3	2	:
35	Colville River	1	1	2	1	2	2	4	6	4	6	3	2	1	1	:	1	:	:	2	3	3	6	2	1	:	:	2	7	3	1	:
36	Oliktok Point	:	:	1	1	1	1	3	4	5	7	4	4	3	1	1	:	:	:	:	1	5	6	4	1	:	1	1	15	5	3	1
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	1	2	3	7	5	7	5	2	2	:	1	:	:	:	2	5	7	1	1	:	:	6	11	4	2
38	Kuparuk River	:	:	:	:	:	:	:	:	1	3	1	4	2	1	1	:	:	:	:	:	:	2	3	:	:	:	:	2	7	3	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	1	2	1	4	1	1	1	:	:	:	:	:	:	2	2	1	:	:	:	2	4	8	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	1	1	1	3	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	1	3	11	:
41	Bullen Point, Point Gordon, Reliance Pt	:	:	:	:	:	:	:	:	:	1	:	3	1	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	1	3	2
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	1	:	4	2	1	3	:	1	:	:	:	:	:	2	3	1	:	:	1	1	5	12
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	1	:	2	1	1	3	1	5	1	:	:	:	:	1	3	2	:	:	:	1	2	3
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	1	:	:	2
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	1	4	:	:	:	:	:	:	1	1	:	:	:	:	1	2
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	1	:	2	3	3	9	2	:	:	:	:	:	2	6	:	:	:	:	:	2
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	1	1	4	6	9	13	9	:	:	:	:	1	4	17	:	:	:	:	1	8
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	6	4	9	:	:	:	:	:	3	7	:	:	:	:	2	3
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	4	3	8	:	:	:	:	:	3	3	:	:	:	:	:	4
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	3	3	12	:	:	:	:	:	2	3	:	:	:	:	1	2
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	4	4	11	:	:	:	:	:	1	6	:	:	:	:	:	3
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	9	:	:	:	:	:	1	3	:	:	:	:	:	1
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	8	:	:	:	:	:	:	1	:	:	:	:	:	1
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	1	:	:	:	:	:	:
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	4	:	:	:	:	:	:	2	:	:	:	:	:	1
56	Ptarmigan Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
57	Roland & Phillips Bay, Kay Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	1	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent, LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-29 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
20	Asiniak Point, Kugrua Bay, Kugrua River	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Skull Cliff	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
24	Walakpa Bay, Walakpa River	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:
25	Barrow, Elson Lagoon	17	15	6	6	4	3	2	2	1	1	:	:	:	:	:	:	:	:	12	3	2	1	:	:	:	5	2	1	:	:	:
26	Dease Inlet	11	18	7	6	5	4	2	1	2	1	1	:	:	:	:	:	:	:	14	6	2	2	:	:	:	8	1	1	1	:	:
27	Kurgorak Bay	7	11	5	5	3	2	1	1	1	:	:	:	:	:	:	:	:	:	8	3	1	1	:	:	:	4	1	:	:	:	:
28	Cape Simpson	6	11	6	12	4	5	3	1	1	1	1	:	:	:	:	:	:	:	6	7	3	1	:	:	:	21	2	1	:	:	:
29	Ikpikpuk River, Smith Bay	2	4	3	7	2	2	2	1	1	:	1	:	:	:	:	:	:	:	3	3	1	1	:	:	:	21	1	:	1	:	:
30	Drew Point, McLeod Point	2	4	7	16	8	8	5	3	3	2	2	1	1	:	:	:	:	:	6	9	5	2	2	:	:	9	3	3	2	:	:
31	Lonely AFS Airport, Pitt Point, Pogik Bay	3	3	9	10	11	18	7	5	4	4	3	2	2	:	:	:	:	:	4	11	5	4	2	:	:	4	6	3	3	1	:
32	Cape Halkett	1	1	3	3	6	14	8	15	5	6	3	3	3	1	1	:	:	:	1	7	10	5	6	:	:	1	19	8	4	2	:
33	Atigaru Point, Kogru River	1	1	1	2	2	5	5	10	3	4	2	1	1	:	:	:	:	:	2	3	4	3	1	:	:	1	18	4	2	:	:
34	Fish Creek	1	1	1	2	2	3	5	9	5	4	3	1	2	1	1	:	:	:	1	2	6	5	2	1	:	1	7	5	3	2	:
35	Colville River	1	1	2	1	2	2	4	6	4	6	3	2	2	1	1	1	1	:	2	3	4	6	2	2	:	:	2	7	3	1	:
36	Oliktok Point	:	:	1	1	1	1	3	5	5	7	4	5	3	1	1	:	:	:	:	2	5	6	5	1	:	1	2	16	6	4	1
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	1	2	3	8	6	7	5	2	2	:	1	:	:	:	2	5	7	1	1	:	:	6	12	4	2
38	Kuparuk River	:	:	:	:	:	:	:	:	1	3	2	4	2	1	1	:	:	:	:	:	:	2	3	1	:	:	:	2	7	3	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	1	2	3	2	5	1	1	1	:	:	:	:	:	:	3	4	1	:	:	:	3	6	8	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	1	2	1	3	1	:	1	:	:	:	:	:	:	2	1	1	:	:	:	1	3	11	:
41	Bullen Point, Point Gordon, Reliance Pt	:	:	:	:	:	:	:	:	:	1	:	3	1	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	1	3	2
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	1	:	4	2	2	3	:	1	:	:	:	:	:	2	3	1	:	:	1	1	5	12
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	1	:	2	1	1	3	1	5	1	:	:	:	:	1	3	2	:	:	:	1	2	3
44	Collinson Point, Konganevik Point	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	1	:	:	2
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	1	4	:	:	:	:	:	:	1	1	:	:	:	:	1	2
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	1	:	2	3	3	9	2	:	:	:	:	:	2	6	:	:	:	:	1	3
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	1	1	5	7	9	13	9	:	:	:	:	1	5	17	:	:	:	:	2	8
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	4	5	6	5	9	:	:	:	:	:	3	7	:	:	:	:	2	4
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	4	3	8	:	:	:	:	:	3	4	:	:	:	:	1	4
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	4	4	12	:	:	:	:	:	3	4	:	:	:	:	1	2
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	5	5	12	:	:	:	:	1	3	7	:	:	:	:	2	3
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	2	2	9	:	:	:	:	:	3	3	:	:	:	:	1	1
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	3	8	:	:	:	:	:	:	2	:	:	:	:	:	2
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	3	:	:	:	:	:	1	3	:	:	:	:	:	1
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	2	5	:	:	:	:	:	1	3	:	:	:	:	:	3
56	Ptarmigan Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	:	:	:	:	:	:	2	:	:	:	:	:	:
57	Roland & Phillips Bay, Kay Point	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	1	1	:	:	:	:	:	:	1	:	:	:	:	:	:
58	Sabine Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
60	Trent and Shoalwater Bays	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:
63	Outer Shallow Bay, Olivier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Middle Channel, Gary Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:
65	Kendall Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:
66	North Point, Pullen Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent, LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-30 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
20	Asiniak Point, Kugrua Bay, Kugrua River	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Skull Cliff	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
24	Walakpa Bay, Walakpa River	2	1	1	1	:	:	:	:	1	1	1	1	:	:	:	:	:	:	2	:	:	1	:	:	:	:	:	:	1	:	:
25	Barrow, Elson Lagoon	17	16	7	6	4	3	2	2	2	2	2	2	3	1	1	:	:	:	12	3	2	2	1	1	:	5	2	1	1	1	:
26	Dease Inlet	11	18	8	7	5	4	2	2	2	2	1	1	:	1	:	:	:	:	15	6	2	2	:	:	:	8	2	1	1	:	:
27	Kurgorak Bay	7	11	5	5	3	2	1	1	1	:	:	:	:	:	:	:	:	:	8	4	1	1	:	:	:	4	1	1	:	:	:
28	Cape Simpson	6	11	6	12	5	5	3	2	1	1	1	1	1	:	:	:	:	:	6	8	3	1	1	:	:	21	2	1	:	:	:
29	Ikpikpuk River, Smith Bay	2	4	3	7	3	3	2	1	1	1	1	:	:	:	:	:	:	:	3	3	1	1	:	:	:	21	2	:	1	:	:
30	Drew Point, McLeod Point,	3	4	8	16	8	8	6	4	4	3	2	1	1	:	:	:	:	:	6	9	5	2	3	:	:	9	3	4	3	1	:
31	Lonely AFS Airport, Pitt Point, Pogik Bay	4	3	9	10	12	18	7	5	6	4	5	3	3	2	2	1	1	:	4	11	6	6	5	2	1	4	6	3	3	1	3
32	Cape Halkett	2	2	4	3	7	15	9	16	6	7	5	4	4	2	1	1	1	:	1	7	11	6	7	2	1	2	19	9	5	2	1
33	Atigaru Point, Kogru River	1	1	2	2	2	5	5	10	3	4	2	1	1	1	1	1	:	:	2	3	4	3	2	:	:	1	18	4	2	:	:
34	Fish Creek	1	1	1	2	2	4	5	9	6	5	4	2	2	2	1	1	1	:	1	3	7	6	3	2	1	1	7	5	4	2	1
35	Colville River	2	2	3	2	3	3	5	7	5	7	4	3	3	1	1	1	1	:	2	4	4	7	3	2	:	1	2	8	3	2	:
36	Oliktok Point	:	:	1	1	2	1	3	5	5	8	5	5	4	2	1	1	:	:	1	2	5	6	5	1	:	1	2	16	6	4	1
37	Milne Point, Simpson Lagoon	:	:	:	:	1	:	1	2	4	8	7	8	7	3	3	1	1	:	:	:	2	6	9	2	1	:	1	6	12	5	2
38	Kuparuk River	:	:	:	:	:	:	:	:	1	3	2	5	3	1	1	:	:	:	:	:	:	3	3	1	:	:	:	2	7	3	1
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	1	1	3	3	3	5	2	1	1	:	:	:	:	1	1	3	4	1	:	:	1	3	6	8	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	1	2	1	3	1	:	1	:	:	:	:	:	:	2	1	1	:	:	:	1	3	11	:
41	Bullen Point, Point Gordon, Reliance Pt	:	:	:	:	:	:	:	:	:	1	:	3	1	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	1	3	2
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	1	1	4	2	2	3	:	1	:	:	:	:	:	2	3	1	:	:	1	1	6	12
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	1	:	2	2	2	3	1	5	1	:	:	:	:	1	3	2	:	:	:	1	2	3
44	Collinson Point, Konganevik Point	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	2	:	:	:	:	:	:	1	1	:	:	1	:	:	2
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	1	4	:	:	:	:	:	:	1	1	:	:	:	:	1	2
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	1	:	2	3	3	9	2	:	:	:	:	:	2	6	:	:	:	:	1	3
47	Kaktovik	:	:	:	:	:	:	:	:	:	1	1	2	3	7	8	10	13	9	:	:	:	:	1	6	17	:	:	1	1	2	10
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	5	5	7	5	9	:	:	:	:	:	5	7	:	:	:	:	3	5
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	5	3	8	:	:	:	:	:	3	4	:	:	:	:	1	5
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	5	5	12	:	:	:	:	1	4	4	:	:	:	1	1	3
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	2	2	3	4	6	7	12	:	:	:	:	1	4	8	:	:	:	:	3	4
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	1	2	4	3	3	3	9	:	:	:	:	:	4	4	:	:	:	:	1	3
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	1	1	2	1	2	3	3	5	4	9	:	:	:	1	2	2	4	:	:	:	2	1	4
54	Nunaluk Spit	:	:	:	:	:	:	:	:	1	:	1	1	1	2	2	4	3	4	:	:	:	:	1	2	5	:	:	:	1	2	3
55	Herschel Island	:	:	:	:	:	:	1	1	2	1	2	2	3	5	5	9	6	7	:	:	3	1	3	6	8	:	1	:	:	2	7
56	Ptarmigan Bay	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	1	2	:	:	:	:	:	1	2	:	:	:	:	1	1
57	Roland & Phillips Bay, Kay Point	1	:	1	:	:	:	:	:	:	:	1	:	1	1	1	2	1	1	:	:	:	:	:	1	1	:	:	:	:	:	:
58	Sabine Point	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	1	:	:	:	:	:	1	:	:	:	:	:	:	1
59	Shingle Point	1	:	2	1	3	1	3	2	3	4	4	3	4	3	2	1	1	:	1	2	3	4	4	1	:	:	1	3	3	1	1
60	Trent and Shoalwater Bays	:	:	:	:	:	:	:	:	:	:	:	1	:	1	1	:	1	:	:	:	:	:	:	:	1	:	:	:	:	1	1
62	Shallow Bay, West Channel	:	:	1	:	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:
63	Outer Shallow Bay, Olivier Islands	:	:	:	:	:	:	:	:	1	1	1	1	1	1	1	2	1	1	:	:	:	1	:	:	1	:	:	1	2	1	1
64	Middle Channel, Gary Island	:	:	:	:	1	1	1	1	1	1	1	1	1	1	1	1	1	:	:	1	1	1	1	1	1	:	1	:	1	1	:
65	Kendall Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:
66	North Point, Pullen Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent, LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-31 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-32 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-33 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
24	Beaufort Sea	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
25	Beaufort Sea	1	:	1	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	1	:	:	:	:
26	Beaufort Sea	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:
27	Beaufort Sea	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	1	:	:
28	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-34 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
22	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:
23	Beaufort Sea	2	1	1	1	1	1	1	1	1	1	:	:	:	:	:	:	:	:	1	:	1	1	:	:	:	1	1	1	:	:	:
24	Beaufort Sea	1	:	1	1	1	1	:	1	:	:	:	:	:	:	:	:	:	:	1	1	1	:	1	:	:	:	1	:	1	:	:
25	Beaufort Sea	3	2	2	1	2	1	1	1	1	:	1	:	:	:	:	:	:	:	3	1	2	1	:	1	:	2	2	1	:	:	:
26	Beaufort Sea	:	:	:	:	2	1	3	1	2	2	3	2	2	1	1	:	:	:	:	:	2	2	3	1	:	:	1	1	2	1	1
27	Beaufort Sea	1	:	1	1	1	:	2	2	3	3	3	2	2	1	1	:	:	:	:	1	1	4	3	2	:	1	:	4	3	2	:
28	Beaufort Sea	:	:	1	:	1	1	2	1	1	:	2	1	1	1	1	:	:	:	:	:	2	:	1	:	:	:	1	:	:	1	:
29	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	:
35	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-35 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
4	Chukchi Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:
17	Chukchi Sea	1	1	1	1	1	:	:	:	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:	:	:	1	:
18	Chukchi Sea	3	2	3	2	2	1	2	1	2	1	1	1	1	:	:	:	:	:	3	1	1	1	1	:	:	1	:	:	1	:	:
19	Chukchi Sea	2	1	2	1	2	:	1	:	1	:	:	:	:	:	:	:	:	1	3	1	:	:	:	:	1	1	:	:	:	:	:
20	Chukchi Sea	1	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Sea	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:
23	Beaufort Sea	2	1	2	1	2	1	2	2	2	1	1	1	:	:	1	1	1	:	2	1	2	2	1	:	:	2	2	2	1	:	1
24	Beaufort Sea	2	1	1	1	1	1	1	1	1	:	:	1	1	:	:	:	:	:	1	1	1	:	1	:	:	:	1	:	1	1	:
25	Beaufort Sea	4	3	2	1	2	1	1	1	1	:	1	:	1	1	:	:	:	:	4	2	2	1	:	1	:	2	3	1	:	:	:
26	Beaufort Sea	1	1	1	1	2	1	3	2	3	3	3	2	3	3	3	2	2	1	2	1	2	3	4	3	1	1	2	2	3	2	2
27	Beaufort Sea	2	1	2	2	2	2	3	3	5	4	5	3	4	4	3	2	1	:	1	2	2	6	5	5	2	3	2	5	4	3	1
28	Beaufort Sea	2	2	4	2	5	3	5	2	3	1	4	1	3	3	1	1	:	:	2	4	4	1	2	1	:	2	3	1	1	1	:
29	Beaufort Sea	1	:	2	1	2	2	3	2	2	1	1	1	2	1	:	1	:	:	1	1	3	1	1	1	:	1	3	1	1	1	:
30	Beaufort Sea	:	:	:	:	1	:	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:
31	Beaufort Sea	:	:	:	:	:	:	1	:	1	1	1	1	1	:	:	:	:	:	:	:	:	1	1	1	:	:	:	1	2	:	:
35	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
36	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
37	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	:	1	1	:	:	:	:	1	:	1
38	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-36 Summer Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
4	Chukchi Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:
17	Chukchi Sea	1	1	1	1	1	:	:	:	1	:	1	:	:	:	:	:	:	:	1	1	:	1	1	:	:	:	:	:	:	1	:
18	Chukchi Sea	3	2	3	2	2	1	2	1	2	1	1	1	1	:	:	:	:	:	3	1	2	1	1	:	:	1	1	1	1	:	:
19	Chukchi Sea	2	1	2	1	2	:	1	:	1	:	:	:	:	:	:	:	:	1	3	1	:	:	:	:	1	1	:	:	:	:	:
20	Chukchi Sea	1	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Sea	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:
23	Beaufort Sea	2	1	2	1	2	1	2	2	2	1	1	1	:	:	1	1	1	:	2	1	2	2	1	:	:	2	2	2	1	:	1
24	Beaufort Sea	2	1	1	1	1	1	1	1	1	:	:	1	1	:	:	:	:	:	1	1	1	:	1	:	:	:	1	:	1	1	:
25	Beaufort Sea	4	3	2	1	2	1	1	1	1	:	1	:	1	1	1	:	:	:	4	2	2	1	:	1	:	2	3	1	:	1	:
26	Beaufort Sea	1	1	1	1	2	1	3	2	3	3	4	3	4	3	3	2	2	1	2	1	3	3	4	3	1	1	2	2	3	2	2
27	Beaufort Sea	2	1	2	2	2	2	3	4	6	5	5	4	4	4	3	2	1	:	1	3	2	7	5	5	2	3	2	6	4	3	1
28	Beaufort Sea	2	2	4	3	6	4	6	3	4	3	5	3	5	4	2	1	1	:	3	5	6	2	4	2	1	2	4	2	3	4	1
29	Beaufort Sea	1	:	2	1	2	2	3	2	2	1	2	1	2	1	1	1	1	:	1	1	3	1	1	1	1	1	3	1	1	1	:
30	Beaufort Sea	1	1	1	:	1	:	1	1	1	1	1	:	1	1	1	:	:	:	:	:	1	1	1	:	:	:	1	1	1	:	:
31	Beaufort Sea	:	:	:	:	:	:	1	:	1	1	1	1	1	:	:	:	:	:	:	:	:	1	1	1	:	:	:	1	2	:	:
35	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
36	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	2	3	2	2	1	:	:	:	:	1	1	2	1	:	:	:	1	2	1
37	Beaufort Sea	:	:	1	:	1	1	1	:	1	:	1	1	1	2	1	1	:	:	:	1	:	:	1	1	:	:	:	:	1	:	1
38	Beaufort Sea	:	:	:	:	:	:	:	:	1	1	1	1	1	1	1	1	1	:	:	:	:	1	1	:	1	:	:	:	:	1	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-37 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	:	2	:	2	:	2	:	2	:	:	:	1	:	:	:	:	1	3	:	:	:	:	:	:	:	7	5	6	4	3	4
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:
5	Midway Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	18	7	3	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	13	1	:	:	:	:	:	1	:	:	:	:	:
25	Beaufort Spring Lead 7	9	15	2	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	26	1	:	:	:	:	:	2	:	:	:	:	:
26	Beaufort Spring Lead 8	1	:	16	2	11	1	:	:	:	:	:	:	:	:	:	:	:	:	2	5	:	:	:	:	:	1	:	:	:	:	:
27	Beaufort Spring Lead 9	1	1	14	5	11	4	:	:	:	:	:	:	:	:	:	:	:	:	4	12	:	:	:	:	:	4	:	:	:	:	:
28	Beaufort Spring Lead 10	:	:	:	:	7	2	16	1	5	:	:	:	:	:	:	:	:	:	:	3	9	:	:	:	:	:	3	:	:	:	:
29	Ice/Sea Segment 1	2	7	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	2	:	:	:	:	:
30	Ice/Sea Segment 2	:	1	1	6	1	5	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	:	4	:	:	:	:	:
31	Ice/Sea Segment 3	:	:	:	:	:	3	2	6	:	1	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	:	5	1	:	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	:	1	2	6	2	1	:	:	:	:	:	:	:	:	2	9	4	:	:	:	:	4	5	:	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	:	1	5	3	:	1	:	:	:	:	:	:	:	6	1	:	:	:	:	:	4	:
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	:	:	1	7	:	4	:	:	:	:	:	:	2	1	:	:	:	:	:	6
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	2	:	:	:	:	:	:	6	:	:	:	:	:	:
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	1	8	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	6	:	:	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	4	:
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	3	:	:	:	:	:	:	3	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-37 (continued) Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Ice/Sea Segment 14	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
53	Ice/Sea Segment 15	:	2	13	43	22	38	3	1	:	:	:	:	:	:	:	:	:	:	3	69	3	:	:	:	:	13	5	:	:	:	:
54	Ice/Sea Segment 16a	:	:	:	:	2	14	50	21	20	3	:	:	:	:	:	:	:	:	:	6	59	5	:	:	:	:	34	3	:	:	:
55	Ice/Sea Segment 17	:	:	:	:	:	:	2	1	32	32	41	10	5	:	:	:	:	:	:	:	9	**	41	:	:	:	:	17	27	1	:
56	Ice/Sea Segment 18a	:	:	:	:	:	:	:	:	:	1	2	40	37	15	14	:	:	:	:	:	:	:	44	43	:	:	:	:	2	37	2
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	:	:	:	:	2	51	14	46	1	:	:	:	:	:	18	59	:	:	:	:	:	69
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	26	4	2	:	:	:	:	:	1	8	:	:	:	:	:	1
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	:	3	1	13	:	1	:	:	:	:	:	:	:	:	:	:	:	:	8	3	:	:	:	:	:	16	:	:	:	:	:
66	ERA 2	:	:	:	:	1	11	1	3	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	5	:	:	:	:
67	Ice/Sea Segment 16b	:	:	:	:	1	4	16	7	7	1	:	:	:	:	:	:	:	:	:	2	20	2	:	:	:	:	11	1	:	:	:
68	Harrison Bay	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	7	:	:	:	:
69	Harrison Bay/Colville Delta	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:
70	ERA 3	:	:	:	:	:	:	1	2	4	9	:	:	:	:	:	:	:	:	:	:	7	7	:	:	:	:	:	16	1	:	:
71	Simpson Lagoon	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	1	:	:
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	:	:	:	:	:	:	14	1	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	1	10	:
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
79	ERA 4	:	:	:	:	:	:	:	:	:	:	:	7	:	:	2	:	:	:	:	:	:	:	:	1	:	:	:	:	:	5	:
80	Ice/Sea Segment 18b	:	:	:	:	:	:	:	:	:	:	:	14	12	5	5	:	:	:	:	:	:	:	14	13	:	:	:	:	1	12	1
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	9	:	:	:	:	:	:	:	1	:	:	:	:	:	1
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	10	:	:	:	:	:	:	8	:	:	:	:	:	:
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	9	2	1	:	:	:	:	:	:	4	:	:	:	:	:	:
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-38 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	2	6	2	6	2	5	2	6	1	3	:	3	:	:	1	:	4	8	3	2	1	1	:	:	3	10	8	9	6	5	5
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	1	5	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	:	1	1	3	1	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	5	2	1	:
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	5	1	:
5	Midway Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	:	1	:	:	:	:	:	:
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	:	:	1	:	:	:	:	:	:
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	21	13	7	4	2	1	:	:	:	:	:	:	:	:	:	:	:	:	20	5	:	:	:	:	:	4	:	:	:	:	:
25	Beaufort Spring Lead 7	13	20	6	6	2	1	:	:	:	:	:	:	:	:	:	:	:	:	28	6	:	:	:	:	:	6	:	:	:	:	:
26	Beaufort Spring Lead 8	3	3	19	7	14	6	2	1	:	:	:	:	:	:	:	:	:	:	6	11	2	:	:	:	:	5	1	:	:	:	:
27	Beaufort Spring Lead 9	2	3	16	10	14	8	3	1	1	:	:	:	:	:	:	:	:	:	7	17	2	:	:	:	:	7	2	:	:	:	:
28	Beaufort Spring Lead 10	:	:	1	1	9	6	21	7	9	4	2	:	:	:	:	:	:	:	:	6	16	4	1	:	:	:	8	4	2	:	:
29	Ice/Sea Segment 1	2	7	1	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	3	:	:	:	:	:
30	Ice/Sea Segment 2	:	1	2	6	2	5	1	1	:	:	:	:	:	:	:	:	:	:	1	3	1	:	:	:	:	5	1	:	:	:	:
31	Ice/Sea Segment 3	:	:	:	1	1	4	3	7	2	2	1	:	:	:	:	:	:	:	:	1	3	2	:	:	:	:	6	2	1	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	1	1	3	7	3	2	1	:	:	:	:	:	:	:	2	9	5	:	:	:	:	5	5	1	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	:	1	6	3	1	2	:	:	:	:	:	:	:	6	2	:	:	:	:	1	5	1
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	1	:	1	7	1	5	:	:	:	:	:	:	3	2	:	:	:	:	1	7
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	4	2	:	:	:	:	:	:	6	:	:	:	:	:	1
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
42	Barrow Subsistence Area 2	2	9	2	3	1	1	:	:	:	:	:	:	:	:	:	:	:	:	4	2	:	:	:	:	:	6	:	:	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	5	1	:	1	:	:	:	:	:	:	:	2	1	:	:	:	:	1	4	1
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	3	:	:	:	:	:	:	4	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-38 (continued) Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Ice/Sea Segment 14	11	4	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:	:	:	:	:	1	:	:	:	:	:
53	Ice/Sea Segment 15	3	6	20	51	31	48	9	7	2	1	:	:	:	:	:	:	:	:	8	72	10	1	:	:	:	20	12	1	:	:	:
54	Ice/Sea Segment 16a	:	:	2	3	8	22	59	36	31	15	6	2	1	:	:	:	:	:	:	11	66	18	4	:	:	:	43	17	7	1	:
55	Ice/Sea Segment 17	:	:	:	:	:	1	7	6	41	46	51	25	17	2	3	:	:	:	:	1	14	**	52	5	:	:	2	26	44	12	1
56	Ice/Sea Segment 18a	:	:	:	:	:	:	:	:	1	2	4	50	41	20	32	2	2	:	:	:	:	2	46	48	1	:	:	:	5	46	11
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	:	:	2	1	5	58	19	56	5	:	:	:	:	1	22	63	:	:	:	:	2	75
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	:	:	4	5	37	16	9	:	:	:	:	:	7	25	:	:	:	:	:	7
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	5	:	:	:	:	:	:	2	:	:	:	:	:	:
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	1	5	3	16	3	4	1	1	:	:	:	:	:	:	:	:	:	:	10	6	:	:	:	:	:	17	1	:	:	:	:
66	ERA 2	:	:	1	2	2	13	4	7	1	1	:	:	:	:	:	:	:	:	:	3	4	1	:	:	:	:	9	2	:	:	:
67	Ice/Sea Segment 16b	:	:	1	1	2	7	19	13	11	6	2	1	:	:	:	:	:	:	:	3	23	8	2	:	:	:	14	8	4	:	:
68	Harrison Bay	:	:	:	:	:	1	1	3	:	1	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	7	1	:	:	:
69	Harrison Bay/Colville Delta	:	:	:	:	:	:	1	3	1	1	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	3	1	:	:
70	ERA 3	:	:	:	:	:	:	3	4	7	15	2	2	1	:	:	:	:	:	:	:	9	14	2	:	:	:	2	20	6	1	:
71	Simpson Lagoon	:	:	:	:	:	:	:	:	:	2	:	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	6	3	1	:
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	:	:	:	:	1	1	15	2	:	2	:	:	:	:	:	:	1	3	2	:	:	:	:	2	12	1
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
79	ERA 4	:	:	:	:	:	:	:	:	:	:	:	8	1	1	3	:	:	:	:	:	:	:	1	1	:	:	:	:	:	7	1
80	Ice/Sea Segment 18b	:	:	:	:	:	:	:	:	:	1	1	17	13	6	11	:	1	:	:	:	:	1	15	15	:	:	:	:	2	15	4
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	11	1	:	:	:	:	:	1	3	:	:	:	:	:	3
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	7	11	:	:	:	:	:	:	11	:	:	:	:	:	1
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	13	7	4	:	:	:	:	:	3	10	:	:	:	:	:	3
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:	:	:	:	:	:	:	:	:	:	:
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-39 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	8	13	6	11	5	10	5	11	4	7	2	6	2	1	3	3	7	14	9	7	5	5	3	2	6	15	13	13	10	8	9
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	4	8	2	3	2	1	1	:	:	:	:	:	:	:	:	:	:	:	6	2	:	:	:	:	:	2	1	:	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	:	1	1	1	3	1	2	1	:	:	:	:	:	:	:	1	2	2	:	:	:	1	7	3	1	:
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	:	:	1	2	1	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	2	6	2	:
5	Midway Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	3	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	1	:	:	:	:	:	:	2	:	:	:	:	:	1
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	2	:	:	:	:	:	:
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
24	Beaufort Spring Lead 6	23	15	10	7	6	3	2	1	1	1	1	:	:	:	:	:	:	:	22	8	2	1	:	:	:	7	1	:	:	:	:
25	Beaufort Spring Lead 7	15	21	9	8	5	4	2	1	1	1	1	:	:	:	:	:	:	:	28	9	2	1	:	:	:	8	1	1	:	:	:
26	Beaufort Spring Lead 8	4	5	20	9	16	8	5	3	3	2	1	1	1	:	:	:	:	:	8	14	4	2	1	:	:	7	3	2	1	:	:
27	Beaufort Spring Lead 9	3	5	17	12	16	11	6	3	3	2	2	1	1	:	:	:	:	:	8	20	5	2	1	:	:	9	4	2	1	:	:
28	Beaufort Spring Lead 10	:	:	2	3	11	9	24	10	13	8	6	3	4	1	2	:	:	:	:	8	20	9	5	2	:	2	11	6	6	2	1
29	Ice/Sea Segment 1	3	7	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	3	:	:	:	:	:
30	Ice/Sea Segment 2	1	2	2	6	2	5	1	1	:	:	:	:	:	:	:	:	:	:	2	3	1	:	:	:	:	5	1	:	:	:	:
31	Ice/Sea Segment 3	:	:	1	1	1	4	3	7	2	2	1	1	:	:	:	:	:	:	:	1	3	3	1	:	:	:	6	3	1	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	1	1	3	7	4	2	2	1	1	:	:	:	:	:	2	9	5	1	:	:	:	5	5	1	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	1	1	6	4	1	2	:	:	:	:	:	:	:	6	2	:	:	:	:	1	5	1
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	1	1	1	8	1	5	:	:	:	:	:	:	3	2	:	:	:	:	1	7
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	4	2	:	:	:	:	:	1	6	:	:	:	:	:	1
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	4	3	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
42	Barrow Subsistence Area 2	3	9	2	3	1	1	:	:	:	:	:	:	:	:	:	:	:	:	4	2	:	:	:	:	:	6	1	:	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	5	2	1	1	:	:	:	:	:	:	:	2	1	:	:	:	:	1	4	1
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	4	:	:	:	:	:	:	4	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-39 (continued) Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Hanna's Shoal Polynya	3	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:
50	Ice/Sea Segment 12	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
51	Ice/Sea Segment 13	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:
52	Ice/Sea Segment 14	19	11	8	5	3	2	1	:	1	:	:	:	:	:	:	:	:	:	13	4	1	:	:	:	:	4	:	:	:	:	:
53	Ice/Sea Segment 15	6	9	24	53	35	52	14	12	8	6	4	2	2	:	:	:	:	:	12	73	15	7	3	1	:	23	18	7	4	1	:
54	Ice/Sea Segment 16a	2	1	6	5	13	26	62	43	40	27	17	9	8	3	3	:	:	:	2	15	69	31	15	3	:	2	47	27	18	6	1
55	Ice/Sea Segment 17	:	:	1	1	3	4	13	11	45	51	56	33	27	11	12	2	2	:	1	2	20	**	58	14	2	:	5	30	48	20	6
56	Ice/Sea Segment 18a	:	:	:	:	:	:	1	:	2	4	6	52	43	23	37	4	5	:	:	:	1	3	47	51	3	:	:	1	7	48	16
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	:	1	3	2	7	60	23	58	7	:	:	:	:	2	24	65	:	:	:	:	4	76
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	:	2	3	9	12	44	25	15	:	:	:	:	1	14	34	:	:	:	:	2	15
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	7	5	10	:	:	:	:	:	2	7	:	:	:	:	:	3
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	:	:	:	:	:	:	2	:	:	:	:	:	:
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	2	6	4	17	4	6	3	2	1	1	1	:	:	:	:	:	:	:	11	8	3	1	1	:	:	18	3	1	1	:	:
66	ERA 2	:	:	2	3	3	14	6	9	3	4	1	1	1	:	:	:	:	:	1	4	6	4	1	:	:	1	11	5	3	1	:
67	Ice/Sea Segment 16b	:	:	1	2	4	8	21	16	15	11	6	4	3	1	2	:	:	:	:	4	25	12	6	2	:	1	16	12	9	2	1
68	Harrison Bay	:	:	:	:	:	1	1	4	1	1	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	8	2	1	:	:
69	Harrison Bay/Colville Delta	:	:	:	:	:	1	1	4	1	2	1	1	:	:	:	:	:	:	:	:	2	2	1	:	:	:	2	4	1	:	:
70	ERA 3	:	:	:	:	1	2	5	6	10	17	5	5	3	1	2	:	:	:	:	1	10	16	6	2	:	:	3	22	10	3	1
71	Simpson Lagoon	:	:	:	:	:	:	1	1	1	3	1	2	1	:	:	:	:	:	:	:	1	1	1	:	:	:	1	6	4	1	:
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	:	:	:	1	1	1	15	3	1	2	:	:	:	:	:	:	1	4	2	:	:	:	:	3	14	2
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	:	:	4	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	5	:
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	:	:	4	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	7	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
79	ERA 4	:	:	:	:	:	:	:	:	:	:	:	8	1	1	4	:	:	:	:	:	:	:	1	2	:	:	:	:	1	8	2
80	Ice/Sea Segment 18b	:	:	:	:	:	:	:	:	1	1	2	18	14	7	12	1	2	:	:	:	:	1	15	15	1	:	:	1	3	16	5
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	12	1	:	:	:	:	:	1	3	:	:	:	:	:	4
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	9	12	:	:	:	:	:	1	13	:	:	:	:	1	3
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	15	10	7	:	:	:	:	:	4	13	:	:	:	:	2	5
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	7	:	:	:	:	:	:	1	:	:	:	:	:	:
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-40 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	13	20	11	18	9	16	9	17	7	12	6	11	6	4	7	6	11	21	16	12	9	9	8	5	9	21	19	18	16	13	12
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	6	12	5	6	3	3	2	1	1	1	1	1	1	:	:	:	:	:	9	4	1	1	1	:	:	3	1	1	:	:	:
3	Thetis and Jones Islands	:	:	:	:	:	1	1	2	2	5	2	2	1	1	1	:	:	:	:	:	1	3	2	1	:	:	2	9	5	2	:
4	Cottle & Return Islands, West Dock	:	:	:	:	:	:	1	:	1	2	1	3	1	:	:	:	:	:	:	:	1	2	1	:	:	:	:	2	8	2	:
5	Midway Islands	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	:	:	:	2	1	:	1	:	:	:	:	:	:	:	1	1	:	:	:	:	1	4	:
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	:	2	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	7	:
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	1	:	:	:	:	:	:	3	:	:	:	:	:	1
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	:	:	:	1	1	:	1	1	2	4	:	:	:	:	1	:	3	:	:	:	:	:	1
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	2	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
24	Beaufort Spring Lead 6	23	17	11	9	7	5	3	2	2	1	2	1	1	1	:	:	:	:	23	10	4	1	1	1	:	9	2	1	1	:	:
25	Beaufort Spring Lead 7	15	22	10	10	7	5	4	2	2	1	2	1	1	1	1	:	:	:	29	10	3	2	1	1	:	9	2	1	1	:	:
26	Beaufort Spring Lead 8	5	5	21	10	18	9	7	4	5	3	3	2	2	2	1	1	1	:	9	14	7	5	2	2	1	7	5	3	2	1	1
27	Beaufort Spring Lead 9	3	5	18	13	17	12	8	5	5	4	3	2	2	2	1	1	1	:	9	20	7	4	2	2	:	11	5	4	3	1	1
28	Beaufort Spring Lead 10	:	1	3	3	11	10	25	12	15	9	8	5	6	3	3	2	1	:	:	9	21	10	7	3	2	2	13	8	7	3	3
29	Ice/Sea Segment 1	3	7	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	3	:	:	:	:	:
30	Ice/Sea Segment 2	1	2	2	6	2	5	1	1	:	:	:	:	:	:	:	:	:	:	2	3	1	:	:	:	:	5	1	:	:	:	:
31	Ice/Sea Segment 3	:	:	1	1	1	4	3	7	2	2	1	1	:	:	:	:	:	:	:	1	3	3	1	:	:	:	6	3	1	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	1	1	3	7	4	2	2	1	1	:	:	:	:	:	2	9	5	1	:	:	:	5	5	1	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	1	1	6	4	1	2	:	:	:	:	:	:	:	6	2	:	:	:	:	1	5	1
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	1	1	1	8	1	5	:	:	:	:	:	:	3	2	:	:	:	:	1	7
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	4	2	:	:	:	:	:	1	6	:	:	:	:	:	1
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41	Barrow Subsistence Area 1	4	3	2	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	2	:	:	:	:	:
42	Barrow Subsistence Area 2	3	9	3	4	2	2	1	1	1	:	:	:	:	:	:	:	:	:	4	3	1	:	:	:	:	7	1	1	:	:	:
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	:	1	5	2	1	1	:	:	:	:	:	:	:	2	1	:	:	:	:	1	4	1
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	:	:	:	:	:	:	4	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-40 (continued) Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	3	1	1	1	1	:	1	:	1	:	:	:	:	:	:	:	:	:	2	1	1	1	:	:	:	1	:	:	:	:	:
49	Hanna's Shoal Polynya	9	5	5	3	3	2	1	1	1	1	1	:	:	:	:	:	:	:	8	3	1	1	:	:	:	2	1	1	:	:	:
50	Ice/Sea Segment 12	3	3	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	1	:	:	:	:	:
51	Ice/Sea Segment 13	4	3	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	3	1	1	:	:	:	:	2	:	:	:	:	:
52	Ice/Sea Segment 14	21	14	11	8	6	4	2	1	1	1	1	:	:	:	:	:	:	:	16	8	2	1	1	:	:	7	2	:	1	:	:
53	Ice/Sea Segment 15	7	11	25	55	36	53	17	14	11	8	8	5	5	3	3	1	1	:	13	73	18	10	8	3	1	25	20	10	7	3	2
54	Ice/Sea Segment 16a	3	3	7	7	15	28	64	45	44	30	22	14	14	7	7	3	2	:	3	16	70	35	19	8	3	4	49	30	21	10	4
55	Ice/Sea Segment 17	1	1	3	2	5	5	17	13	48	52	58	36	31	14	15	5	4	1	1	4	23	**	60	16	3	1	7	33	49	22	9
56	Ice/Sea Segment 18a	:	:	:	:	1	1	2	1	3	5	8	53	43	24	38	5	6	1	:	1	2	4	48	51	4	:	1	2	8	49	16
57	Ice/Sea Segment 19	:	:	:	:	:	:	:	:	:	1	1	4	3	8	60	25	59	8	:	:	:	1	3	25	65	:	:	:	1	5	76
58	Ice/Sea Segment 20a	:	:	:	:	:	:	:	:	:	:	1	2	4	12	15	47	28	18	:	:	:	:	2	17	37	:	:	:	:	3	19
59	Ice/Sea Segment 21	:	:	:	:	:	:	:	:	:	:	:	1	1	4	5	12	9	12	:	:	:	:	:	5	11	:	:	:	:	1	6
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	3	5	:	:	:	:	:	2	4	:	:	:	:	:	2
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	1	1	:	:	:	:	:	1	2	:	:	:	:	:	1
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:	1	:	:	:	:	:	1
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:	:	:	:	:
65	ERA 1	2	6	5	18	5	7	4	3	3	2	2	1	2	1	1	:	:	:	11	9	4	3	2	:	:	20	4	2	2	1	:
66	ERA 2	:	1	2	3	4	15	7	12	5	6	3	3	2	1	2	1	1	:	1	5	7	6	3	1	1	2	14	7	4	1	2
67	Ice/Sea Segment 16b	:	1	2	3	5	9	22	17	16	13	8	6	5	3	3	1	2	:	1	6	26	14	8	3	2	2	18	13	10	4	2
68	Harrison Bay	:	:	:	:	:	2	1	5	1	2	1	1	1	:	:	:	:	:	:	:	1	2	1	:	:	:	10	2	2	1	:
69	Harrison Bay/Colville Delta	:	:	:	:	1	1	2	6	2	3	1	1	1	:	:	:	:	:	:	1	2	2	1	:	:	:	3	7	2	1	:
70	ERA 3	:	:	1	1	2	3	6	8	10	18	6	7	5	3	3	1	1	:	:	2	12	16	8	4	1	1	4	24	12	6	2
71	Simpson Lagoon	:	:	:	:	:	:	1	2	1	4	1	2	1	:	1	:	:	:	:	:	1	2	2	:	:	:	2	8	6	1	:
72	Gwyder Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	:	1	:	1	2	1	16	3	1	3	:	1	:	:	:	1	1	4	2	:	:	:	1	3	17	2
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	1	:	5	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	6	1
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	1	:	4	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	10	1
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	8	:
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
79	ERA 4	:	:	:	:	:	:	:	:	:	:	:	9	1	1	4	:	1	:	:	:	:	1	1	2	:	:	:	:	1	10	2
80	Ice/Sea Segment 18b	:	:	:	:	:	:	1	:	1	2	2	19	14	7	12	1	2	:	:	:	1	1	15	15	1	:	:	1	3	18	6
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	13	1	:	:	:	:	:	1	4	:	:	:	:	1	4
83	Kaktovik ERA	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	3	10	13	:	:	:	:	1	1	13	:	:	:	:	1	3
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	:	:	:	1	1	3	5	15	11	8	:	:	:	:	1	5	14	:	:	:	:	2	5
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	9	:	:	:	:	:	1	2	:	:	:	:	:	1
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	4	:	:	:	:	:	1	1	:	:	:	:	:	:
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:	1	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-41 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
—	Land	28	41	28	41	28	39	29	43	27	34	24	35	25	27	31	33	40	57	33	32	28	30	28	30	38	47	43	40	39	39	37
1	Kasegaluk Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Point Barrow, Plover Islands	13	25	11	13	9	7	5	4	3	2	3	2	2	2	2	2	1	:	17	10	4	3	2	2	1	8	4	2	1	1	1
3	Thetis and Jones Islands	:	:	1	1	2	3	5	8	8	15	7	8	5	2	3	:	1	:	:	2	6	11	9	4	:	:	6	21	13	5	1
4	Cottle & Return Islands, West Dock	:	:	:	:	1	1	2	2	3	6	3	8	2	1	2	:	:	:	:	1	2	4	4	1	:	:	1	4	19	4	1
5	Midway Islands	:	:	:	:	:	:	:	:	1	1	1	4	1	:	1	:	:	:	:	:	:	1	1	1	:	:	:	:	2	3	1
6	Cross and No Name Islands	:	:	:	:	:	:	:	:	1	1	1	5	1	1	2	1	1	:	:	:	:	1	2	1	:	:	:	1	2	8	2
7	Endicott Causeway	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	7	:
8	McClure Islands	:	:	:	:	:	:	:	:	:	:	1	3	1	1	2	:	:	:	:	:	:	:	1	1	:	:	:	:	1	16	1
9	Stockton Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	2	:	1	:	:	:	:	:	:	1	:	:	:	:	:	3	2
10	Tigvariak Island	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
11	Maguire Islands	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	6
12	Flaxman Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:	:	1	:	:	:	:	1	6
13	Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	:	:	:	:	:	:	1	2	:	:	:	:	:	1
14	Anderson Point Barrier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:
15	Arey and Barter Islands, Bernard Spit	:	:	:	:	:	:	:	:	:	:	1	1	1	1	3	3	8	4	:	:	:	:	1	2	7	:	:	:	:	2	3
16	Jago and Tapkaurak Spits	:	:	:	:	:	:	:	:	1	1	1	1	1	2	2	3	5	9	:	:	:	:	1	1	6	:	:	:	1	1	2
17	Angun and Beaufort Lagoons	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	8	:	:	:	:	:	:	1	:	:	:	:	:	:
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	11	:	:	:	:	:	1	2	:	:	:	:	:	1
19	Chukchi Spring Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spring Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spring Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spring Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spring Lead 5	3	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
24	Beaufort Spring Lead 6	25	20	13	11	9	6	5	3	4	2	3	2	3	3	2	2	1	:	25	12	6	3	3	3	1	11	3	2	2	1	1
25	Beaufort Spring Lead 7	18	27	12	12	8	7	5	3	4	3	3	2	3	2	2	2	1	:	32	12	5	3	3	2	1	12	3	2	2	1	1
26	Beaufort Spring Lead 8	6	7	22	13	19	11	8	5	7	5	5	3	4	4	2	3	2	:	10	16	8	6	4	3	2	10	6	6	3	2	3
27	Beaufort Spring Lead 9	5	8	20	17	18	15	9	6	7	5	5	3	4	4	3	3	2	:	11	22	9	6	4	3	2	16	7	7	4	2	3
28	Beaufort Spring Lead 10	1	1	4	5	13	12	27	16	17	12	11	7	8	5	5	4	3	:	1	11	23	12	8	6	4	3	20	10	11	6	5
29	Ice/Sea Segment 1	4	8	2	3	1	1	1	:	:	:	:	:	:	:	:	:	:	:	5	2	1	:	:	:	:	4	1	:	:	:	:
30	Ice/Sea Segment 2	1	2	2	7	2	6	2	2	1	1	:	:	:	:	:	:	:	:	2	3	2	1	:	:	:	5	2	1	:	:	:
31	Ice/Sea Segment 3	:	:	1	1	1	4	3	7	2	3	1	1	1	:	:	:	:	:	:	1	3	3	1	:	1	:	6	3	1	:	:
32	Ice/Sea Segment 4	:	:	:	:	:	:	1	1	4	7	5	3	2	1	1	:	:	:	:	:	2	10	5	1	:	:	1	5	6	1	:
33	Ice/Sea Segment 5	:	:	:	:	:	:	:	:	:	1	1	6	4	1	2	:	:	:	:	:	:	:	6	2	:	:	:	:	1	5	1
34	Ice/Sea Segment 6	:	:	:	:	:	:	:	:	:	:	:	1	1	1	8	1	5	:	:	:	:	:	:	3	2	:	:	:	:	1	7
35	Ice/Sea Segment 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	4	3	:	:	:	:	:	1	6	:	:	:	:	:	1
36	Ice/Sea Segment 8	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	3	:	:	:	:	:	:	1	:	:	:	:	:	:
37	Ice/Sea Segment 9	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	1	2	:	:	:	:	1	1	1	:	:	:	:	1	:
38	Point Hope Subsistence Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Point Lay Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wainwright Subsistence Area	2	1	1	1	1	:	:	:	:	:	1	:	:	1	:	1	1	:	2	1	:	:	:	1	:	1	:	:	:	:	:
41	Barrow Subsistence Area 1	4	3	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	4	2	:	:	:	:	:	2	:	:	:	:	:
42	Barrow Subsistence Area 2	5	10	4	5	4	3	3	2	3	1	2	1	2	2	2	2	2	:	6	4	3	1	1	3	1	8	3	4	1	1	1
43	Nuiqsut Subsistence Area	:	:	:	:	:	:	:	:	:	1	1	5	2	1	1	:	:	:	:	:	:	:	2	1	:	:	:	:	1	4	1
44	Kaktovik Subsistence Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	4	:	:	:	:	:	:	4	:	:	:	:	:	1

Note Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-41 (continued) Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	7	4	4	2	3	1	2	1	2	1	1	1	1	1	1	:	:	:	6	2	2	2	1	:	:	3	1	2	1	1	:
49	Hanna's Shoal Polynya	16	10	10	7	6	5	3	2	2	1	1	1	2	1	1	:	:	:	14	7	3	2	2	1	:	6	2	1	1	1	1
50	Ice/Sea Segment 12	6	4	3	2	2	1	1	1	2	1	2	1	1	1	1	1	:	:	5	2	1	2	1	1	:	4	:	1	1	:	:
51	Ice/Sea Segment 13	6	4	4	3	3	1	2	1	1	1	1	:	1	1	1	2	1	:	5	2	1	1	1	1	1	4	1	1	1	:	1
52	Ice/Sea Segment 14	25	17	15	10	10	6	5	3	4	2	3	1	2	2	1	3	1	1	19	11	5	3	3	1	3	10	4	4	2	1	2
53	Ice/Sea Segment 15	9	13	27	59	38	57	21	18	16	13	12	8	9	7	7	6	5	1	14	74	22	14	12	6	4	31	25	15	9	4	6
54	Ice/Sea Segment 16a	4	4	9	11	17	31	65	51	49	38	29	21	20	11	12	6	5	1	4	18	73	42	27	12	5	7	56	39	28	16	7
55	Ice/Sea Segment 17	2	2	4	4	7	8	20	19	50	58	60	41	34	17	18	7	5	1	2	6	27	**	63	18	4	2	9	40	56	27	11
56	Ice/Sea Segment 18a	:	:	:	1	1	1	3	2	5	7	10	57	44	25	40	6	6	1	:	1	3	7	50	52	4	:	2	4	10	55	18
57	Ice/Sea Segment 19	:	:	1	:	1	:	1	:	1	1	2	6	3	8	62	26	64	9	:	1	1	2	3	25	66	1	1	1	2	10	79
58	Ice/Sea Segment 20a	2	1	2	:	2	:	1	:	1	1	2	5	6	15	19	50	34	23	1	1	1	1	3	20	42	1	:	:	1	7	25
59	Ice/Sea Segment 21	2	1	2	:	1	:	1	:	1	:	1	2	3	8	9	18	14	17	2	1	:	1	1	9	17	:	:	:	:	2	10
60	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	:	1	2	3	6	8	11	8	8	:	:	:	:	2	8	9	:	:	:	:	3	7
61	Ice/Sea Segment 22	:	:	:	:	:	:	:	:	:	1	1	3	3	8	7	9	7	4	:	:	1	1	2	7	7	:	:	1	1	4	8
62	Ice/Sea Segment 24a	:	:	:	:	:	:	:	:	:	1	1	2	2	4	4	5	5	4	:	:	:	1	1	4	5	:	:	:	1	3	4
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	2	1	1	1	1	:	1	:	:	:	1	:	:	1	1	2	1	:	2	1	1	:	:	1	1	1	:	:	:	:	:
65	ERA 1	3	10	8	25	8	10	6	5	4	3	3	2	3	3	3	2	2	:	13	11	7	4	3	2	1	28	7	3	3	1	2
66	ERA 2	1	1	4	6	6	22	13	23	13	15	9	8	6	5	5	4	3	1	1	8	14	14	9	5	3	4	24	15	10	4	5
67	Ice/Sea Segment 16b	1	2	3	6	7	14	26	25	22	22	14	12	10	5	7	4	3	1	1	8	31	21	14	6	4	5	27	23	19	11	5
68	Harrison Bay	:	:	:	:	1	3	2	10	3	4	2	3	2	1	2	1	1	:	:	1	3	3	3	2	1	:	19	4	3	4	1
69	Harrison Bay/Colville Delta	:	:	1	1	2	3	5	14	6	11	6	4	4	2	2	1	:	:	:	3	6	8	5	2	:	1	6	18	7	2	1
70	ERA 3	1	1	1	2	3	6	11	16	18	30	14	15	10	6	8	2	3	:	1	4	18	26	16	7	2	1	8	39	20	14	5
71	Simpson Lagoon	:	:	1	1	2	3	5	7	6	12	6	8	4	2	3	:	:	:	:	2	5	9	8	3	:	1	6	19	19	4	1
72	Gwyder Bay	:	:	:	:	:	:	1	:	1	1	:	2	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	1	7	1	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
74	Cross Island ERA	:	:	:	:	:	1	1	1	2	4	3	23	5	3	6	1	1	:	:	:	2	4	7	4	1	:	1	2	6	27	5
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	:	1	1	7	1	1	2	:	:	:	:	:	:	:	2	1	:	:	:	:	2	13	2
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	:	1	1	7	1	1	2	:	:	:	:	:	:	:	1	1	:	:	:	:	1	23	2
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	16	1
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
79	ERA 4	:	:	:	:	:	1	1	:	1	1	1	13	2	2	6	1	1	:	:	:	1	2	3	3	:	:	1	1	2	17	3
80	Ice/Sea Segment 18b	:	:	:	:	:	1	1	1	3	4	4	25	16	8	15	2	3	:	:	:	2	4	19	17	1	:	1	2	6	25	8
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	1	:	1	4	3	23	3	:	:	:	:	1	2	7	:	:	:	:	2	6
83	Kaktovik ERA	:	:	:	:	:	:	:	:	1	1	1	3	2	3	6	9	23	24	:	:	:	1	2	4	26	:	:	:	1	4	8
84	Ice/Sea Segment 20b	:	:	:	:	:	:	:	:	1	:	1	3	2	5	7	18	17	14	:	:	:	1	2	6	19	:	:	:	1	6	10
85	ERA 6	:	:	:	:	:	:	:	:	:	:	:	1	1	2	3	5	5	22	:	:	:	:	1	3	4	:	:	:	:	:	2
86	ERA 7	:	:	:	:	:	:	:	:	:	:	:	1	1	2	3	4	3	7	:	:	:	:	1	3	4	:	:	:	:	1	2
87	ERA 8	:	:	:	:	:	:	:	:	:	:	:	1	1	4	5	5	5	5	:	:	:	:	1	4	5	:	:	:	:	2	5
88	Ice Sea Segment 24b	:	:	:	:	:	:	:	:	:	:	1	1	2	4	3	5	5	3	:	:	:	:	1	3	5	:	:	:	:	2	4

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-42 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
?	La:d	39	54	42	54	43	54	45	60	45	52	43	55	46	51	55	61	67	81	44	47	44	49	47	52	66	61	60	57	57	61	62
1	Kasegaluk Lagoo:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
2	Poi:t Barrow, Plover Isla:ds	16	29	14	16	12	10	8	5	6	3	5	3	5	4	3	3	2	:	20	13	7	5	4	4	1	12	6	3	2	2	2
3	Thetis a:d Jo:es Isla:ds	1	1	2	1	4	4	7	11	11	20	12	12	9	4	5	2	1	:	1	4	8	15	15	5	1	:	8	27	20	8	2
4	Cottle & Retur: Isla:ds, West Dock	:	:	:	:	1	1	2	3	4	8	5	11	4	2	3	1	1	:	:	1	2	6	7	1	1	:	1	5	24	8	1
5	Midway Isla:ds	:	:	:	:	:	:	:	:	1	2	1	5	1	1	1	:	:	:	:	:	:	1	1	1	:	:	:	1	2	4	1
6	Cross a:d :o :ame Isla:ds	:	:	:	:	:	:	:	:	1	2	1	6	2	2	3	1	1	:	:	:	:	2	3	2	:	:	:	1	2	9	2
7	E:dicott Causeway	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	9	:
8	McClure Isla:ds	:	:	:	:	:	:	:	:	:	:	1	4	1	1	3	1	1	:	:	:	:	:	1	1	:	:	:	:	1	17	2
9	Stockto: Isla:ds	:	:	:	:	:	:	:	:	:	:	:	2	1	1	3	1	1	:	:	:	:	:	:	1	1	:	:	:	:	3	4
10	Tigvariak Isla:d	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
11	Maguire Isla:ds	:	:	:	:	:	:	:	:	:	:	:	1	1	:	2	:	1	:	:	:	:	:	:	1	:	:	:	:	:	1	8
12	Flaxma: Isla:d	:	:	:	:	:	:	:	:	:	:	:	1	:	1	2	1	2	:	:	:	:	:	:	1	1	:	:	:	:	1	8
13	Barrier Isla:ds	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	5	1	:	:	:	:	:	1	3	:	:	:	:	:	1
14	A:derso: Poi:t Barrier Isla:ds	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:
15	Arey a:d Barter Isla:ds, Ber:ard Spit	:	:	:	:	:	:	:	:	:	:	1	1	1	2	4	4	10	5	:	:	:	:	1	3	9	:	:	:	:	2	5
16	Jago a:d Tapkaurak Spits	:	:	:	:	:	:	:	1	1	1	1	2	2	3	3	5	8	12	:	:	:	:	1	3	10	:	:	:	1	1	3
17	A:gu: a:d Beaufort Lagoo:s	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	10	:	:	:	:	:	1	2	:	:	:	:	:	1
18	Icy Reef	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	3	16	:	:	:	:	:	2	4	:	:	:	:	:	1
19	Chukchi Spri:g Lead 1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
20	Chukchi Spri:g Lead 2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
21	Chukchi Spri:g Lead 3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Chukchi Spri:g Lead 4	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Chukchi Spri:g Lead 5	3	3	2	1	1	1	1	:	1	:	:	:	:	:	:	:	:	:	3	1	:	1	:	:	:	1	:	:	:	:	:
24	Beaufort Spri:g Lead 6	25	22	14	11	9	6	6	3	4	3	4	2	3	3	2	2	1	:	25	12	6	4	4	3	1	11	3	2	2	1	1
25	Beaufort Spri:g Lead 7	18	29	13	13	9	8	6	4	5	3	4	2	3	2	2	2	1	:	33	13	6	4	3	2	1	12	4	3	2	1	1
26	Beaufort Spri:g Lead 8	6	8	23	14	19	12	9	5	7	5	5	3	4	4	2	4	2	:	11	16	9	7	4	3	2	11	7	7	4	2	3
27	Beaufort Spri:g Lead 9	6	10	21	19	19	16	11	7	8	6	6	4	4	4	3	3	2	:	12	23	11	7	4	4	2	18	8	7	4	2	3
28	Beaufort Spri:g Lead 10	1	1	4	6	14	14	29	18	19	14	13	8	10	5	5	5	3	:	1	12	25	15	10	6	4	4	21	12	12	6	5
29	Ice/Sea Segme:t 1	4	8	3	3	2	2	1	1	1	:	1	:	:	:	:	:	:	:	6	2	1	:	:	:	:	4	1	:	:	:	:
30	Ice/Sea Segme:t 2	2	2	2	7	3	6	2	2	2	1	1	:	1	1	1	1	1	1	2	4	2	1	1	1	1	5	2	2	:	:	1
31	Ice/Sea Segme:t 3	:	:	1	1	1	4	3	7	2	3	1	1	1	:	:	1	1	1	:	1	3	3	1	1	2	:	6	3	1	:	:
32	Ice/Sea Segme:t 4	:	:	:	:	:	1	1	1	4	7	5	3	2	1	1	:	:	:	:	:	3	10	5	1	:	:	1	5	6	1	1
33	Ice/Sea Segme:t 5	:	:	:	:	:	:	:	:	:	1	1	6	4	1	2	:	:	:	:	:	:	:	6	2	:	:	:	:	1	5	1
34	Ice/Sea Segme:t 6	:	:	:	:	:	:	:	:	:	:	:	1	1	1	8	1	5	:	:	:	:	:	:	3	2	:	:	:	:	1	7
35	Ice/Sea Segme:t 7	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	4	3	:	:	:	:	:	1	7	:	:	:	:	:	1
36	Ice/Sea Segme:t 8	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	1	1	3	:	:	:	:	:	:	1	:	:	:	:	:	1
37	Ice/Sea Segme:t 9	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	2	2	3	:	:	:	:	1	1	2	:	:	:	:	1	1
38	Poi:t Hope Subsiste:ce Are	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
39	Poi:t Lay Subsiste:ce Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
40	Wai:wright Subsiste:ce Area	2	2	1	1	1	:	1	:	1	1	1	:	1	2	1	2	1	:	2	1	1	1	1	1	1	2	1	:	1	1	1
41	Barrow Subsiste:ce Area 1	4	3	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	4	2	:	:	:	:	:	2	:	:	:	:	:
42	Barrow Subsiste:ce Area 2	6	11	5	6	5	4	4	3	4	2	4	2	4	4	4	4	3	1	6	5	4	3	2	5	2	9	3	6	1	1	3
43	:uiqsut Subsiste:ce Area	:	:	:	:	:	:	:	:	:	1	1	5	2	1	1	:	:	:	:	:	:	1	2	1	:	:	:	:	1	5	1
44	Kaktovik Subsiste:ce Area	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	4	:	:	:	:	:	:	4	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-42 (continued) Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Environmental Resource Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
45	Whale Concentration Area	:	:	:	:	:	:	1	:	:	:	:	1	1	1	1	2	1	1	:	:	:	:	1	1	2	:	1	:	:	:	1
46	Herald Shoal Polynya	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
47	Ice/Sea Segment 10	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Ice/Sea Segment 11	7	5	4	3	3	1	2	1	2	1	2	1	1	1	1	:	:	:	6	3	2	2	2	1	:	3	1	3	1	1	:
49	Hanna's Shoal Polynya	17	11	11	8	7	5	3	3	3	3	2	2	2	1	1	1	:	:	14	8	4	3	2	1	:	7	2	3	1	1	1
50	Ice/Sea Segment 12	6	5	3	3	2	1	2	1	2	1	2	1	1	2	1	1	:	:	6	2	1	2	1	1	1	5	:	1	1	:	1
51	Ice/Sea Segment 13	7	5	4	3	3	1	2	1	1	1	1	1	1	2	1	2	1	:	5	3	2	1	1	2	1	5	1	1	1	:	1
52	Ice/Sea Segment 14	26	18	16	11	11	7	6	4	5	3	4	2	3	3	2	4	2	1	20	12	6	4	4	2	3	11	5	5	3	1	3
53	Ice/Sea Segment 15	9	15	28	61	39	59	22	20	17	15	14	9	11	9	9	7	7	1	15	74	24	16	14	8	6	33	26	17	10	6	8
54	Ice/Sea Segment 16a	5	6	10	13	18	33	66	55	51	42	32	24	22	12	13	7	6	2	6	20	75	45	30	13	7	10	59	43	32	18	8
55	Ice/Sea Segment 17	3	2	4	5	8	9	21	22	51	61	60	44	35	18	20	7	6	1	3	7	28	**	65	20	5	3	11	43	58	30	12
56	Ice/Sea Segment 18a	:	:	1	1	1	2	3	2	6	8	10	59	44	25	41	6	7	1	1	1	3	8	50	52	4	1	2	4	11	58	19
57	Ice/Sea Segment 19	1	1	1	1	2	1	2	1	2	2	3	8	5	9	63	26	67	10	1	1	1	2	4	26	66	1	1	1	2	12	80
58	Ice/Sea Segment 20a	3	2	3	2	4	2	3	1	3	2	4	7	8	17	23	51	38	27	3	3	2	2	5	22	46	2	2	1	2	10	28
59	Ice/Sea Segment 21	2	2	2	:	2	:	1	1	1	1	2	3	4	9	11	21	18	22	3	1	1	1	3	10	20	:	:	1	1	4	12
60	Ice/Sea Segment 22	1	1	2	1	2	1	2	2	2	2	2	5	5	9	12	15	14	11	1	2	2	1	3	11	14	1	1	2	2	8	11
61	Ice/Sea Segment 22	1	1	2	1	3	2	3	3	4	4	5	7	7	12	12	12	11	5	1	3	4	4	5	10	11	1	2	4	3	8	13
62	Ice/Sea Segment 24a	1	1	1	1	1	1	2	1	3	3	4	5	6	8	7	7	9	6	1	1	2	3	4	7	8	1	2	3	3	6	7
63	Ledyard Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
64	Peard Bay	3	2	1	1	1	:	1	:	:	:	1	:	:	1	1	2	1	:	2	1	1	:	:	1	1	1	:	:	:	:	1
65	ERA 1	5	12	9	28	10	13	8	7	7	5	5	3	5	5	5	3	3	:	15	14	10	6	5	4	2	30	9	5	3	2	3
66	ERA 2	1	2	5	8	8	25	16	27	16	19	13	11	10	7	7	6	4	1	2	10	17	19	13	7	5	4	28	20	14	7	7
67	Ice/Sea Segment 16b	2	3	4	8	8	16	29	30	26	27	19	16	13	7	9	5	5	1	2	9	34	26	18	8	5	7	30	28	22	13	6
68	Harrison Bay	:	:	1	:	1	4	3	12	4	6	3	5	3	3	3	2	1	1	:	1	4	4	4	3	2	:	24	7	5	5	2
69	Harrison Bay/Colville Delta	:	:	2	2	3	5	8	18	9	15	9	6	6	3	2	1	:	:	:	4	9	13	8	3	1	1	9	23	11	4	1
70	ERA 3	1	1	2	3	4	7	13	20	21	36	18	20	14	8	10	4	4	1	1	5	20	31	21	9	3	3	11	45	26	16	6
71	Simpson Lagoon	1	1	2	1	4	4	7	10	9	17	10	12	8	4	4	1	1	:	1	3	7	13	13	4	1	1	8	23	26	7	2
72	Gwyder Bay	:	:	:	:	:	:	1	1	1	1	1	3	1	:	:	:	:	:	:	:	1	1	1	:	:	:	:	1	8	2	:
73	Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:
74	Cross Island ERA	:	:	:	1	:	1	1	1	3	5	4	26	7	4	8	2	2	:	:	:	2	5	8	6	1	:	1	2	7	31	6
75	Water over Boulder Patch 1	:	:	:	:	:	:	:	:	1	1	1	8	1	1	3	1	1	:	:	:	:	1	2	1	1	:	:	:	2	16	3
76	Water over Boulder Patch 2	:	:	:	:	:	:	:	:	1	1	1	8	1	1	3	1	1	:	:	:	:	:	2	1	:	:	:	:	2	27	3
77	Foggy Island Bay	:	:	:	:	:	:	:	:	:	1	1	4	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	20	1
78	Mikkelsen Bay	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2
79	ERA 4	:	:	:	1	:	1	1	1	1	2	2	14	3	2	8	1	2	:	:	:	1	2	3	4	1	:	1	1	3	19	5
80	Ice/Sea Segment 18b	:	:	:	1	1	1	2	1	3	5	5	28	17	9	17	2	3	:	:	:	2	4	20	18	1	:	1	2	6	28	9
81	Simpson Cove	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:
82	ERA 5	:	:	:	:	:	:	:	:	:	:	:	1	1	2	6	5	28	4	:	:	:	:	1	4	9	:	:	:	:	2	9
83	Kaktovik ERA	:	:	:	:	:	:	:	:	1	1	2	4	3	6	10	15	31	30	:	:	:	1	3	8	36	:	1	1	1	5	13
84	Ice/Sea Segment 20b	:	:	:	:	1	:	:	:	1	1	1	4	3	6	10	20	22	18	:	:	:	1	2	8	23	:	:	:	1	8	14
85	ERA 6	1	:	:	:	:	:	:	:	:	:	1	1	2	5	5	10	9	30	1	:	:	1	1	5	11	:	:	:	:	1	5
86	ERA 7	:	:	1	:	1	:	:	:	:	:	1	2	2	4	5	7	6	11	:	1	:	:	1	4	8	:	:	:	:	1	4
87	ERA 8	1	1	1	1	2	1	1	:	:	:	1	2	3	8	8	9	10	9	1	1	1	:	2	6	9	1	1	:	1	3	10
88	Ice Sea Segment 24b	:	:	1	1	1	1	1	1	1	1	2	3	5	7	6	7	8	6	1	1	1	1	3	6	8	1	1	1	1	5	6

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline.

Table A2-43 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
26	Dease Inlet	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Cape Simpson	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:
30	Drew Point, McLeod Point,	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
31	Lonely, Pitt Point, Pogik Bay	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
32	Cape Halkett	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:
33	Atigaru Point, Kogru River	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:
36	Oliktok Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
40	Foggy Island Bay, Kadleroshilik River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-44 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
25	Barrow, Elson Lagoon	1	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
26	Dease Inlet	1	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
27	Kurgorak Bay	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
28	Cape Simpson	:	1	:	2	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	4	:	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:
30	Drew Point, McLeod Point,	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:
31	Lonely, Pitt Point, Pogik Bay	:	:	:	1	1	2	:	1	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:
32	Cape Halkett,	:	:	:	:	:	1	1	2	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	3	1	:	:	:
33	Atigaru Point, Kogru River	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:
34	Fish Creek	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:
35	Colville River	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:
36	Oliktok Point	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	1	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:
40	Foggy Island Bay, Kadleroshilik River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	2	:	:	:	:	:	:
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-45 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
24	Walakpa Bay, Walakpa River	2	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
25	Barrow, Elson Lagoon	3	4	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	3	1	:	:	:	:	:	1	:	:	:	:	:
26	Dease Inlet	1	3	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
27	Kurgorak Bay	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
28	Cape Simpson	:	2	1	3	1	1	1	1	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	5	1	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:
30	Drew Point, McLeod Point	:	:	:	2	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:
31	Lonely, Pitt Point, Pogik Bay	:	:	1	1	1	3	1	1	1	1	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	1	1	1	:	:	:
32	Cape Halkett	:	:	:	:	:	2	1	3	1	1	:	:	:	:	:	:	:	:	:	1	2	1	1	:	:	:	4	1	1	:	:
33	Atigaru Point, Kogru River	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:
34	Fish Creek	:	:	:	:	:	:	1	2	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	:	:	:	:
35	Colville River	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	2	:	:	:
36	Oliktok Point	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6	:	:	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	1	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:
40	Foggy Island Bay, Kadleroshilik River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	:
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	:	:	:	:	:	:	3	:	:	:	:	:	:
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:	:
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-46 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
23	Nulavik	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
24	Walakpa Bay, Walakpa River	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	1	:	:	:	:	:
25	Barrow, Elson Lagoon	6	7	3	3	2	2	1	1	1	:	1	:	:	:	:	:	:	:	5	3	1	:	1	:	:	1	:	:	:	:	:
26	Dease Inlet	2	5	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	4	1	:	:	:	:	:	1	:	:	:	:	:
27	Kurgorak Bay	1	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	1	:	:	:	:	:
28	Cape Simpson	:	2	1	4	1	2	1	1	1	:	:	:	:	:	:	:	:	:	2	1	1	1	:	:	:	8	1	:	:	:	:
29	Ikpikpuk River, Smith Bay	:	:	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	5	:	:	:	:	:
30	Drew Point, McLeod Point,	:	:	1	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	2	1	:	:	:	:
31	Lonely, Pitt Point, Pogik Bay	:	:	1	2	1	4	2	2	1	1	1	1	1	:	:	:	:	:	:	1	2	1	1	:	:	1	2	1	1	:	1
32	Cape Halkett	:	:	1	1	1	3	1	4	1	2	1	1	1	:	1	:	:	:	:	1	2	2	1	1	:	:	6	3	2	1	:
33	Atigaru Point, Kogru River	:	:	:	:	:	1	:	2	:	1	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	4	1	1	:	:
34	Fish Creek	:	:	:	:	:	:	1	2	:	1	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	:	:	:	:
35	Colville River	:	:	:	:	:	:	:	2	:	1	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	3	1	:	:
36	Oliktok Point	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	1	7	:	:	:
37	Milne Point, Simpson Lagoon	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	5	1	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:
40	Foggy Island Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	5
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	:	:	:	1	:	:	:	:	:	1
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	3	:	:	:	:	1	:	3	:	:	:	:	:	:
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	:	:	:	:	:	:	1	:	:	:	:	:	:
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	:	:	:	:	:	:	:	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	:	:	:	:	:	:	1	:	:	:	:	:	:
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	:	:	:	:	:	:	:	:	:	:	:	:	:
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-47 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
19	Wainwright, Wainwright Inlet	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
22	Skull Cliff	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	Nulavik	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
24	Walakpa Bay, Walakpa River	3	3	1	2	1	1	1	:	1	:	:	:	1	1	:	:	:	:	3	1	1	:	1	:	1	1	:	:	:	:	1
25	Barrow, Elson Lagoon	12	14	8	7	6	4	4	2	2	2	2	2	2	2	2	2	1	:	11	8	3	2	2	2	1	5	2	1	1	1	1
26	Dease Inlet	4	9	4	4	3	2	1	1	1	1	1	:	:	1	:	:	:	:	7	3	1	1	1	1	:	2	1	1	:	:	:
27	Kurgorak Bay	2	4	2	3	1	1	1	1	1	:	:	:	:	:	:	:	:	:	2	2	1	:	:	:	:	2	1	:	:	:	:
28	Cape Simpson	1	5	3	11	3	4	2	2	1	1	1	:	1	1	:	:	:	:	3	4	2	1	1	:	:	21	3	1	:	:	:
29	Ikpikpuk River, Smith Bay	:	1	1	3	2	2	1	1	1	1	:	:	:	:	:	:	:	:	1	2	:	1	1	:	1	8	1	:	:	:	:
30	Drew Point, McLeod Point,	1	1	1	4	2	2	2	1	1	1	1	1	1	1	1	:	:	:	1	1	2	1	1	1	:	4	1	1	1	:	1
31	Lonely, Pitt Point, Pogik Bay	1	2	3	5	5	11	5	6	4	6	4	3	3	3	3	2	1	:	2	5	4	5	4	2	2	2	5	5	4	1	3
32	Cape Halkett	:	:	1	1	1	5	4	10	4	6	3	3	2	1	2	1	1	:	:	2	5	5	3	2	1	:	12	6	4	5	1
33	Atigaru Point, Kogru River	:	:	:	:	:	1	1	4	1	1	1	1	1	:	1	:	:	:	:	:	1	1	1	1	:	:	6	1	1	1	:
34	Fish Creek	:	:	:	:	1	1	1	4	1	1	1	1	1	:	:	:	:	:	:	1	1	2	1	:	:	:	2	1	1	:	:
35	Colville River	:	:	:	:	1	1	2	5	2	4	2	2	2	1	1	:	:	:	:	1	2	3	2	1	:	:	1	7	3	1	:
36	Oliktok Point	:	:	:	:	1	1	2	3	2	3	2	1	1	1	1	:	:	:	:	1	3	3	2	1	:	:	3	10	2	1	:
37	Milne Point, Simpson Lagoon	:	:	:	:	1	1	1	2	2	5	2	4	2	1	1	:	:	:	:	1	1	3	3	:	:	:	2	3	13	1	:
38	Kuparuk River	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	1	:
39	Point Brower, Prudhoe Bay	:	:	:	:	:	:	:	:	:	1	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	11	:
40	Foggy Island Bay, Kadleroshilik River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	5	:
41	Bullen Point, Point Gordon, Reliance Pt.	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3
42	Point Hopson, & Sweeney, Staines River	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	1	:	:	:	:	:	:	1	1	:	:	:	:	1	7
43	Brownlow Point, Canning River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	1	:	:	:	:	:	1	2	:	:	:	:	:	1
44	Collinson Point, Konganevik Point,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:
45	Anderson Point, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:	:
46	Arey Island, Barter Island,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	4	1	:	:	:	:	:	1	3	:	:	:	:	1	2
47	Kaktovik	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	3	5	6	:	:	:	1	1	2	6	:	:	:	1	1	2
48	Griffin Point, Oruktalik Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	6	:	:	:	:	:	:	2	:	:	:	:	:	1
49	Angun Point, Beaufort Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	5	:	:	:	:	:	:	:	:	:	:	:	:	:
50	Icy Reef, Kongakut River, Siku Lagoon	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	8	:	:	:	:	:	:	1	:	:	:	:	:	:
51	Demarcation Bay, Demarcation Point	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	7	:	:	:	:	:	1	1	:	:	:	:	:	1
52	Clarence Lagoon, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	8	:	:	:	:	:	1	2	:	:	:	:	:	1
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	2	2	5	:	:	:	:	:	2	2	:	:	:	:	:	1
54	Nunaluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	1	:	:	:	:	:	:	:
55	Herschel Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	2	:	:	:	:	:	1	1	:	:	:	:	:	1
56	Ptarmigan Bay	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1
57	Roland & Phillips Bay, Kay Point	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	1	1	:	:	:	:	:	:	1	1	:	:	:	:	2	:
59	Shingle Point	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:
60	Trent and Shoalwater Bays	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63	Outer Shallow Bay, Olivier Islands	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	:	1	:	:	:	:	:	1
64	Middle Channel, Gary Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
65	Kendall Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
66	North Point, Pullen Island	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	:	1	:	:	:	:	1	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-48 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Land Segment Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
19	Wai:wright, Wai:wright I:let	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
21	Peard Bay, Poi:t Fra:kli:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:
22	Skull Cliff	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
23	:ulavik	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
24	Walakpa Bay, Walakpa River	3	4	2	2	1	1	1	:	1	1	1	1	1	1	1	1	1	:	3	1	1	1	1	1	1	2	:	:	1	:	1
25	Barrow, Elso: Lagoo:	14	17	10	9	8	6	5	3	4	2	4	3	3	3	3	2	1	:	13	10	5	3	3	3	1	7	4	2	2	2	2
26	Dease I:let	5	11	4	5	3	3	2	1	1	1	1	1	1	1	1	1	1	:	8	3	2	1	1	2	:	4	2	1	1	:	:
27	Kurgorak Bay	2	5	2	3	2	2	1	1	1	:	1	:	1	1	:	1	:	:	3	2	1	1	:	1	:	3	1	1	:	:	:
28	Cape Simpso:	2	6	4	13	5	5	3	2	2	2	2	1	2	1	1	:	1	:	4	6	3	3	1	1	:	23	4	1	1	:	1
29	Ikpikpuk River, Smith Bay	1	1	2	3	2	3	2	1	1	1	1	1	1	1	1	:	1	:	1	2	1	1	1	1	1	10	2	1	1	:	1
30	Drew Poi:t, McLeod Poi:t,	1	2	3	6	3	4	3	2	2	2	2	2	2	2	2	1	1	:	2	3	3	2	2	2	:	5	2	2	1	1	1
31	Lo:ely, Pitt Poi:t, Pogik Bay	2	2	5	6	6	14	8	9	7	8	6	5	6	5	4	4	3	:	3	7	6	7	6	4	3	2	8	8	6	3	5
32	Cape Halkett	:	:	2	1	2	7	6	13	6	9	5	6	5	3	4	3	2	1	1	3	8	8	6	5	3	:	15	10	7	6	2
33	Atigaru Poi:t, Kogru River	:	:	1	:	1	2	2	5	2	2	1	2	1	1	2	:	1	:	:	:	2	2	1	1	:	:	8	1	1	1	1
34	Fish Creek	:	:	1	1	1	1	2	6	2	2	1	1	1	1	1	1	:	:	:	1	2	2	2	1	:	:	3	2	1	1	:
35	Colville River	:	:	1	:	1	1	2	6	3	6	3	3	3	1	1	:	:	:	:	1	2	4	3	1	:	:	3	10	5	2	:
36	Oliktok Poi:t	:	:	1	1	1	2	3	4	3	5	3	2	2	1	1	:	:	:	:	2	3	4	3	1	:	1	4	11	3	1	:
37	Mil:e Poi:t, Simpso: Lagoo:	:	:	:	:	1	1	2	3	3	6	3	6	3	2	2	:	:	:	:	1	2	4	5	1	:	:	2	4	16	3	1
38	Kuparuk River	:	:	:	:	:	:	:	:	1	1	1	2	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	:	6	2	:
39	Poi:t Brower, Prudhoe Bay	:	:	:	:	:	:	:	1	1	1	1	4	:	:	:	:	:	:	:	:	:	1	1	:	:	:	:	1	1	13	1
40	Foggy Isla:d Bay, Kadleroshilik River,	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	1	7	:
41	Bulle: Poi:t, Poi:t Gordo:, Relia:ce Pt.	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	4
42	Poi:t Hopso:, & Swee:ey, Stai:es River	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	1	1	:	:	:	:	:	:	1	1	:	:	:	:	1	8
43	Brow:low Poi:t, Ca::i:g River	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	6	1	:	:	:	:	:	1	3	:	:	:	:	:	2
44	Colli:so: Poi:t, Ko:ga:evik Poi:t,	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	1	:
45	A:derso: Poi:t, Sadlerochit River	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	1	:	:	:	:	:	:
46	Arey Isla:d, Barter Isla:d,	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	5	1	:	:	:	:	:	1	3	:	:	:	:	1	2
47	Kaktovik	:	:	:	:	:	:	:	:	1	1	1	2	1	2	3	5	8	7	:	:	:	1	2	3	9	:	:	:	1	2	4
48	Griffi: Poi:t, Oruktalik Lagoo:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	2	8	:	:	:	:	:	1	3	:	:	:	:	:	2
49	A:gu: Poi:t, Beaufort Lagoo:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	6	:	:	:	:	:	:	1	:	:	:	:	:	1
50	Icy Reef, Ko:gakut River, Siku Lagoo:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	11	:	:	:	:	:	1	3	:	:	:	:	:	1
51	Demarcatio: Bay, Demarcatio: Poi:t	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	3	3	9	:	:	:	:	:	2	3	:	:	:	:	:	2
52	Clare:ce Lagoo:, Backhouse River	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	4	5	11	1	:	:	:	1	2	6	:	:	:	:	:	2
53	Komakuk Beach, Fish Creek	:	:	:	:	:	:	:	:	:	:	:	1	1	2	2	4	3	6	:	:	:	:	1	3	4	:	:	:	:	1	2
54	:u:aluk Spit	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	2	:	:	:	:	:	1	1	:	:	:	:	:	1
55	Herschel Isla:d	:	:	:	:	:	:	1	1	1	1	1	1	1	2	2	2	1	2	:	1	1	1	1	2	1	:	1	1	:	1	2
56	Ptarmiga: Bay	:	:	:	:	:	:	:	:	1	:	1	1	1	1	1	1	1	1	:	:	:	:	1	1	1	:	:	:	:	1	1
57	Rola:d & Phillips Bay, Kay Poi:t	:	:	:	:	:	:	:	:	:	:	:	2	1	1	1	1	1	1	:	:	:	:	1	1	1	:	:	:	:	5	1
58	Sabi:e Poi:t	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:
59	Shi:gle Poi:t	1	:	1	:	1	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:
60	Tre:t a:d Shoalwater Bays	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
62	Shallow Bay, West Cha::el	:	:	1	:	1	:	:	:	:	:	:	:	:	1	1	1	2	1	:	:	:	:	:	:	:	:	:	:	:	:	1
63	Outer Shallow Bay, Olivier Isla:ds	:	:	:	:	:	:	:	:	:	:	:	:	:	2	2	2	2	2	:	:	:	:	:	1	1	:	:	:	:	:	2
64	Middle Cha::el, Gary Isla:d	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	1	3	1	:	:	:	:	:	1	3	:	:	:	:	1	2
65	Ke:dall Isla:d	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	2	2	3	:	:	:	:	:	1	1	:	:	:	:	1	1
66	:orth Poi:t, Pulle: Isla:d	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	1	2	:	:	:	:	1	2

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-49 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-50 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-51 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
21	Chukchi Sea	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
22	Beaufort Sea	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
23	Beaufort Sea	2	1	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	1	:	:	:	:
24	Beaufort Sea	2	1	1	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	1	1	1	:	:	:	:	1	:	:	:	:	:
25	Beaufort Sea	1	1	2	1	2	2	2	1	1	:	1	:	:	:	:	:	:	:	1	2	1	:	:	:	:	1	1	:	:	:	:
26	Beaufort Sea	1	1	1	1	2	1	2	1	1	1	1	:	:	:	:	:	:	:	1	1	2	1	1	:	:	:	1	:	:	:	:
27	Beaufort Sea	1	:	1	1	1	1	1	:	1	:	1	:	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-52 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
18	Chukchi Sea	2	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:
19	Chukchi Sea	3	1	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
20	Chukchi Sea	3	2	2	1	1	1	:	:	:	:	:	:	:	:	:	:	:	:	2	1	:	:	:	:	:	1	:	:	:	:	:
21	Chukchi Sea	1	1	1	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	2	1	2	1	1	1	1	:	1	:	:	:	:	:	:	:	:	:	1	1	1	:	1	:	:	:	1	:	1	:	:
23	Beaufort Sea	3	2	3	2	2	2	1	1	1	:	1	1	1	:	:	:	:	:	3	2	1	:	1	:	:	2	1	:	:	:	:
24	Beaufort Sea	4	2	3	2	2	1	1	1	1	:	1	:	1	:	:	:	:	:	3	2	1	:	:	:	:	2	1	:	:	:	:
25	Beaufort Sea	2	2	4	2	4	3	3	2	2	1	2	1	2	2	1	1	1	:	2	4	2	1	1	2	1	2	2	1	1	1	1
26	Beaufort Sea	2	2	3	2	4	2	4	2	4	3	3	2	3	3	1	2	1	:	2	3	4	3	2	2	1	1	2	1	2	1	1
27	Beaufort Sea	1	1	3	2	4	2	3	2	3	2	3	1	2	2	1	1	:	:	2	2	3	2	1	2	:	1	2	1	1	1	1
28	Beaufort Sea	1	1	1	1	1	1	1	:	1	1	2	1	1	1	1	1	:	:	1	1	1	1	1	:	1	:	1	:	1	:	1
29	Beaufort Sea	:	:	:	:	1	:	1	:	:	:	1	:	1	1	1	1	:	:	:	:	:	:	1	1	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-53 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
18	Chukchi Sea	4	3	3	2	2	2	1	:	:	:	:	:	:	:	:	:	:	:	3	2	1	:	:	:	:	1	1	:	:	:	:
19	Chukchi Sea	6	4	4	2	2	2	1	1	1	1	1	:	1	1	:	:	:	:	5	2	1	1	1	:	:	2	1	:	:	:	:
20	Chukchi Sea	6	4	4	3	2	1	1	1	:	:	:	:	:	:	:	:	:	:	5	3	1	:	:	:	:	2	1	1	:	:	:
21	Chukchi Sea	2	2	2	1	1	1	1	:	1	:	:	:	:	:	:	:	:	:	2	1	1	1	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	2	1	2	1	2	1	1	1	1	1	1	1	1	:	:	:	:	:	2	1	1	:	1	:	:	1	1	:	1	1	:
23	Beaufort Sea	4	2	3	2	3	2	2	1	1	1	2	1	1	1	1	:	:	:	3	2	2	1	2	1	:	2	2	1	1	1	:
24	Beaufort Sea	4	3	3	2	3	2	2	2	2	1	1	1	1	1	1	:	:	:	4	2	3	1	1	1	:	2	2	1	1	1	:
25	Beaufort Sea	3	2	4	3	5	4	5	3	4	3	4	2	3	3	2	1	1	:	3	4	4	3	3	4	1	2	3	2	3	2	1
26	Beaufort Sea	3	2	4	3	5	4	6	4	6	4	6	4	5	5	4	4	3	1	3	5	6	5	5	4	4	2	4	3	3	3	4
27	Beaufort Sea	2	2	4	4	7	5	8	6	8	6	8	5	8	7	6	4	2	1	3	5	8	7	6	6	1	2	7	5	5	4	5
28	Beaufort Sea	3	2	3	3	4	4	4	3	4	3	5	3	4	4	3	4	3	2	3	4	4	5	4	3	4	2	3	1	2	1	3
29	Beaufort Sea	2	1	1	1	1	1	2	1	2	2	3	3	3	3	3	4	2	1	2	1	2	2	4	3	3	1	1	1	2	1	2
30	Beaufort Sea	:	:	:	:	:	:	1	:	1	1	1	1	1	:	1	1	1	:	:	:	1	1	1	1	:	:	:	1	1	1	1
31	Beaufort Sea	:	:	:	:	1	1	1	1	1	1	2	1	2	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	:	:	:
34	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
35	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	1	1	:	:	:	:	:	1	1	1	:	:	:	1	:	:
36	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	2	1	1	:	:	:	1	:	2	2	:	:	:	:	1	2
37	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	1	2	1	3	2	1	:	:	:	:	1	1	2	:	:	:	1	:	2
38	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	1	:	:	:	:	:	1	2	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-54 Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at a Particular Location Will Contact a Certain Boundary Segment Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
17	Chukchi Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:
18	Chukchi Sea	4	3	3	2	2	2	1	1	1	:	:	:	:	:	:	:	:	:	3	3	1	:	:	:	:	3	1	:	:	:	:
19	Chukchi Sea	6	4	4	3	3	2	1	2	1	1	1	1	1	1	:	:	:	:	5	3	1	1	1	:	:	2	2	1	1	:	:
20	Chukchi Sea	6	4	4	3	2	1	1	1	1	1	:	:	:	:	:	:	:	:	5	3	1	:	:	:	:	2	1	1	:	:	:
21	Chukchi Sea	3	2	2	1	1	1	1	:	1	:	:	:	:	:	:	:	:	:	2	1	1	1	:	:	:	1	:	:	:	:	:
22	Beaufort Sea	3	2	3	2	2	1	1	1	1	1	1	1	1	:	:	:	:	:	2	2	2	:	1	:	:	1	1	:	1	1	:
23	Beaufort Sea	4	2	3	2	3	2	2	1	1	1	2	1	1	1	1	:	:	:	3	2	2	1	2	1	:	2	2	1	1	1	:
24	Beaufort Sea	4	3	3	2	3	2	2	2	2	1	1	1	1	1	1	:	:	:	4	2	3	1	1	1	:	2	2	1	1	1	:
25	Beaufort Sea	4	3	5	3	5	4	5	3	4	3	4	2	4	3	2	1	1	:	3	5	4	3	3	4	1	2	3	2	3	2	1
26	Beaufort Sea	3	2	5	3	5	5	7	4	6	4	6	4	5	5	4	4	3	1	3	5	7	5	5	4	4	2	4	3	3	3	5
27	Beaufort Sea	2	3	5	5	8	7	9	8	9	8	10	7	9	8	7	4	3	1	3	6	9	8	8	7	2	3	9	7	8	6	5
28	Beaufort Sea	3	3	4	3	5	5	5	3	5	4	5	4	5	5	4	4	4	2	3	4	5	5	5	3	5	2	3	2	4	2	3
29	Beaufort Sea	2	1	1	1	2	1	2	2	2	2	3	3	3	4	3	4	3	1	2	1	2	3	4	4	3	1	1	1	3	2	2
30	Beaufort Sea	:	:	:	:	:	:	1	:	2	1	1	1	1	:	1	1	1	:	:	:	1	2	1	1	:	:	:	1	1	1	1
31	Beaufort Sea	:	:	:	:	1	1	1	1	1	1	2	1	2	1	:	:	:	:	:	1	1	1	1	1	:	:	:	:	:	:	:
33	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:
34	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	:	:	1	1	1	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:
35	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	1	1	1	1	1	:	:	:	:	:	1	1	2	:	:	:	1	1	:
36	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	2	2	2	2	2	1	:	:	:	1	1	2	2	:	:	:	1	1	2
37	Beaufort Sea	:	:	:	:	:	:	:	:	:	:	1	1	2	3	2	3	3	1	:	:	:	:	1	2	3	:	:	:	1	1	3
38	Beaufort Sea	:	:	1	:	1	:	1	:	:	:	1	1	1	2	2	3	2	1	:	1	1	:	:	2	3	:	1	:	:	:	2

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent; LA = Launch Area, P = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A2-55 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
?	Land	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
28	Beaufort Spring Lead 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
32	Ice/Sea Segment 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
33	Ice/Sea Segment 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
34	Ice/Sea Segment 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
43	Nuiqsut Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-55 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
54	Ice/Sea Segment 16a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
55	Ice/Sea Segment 17	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
56	Ice/Sea Segment 18a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
57	Ice/Sea Segment 19	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
58	Ice/Sea Segment 20a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
59	Ice/Sea Segment 21	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
66	ERA 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
67	Ice/Sea Segment 16b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
68	Harrison Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
69	Harrison Bay/Colville Delta	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
70	ERA 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
71	Simpson Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
80	Ice/Sea Segment 18b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
83	Kaktovik ERA	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
84	Ice/Sea Segment 20b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-56 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
?	Land	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
28	Beaufort Spring Lead 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
32	Ice/Sea Segment 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
33	Ice/Sea Segment 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
34	Ice/Sea Segment 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
43	Nuiqsut Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-56 (continued). Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
54	Ice/Sea Segment 16a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
55	Ice/Sea Segment 17	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
56	Ice/Sea Segment 18a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
57	Ice/Sea Segment 19	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
58	Ice/Sea Segment 20a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
59	Ice/Sea Segment 21	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
66	ERA 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
67	Ice/Sea Segment 16b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
68	Harrison Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
69	Harrison Bay/Colville Delta	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
70	ERA 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
71	Simpson Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
80	Ice/Sea Segment 18b	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
83	Kaktovik ERA	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
84	Ice/Sea Segment 20b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-57 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
?	Land	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
28	Beaufort Spring Lead 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
32	Ice/Sea Segment 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
33	Ice/Sea Segment 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
34	Ice/Sea Segment 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
43	Nuiqsut Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-57 (continued). Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
54	Ice/Sea Segment 16a	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0
55	Ice/Sea Segment 17	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0
56	Ice/Sea Segment 18a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
57	Ice/Sea Segment 19	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
58	Ice/Sea Segment 20a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
59	Ice/Sea Segment 21	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
66	ERA 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
67	Ice/Sea Segment 16b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
68	Harrison Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
69	Harrison Bay/Colville Delta	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
70	ERA 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
71	Simpson Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
80	Ice/Sea Segment 18b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
83	Kaktovik ERA	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
84	Ice/Sea Segment 20b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-58 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
?	Land	3	0.0	3	0.0	2	0.0	2	0.0	2	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
28	Beaufort Spring Lead 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
32	Ice/Sea Segment 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
33	Ice/Sea Segment 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
34	Ice/Sea Segment 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
43	Nuiqsut Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-58 (continued). Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
54	Ice/Sea Segment 16a	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
55	Ice/Sea Segment 17	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
56	Ice/Sea Segment 18a	2	0.0	2	0.0	1	0.0	1	0.0	1	0.0
57	Ice/Sea Segment 19	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
58	Ice/Sea Segment 20a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
59	Ice/Sea Segment 21	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
66	ERA 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
67	Ice/Sea Segment 16b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
68	Harrison Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
69	Harrison Bay/Colville Delta	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
70	ERA 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
71	Simpson Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
80	Ice/Sea Segment 18b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
83	Kaktovik ERA	1	0.0	1	0.0	1	0.0	:	0.0	1	0.0
84	Ice/Sea Segment 20b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-59 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
?	Land	5	0.1	5	0.1	4	0.0	4	0.0	4	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
28	Beaufort Spring Lead 10	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
32	Ice/Sea Segment 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
33	Ice/Sea Segment 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
34	Ice/Sea Segment 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
43	Nuiqsut Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-59 (continued). Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
54	Ice/Sea Segment 16a	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
55	Ice/Sea Segment 17	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
56	Ice/Sea Segment 18a	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0
57	Ice/Sea Segment 19	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
58	Ice/Sea Segment 20a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
59	Ice/Sea Segment 21	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
66	ERA 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
67	Ice/Sea Segment 16b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
68	Harrison Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
69	Harrison Bay/Colville Delta	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
70	ERA 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
71	Simpson Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
83	Kaktovik ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
84	Ice/Sea Segment 20b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-60 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
?	Land	7	0.1	6	0.1	6	0.1	6	0.1	6	0.1
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
3	Thetis and Jones Islands	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
28	Beaufort Spring Lead 10	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
32	Ice/Sea Segment 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
33	Ice/Sea Segment 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
34	Ice/Sea Segment 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
43	Nuiqsut Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-60 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Environmental Resource Area Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
54	Ice/Sea Segment 16a	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
55	Ice/Sea Segment 17	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
56	Ice/Sea Segment 18a	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0
57	Ice/Sea Segment 19	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
58	Ice/Sea Segment 20a	2	0.0	2	0.0	2	0.0	1	0.0	2	0.0
59	Ice/Sea Segment 21	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
60	Ice/Sea Segment 22	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
61	Ice/Sea Segment 22	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
66	ERA 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
67	Ice/Sea Segment 16b	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
68	Harrison Bay	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
69	Harrison Bay/Colville Delta	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
70	ERA 3	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
71	Simpson Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
83	Kaktovik ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
84	Ice/Sea Segment 20b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table A2-61 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-62 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-63 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-64 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-65 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-66 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
31	Lonely AFS Airport, Pitt Point, Pogik Bay	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Cape Halkett	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-67 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Boundary Segment over the Assumed Production Life of the Lease Area Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-68 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Boundary Segment over the Assumed Production Life of the Lease Area Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-69 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Boundary Segment over the assumed Production Life of the Lease Area Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-70 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Boundary Segment over the Assumed Production Life of the Lease Area Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-71 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Boundary Segment over the Assumed Production Life of the Lease Area Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Resource Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	

Notes: All boundary segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table A2-72 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Boundary Segment over the Assumed Production Life of the Lease Area Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Boundary Segment Name	Proposal (Alternative I)		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral	
27	Beaufort Sea	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown

Table A2-73. Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 3 Days, Beaufort Sea Multiple-Sale

ID	Land Segments Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,4748,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	6	:	:	:	:	:	:	1	:	:	:	:	:	:
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	:	:	1	3	1	5	:	2	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	7	8	:	:	:	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown

Table A2-74. Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segments Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	1	9	14	:	:	:	:	:	1	7	:	:	:	:	:	2
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	:	2	3	9	4	11	2	8	1	1	:	:	:	:	:	:	:	:	2	5	2	1	:	:	:	11	14	2	:	:	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown

Table A2-75. Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	1	1	2	5	6	15	21	:	:	:	:	:	4	13	:	:	:	:	1	7
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	6	:	:	:	:	:	:	1	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	2	4	6	12	8	16	8	13	4	5	2	1	1	:	:	:	:	:	4	9	8	4	2	:	:	14	19	6	3	1	1
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown

Table A2-76. Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	2	2	5	8	10	18	25	:	:	:	:	1	6	17	:	:	:	1	3	10
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	2	9	:	:	:	:	:	1	3	:	:	:	:	:	1
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	3	4	8	14	10	19	10	16	6	8	5	4	3	1	1	:	:	:	5	11	10	7	5	1	:	15	22	9	5	2	1
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	1	:	:	:	:	:	1	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown

Table A2-77. Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	1	1	1	4	4	8	12	15	28	38	:	:	:	1	2	9	24	:	:	1	1	6	13
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	1	2	2	4	4	7	6	17	:	:	:	:	1	4	7	:	:	:	:	2	4
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	2	2	:	:	:	:	:	1	2	:	:	:	:	:	2
29,30,31,32,33	Teshekpuk Lake Special Use Area	4	6	11	19	14	28	16	25	12	14	9	9	8	5	5	3	3	1	7	16	15	13	10	5	3	19	30	15	10	6	4
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	3	:	:	:	:	:	1	2	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown

Table A2-78. Annual Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	1	:	:	:	:	:	:	1	1	1	2	6	5	12	17	22	36	47	1	1	:	1	4	15	33	:	:	1	2	7	19
52,53,54,56,57	Ivvavik National Park	1	:	1	:	1	1	1	:	1	1	2	4	5	9	8	13	11	22	1	1	1	1	3	8	13	:	:	1	2	6	8
63,64	Kendall Island Bird Sanctuary	:	:	1	:	1	:	:	:	1	:	1	1	1	3	3	3	3	3	:	1	:	1	1	2	3	:	:	:	1	1	4
29,30,31,32,33	Teshekpuk Lake Special Use Area	4	6	11	19	14	28	16	25	13	15	10	9	8	5	6	4	4	1	7	16	16	14	10	6	4	19	30	15	11	6	5
55	Hershel Island Territorial Park	:	:	:	:	:	:	1	1	1	1	1	1	1	2	3	4	3	4	:	1	1	1	1	3	3	:	1	1	:	1	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-79. Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	3	:	:	:	:	:	:	:	:	:	:	:	:	:
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	:	:	:	1	:	2	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4	5	:	:	:	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-80. Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	4	7	:	:	:	:	:	:	3	:	:	:	:	:	1
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	:	:	1	3	1	4	1	4	:	1	:	:	:	:	:	:	:	:	:	2	1	1	:	:	:	5	7	1	:	:	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-81. Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	2	7	11	:	:	:	:	:	1	6	:	:	:	:	:	3
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:	:	:	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	:	1	2	4	2	6	3	6	2	3	1	1	:	:	:	:	:	:	1	3	3	2	1	:	:	7	9	3	2	1	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-82. Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	1	1	1	3	3	9	15	:	:	:	:	1	1	7	:	:	:	:	1	3
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	5	:	:	:	:	:	1	1	:	:	:	:	:	1
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	1	1	3	6	3	10	4	9	3	5	3	3	2	1	1	:	:	:	1	4	5	4	3	1	:	8	13	5	4	2	1
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-83. Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	1	1	2	3	3	4	7	9	20	33	:	:	:	1	2	4	16	:	:	1	1	3	8
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	1	2	2	4	4	7	6	15	:	:	:	:	1	5	6	:	:	:	:	3	4
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	1	:	:	:	:	:	:	:	2	2	2	2	2	:	:	:	:	:	1	2	:	:	:	:	:	2
29,30,31,32,33	Teshekpuk Lake Special Use Area	2	4	7	13	9	21	13	21	11	14	9	9	8	6	7	3	3	1	3	10	12	12	9	6	4	13	24	13	10	7	5
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	2	1	2	:	:	:	:	:	1	1	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-84. Winter Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	1	1	:	:	:	:	:	1	1	1	2	4	4	7	11	17	30	44	1	1	:	1	3	10	27	:	1	1	2	5	13
52,53,54,56,57	Ivvavik National Park	1	:	1	:	1	1	1	:	1	1	2	5	4	8	8	12	10	21	1	1	:	q	3	7	13	:	:	1	1	7	7
63,64	Kendall Island Bird Sanctuary	:	:	1	:	1	:	:	:	:	:	:	:	1	1	3	3	4	4	:	:	:	:	:	2	4	:	:	:	:	1	4
29,30,31,32,33	Teshekpuk Lake Special Use Area	3	4	7	13	9	21	13	22	12	15	10	10	9	7	8	5	5	1	4	10	12	13	10	8	6	13	24	14	11	8	6
55	Hershel Island Territorial Park	:	:	:	:	:	:	1	1	1	1	1	1	1	2	2	2	1	2	:	1	1	1	1	2	1	:	1	1	:	1	2

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-85. Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 3 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	8	14	:	:	:	:	:	:	3	:	:	:	:	:	1
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	:	:	:	:	:	:	:	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	:	1	2	10	2	13	:	6	:	:	:	:	:	:	:	:	:	:	1	2	:	:	:	:	:	17	17	:	:	:	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-86. Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 10 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	:	:	1	1	1	6	4	23	36	:	:	:	:	:	4	18	:	:	:	1	1	7
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	7	:	:	:	:	:	:	:	:	:	:	:	:	:
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	1	6	9	26	10	31	6	20	1	3	:	:	:	:	:	:	:	:	5	14	5	2	:	:	:	29	34	4	1	:	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-87. Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 30 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	1	:	3	1	5	15	17	38	49	:	:	:	:	1	11	34	:	:	1	1	4	20
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	16	:	:	:	:	:	:	2	:	:	:	:	:	1
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	7	12	19	36	25	45	22	34	11	11	6	3	3	:	1	:	:	:	13	29	23	8	5	:	:	35	46	13	5	1	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	2	:	:	:	:	:	:	:	:	:	:	:	:	:

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-88. Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 60 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	1	:	6	5	16	26	29	46	52	:	:	:	:	2	20	44	:	:	1	2	8	29
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	:	:	:	1	2	5	5	21	:	:	:	:	:	1	7	:	:	:	:	:	3
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
29,30,31,32,33	Teshekpuk Lake Special Use Area	9	13	23	38	28	47	26	35	16	16	11	6	6	2	1	:	:	:	16	32	26	14	11	1	:	36	47	18	11	2	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	4	:	:	:	:	:	:	2	:	:	:	:	:	1

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-89. Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 180 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	:	2	1	9	7	20	29	32	49	53	:	:	:	:	3	24	47	:	:	1	2	12	31
52,53,54,56,57	Ivvavik National Park	:	:	:	:	:	:	:	:	:	:	1	1	3	5	5	8	8	23	:	:	:	:	1	3	11	:	:	:	1	1	5
63,64	Kendall Island Bird Sanctuary	:	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	1	1	:	:	:	:	:	1	1	:	:	:	:	:	1
29,30,31,32,33	Teshekpuk Lake Special Use Area	10	13	24	39	29	48	26	35	17	17	11	7	7	2	1	:	:	:	16	33	26	15	12	1	:	36	47	18	12	3	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	:	:	:	:	:	:	:	1	1	3	2	5	:	:	:	:	:	1	3	:	:	:	:	:	3

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table A2-90. Summer Conditional Probabilities (Expressed As Percent Chance) That An Oil Spill Starting At A Particular Location Will Contact A Certain Group of Land Segments Within 360 Days, Beaufort Sea Sales 186, 195, and 202

ID	Land Segment Name	LA 1	LA 2	LA 3	LA 4	LA 5	LA 6	LA 7	LA 8	LA 9	LA 10	LA 11	LA 12	LA 13	LA 14	LA 15	LA 16	LA 17	LA 18	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13
43,44,45,46,47,48,49,50,51	Arctic National Wildlife Refuge	:	:	:	:	:	:	:	:	1	3	2	11	10	27	35	38	53	54	:	1	:	1	5	30	49	:	:	2	3	14	37
52,53,54,56,57	Ivvavik National Park	1	:	1	:	:	1	1	:	2	1	4	4	6	11	10	16	13	25	:	:	1	1	4	10	16	:	:	1	3	5	11
63,64	Kendall Island Bird Sanctuary	:	:	1	1	1	1	1	1	2	2	2	2	2	2	2	3	1	2	1	1	1	2	1	1	2	:	1	1	3	2	2
29,30,31,32,33	Teshekpuk Lake Special Use Area	10	13	24	39	29	48	26	35	17	17	11	7	7	2	1	:	:	:	16	33	26	15	12	1	:	36	47	18	12	3	:
55	Hershel Island Territorial Park	:	:	:	:	:	:	1	1	2	1	2	2	3	5	5	9	6	7	:	:	3	1	3	6	8	:	1	:	:	2	7

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

APPENDIX B

OIL AND GAS RESOURCE ESTIMATES

OIL AND GAS RESOURCE ESTIMATES

Geologic assessments of undiscovered oil and gas resources are used by the MMS to identify prospective areas for leasing and as a basis for analysis of future petroleum activities. We assume that the effects of petroleum development will be proportional to oil volumes produced. It is reasonable to assume that industry will only develop discoveries that are economically viable (or commercial). Most of the oil and gas resources in arctic offshore provinces are noncommercial for geologic reasons (pools are too small) and economic reasons (oil prices do not support development costs).

Resource-assessment models evaluate the geologic and engineering characteristics of hypothetical new fields and the transportation and marketing factors associated with their production. Computer models (*GRASP* and *PRESTO*) determine the economic viability of discoveries by simulating field discovery, development, and production activities and performing a discount cash-flow analysis of the cost and income streams. Simulated projects that have positive net present value have their resources added to the total economic volume available in the province. A detailed description of MMS assessment methodology is provided in Sherwood et al., 1998.

The process of estimating undiscovered oil and gas resources has many uncertainties. Although the size, number, and location of prospects (potential traps) can be identified using seismic surveys, actual oil and gas reservoirs cannot be confirmed without drilling. In a frontier area with limited seismic data coverage, most of the modeled undiscovered resources could occur in pools that are not identified. The reservoirs, source rocks, and seals associated with the prospects are inferred from nearby wells (well logs) or by comparisons to known pools (analogs). Development cost estimates also are uncertain, because relevant projects may not have been completed under the equivalent environmental conditions.

Because of the many geologic, engineering, and economic uncertainties, resource estimates typically are presented as a range of values associated with probability levels. We report a “low case” at a 95% probability level (a 19-in-20 chance of occurrence), an “expected case” (mean or average) of the range, and a “high case” at 5% probability (1-in-20 change of occurrence). Larger volumes are associated with lower probabilities. Economic uncertainties are handled by using a range of market prices (a price of $18 and $30 per barrel). Typically, higher prices support greater levels of activity and more resources discovered and developed.

New resource assessments often differ from older assessments, because geologic concepts evolve with new data. Despite decreasing sophistication of technology, many discoveries are made inadvertently while drilling for different reservoir targets. No one can predict when and where commercial-sized fields will be found. The prospect inventory is likely to be different for each company. Increasing the area open to leasing and exploration will increase the likelihood of future discoveries. In a frontier area, area equates to opportunity.

B.1 Geologic Play Concepts

Undiscovered petroleum resources are modeled using a geologic play analysis. Each geologic play is defined by unique characteristics such as reservoirs, trap types, and similar geologic histories. Plays typically contain many prospects (untested but potential traps for oil/gas pools); some are mapped and some are unidentified. Proven plays contain oil and gas discoveries, and future exploration success rates generally are higher in the play, because all of the key elements are known to be present. Unproven plays have not been tested by drilling or lack discoveries in exploration tests. The majority of petroleum resources often is contained in unidentified prospects that either have not been mapped (lack of seismic data) or cannot be mapped using available data (require 3-dimensional seismic and well control). Consequently, estimating the oil and gas resource potential is speculative, even with the aid of complex computer models.

The regional geology and assessment methodology for the Beaufort province is discussed in detail by Sherwood et al., 1998, and the results presented here are an update of this assessment effort. Minor adjustments in play boundaries between the adjacent Beaufort and Chukchi planning areas and minor corrections to previous modeling inputs resulted in similar conclusions for the current (2002-2007) leasing-program area. The brief play descriptions that follow essentially are unchanged from the earlier 1995 assessment, because there has been very little exploration activity on the Beaufort Shelf since the 1995 assessment. The regional geologic history and stratigraphy are discussed in Section III.A.

The **Undeformed Pre-Mississippian Basement Play** consists of carbonate or sandstone reservoirs of the Franklinian sequence (Figure III.A.3). This play is unproven, because no OCS wells have reported pooled oil/gas. However, encouraging well tests were made on Flaxman Island.

The **Endicott Play** consists of sandstone reservoirs of the Mississippian Endicott Group (Figure III.A.3). This play is proven, because oil and gas fields were discovered at Endicott/Duck Island and Tern/Liberty, although two OCS wells were unsuccessful tests in this play.

The **Lisburne Play** consists of limestone and dolomite reservoirs of the Mississippian to Pennsylvanian age Lisburne Group (Figure III.A.3). This play is proven, because there is production in the Lisburne field onshore. Six OCS wells have tested the play without a commercial success.

The **Upper Ellesmerian Play** consists of Triassic and Permo-Triassic sandstone reservoirs of the Sag River Formation and Sadlerochit Group (Figure III.A.3). This play is considered proven, because most of the North Slope reserves are contained in this play, most notably the Prudhoe Bay field. The play has been tested by 13 OCS wells, resulting in the discovery of 2 offshore oil and gas fields (Northstar and Sandpiper).

The **Rift Play** consists of sandstone reservoirs of Jurassic to early Cretaceous age (Figure III.A.3). The play is proven, because there are many fields producing from these reservoirs on the North Slope (including the South Barrow, East Barrow, and Walakpa gas fields in the National Petroleum Reserve-Alaska, and Kuparuk River, Milne Point, Point McIntyre, Alpine, Niakuk, and other satellites) in addition to the undeveloped Point Thomson gas-condensate field. The play has been tested at several locations on the Beaufort shelf, raging from Aurora (east of Barter Island) to Cabot (near Barrow), without a commercial success.

The **Brookian Unstructured Western Topset Play** is an unproven play located on the inner to middle shelf in the western part of the Beaufort Sea. The play consists of deltaic sandstone reservoirs (Nanushuk Group) in early Cretaceous strata of the Brookian sequence (Figure III.A.3). Although discoveries have not been made offshore, several oil shows have been reported in the northern National Petroleum Reserve-Alaska (Simpson and Fish Creek).

The **Brookian Faulted Western Topset Play** is an unproven play located on the middle to outer shelf in the western Beaufort Sea. The play consists of Cretaceous deltaic sandstone reservoirs assigned to the Nanushuk and Colville Group (Figure III.A.3). No prospects have been drilled in this play.

The **Brookian Unstructured Western Turbidite Play** is a proven play located on the inner Beaufort shelf west of the Colville River. It includes deepwater strata of Cretaceous age) Torok Formation and Colville Group) containing turbidite sandstone reservoirs (Figure III.A.3). Two onshore fields (Tarn and Meltwater) are producing oil from equivalent reservoirs. This play has been penetrated by numerous OCS wells without encountering a commercial pool. The Phoenix well tested heavy oil from Torok turbidite sands, and oil shows were reported in the Mukluk well.

The **Brookian Faulted Western Turbidite Play** is an unproven play located on the middle to outer shelf in the western Beaufort Sea. The play consists of deepwater strata of early Cretaceous (Torok Formation) to late Cretaceous (Colville Group) age assigned to the Brookian sequence (Figure III.A.3). Potential reservoirs include turbidite sands in submarine fan environments. No prospects have been tested in the play.

The **Brookian Unstructured Eastern Topset Play** is a proven play located on the inner to middle shelf in the central part of the Beaufort Sea. The play consists of late Cretaceous to Tertiary age deltaic sandstone reservoirs assigned to the Brookian sequence (Figure III.A.3). Oil was discovered in the OCS at Hammerhead and Kuvlum and is being produced onshore from reservoirs in the West Sak (Kuparuk River Unit) and Schader Bluff (Milne Point Unit). In Harrison Bay, the Phoenix well tested oil in Colville Group strata. The results of the Warthog well and Stinson nearshore wells remain confidential, because their bottomhole location was on State submerged lands.

The **Brookian Faulted Eastern Topset Play** is a proven play located on the middle to outer Beaufort shelf in the central part of the Beaufort Sea. The play consists of Cretaceous and Tertiary deltaic sandstone reservoirs assigned to the Brookian sequence (Figure III.A.3). One OCS well (Galahad) recovered gas and condensate; however, the well was not flow tested or certified as capable of producing in paying quantities. We are confident that oil and gas are pooled in the Galahad prospect, but current economics do not support very high appraisal and development costs.

The **Brookian Unstructured Eastern Turbidite Play** is a proven play on the inner to middle Beaufort shelf. It includes Late Cretaceous and Tertiary turbidite reservoirs localized in submarine fan complexes. Stratigraphic traps predominate and prospects are difficult to map without 3-dimensional seismic surveys. One nearshore OCS well (Beechy Point No. 2) flowed oil and gas out of a thin turbidite sand. Onshore, this play has produced oil in the Badami field.

The **Brookian Faulted Eastern Turbidite Play** is an unproven play on the middle to outer Beaufort shelf. It includes the late Cretaceous and Tertiary turbidite reservoirs assigned to the Brookian sequence (Figure III.A.3). Numerous prospects in the play are formed by faults related to the Hinge Line (Figure III.A.4). Stratigraphic traps probably also are present but are difficult to map using the available 2-dimensional seismic data. No wells have tested the play.

The **Brookian Foldbelt Play** is a proven play in the eastern Beaufort shelf. Potential reservoirs are primarily Tertiary strata assigned to the Brookian sequence (Figure III.A.3). The structural character of prospects is complex, because it is influenced by intersecting tectonic trends of the Brooks Range orogenic belt and Hinge Line fault system. Several OCS wells have tested this play with mixed results. Shows were reported from the Belcher well, although reservoir quality typically was poor in the Corona, Aurora, and Belcher wells. The play area extends (geologically) into Canadian waters, where a small oil pool was discovered at Adlartok. Other Canadian Beaufort wells contain good quality reservoir rocks (Natsek).

B.2 Assessment Results

The resource potential of the Beaufort shelf province was analyzed by computer models in spring 2001. Two sets of petroleum-resource estimates were generated. The updated assessment for the Beaufort Sea Planning Area reports a mean conventionally recoverable volume of 6.94 billion barrels of oil and 32.07 trillion cubic feet of gas. This estimate includes available resources (unleased and undiscovered) recoverable using current technology without regard to their economic viability.

Because most of the resource endowment occurs in pools too small or costly to develop, the economically recoverable resource estimates are lower. For the Beaufort Sea Planning Area, the mean economically recoverable resource estimate is 1.78 billion barrels of oil at $18.00 per barrel; and 3.24 billion barrels of oil is recoverable at $30.00 per barrel. The oil volumes at other probability levels are listed in Table B-1.

Resource estimates for the Beaufort Sea Planning Area are somewhat lower, because the area is smaller and opportunities for commercial discoveries are correspondingly reduced. No gas resources on the Beaufort OCS are shown as economically recoverable, because there is no gas-transportation system from arctic Alaska to outside markets.

The Beaufort Sea Planning Area contains petroleum resources in 14 geologic plays, 9 of which have been proven to contain oil or gas pools. Exploration drilling in the past has covered all parts of the Beaufort shelf out to a maximum water depth of about 50 meters (Belcher, 167 feet; Galahad, 166 feet). At $18.00 per barrel, three plays contain 95% of the total economically recoverable resources modeled in the planning area. Relative contributions are from the Rift play (38%), The Upper Ellesmerian play (37%), and the Brookian foldbelt play (20%). These areas covered by these three plays are shown in Figures B-1 and B-2. Of the three major plays, only the Brookian foldbelt play is affected by removing a large portion of the eastern Beaufort Sea Planning Area from the current program area.

At a higher price of $30.00 per barrel, the results are much the same. However, another play (Brookian unstructured eastern topset play) joins the previous plays to comprise 97% of the total available economic resources. Relative contributions are from the Rift play (39%), the Upper Ellesmerian play (29%), the

Brookian foldbelt play (20%), and the Brookian Unstructured Eastern Topset play (9%). The areas covered by these four plays are shown in Figures B-3 and B-4.

Industry activities in the Beaufort Sea generally support these conclusions. Exploration efforts (leasing, marine seismic surveys, and drilling) have focused on the nearshore of the central Beaufort. Most of the geologic plays present in this "core area" are proven by discoveries in the OCS or commercial production in adjacent coastal areas. Industry has actively leased and drilled Ellesmerian prospects, because they were expected to contain thick, highly productive reservoirs similar to the Prudhoe Bay field. Rift sequence prospects also have been of high industry interest because of the prolific nearshore fields, such as the Point McIntyre field. Prospects in the Brookian sequence generally have been overlooked in favor of more easily mapped prospects. However, with new exploration technologies (3-dimensional seismic surveys), Brookian stratigraphic prospects represent new exploration opportunities throughout the program area.

Table B-1
Summary of Resource Assessment for the Beaufort Sea Planning Area

Conventionally Recoverable	95% Probability	Mean (average)	5% Probability
Planning Area*	3.56	6.94	11.84
Program Area*			
$18.00 per barrel	**95% Probability**	**Mean (average)**	**5% Probability**
Planning Area*	0.00	1.78	6.64
Program Area*		1.68	
$30.00 per barrel	**95% Probability**	**Mean (average)**	**5% Probability**
Planning Area*	1.00	3.24	7.76
Program Area*		2.87	

Source: USDOI, MMS, Alaska OCS Region
*billion barrels of oil

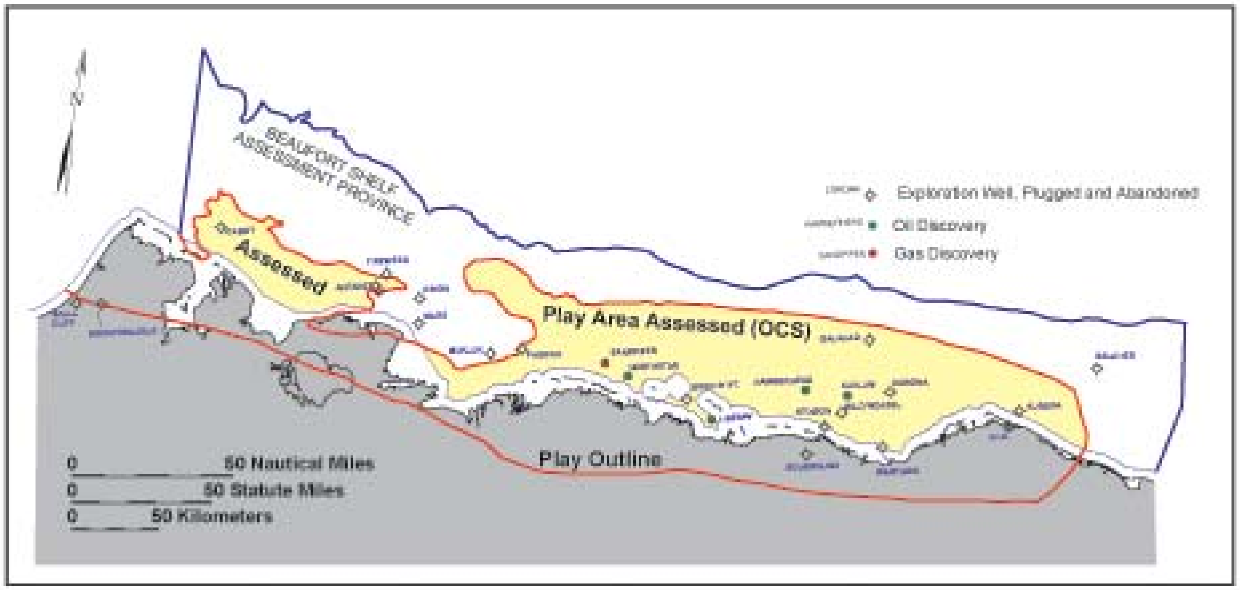


Figure B-1 Beaufort Rift Play

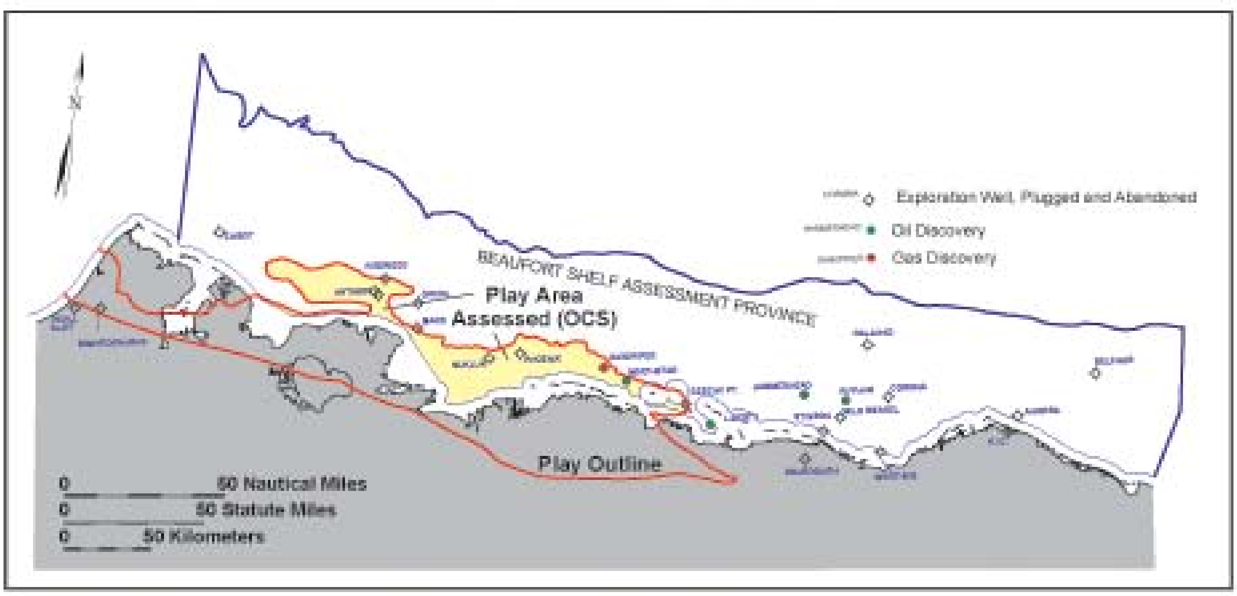


Figure B-2 Beaufort Upper Ellesmerian Play

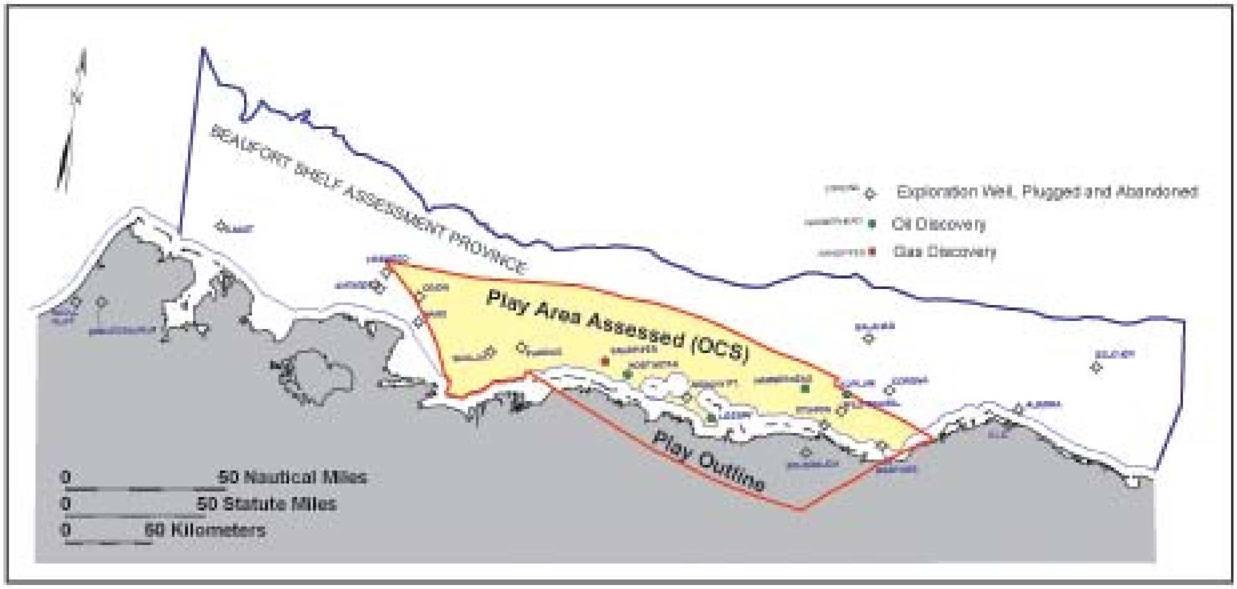


Figure B-3 Beaufort Brookian Unstructured Eastern Topset Play

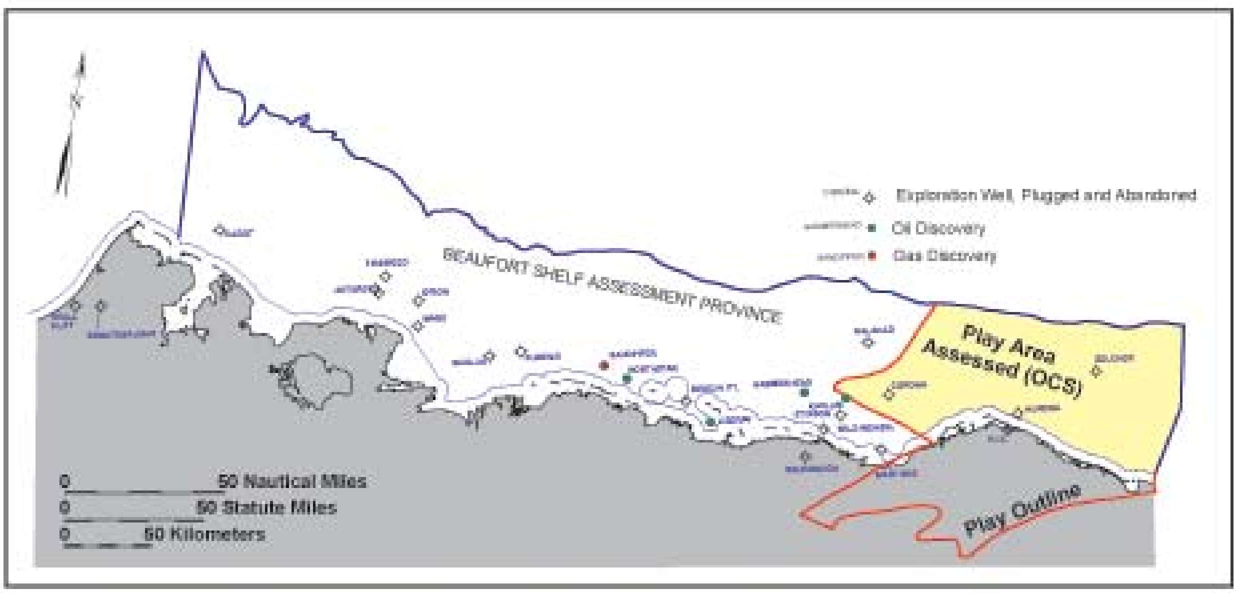


Figure B-4 Beaufort Brookian Foldbelt Play

APPENDIX C

ENDANGERED SPECIES ACT,
SECTION 7
CONSULTATION
AND
COORDINATION

List of Items in Appendix C

MMS memorandum dated January 7, 2002 sending listed species for Proposed Beaufort Sea Multiple-Sale Oil and Gas Lease Sales to USFWS.

USFWS memorandum response dated February 11, 2002.

MMS letter dated January 7, 2002 sending listed species for Proposed Beaufort Sea Multiple-Sale Oil and Gas Lease Sales to NMFS.

NMFS letter response dated February 11, 2002 indicating that they recently revised the Arctic Regional Biological Opinion in May 2001.

USFWS memorandum dated October 22, 2002 forwarding the Biological Opinion for Sale 186.

MMS memorandum dated May 9, 2002 requesting formal consultation with USFWS under the ESA, and forwarding the Draft EIS for the Proposed Beaufort Sea Multiple-Sale Oil and Gas Lease Sales.

MMS letter dated May 9, 2002 requesting formal consultation with NMFS under the ESA, forwarding the Draft EIS for the Proposed Beaufort Sea Multiple-Sale Oil and Gas Leasing Sales, and inquiring as to the status of May 2001 NMFS Biological Opinion in light of the Proposed Beaufort Sea Multiple-Sale Oil and Gas Lease Sales.

NMFS letter response dated July 23, 2002 to MMS saying that the previous May 2001 Biological Opinion was relevant to the Proposed Beaufort Sea Multiple-Sale Oil and Gas Lease Sales. This consultation is applicable to Sale 186.

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
949 East 36th Avenue, Suite 300
Anchorage, Alaska 99508-4363

JAN - 7 2002

Memorandum

To: Regional Director, U.S. Fish and Wildlife Service

From: Regional Director

Subject: Endangered Species - Proposed Beaufort Sea Multi-Sale Oil and Gas Lease Sale

The Minerals Management Service has initiated the planning process for leasing and exploration associated with the proposed Outer Continental Shelf (OCS) Beaufort Sea Multi-Sale Oil and Gas Lease Sale plan for the Beaufort Sea. The multi-sale plan provides for three sales in the Beaufort Sea Planning Area, Sale 186 in 2003, Sale 195 in 2005, and Sale 202 in 2007, as described in the Draft OCS Oil and Gas Leasing Program: 2002-2007. The planning area will be identical to the program area adopted in the 1997-2002 OCS Oil and Gas Leasing Program (see enclosure).

In accordance with the Endangered Species Act section 7 regulations governing interagency cooperation, we are providing a notification of the listed and proposed species and critical habitat that will be included in our biological evaluation.

In our biological evaluation, we will review the following listed species that may be present in the proposed sale area.

Common Name	Scientific Name	Status
Spectacled eider	*Somateria fischeri*	threatened
Steller's eider	*Polysticta stelleri*	threatened

It is our understanding there is no designated or proposed critical habitat for any listed or proposed species in OCS regions potentially affected by activities associated with the Beaufort Sea Multi-Sale plan.

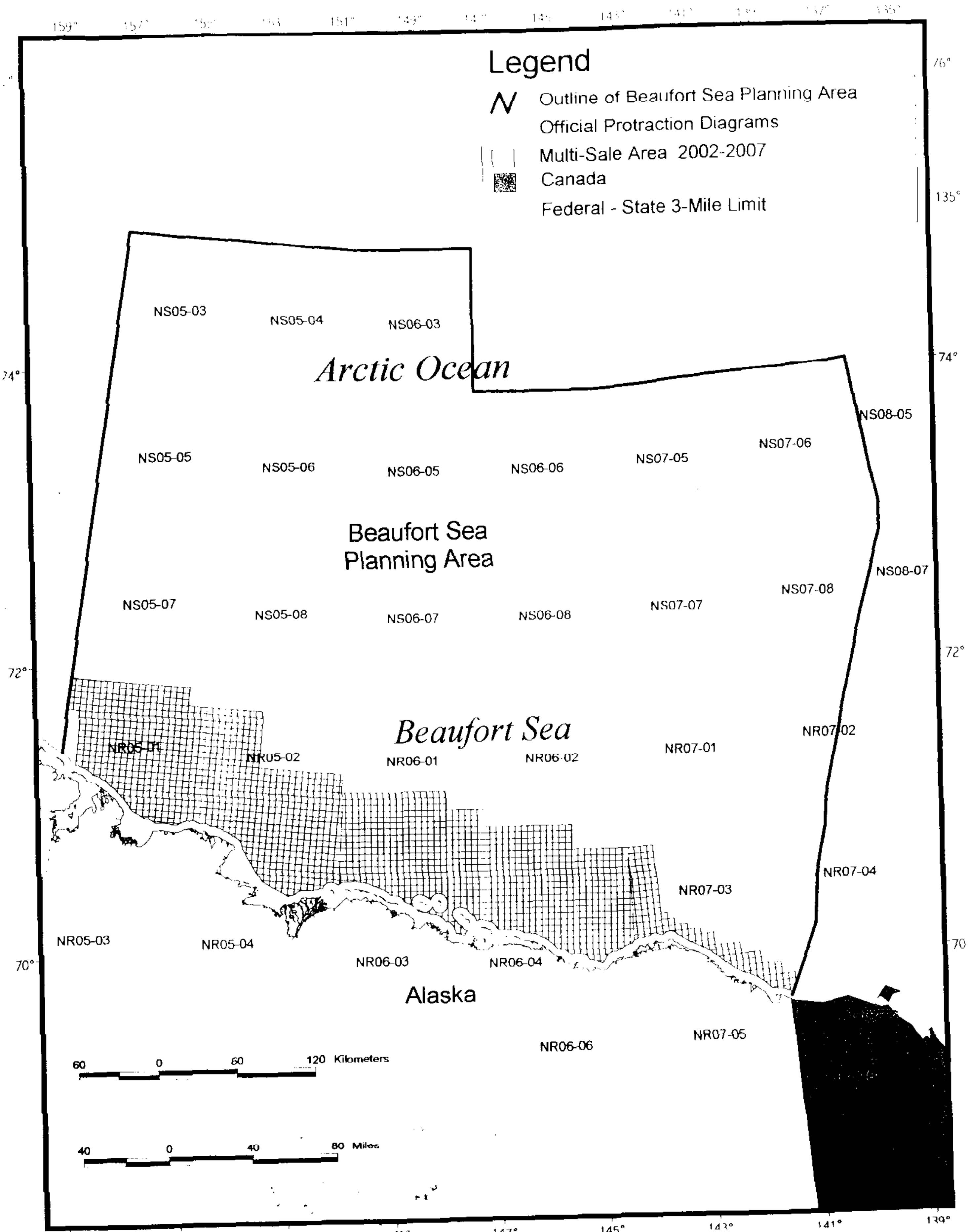
In previous consultations with the Fish and Wildlife Service (FWS) we also consulted on listed species and critical habitat along the transportation corridor from Valdez to ports along the Pacific coast and to the Far East. In the most recent section 7 consultation on the Liberty Development and Production Project, the FWS elected to address the effects of oil-tankering on listed species/critical habitat through a separate consultation with the U.S. Coast Guard in recognition of the Coast Guard's statutory authority relative to tankering activities. In addition, the National Marine Fisheries Service (NMFS) determined they would not be able to meaningfully measure, detect, or evaluate the effects associated with the transportation corridor.

NMFS therefore considered these effects as discountable and did not include them in the biological opinion for the proposed action. We understand that NMFS also may consider addressing the effects of oil-tankering on listed species/critical habitat through a separate consultation with the U.S. Coast Guard. Accordingly, we do not plan to consult on listed species and critical habitat along the transportation corridor from Valdez to ports along the Pacific coast and to the Far East.

Please review our list and notify us of your concurrence or necessary revisions and of any new information concerning these species or other species under FWS jurisdiction in relation to the proposed project. Also please advise us on the necessity to consult on the transportation corridor based on the discussion in the previous paragraph. To facilitate the review, we have provided a copy of this letter to your Northern Alaska Ecological Services Field Office. Upon receipt of your reply, we will begin preparation of the biological evaluation reviewing potential effects of the proposed action.

We look forward to working with you and your staff in protecting and conserving endangered and threatened species. If you have any questions concerning this proposed action, please contact Joel Hubbard at (907) 271-6670 or Frank Wendling at (907) 271-6510.

Attachment



Legend
Outline of Beaufort Sea Planning Area
Official Protraction Diagrams
Multi-Sale Area 2002-2007
Canada
Federal - State 3-Mile Limit
Arctic Ocean
Beaufort Sea Planning Area
Beaufort Sea
Alaska
NS05-03
NS05-04
NS06-03
NS05-05
NS05-06
NS06-05
NS06-06
NS07-05
NS07-06
NS08-05
NS05-07
NS05-08
NS06-07
NS06-08
NS07-07
NS07-08
NS08-07
NR05-01
NR05-02
NR06-01
NR06-02
NR07-01
NR07-02
NR07-03
NR07-04
NR05-03
NR05-04
NR06-03
NR06-04
NR06-06
NR07-05
60 0 60 120 Kilometers
40 0 40 80 Miles
76°
135°
74°
72°
70°
155°
153°
151°
149°
147°
145°
143°
141°
139°

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska 99503-6199

IN REPLY REFER TO:

AFES

FEB 11 2002

Memorandum

To: Regional Director - Minerals Management Service

From: Regional Director - Region 7

Subject: Endangered Species - Proposed Beaufort Sea Multi-Sale Oil and Gas Lease Sale

This memorandum constitutes the U.S. Fish and Wildlife Service's response to your memorandum dated January 7, 2002, in which you requested concurrence on two issues relating to consultation of the effects of a proposed Outer Continental Shelf Multi-Sale Oil and Gas Lease Sale plan for the Beaufort Sea on threatened and endangered wildlife.

First, you asked us to review your list of threatened and endangered species that may be present in the proposed sale area. We concur that Spectacled Eiders (Somateria fischeri) and Steller's Eiders (Polysticta stelleri) may occur in the proposed sale area. We also agree that there is no designated or proposed critical habitat for listed species that would likely be affected by the proposed lease sale.

Second, you asked us to comment on the necessity to include an evaluation of the impacts of transporting oil from Valdez to ports along the Pacific coast and the Far East in your biological evaluation and the ensuing consultation. We continue to believe that it is preferable to address the effects of oil-tankering on listed species in a separate consultation with the U.S. Coast Guard, rather than consulting on the effects piecemeal during multiple consultations on lease sales and development projects. There is no need, therefore, to include an evaluation of the effects of oil-tankering in your biological evaluation or the ensuing consultation on the proposed lease sale.

Thank you for your interest in protecting threatened and endangered species. If you have any questions about our response, please contact Patrick Sousa, Field Supervisor, Northern Alaska Ecological Services Field Office, at (907) 456-0327 or Ted Swem, Endangered Species biologist, Northern Alaska Ecological Services Field Office, at (907) 456-0441.

Dale B Hall

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
949 East 36th Avenue, Suite 300
Anchorage, Alaska 99508-4363

JAN - 7 2002

Mr. James Balsiger
Regional Administrator, Alaska Region
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

Dear Mr. Balsiger:

The Minerals Management Service has initiated the planning process for leasing and exploration associated with the proposed Outer Continental Shelf (OCS) Beaufort Sea Multi-Sale Oil and Gas Lease Sale plan for the Beaufort Sea. The multi-sale plan provides for three sales in the Beaufort Sea Planning Area, Sale 186 in 2003, Sale 195 in 2005, and Sale 202 in 2007, as described in the Draft OCS Oil and Gas Leasing Program: 2002-2007. The planning area will be identical to the program area adopted in the 1997-2002 OCS Oil and Gas Leasing Program (see enclosure).

In accordance with the Endangered Species Act section 7 regulations governing interagency cooperation, we are providing a notification of the listed and proposed species and critical habitat that will be included in our biological evaluation.

In our biological evaluation, we will review the following listed species that may be present in the proposed sale area.

Common Name	Scientific Name	Status
Bowhead whale	*Balaena mysticetus*	endangered

It is our understanding there is no proposed or designated critical habitat for any listed or proposed species in OCS regions potentially affected by activities associated with the Beaufort Sea Multi-Sale plan.

In previous consultations with the National Marine Fisheries Service (NMFS) we also consulted on listed species and critical habitat along the transportation corridor from Valdez to ports along the Pacific coast and to the Far East. In the most recent section 7 consultation on the Liberty Development and Production Project, NMFS determined they would not be able to meaningfully measure, detect, or evaluate the effects associated with the transportation corridor. NMFS therefore considered these effects as discountable and did not include them in the biological opinion for the proposed action. In addition, we understand that the Fish and Wildlife Service and NMFS have elected to address the effects of oil-tankering on listed species/critical habitat through a separate consultation with the U.S. Coast Guard in recognition of the Coast Guard's statutory authority relative to tankering activities. Accordingly, we do not plan to consult on listed species and critical habitat along the transportation corridor from Valdez to ports along the Pacific coast and to the Far East.

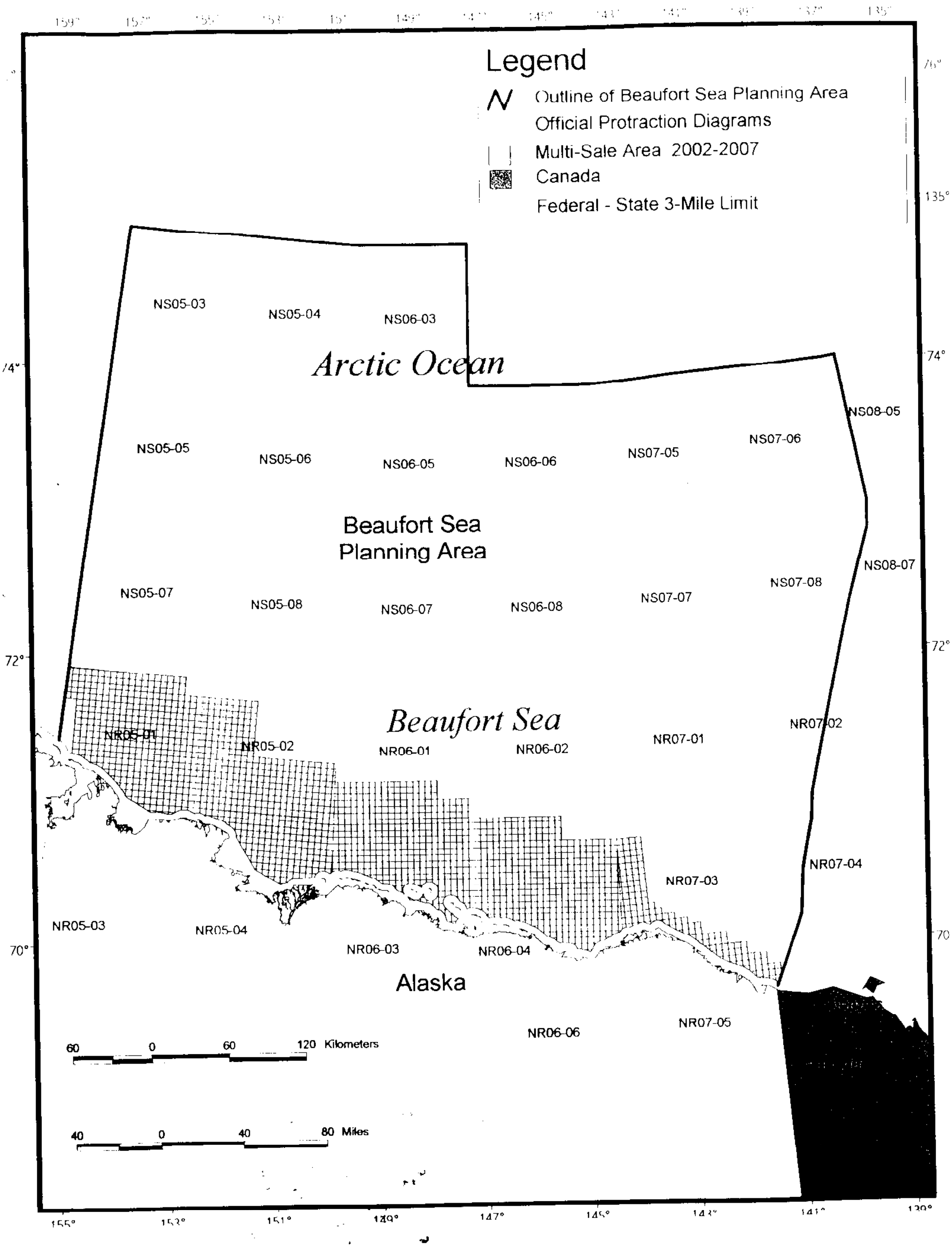
Please notify us of your concurrence or necessary revisions and of any new information concerning this species or other species under your agency's jurisdiction in relation to the proposed project. Also please advise us on the necessity to consult on the transportation corridor based on the discussion in the previous paragraph. To facilitate the review, we have provided a copy of this letter to your Anchorage field office. Upon receipt of your reply, we will begin preparation of the biological evaluation reviewing potential effects of the proposed action.

We look forward to working with you and your staff in protecting and conserving endangered and threatened species. If you have any questions concerning this proposed action, please contact Frank Wendling at (907) 271-6510 or Joel Hubbard at (907) 271-6670.

Sincerely,

John T. Goll
Regional Director

Enclosure



Legend
Outline of Beaufort Sea Planning Area
Official Protraction Diagrams
Multi-Sale Area 2002-2007
Canada
Federal - State 3-Mile Limit
NS05-03
NS05-04
NS06-03
Arctic Ocean
NS08-05
NS05-05
NS05-06
NS06-05
NS06-06
NS07-05
NS07-06
Beaufort Sea
Planning Area
NS05-07
NS05-08
NS06-07
NS06-08
NS07-07
NS07-08
NS08-07
Beaufort Sea
NR05-01
NR05-02
NR06-01
NR06-02
NR07-01
NR07-02
NR07-03
NR07-04
NR05-03
NR05-04
NR06-03
NR06-04
Alaska
NR06-06
NR07-05
60 0 60 120 Kilometers
40 0 40 80 Miles
74°
72°
70°
135°
147°

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

February 11, 2002

RECEIVED
JAN ? 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

John T. Goll
Director,
Alaska Outer Continental Shelf Region
Minerals Management Service
949 East 36th Avenue, Suite 300
Anchorage, Alaska 99508-4363

Dear Mr. Goll:

Thank you for your letter regarding threatened and endangered species which might be affected by the proposed Beaufort Sea Multi-Sale Oil and Gas Lease Sale. We agree with your determination to confine the biological evaluation to one listed species; the bowhead whale. Separate consultations are underway or will be initiated regarding the effects of the Trans-Alaska Pipeline System and the marine transport of oil from the terminal at Valdez. We are therefore in agreement with the position of Minerals Management Service not to consult on listed species and critical habitat along the pipeline or out of Valdez.

The Arctic Regional Biological Opinion (ARBO) was revised in May 2001, and we expect that document will continue to represent the most current assessment of the effects of leasing actions in the Beaufort Sea on the bowhead whale. We will confirm the applicability of the ARBO after reviewing the Biological Evaluation for this multi-sale.

We appreciate this opportunity for comment. Please direct any questions to Brad Smith in our Anchorage office at (907) 271-5006.

Sincerely,

James W. Balsiger
Administrator, Alaska Region

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E Tudor Rd.
Anchorage, Alaska 99503-6199

IN REPLY REFER TO

AFES/DES/FFWFO

OCT 22 2002

Memorandum

To: Regional Director - Minerals Management Service

From: Acting Regional Director - Region 7

Subject: Section 7 Consultation for Proposed Beaufort Sea Natural Gas and Oil Lease Sale 186 - Final Biological Opinion

This memorandum transmits the U.S. Fish and Wildlife Service's final no jeopardy biological opinion based on our review of the Minerals Management Service's proposed Natural Gas and Oil Lease Sale 186 and associated exploration activities in the Beaufort Sea Planning Area in accordance with Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Over the last several weeks our staff worked closely together in reviewing and revising the document. We appreciated the open, and constructive dialogue that led to the finalization of the biological opinion. We look forward to working collaboratively with the Minerals Management Service staff in implementing the terms and conditions of the biological opinion. If your staff have any questions regarding the final biological opinion, please have them contact Steve Lewis, Project Leader, Fairbanks Fish and Wildlife Field Office, at (907) 456-0272, or Jonathan Priday, Endangered Species Biologist, FFWFO, at (907) 456-0499.

Attachment

Doing visual inspection for mercury/worker safety? What are your analytical costs for mercury (see low)?

While a visual inspection will be used to direct soil sampling, potential mercury hazards will be investigated by sampling up to 50 locations in and around Peavy. Again there was a miscommunication regarding this proposal and a revised budget is attached.. Our current best estimate is $6,550 for PACF analytical: 50 soil/sediment samples for cold vapor mercury analysis ($64 each) with sample preparation costs of $67 per sample. RTI contact costs were used to prepare this estimate. Actual costs may be lower, depending on which lab performs the analysis.

Biological Opinion
for Minerals Management Service's
Proposed Beaufort Sea Natural Gas and Oil Lease Sale 186

Introduction

This documents transmits the U.S. Fish and Wildlife Service's (Service) final biological opinion based on our review of the Minerals Management Service's (MMS) proposed Natural Gas and Oil Lease Sale 186 and associated exploration activities in the Beaufort Sea Planning Area in accordance with Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The MMS's May 9, 2002, request for formal consultation was received on May 29, 2002. The MMS requested programmatic Section 7 consultation for proposed Beaufort Sea lease sales from 2003 through 2007 identified as Lease Sales 186, 195, and 202. The May 2002 Draft Alaska Outer Continental Shelf (OCS) Environmental Impact Statement (EIS) states that it is the sole National Environmental Policy Act (NEPA) analysis for Lease Sale 186 and that MMS will prepare an Environmental Assessment (EA) or supplemental EIS for Sales 195 and 202. Based upon the information contained in any future EA or supplemental EIS, the MMS will reinitiate programmatic consultation on Lease Sales 195 and/or 202 at later dates if new information comes to light that would trigger the need for reinitiation.

The MMS requested that the following biological opinion supercede previous consultations on all prior and existing lease sale activity in the Beaufort Sea. The Service and MMS previously consulted on OCS Lease Sales 124, 144, and 170, all of which overlap with portions of the area covered in Lease Sale 186. Thus far, leases on all or parts of 60 blocks have been sold in previous actions resulting in one exploration project, McCovey, and two development/production projects, Liberty and the Northstar project. Consultations for the McCovey, Liberty, and Northstar projects have been completed. However, since the McCovey exploration project falls within the current proposed action, the final biological opinion for Lease Sale186 will supercede the prior consultations covering McCovey. This biological opinion does not affect the consultations completed on the Northstar and Liberty projects.

For actions such as OCS oil and gas lease sales that are completed in incremental steps, the Service issues biological opinions on each step being considered. The following "incremental step" consultation is appropriate for long-term, multi-staged activities such as Lease Sale 186, for which agency actions occur in discrete steps. Although this is an "incremental step" consultation on leasing and exploration, information was also provided by MMS on potential development and production scenarios so that the Service could evaluate the likelihood of the entire action proceeding without violating Section 7(a)(2) of the Act.

In the first step of an incremental consultation, the Service must evaluate not only the proposed action, but also the potential entire action in order to determine the likelihood of the entire action violating Section 7(a)(2) of the Act. In this case, leasing and exploration are the proposed actions. Subsequent actions such as development and production are actions that may occur at a later date and will require separate consultations. Based on the information provided on the proposed and potential activities, and the information currently available on listed and proposed species and designated and proposed critical habitat, the Service has determined that it is unlikely that the entire action, including development and production, will violate Section 7(a)(2) of the Act.

This final biological opinion is based on information provided in the May 2002 Draft Alaska OCS Environmental Impact Statement and other sources of supplied information to evaluate the effects of the proposed leasing and exploration actions. The following document represents the Service's biological opinion on the effects of that action on the threatened spectacled eider (*Somateria fischeri*) and Steller's eider (*Polysticta stelleri*), in accordance with Section 7 of the Act.

A chronology of the consultation actions regarding Lease Sale 186 is provided in Attachment 1. A complete administrative record of this consultation is on file at the Fairbanks Fish and Wildlife Field Office, 101 12th Ave., Box 19, Fairbanks, Alaska 99701.

Description of the Proposed Action

The activities considered in this consultation are oil and gas lease sales and subsequent exploratory drilling, testing, and surveying. Separate consultations for development and production activities will be conducted if oil is discovered and development plans are proposed. Lease Sale 186 is tentatively scheduled for September 2003. If held, Lease Sale 186 would be the eighth Federal offshore sale in the Beaufort Sea Planning Area. The proposal would offer for lease 1,877 blocks encompassing about 3.9 million hectares (9.7 million acres). The blocks that comprise the proposed action are approximately 3 to 25 nautical miles offshore in water depths that range from approximately <1 to 1,500 meters (2 to 4,900 feet).

Six exploration and 6 delineation wells are proposed to be drilled during the period 2004 through 2010. The project description indicates that a maximum of two drilling rigs would be operable in any one exploratory year, assuming one exploration rig per platform. According to MMS's estimates within the Lease Sale 186 EIS, it is likely that one exploration well will be drilled per year for 6 consecutive years starting in 2004.

Based on geologic studies, the MMS indicates that each exploratory or delineation well would require 425 short tons of drilling muds (dry weight) and produce approximately 525 short tons of dry rock cuttings. The MMS estimates 935-1,040 short tons (dry weight) of drilling muds and 5,775-6,300 short tons (dry weight) of bore cuttings would need to be disposed for the exploration and delineation activities for Lease Sale 186.

If the first commercial discovery is made in 2005, 2 years after the sale date in 2003, production from Lease Sale 186 would begin by 2010. Between 2009 and 2014, three production facilities are likely to be brought online. The MMS estimates ~70 percent of production facilities would be located between the Canning River on the east and Colville River on the west in water depths less than 10 meters (Near Zone), ~30 percent would be located between Barter Island in the east to Cape Halkett in the west in water depths between 10 and 30 meters (Midrange Zone), and 0 percent would be located in the remainder of the program area extending from Barrow on the west to the Canadian boarder on the east (Far Zone). Spectacled eiders, especially females and broods, utilize the nearshore area of all three of these zones, especially areas offshore from the Colville Delta, Harrison Bay and Smith Bay (TERA 2002, review). Aerial surveys in the central Beaufort area done in 1999 and 2000 estimated that 166-371 spectacled eiders could have utilized the area that includes the Near and western Mid Zones (Stehn and Platte 2000). Steller's eiders are rarely found in the Far Zone and even less common farther east into the Mid- and Near Zones. Drilling production and injection wells are projected to begin in 2009 and conclude in 2017, with a total of 102 wells drilled. Oil production from Lease Sale 186 would end by 2033. Offshore pipeline construction is slated to begin in 2009 and finish in 2015, with 40 miles of new offshore pipeline installed. The offshore pipeline would likely connect to existing onshore pipelines.

Ice roads are assumed to be the principal transportation mode for routine supplies and materials to be transported to ice islands and/or nearshore gravel islands. For drilling platforms farther offshore in the broken-ice zone, material and supplies would be transported by support/supply boats (with icebreaking capacity, if necessary) during the open-water season and by helicopter at other times. For both types of drilling structures, most personnel would be transported by helicopters. The number of helicopter trips flown in support of exploration- and delineation-well drilling is assumed to range from about 90-270 each year, depending on the number of wells (1-3) that are drilled. For each drilling operation, there would be 1 flight per day of drilling. The time required to drill and test a well is about 90 days.

In the formulation of this biological opinion, the Service considered activities that would be interrelated and interdependent to the proposed action as well as accidental events that may occur as a result of the proposed action. Interrelated actions are those actions that are part of a larger action and depend on the larger action for their jurisdiction. Interdependent actions are those actions that have no independent utility apart from the action being considered in the biological opinion. Interrelated and interdependent activities that may occur in conjunction with the proposed action include construction of onshore support facilities, construction of onshore and offshore pipelines, and accidental oil spills originating from platforms, pipelines, and supply vessels.

STATUS OF THE LISTED SPECIES

Spectacled eider

The spectacled eider was listed as a threatened species under the Act in May 1993. Currently, primary nesting grounds are the Yukon-Kuskokwim Delta, the North Slope (Cape Simpson to the Sagavanirktok River) of Alaska, and in the Chaun Gulf and the Kolyma, Indigirka, and Yana river deltas of Arctic Russia. Post-breeding flocks of staging and molting spectacled eiders have been observed in Mechigmenan Bay (on the eastern coast of Russia's Chukotsk Peninsula), Alaska's Ledyard Bay (southwest of Point Lay), Peard Bay, Norton Sound, and 80 km south of Saint Lawrence Island. An estimated 7,370 spectacled eiders occupied the Arctic Coastal Plain of Alaska in June 2001 (Larned et al. 2001a), about 2 percent of the estimated 375,000 world population (Larned and Tiplady 1999).

From late December to early April, the only known wintering area of spectacled eiders is among leads in the pack ice southwest of St. Lawrence Island in the Bering Sea (Petersen et al. 1999). Leads in ocean ice are important pathways for marine bird and mammal species migrating along the Beaufort Sea coast in Alaska and Canada. All species of eiders use this lead system as well, flying at altitudes that are usually less than 30 meters (Johnson and Richardson 1982). Very little is known about migratory routes east of Barrow, but the definitive lead system transforms into numerous branches varying in location and extent from year-to-year. Because few spectacled eiders are observed in marine areas along the Beaufort coast in spring, a majority may migrate to the nesting areas overland from the Chukchi Sea (TERA 2002, review). Migration of eiders (the majority of which are king and common eiders) along Alaska's northern coast has been described in several studies (Thompson and Person 1963, Johnson 1971, Woodby and Divoky 1982). Spectacled eiders are observed in mixed flocks of king, common, and sometimes Steller's eiders, but the percentage of both spectacled and Steller's eiders is quite small.

Spectacled eiders arrive on North Slope breeding grounds paired, often in small flocks, in late May to early June. Spectacled eider nests are widely separated, nesting mainly from the Sagavanirktok River to the Chukchi Sea, and only sparsely to the east (Larned et al. 2001a). The highest densities determined from Service aerial surveys for eiders in 1998-2001 on the Arctic Coastal Plain east to the Arctic National Wildlife Refuge were found south of Barrow, with smaller areas east of Teshekpuk Lake, on the Colville River Delta, and near western Simpson Lagoon. Overall density was determined as 0.24 birds per square kilometer in 2001 (Larned et al. 2001a).

Male spectacled eiders begin to depart breeding areas during incubation, which coincides with late June on the North Slope. On the North Slope, the number of pairs peaks in mid-June and the number of males declines 4-5 days later (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995). Following their late June departure from the nesting areas, males apparently make little use of the Beaufort before migrating to the Chukchi Sea.

During late June the Beaufort Sea has little open water, hence males present at breeding grounds east of Barrow normally do not use marine habitats and fly directly overland (most heading to a molting/staging area in Ledyard Bay) (TERA 2002, review). Later in the season (late June through September), when females depart the North Slope, much more of the nearshore zone is ice free. Open water in marine habitat allows for extensive use of the western Beaufort Sea. Radio telemetry studies have shown that most female spectacled eiders that migrate west toward Barrow use the nearshore zone of the Beaufort Sea as they transit to their molting/staging areas. The 13 female spectacled eiders tracked by Troy et al. (2002, review) primarily used the western Beaufort (71 percent of all bird-days) while areas near Stockton Island were also extensively used (17 percent of all bird-days). The females remained in the Beaufort Sea nearshore zone for an average of about 2 weeks (range 6-30 days).

Predators of spectacled eider eggs include gulls, jaegers, and foxes. In Arctic Russia, apparent nest success has been calculated to be as low as <2 percent in 1994 and 27 percent in 1995; foxes, gulls, and jaegers are suspected to have depredated most of the nests (Pearce et al. 1998). On Kigigak Island in the Yukon-Kuskokwim Delta, nest success ranged from 20-95 percent in 1991-1995 (Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995, Moran 1996). Nest success may have been higher in 1992 than in other years of observation, because foxes were eliminated from the Island prior to the nesting season that year. Nest success in 1991 and 1993-1995 in the Kuparuk and Prudhoe Bay oil fields on the North Slope ranged from 25-40 percent (Warnock and Troy 1992, Anderson et al. 1998).

Spectacled eider incubation lasts 20-25 days (Dau 1974, Kondratev and Zadorina 1992, Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995). Hatching on the North Slope occurs from mid- to late July (Warnock and Troy 1992). Fledging occurs approximately 50 days after hatching. At this time, females with broods move directly from freshwater to marine habitats (Dau 1974, Kistchinski and Flint 1974).

On the nesting grounds, spectacled eiders feed by dabbling in shallow freshwater or brackish ponds, or on flooded tundra (Dau 1974, Kistchinski and Flint 1974). Food items include molluscs, insect larvae such as craneflies, trichopterans, and chironomids; small, freshwater crustaceans, and plants or seeds (Cottam 1939, Dau 1974, Kistchinski and Flint 1974, Kondratev and Zadorina 1992). Spectacled eiders in the marine environment feed predominately on clams and small amounts of snails, amphipods, and other bivalves. In March-April 1999 and 2001, studies within the spectacled eider wintering areas showed that the esophagi of collected eiders contained only clams, almost entirely *Nuculana radiata* with no trace of the once-dominant and preferred *Macoma calcarea* (Lovvorn 2002). Changes in the density of *Macoma calcarea* in the Bering Sea are coincident with an oceanic regime shift to warmer conditions in 1976-77 (Lovvorn et al. 2002 review). Exceptional climate change in the arctic and subarctic, and associated changes in marine communities and ice dynamics in spring, may have had important impacts on spectacled eiders whose declines of ~90 percent are largely unexplained.

timed in mid-June, indicates a smaller population, averaging about 200 birds from 1992-2001 (Larned et al. 2001b). These surveys likely underestimate actual population size, however, because an unknown proportion of birds are missed when counting from aircraft, and no species-specific correction factor has been developed and applied. Nonetheless, these observations indicate that hundreds or low thousands of Steller's eiders occur on the North Slope. These surveys do not demonstrate a significant population trend over the last decade. However, based on the observed interannual variability, it is estimated that it would take 14 years to detect a trend equivalent to a 50 percent change over 10 years (Larned et al. 2001a). Current sampling intensity is too low to provide useful trend data for this very rare species. There is some support for the hypothesis that Steller's eiders have abandoned formerly occupied areas in eastern portions of the North Slope; if true, this likely indicates that the Alaska-breeding population is in decline.

Steller's eiders spend most of the year in marine habitats. During winter, most of the Steller's eiders concentrate along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet in shallow, near-shore marine waters (Jones 1965, Petersen 1980). They also occur in the western Aleutian Islands and along the Pacific coast, occasionally to British Columbia, along the Asian coast (from the Commander islands to the Kuril islands), and some are found along the north Siberian coast west to the Baltic States and Scandinavia (Palmer 1976, Cramp et al. 1977). In spring, large numbers concentrate in Bristol Bay before migration; in 1992, an estimated 138,000 Steller's eiders congregated there before sea ice conditions allowed movement northward (Larned et al. 1994).

Steller's eiders arrive in pairs on the North Slope in early June. Nesting effort varies widely from year to year. In the years from 1991-2001, there were 6 "nesting years" (1991, 1993, 1995, 1996, 1999, 2000) when typical breeding activities occurred, and 5 "non-nesting years" (1992, 1994, 1998, 2001) when birds appeared in early summer, but no nests were found and Steller's eiders are believed not to have nested (Quakenbush et al. 1995, Obritschkewitsch et al., unpublished data). Four nests were found in 1997, but these were initiated late (early July) and none survived past mid-incubation (Service/North Slope Borough), unpublished data). The reasons for the observed variation in nesting effort are unknown, but an association has been noted between nesting years and years of lemming abundance. Nest success could be enhanced in years of lemming abundance, because predators are less likely to prey on eider nests when small mammals are abundant. It has also been hypothesized that avian predators such as pomarine jaegers (*Stercorarius pomarinus*) and snowy owls (*Nyctea scandiaca*), which nest at high densities only when lemmings are abundant, may provide protection for nearby eider nests incidental to defense of their nesting territories (Quakenbush and Suydam 1999). If this hypothesis is correct, the presence of avian predators is an essential element of breeding habitat.

In nesting years, initiation dates are typically in the first half of June (Quakenbush et al. 1995), and hatching dates range from 7 July to 3 August (Quakenbush et al. 1998). Nests in Barrow are located in wet tundra, in areas of low-center polygons or low (indistinct flat-centered) polygons, frequently within drained lake basins (Quakenbush et al. 1998). Average clutch sizes at Barrow ranged from 5.3-6.3 in 5 different years, with clutches up to 8 reported (Quakenbush et al. 1995). Nest success (proportion of nests at which at least 1 egg hatched) at Barrow averaged approximately 17 percent from 1991-2001 (Service, unpublished data). Egg loss was attributed mostly to predation by predators, including jaegers, common ravens (*Corvus corax*), and possibly glaucous gulls (*Larus hyperboreus*) and Arctic foxes (*Alopex lagopus*) (Quakenbush et al. 1995, Obritschkewitsch et al. 2001). The fledging period is not known, but is estimated to be 37 days (Obritschkewitsch et al. 2001). Broods most often used ponds with emergent grass (*Arctophila fulva*) (Quakenbush et al. 1998). Broods were reared close to their nest site; 8 broods tracked near Barrow in 1995 remained within 650m of their nest sites during the first 32 days after hatching (Quakenbush et al. 1998).

Males typically depart the breeding grounds after females begin incubating. Based on observations in the Barrow area, and on a small sample of birds equipped with satellite transmitters, males depart Barrow around the end of June or early July (Quakenbush et al. 1995, Obritschkewitsch et al. 2001). Both males and females tracked with satellite transmitters in a non-breeding year dispersed across the area between Admiralty Inlet and Wainwright in late June and early July, with most birds entering marine waters by the first week of July. The satellite-tracked birds used coastal locations from Barrow to Cape Lisburne, and made extensive use of lagoons and bays on the north coast of Chukotka (Service, unpublished data). Visual observations in other years confirm the use of nearshore areas of the Chukchi Sea; small groups of males (less than 10) have been observed in July near Barrow (Service, unpublished data). Females that fail in breeding attempts may remain near Barrow later in the summer; a single failed-breeding female equipped with a transmitter in 2000 remained near the breeding site until the end of July, and stayed in the Beaufort Sea off Barrow until late August. Females and fledged young depart the breeding grounds in early to mid-September.

In mid-August, Alaska-breeding Steller's eiders migrate to molting areas, where they congregate in large flocks in protected waters. Concentrations of molting Steller's eiders have been noted in Russia on the Chukchi and Bering sea coasts, near Saint Lawrence Island in the Bering Sea , and along the northern shore of the Alaska Peninsula (Kistchinski 1973, Fay 1961, Jones 1965, Petersen 1981). Satellite-tracked birds from Barrow molted at Nunivak Island, Cape Avinof (Kuskokwim Shoals), Nelson Lagoon/Port Moller, and Izembek Lagoon (Service, unpublished data).

Causes of suspected population declines are not known. Possible causes currently being examined include community dynamics of nesting avian populations in the Barrow area, artificial increases in predator populations on the North Slope, subsistence harvest and lead contamination.

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR §402.2) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone Section 7 consultation, and the impacts of State and private actions, which are contemporaneous with the consultation in progress.

Status of Spectacled Eiders and Steller's Eiders Within the Action Area

Currently, no trend is discernible in spectacled and Steller's eider population sizes on the North Slope. Furthermore, the factors that limit population size on the North Slope have not been identified. Therefore, it is impossible to determine whether human activity and habitat alteration have affected the status of the species in the project area. However, factors that may have affected the status of the species in the project area include loss of breeding habitat, disturbance from oilfield operations, research efforts, lead contamination, increases in predator populations, and subsistence harvest.

Factors Affecting Species Environment Within the Action Area

Breeding habitat on the North Slope has remained largely unaltered and uninhabited by humans. A small portion of the species' potential breeding range has been altered by oil and gas development. Within the last decade oil and gas development has spread out from the coastal plain near Prudhoe Bay to offshore platforms in the Beaufort Sea to the borders of the Arctic National Wildlife Refuge in the east and the Colville River in the west. Since 1979, 7 OCS lease sales have been held and 30 OCS exploration wells have been drilled in the Beaufort Sea Planning Area. In 1999, the Service has completed Section 7 consultation on a development and production plan for the Northstar Project, which straddles Alaska State and Federal waters (Lease Sale 186 EIS). Northstar began production on October 31, 2001. The Service also completed consultation on a development and production plan for the Liberty Project, which is wholly located on the Federal OCS. A final EIS for the Liberty Project was published in May 2002. The applicant, BP Exploration (Alaska) Inc., announced that it has suspended work on the project pending a re-evaluation of project costs. The future of this project is uncertain. Impacts of oil development include construction, accidental spills of toxic materials, off-road vehicle use, wetland filling, and indirect effects of human presence in areas previously uninhabited.

Human population growth in the vicinity of Barrow and other North Slope communities has also resulted in localized habitat loss due to construction activities and off-road vehicle use. On-road and off-road vehicle traffic are potential sources of disturbance. Steller's eider research conducted jointly by the Service and North Slope Borough is also a source of disturbance, because those activities are oriented toward locating nests and broods. One nest was depredated in 2000 as a likely result of nest-search disturbance, when a nest was left exposed to a jaeger because of the proximity of the researcher (Service, unpublished data). Nest abandonment, in the absence of predation, has only been documented as a result of research-related trapping and handling of an incubating hen; it is possible, however, that chronic human disturbance close to a nest could cause abandonment.

Lead or other sources of contamination of habitat or prey species are possible in localized areas within the range of Steller's and spectacled eiders. Exposure of waterfowl to lead has been documented in the range of the Alaska-breeding population of Steller's eiders. Elevated blood and tissue lead levels, morbidity, and mortality from lead poisoning were found in spectacled and common eiders (*Somateria fischeri* and *S. mollissima*, respectively) on the Yukon-Kuskokwim Delta (Franson et al. 1995, Flint et al. 1997, Flint and Herzog 1999). On the breeding grounds near Barrow, one Steller's eider found dead in June had liver and kidney lead concentrations suggestive of lead poisoning, although several other Steller's eiders examined at the same time of year had lower lead tissue concentrations (Trust et al. 1997, Service, unpublished). Blood samples from nesting hens trapped near Barrow in 1999 and 2000 showed that all (8 of 8) had concentrations exceeding the clinical threshold for lead exposure and 7 of 8 exceeded thresholds for lead poisoning in waterfowl.

Often, with increases in human presence, there is a concomitant increase in nest predator populations such as gulls, ravens, and foxes. Residents of Barrow and other North Slope communities have observed an increase in populations of gulls and arctic foxes. There is very little information on predation of Steller's and spectacled eider nests throughout most of the species' range in Alaska. Near Barrow, however, Steller's eider nest success in recent years has been very poor. Of 186 nests found from 1991-2000, only 15-18 percent survived until hatching, with predation thought to be the primary factor causing nest failures (Quakenbush et al. 1995, Obritschkewitsch et al. 2001). In addition to causing complete nest failures during incubation, predators at Barrow further reduced productivity through partial predation (where some but not all eggs in a nest were taken) and by killing ducklings that survived the incubation period (Quakenbush et al. in prep.). Studies of nest predation in other areas have reported mixed results. For example, "apparent" nest success on the Indigirka River Delta, Russia in 1971 was 10-15 percent, and eiders nesting near gull nests had higher nesting success (Kistchinski and Flint 1974, Mayfield 1975). However, in 1994 nest success was <2 percent and nest predators such as Arctic foxes, glaucous and herring gulls, and parasitic and pomarine jaegers are suspected to have depredated most of the nests (Pearce et al. 1994). Also, nearly complete predation of spectacled eider nests by jaegers and foxes was recorded on the Chaun River Delta, Russia after a June snow storm (Kondratev and Zadorina 1992). Predation by gulls, jaegers, and Arctic foxes probably affects the survival of Steller's and spectacled eider eggs and ducklings throughout the species' range.

Sport hunting for Steller's and spectacled eiders was closed in 1991 by Alaska State regulations and Service policy. Outreach efforts have been conducted by the North Slope Borough and Service to inform hunters of these closures. Accurate information on current harvest rates is not available, but hunter surveys and other observations indicate that hunting of Steller's and spectacled eiders likely continues in Northwest Alaska (Paige et al. 1996, Georgette 2000, Wentworth 2001).

Conservation efforts also affect spectacled eiders and their habitat within the action area. The Service provides project applicants with recommendations and restrictions intended to minimize impacts of oilfield activities on spectacled eiders. These include timing restrictions and buffers around known nest sites and likely benefit spectacled eiders at the individual level.

All of the factors discussed here may have influenced populations of spectacled and Steller's eiders in northern Alaska, although it is unknown if these factors played a major role in either species' decline.

EFFECTS OF THE ACTION ON LISTED SPECIES

Helicopter Overflights

Nesting Steller's and spectacled eiders could be disturbed by helicopter overflights related to exploration and delineation activities. However, disturbance to nesting spectacled and Steller's eiders is unlikely due to their extremely low densities across the North Slope. Across the Arctic Coastal Plain of the North Slope, breeding season density averages approximately one pair per 8 km^2 for spectacled eiders (Larned et al. 2002a). Steller's eiders are so rare in some years that they are not detected at all by aerial survey methods. In the core Steller's eider breeding area near Barrow, the highest density recorded in 4 years of aerial surveys was estimated as approximately one pair per 12.5 km (Ritchie and King 2002). Densities elsewhere on the Arctic Coastal Plain are much lower, and may approach zero.

The number of helicopter trips flown in support of exploration- and delineation-well drilling is assumed to range from about 90-270 each year, depending on the number of wells (1-3) that are drilled. For each drilling operation, it is assumed that there would be one flight per day of drilling. The time required to drill and test a well is about 90 days. Most flights will transport employees between Deadhorse and as yet unspecified exploration sites.

Heavy helicopter traffic could adversely affect spectacled eiders by: 1) displacing adults and/or broods from preferred habitats during pre-nesting, nesting, brood rearing and migration; 2) displacing females from nests, exposing eggs or small young to inclement weather or predators; and 3) reducing foraging efficiency and feeding time. The behavioral response of eiders to aircraft overflights is unknown; some spectacled eiders nest and rear broods near the Deadhorse Airport, indicating that some individuals may tolerate frequent aircraft noise. Individual tolerances are likely to vary, however, and the intensity of disturbance associated with the proposed action would, in some cases, be greater than that experienced by birds near the airport. Some birds may be displaced, with unknown physiological and reproductive consequences. The number of eiders that would be exposed to helicopter overflights is variable, however. This is, in part, because the potential flight paths to drilling sites within the Lease area could range from short (e.g., a direct route from Deadhorse to Beaufort Sea) to lengthy (e.g., a flight path to a remote site 25 mi. north of Barrow). Because most oil exploration and development in the Lease Sale 186 area is anticipated to occur in the Near and Mid Zone areas close to primary support facilities at Deadhorse and vicinity, spectacled eiders in the Deadhorse area are much more likely to be overflown than those in more distant portions of the lease area.

In conclusion, while helicopter overflights potentially could cause adverse effects to individuals of either species of listed eider, their low nesting densities and low use of nearshore areas during migration, suggest that few individuals would likely be impacted. Likewise, the wide range of tolerances found in individual birds to this type of potential disturbance make it difficult to predict whether adverse impacts would actually occur. Finally, the EIS indicates that the most likely locations for exploration are in the Near and Mid zones. Steller's eiders are extremely rare in these zones, and the probability of affecting large numbers is diminished because of the relatively short flight paths.

Onshore Bases and Pipelines

Disturbance to Steller's and spectacled eiders from onshore bases and pipelines is also possible. The level of disturbance anticipated is highly variable depending on the zone within the OCS within which future development actually occurs. For the Near Zone, an area anticipated to receive over 70 percent of all development, MMS expects that no new landfalls, shore bases, or new onshore processing facilities would be required. For development within the Mid- and Far Zones, projects could involve new pipeline landfalls and shore bases. Because the Mid- and Far Zones are mostly beyond the influence of existing infrastructure on the North Slope, new development projects could introduce significant changes to the level of disturbance experienced at landfall areas. The MMS's Lease Sale 186 EIS states that route selection and installation of offshore pipelines could occur either in the summer open-water season or during mid- to late winter when landfast ice has stabilized. New onshore pipeline sections would be constructed simultaneously with the offshore pipeline installation. Because onshore pipelines and support bases may be constructed during the summer breeding season, there is potential for disturbance to nesting spectacled eiders. Observations from Prudhoe Bay suggest that spectacled eiders exhibit some tolerance of facilities (including pipelines) and service roads (TERA 1996). Telemetry studies in 1993 and 1994 showed broods spending time within 200 m (656 feet) of facilities, and crossing roads (five known broods in 1995 and two in 1994).

The development of onshore bases and pipelines would only occur in support of oil production and thus is not a part of the leasing and exploration action being considered in this incremental consultation other than with regard to the jeopardy determination. Although construction and operation of onshore bases may displace and/or disturb individual eiders, the total area affected is not expected to result in population-level impacts. If onshore bases and additional pipelines to transport produced oil and gas are proposed in the future, the impacts of those actions would be fully considered when consultation is requested on that increment of the OCS program.

Exploration, Production and Support Activity

Encounters between marine seismic equipment, offshore drilling, dredging, and vessels involved in ice breaking and threatened eiders at sea is also a possibility. During the open-water season, MMS assumes various levels of seismic-survey activity and supply boat support. Site-specific surveys of the exploration and delineation well sites would be conducted during the ice-free seasons of the years of the exploratory phase. The MMS estimates each survey would cover roughly 23 square kilometers for each exploration well and last between 2 and 5 days. The annual number of supply boat trips per open-water season could be as high as 14.

If exploration occurs between October and May, the probability of exploratory activities (not including accidental discharge of oil) in the Beaufort Sea resulting in encounters with spectacled or Steller's eiders would be low. This probability increases, however, if the action occurs between May and October because of the presence of spectacled and Steller's eiders migrating across the Chukchi and Beaufort seas to reach breeding grounds in the spring and when migrating to molting/staging areas in the summer and fall.

Extensive nearshore and offshore aerial surveys in the Beaufort Sea in 1999 and 2000 failed to detect concentrations of spectacled eiders (no Steller's eiders were observed), except for two flocks (numbering 40 and 100) offshore in the Harrison Bay area (Fischer at al. 2002). Given the rarity of these species, we assume that few threatened eiders would encounter vessel traffic. We surmise that eiders would avoid such encounters by diving or flying away, that the frequency of those disturbances will not reach the threshold that would impair survival, and that alternative suitable habitat is available. Under these conditions, take is unlikely, and would not reach a population-level effect.

Collisions with Drilling Structures

Migrating birds are at risk of collision with objects in their path, particularly when visibility is impaired during darkness or inclement weather, such as rain, drizzle, or fog (Weir 1976). The incidence of bird strikes appears to rise when objects are illuminated with constant diffuse light, and the tendency for birds to be drawn to diffuse light appears to increase during rainy or foggy weather. Accidental strikes of "hundreds" of unidentified eiders were reported to have occurred in association with the Bering Sea crab fishery, presumably influenced by the bright lights used on fishing vessels (Service 1996). Comparisons have shown that blinking lights cause less mortality than constant lighting, and the color of the lights and the object may influence collision frequency (Weir 1976). Cross-sectional area also affects the number of birds that strike an obstruction.

Johnson and Richardson (1982) reported that 88 percent of eiders flew below an estimated altitude of 10 m (32 feet) and well over half flew below 5 m (16 feet). Recently, (September/October 2001) several sea duck fatalities as a result of platform strikes were documented at Northstar Island, a production platform within the Lease Sale 186 area. In 2001,18 birds were retrieved at Northstar Island, all sea ducks, including 4 king eiders, 6 common eiders, and 8 long-tailed ducks (Service, unpublished). The densities of Steller's and spectacled eiders on the North Slope are much lower than those of the species found dead at Northstar. Therefore the potential for them striking OCS oil platforms is much lower. Although information specific to spectacled eider flight behavior is lacking, a spectacled eider was seen striking a utility wire near an electric light in white-out conditions on St. Lawrence Island in 1998 (Service, unpublished).

Several structures associated with exploration and delineation wells may pose a risk to migrating eiders, including crane boom, drilling rigs, and other buildings. Although the total profile of exploratory and delineation wells and associated structures is small relative to the Beaufort Sea, the Service believes that the structures pose a risk to migrating eiders, including spectacled and possibly Steller's eiders, because: 1) the Lease Sale186 area contains the "main route" used by female eiders migrating west through the Beaufort Sea, speculated to be "just north of the barrier islands" (Johnson and Richardson 1982); 2) the artificial lighting associated with drill rigs may serve as a magnet to migrants, particularly during fog and rain (Weir 1976); and 3) the flight altitude of migrating eiders is low and within the height range of exploration and production facilities.

It is estimated that 47 percent of the North Slope spectacled eider population breeds to the east of Barrow, and it is a reasonable (though unproven) assumption that birds breeding west of the project infrastructure do not wander eastward (Service, unpublished). The likelihood of death or injury as a result of collision is diminished because recent radio telemetry studies have shown that few male spectacled eiders migrate through the Beaufort Sea on their way from their North Slope breeding grounds to molting/staging areas in the Chukuchi Sea (TERA 2002 review). Females nesting east of Barrow have been shown to utilize the western regions of the Beaufort Sea extensively en route to molting/staging areas (TERA 2002, review). Therefore, based on our understanding of the biology of the species, their migration routes, distribution, and behavior, we believe that there is some risk of injury or death of some individuals from collisions with oil and gas exploration and delineation structures. However, the best available scientific and commercial information does not lead us to believe that significant population-level impacts are likely to result from the proposed action.

Increase in Predator Populations

Several North Slope predators that prey on waterfowl eggs and young concentrate in areas where anthropogenic food sources are made available. Examples include glaucous gulls, ravens, and Arctic foxes that are abundant near camps, roads, oilfields, and villages. For ravens and foxes, there is evidence showing population increases and/or changes in distribution in response to anthropogenic food sources, and the breeding distribution of ravens has expanded on the North Slope because buildings and other structures in oil developments provide nesting sites (Day 1998). The predation pressure that foxes and, to a lesser degree, gulls and ravens, exert on ground-nesting birds is also well documented, and in some areas predation may be the single most important factor affecting nest success (ibid.).

Spectacled and Steller's eiders may be adversely affected by increased numbers or distribution of predators. Ravens apparently never successfully nested in Barrow until 1991 when a single pair began raising a brood each year on a man-made structure. In 1991, one of these ravens was seen depredating five eggs from two Steller's eider nests (Quakenbush et al. 1995). Although information showing a direct link between oilfield activities and waterfowl nest predation rates is lacking, the Service believes that actions that artificially enhance predator populations are a potential adverse impact to listed eiders.

The development of significant permanent infrastructure would only occur in support of oil production and thus is not a part of the leasing and exploration action being considered in this incremental consultation other than with regard to the jeopardy determination. If permanent infrastructure is proposed in the future, the impacts of those actions would be fully considered when consultation is requested on that increment of the OCS program including their potential impacts on predator populations. Based on the limited number and ephemeral nature of exploratory drilling rigs, we do not believe that these will affect predator populations sufficiently to cause impacts to threatened eiders on the population level.

Oil Spills

Spilled oil can have significant impacts on birds. Exposure to oil can affect birds in several ways. Most birds exposed to oil die within a short period of time, often through loss of the insulative properties of their plumage so that hypothermia ensues (Hunt 1987, Piatt et al. 1990). Embryos or young can be killed by contact with adults that have oiled plumage (King and Lefever 1979, Peakall et al. 1982). Birds that ingest contaminated food can suffer fatal toxicological effects (Peakall et al. 1983). Species that feed on invertebrates or other organisms that bioaccumulate and/or biomagnify toxins are particularly vulnerable.

Oil spills and associated clean-up could result from the proposed project. Potential sources of a spill include a drilling blowout, failure of diesel fuel storage tanks on exploratory islands, rupture of pipelines (loss > 0.15 percent of flow rates), chronic leaks from the pipelines (loss < 0.15 percent of flow rate), or spills from barges or trucks used to transport fuel oil to exploratory and delineation rigs. Historical data from North Slope oil production show that between 0 and 102 spills per year occurred from 1970-1997; most were small spills, as mean spill size in all years was <100 bbl (Lease Sale 186 EIS). Small spills, although the most likely, have the least impact to wildlife populations because a smaller area is affected and fewer individuals are likely to be exposed. Similarly, spills in the terrestrial environment, though possible, will likely have minimal impact because the density of Steller's and spectacled eiders is relatively low in the project area and spills on land spread slowly and will be more easily detected and contained. Therefore, the Service considers the possible impacts from small marine spills and spills in the terrestrial environment to be unlikely to affect more than a few individual Steller's and spectacled eiders. Thus, the remainder of this discussion will focus exclusively on medium or large (≥1,000 bbl [42,000 gal]) spills in the marine environment.

The expected impacts of oil spills depends on how accurately spill characteristics, as well as the distribution and behavior of the birds are predicted. Estimating the probability of spills is fundamental: if no oil is spilled, there will be no impacts. If one or more spills occur, characteristics such as volume, trajectory, and timing will greatly influence the impact on eiders. Patterns of use of the Beaufort Sea by Steller's and spectacled eiders are equally relevant. Evaluating the likelihood of spills from exploration and delineation is constrained by the small number of comparable projects in the Beaufort Sea. The Lease Sale 186 EIS estimated that the risk of one or more spills of at least 1,000 bbl (42,000 gal) over the life of the project is 8-10 percent. Oil-Spill-Risk Analysis modeling within the Lease Sale 186 EIS estimates that if such a spill does occur the chance that listed eiders will come in contact with spilled oil in nearshore or offshore areas ranges up to 55 percent in summer; along the shoreline contact probability is less than 8 percent. No estimates of spill risk from barges or trucks used to transport fuel oil to exploratory and delineation sites were given in the Lease Sale 186 EIS.

Cleanup of a spill in the Beaufort is anticipated to be limited by ice and weather conditions in the area. In many cases, final cleanup of an oil spill may only be possible from early July through August after the Lease Sale 186 area is ice free (National Research Council 1994). Because of unstable and broken ice conditions in the area, once a leak is detected, response for containment and cleanup of a spill will be delayed or hindered during 6 months of the year, and then only as weather permits. In addition, historical recovery rates of spilled oil are traditionally very low even when cleanup is not hampered by Arctic weather and frozen or partially frozen seas. Based on national and international data, recovery rates of 20-25 percent are considered high and are usually not above 10 percent (Alaska Department of Environmental Conservation 1998, National Research Council 1994).

Oil spill response activities such as hazing and other human activities (boat and air traffic) could also impact spectacled eiders. Hazing, according to the Lease Sale 186 EIS, may have limited success during spring when migrants occupy open water in ice leads. The hazing effect of cleanup activity or actively hazing birds out of ice leads that oil is expected to enter may be counterproductive, because there are few alternative habitats that flushed birds can occupy. Cleanup activities in leads during May and open water in July through September are likely to adversely affect spectacled eiders.

In summary, accidental oil spills can have significant impacts on birds as a result of direct and indirect contact. Potential sources of a spill include a drilling blowout, failure of diesel fuel storage tanks on exploratory islands, rupture of pipelines, chronic leaks from the pipelines, or spills from barges or trucks used to transport fuel oil to exploratory and delineation rigs. Small spills are the most likely to occur but that also have the least potential impact to listed species because a smaller area is affected and fewer individuals are likely to be exposed. Similarly, spills in the terrestrial environment will likely have minimal impact because the density of Steller's and spectacled eiders is relatively low in the project area and spills on land spread slowly and will be more easily detected and contained. Large spills (≥1,000 bbl [42,000 gal]) spills in the marine environment are of a greater concern, however, the risks during exploration and delineation are significantly less than during production, which the EIS indicates is 8-10 percent over the life of the proposed project. The probability of a large oil spill contacting a significant number of spectacled or Steller's eiders is further diminished by considerations of timing, ice and weather conditions, effectiveness of spill response, and the dispersed nature of the birds' distribution. The coincidence of all those factors which would have to occur simultaneously in order to appreciably reduce the likelihood of survival and recovery is improbable. Thus, we conclude that such an impact is not reasonably certain to occur.

Toxics Contamination

Leasing and exploration may also result in increasing contamination of marine habitats, due to the disposal of drilling muds and cuttings, or accidental eruption of oil from test wells during a blowout. Such contamination may impact individuals either through direct contact or indirectly as a result of effects on prey populations or important habitats. Information provided by the MMS indicates that industry's record on the Outer Continental Shelf allows the assumption of a probability of crude-oil release during exploration to be zero, however the potential for such an occurrence exists.

The Lease Sale 186 scenario developed by the MMS, which this opinion will assume, indicates that 6 exploration and 6 delineation wells are expected to be drilled during the period 2004 through 2010. A maximum of two drilling rigs would be operable in any one exploratory year, assuming one exploration rig per platform. Discharges as a result of these wells are regulated by the Environmental Protection Agency through a National Pollutant Discharge Elimination System (NPDES). The EPA initiated consultation with the Service in January 1994 to determine the likelihood that the proposed discharges associated with exploratory drilling would adversely affect listed species. The Service concurred with the EPA that the proposed NPDES permit issuance would not be likely to adversely affect listed species. Therefore, the EPA and MMS have already satisfied the requirements of the

Endangered Species Act regarding effluent discharges associated with oil and gas exploration in the Beaufort and Chukchi seas (State and Federal waters).

CUMULATIVE EFFECTS

Cumulative effects include future State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State or private actions reasonably certain to occur within or near the proposed sale area would include: State of Alaska oil and gas lease sales, exploration, development, and production; gravel mining, support facility and road construction to support these activities as well as pipelines and related oil and gas transport facilities, including feeder lines, Trans-Alaska Pipeline operation and maintenance; possibly some future Canadian Beaufort Sea oil and gas activities; land reconveyances from Native corporations to private individuals; subsistence harvest activities; commercial fishing; marine shipping; and recreational activities.

CONCLUSION

After reviewing the proposed action, the current status of spectacled and Steller's eiders, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that Beaufort Sea Oil and Gas Lease Sale 186 and associated activities, as proposed, are not likely to jeopardize the continued existence of the spectacled and Steller's eider. There is no designated or proposed critical habitat on the North Slope for spectacled or Steller's eiders.

Regulations (51 FR 19958) that implement Section 7(a)(2) of the Act define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." In evaluating the impacts of the proposed Lease Sale 186 to Steller's and spectacled eiders, the Service identified a series of direct impacts that could result, such as disturbance from helicopter overflights, collisions with drill rig facilities by migrants, and changes in the number or distribution of predators. However, the Service believes that the combined impacts to spectacled and Steller's eiders through these avenues will be minimal for the reasons given in the *Effects of the Action* section of this biological opinion. The widely dispersed nature of these two species, both onshore and offshore in the Beaufort Sea region, reduces their vulnerability to perturbations of limited geographic scope.

The Service believes that the greatest risk to listed species from the proposed Lease Sale 186 is potential impacts from accidental oil spills in the marine environment. However, as noted above, for the project to jeopardize the continued existence of spectacled eiders, an appreciable reduction in the likelihood of both the survival and recovery of one or both species must be "reasonably expected to occur." Thus, when determining whether possible oil spills jeopardize listed species, the Service must consider the following: 1) the likelihood of one or more spills occurring; and 2) if one or more spills occur(s), the likelihood that the spill(s) will kill enough spectacled eiders to appreciably reduce their likelihood of survival and recovery.

The likelihood of one or more large spills $\geq$1,000 bbl in size occurring during the lifetime of Lease Sale 186 is estimated to be 8-10 percent. Assuming factors similar to Northstar, the likelihood of a very large spill (blowout) $\geq$150,000 bbl in size occurring during the lifetime of Lease Sale 186 is 9.4×10^{-7}. However, the impacts of a spill to biological resources (e.g., eiders) vary with spill volume, spill trajectory, whether the resource is present during the time of year that spilled oil is present, and the length of time that oil persists in the environment. This is exemplified by Stehn and Platte's (2000) model, which estimated mortality from a 30 day spill in July caused by exploratory activity within the Lease Sale 186 area at 2-52 spectacled eiders. While if a 30 day spill were to occur throughout August during the period of active westward migration, mortality resulting from a large spill is estimated to be $\leq$100 individuals. Although the estimates of spill probability and impacts to threatened eiders are constrained by lack of information on oil development, subsea pipeline safety, and numbers/locations of threatened eiders in the region, the available information leads the Service to conclude that an appreciable reduction in the likelihood of survival and recovery of listed eiders is not reasonably expected to occur.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. "Harm" is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by MMS so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The MMS has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the MMS fails to assume and implement the terms and conditions or fails to require any applicant to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the MMS must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement. [50 CFR 402.14(i)(3)]

Helicopter Overflights

Disturbance from helicopter overflight to Steller's and spectacled eiders is unlikely because over most of the lease area, there is a low probability that the few areas occupied by scattered flocks during the spring to fall staging and migration periods would be overflown routinely by support aircraft flying between a few offshore drill sites and onshore facilities. A potential exception might be spectacled eiders occurring in coastal or offshore portions of the Near Zone or western Midrange Zone areas that are relatively close to primary support facilities at Deadhorse. Eiders in this vicinity may be more likely to be overflown than those in the more distant portions of the lease area. However, few eiders remain for long in marine waters in the immediate vicinity of Prudhoe Bay and therefore disturbance would be minimal (TERA 1997, 1999).

As described in the *Effects of the Proposed Action* above, spectacled and Steller's eider adults and/or broods may occur below or adjacent to helicopter routes. However, the Service does not anticipate that helicopter flights associated with Lease Sale 186 will result in take of spectacled or Steller's eiders due to low recorded densities of breeding and migrating spectacled eiders in the project area and observed tolerance of nesting spectacled eiders to overhead flights near Deadhorse airport.

Exploration, Production and Support Activity

Because Steller's eiders using the marine environment rarely occur in the Near or Midrange Zones from Harrison Bay east, where 90 percent of the Lease Sale 186 leasing activity and development projects are expected to occur, it is unlikely that the action will generate major disturbance. Because of the large amount of nearshore habitat available to spectacled eiders in the Beaufort Sea, spectacled eiders staging or migrating in offshore water are not likely to experience significant disruption of foraging or displacement as a result of routine exploration, development, or support activities during the open-water season.

Despite potential encounters with exploration and support activities at sea, eiders typically avoid such encounters by diving or flying away from such disturbance. Substantial adverse effects on spectacled or Steller's eiders resulting from offshore marine activities in the vicinity of the proposed area of the action are unlikely. Therefore, the Service does not anticipate that disturbance from exploration, production and support activity will result in take of spectacled or Steller's eiders.

Collisions with Drilling Structures

The Service anticipates that some level of take of spectacled and/or Steller's eiders may result from collisions with exploratory, delineation and production drilling structures. Such losses may affect the regional population of spectacled eiders, which shows a non-significant downward trend in the past decade, and Steller's eiders, which shows a nonsignificant upward trend over the same time period. However, the MMS's uncertainty over locations, number and size of drilling platforms within Lease Sale 186 makes quantifying potential bird strikes difficult. Also, limited information available on spectacled and Steller's eider migration routes, behavior, and vulnerability to obstructions when migrating further complicates estimating anticipated take. However, the anticipated footprint of all exploratory and production platforms is likely to be relatively small within the Lease Sale 186 area (3.95 million hectares) and the majority of eiders encountering platforms during migration are likely to miss or avoid the obstruction.

Estimating incidental take of Steller's and spectacled eiders from strikes is extremely difficult due to a lack of available information on sea duck strikes coupled with uncertainty over potential numbers, locations, seasonality and duration of potential Beaufort OCS activities. Limited data is available for common eider (*Somateria mollissima v-nigra*) strikes to Northstar Island, which is located within the Lease Sale 186 area. From this data it is possible to generate a generic strike rate for sea ducks per well-year by dividing the number of common eider strikes (6) to Northstar Island in 2002 by the most recent population estimate of common eiders migrating west over the Beaufort Sea (111,635) (Suydam et al. 1996, Service, unpublished). That number is then multiplied by the North Slope population estimates for spectacled (7,370) and Steller's eiders (433) (Larned et al. 2001a) to give a "strikes per well year" estimate for both species. The results of this methodology indicate that 0.40 spectacled and 0.02 Steller's eiders will be taken per well-year as a result of colliding with drill rigs and/or other exploratory and delineation structures.

The Lease Sale 186 EIS states that no more than two drilling rigs would operate at any time, with a total of 6 exploration and 6 delineation wells expected to be drilled over a 7-year exploration period. Therefore, the Service anticipates that the maximum number of exploration and/or delineation wells drilled within the Beaufort Sea resulting from the MMS's Lease Sale 186 would be twelve. Twelve wells result in 12 well-years, from which we estimate take of five spectacled and one Steller's eider over the life of the proposed leases.

It is important to note that the above estimates for incidental take from strikes to drill rigs are crude. The estimates do not take into consideration that eider strikes are episodic in nature, many spectacled and most Steller's eiders never migrate through the Beaufort Sea, and that the strike rates are generated from only 1 year of data at a single location in the Lease area. Therefore, as more data on eider strikes to OCS platforms in the Beaufort Sea becomes available, the MMS may need to reinitiate consultation if observed strike rates are higher than the above anticipated incidental take level.

Increase in Predator Populations

State of Alaska, Department of Environmental Conservation regulations that govern refuse management in oilfields include provisions to make it illegal for any person to intentionally feed wildlife or leave human food or garbage in a manner that attracts wildlife [5 AAC 92.230]. The Service assumes that the applicant will completely comply will all applicable regulations governing waste management, and therefore anticipates that no incidental take of listed eiders will result from an increase in predator abundance caused by improper waste management.

Oil Spills

If a large oil spill occurred in the location of and during spectacled eider presence, spectacled eider mortality likely would be ≤100 individuals; however, any substantial loss (25+ individuals) would represent a significant effect (MMS Lease Sale 186). It is unlikely that take of Steller's eiders will result from a large oil spill in late spring or in early summer unless atmospheric and oceanic conditions were such that spilled oil dispersed towards Barrow and into the Chukchi Sea. The MMS's Lease Sale 186 Oil-Spill-Risk-Analysis modeling runs predict the probability of such a spill scenario to be very low.

Extent of take that will result from oil spills from the proposed action is extremely difficult to estimate. First, it is uncertain that oil will be spilled. As stated in the biological evaluation, the likelihood of at least one spill of at least 1,000 bbl (42,000 gal) during the life of the project (~26 years) is currently estimated to be 8-10 percent. In the unlikely event of such an oil spill, the extent of take will be greatly influenced by the number, volume, trajectory, and timing of spills as well as the period that oil remains in the environment. In addition, the low probability of such an event, combined with the uncertainty of the location of the spill, and the seasonal nature of the resources inhabiting the area, make it highly unlikely that a large oil spill would contact a threatened eider. Spectacled and Steller's eiders are present on the North Slope for only 3-5 months out of the year. Even if an eider were present in the vicinity of an oil spill, it might not be contacted by the oil due to avoidance behavior, ice conditions or weather patterns. Furthermore, the MMS requires companies to have and implement oil-spill-response plans to help prevent oil from reaching critical areas and to remove oil from the environment. Therefore, the probability of a large oil spill contacting a Steller's or spectacled eider is much less than 8-10 percent over the 30 year life of the proposed leases (2003-2033).

Considering the low probability of a large spill coupled with a variety of other factors that would need to satisfied to result in take, the Service anticipates that it is highly unlikely that incidental take of listed eiders will result from oil spills within the Lease Sale 186 area. However, should any oil spill within the Lease Sale 186 area result in the take of any Steller's or spectacled eider, the MMS will immediately cease all operations responsible for the take pending reinitiation.

Toxics Contamination

The EPA initiated consultation with the Service in January 1994 to determine the likelihood that the proposed discharges associated with exploratory drilling would adversely affect listed species. The Service concurred with the EPA that the proposed NPDES permit issuance would not be likely to adversely affect listed species. Therefore, the EPA and MMS have already satisfied the requirements of the Endangered Species Act regarding effluent discharges associated with oil and gas exploration in the Beaufort and Chukchi seas (State and Federal waters). The Service anticipates that no incidental take of listed eiders will result from an increase in discharges associated with exploratory drilling.

Conclusion

In conclusion, the Service anticipates the proposed action will likely result in the take of five spectacled and one Steller's eiders over the life of the lease sale as a result of bird collisions with exploratory and delineation structures. The take is expected to be in the form of killing. In the accompanying Biological Opinion, the service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

While the incidental take statement provided in this consultation satisfies the requirements of the Act, as amended, it does not constitute an exemption from the prohibitions of take of listed migratory birds under the more restrictive provisions of the Migratory Bird Treaty Act. However, the Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of Steller's and spectacled eiders: to minimize the likelihood that migrating spectacled or Steller's eiders will strike exploration or delineation structures, the MMS and the Service will cooperatively develop a lighting protocol intended to reduce radiation of light outward from structures and to increase the visibility of structures to migrating eiders.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, the MMS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

To minimize the likelihood that migrating spectacled or Steller's eiders will strike structures associated with exploration and delineation drilling, the MMS and Service will cooperatively develop a lighting protocol to be used on exploration and delineation structures and identify where and when the protocol should be applied. The lighting protocol will contain the following two components:

1. The radiation of light outward from exploration/delineation structures will be minimized. This will be achieved by shading and/or light fixture placement to direct light inward and downward to living and work surfaces while minimizing light radiating upward and outward.

2. Structures will be lighted and/or marked to improve visibility to migrants according to a strategy to be jointly developed by the MMS and the Service.

a) This strategy will be developed using available information on bird avoidance measures including, but not limited to, results of the ongoing study of lighting regimes for Northstar Island being conducted by BP Alaska, ABR, Inc., and the Service.

b) A draft strategy will be provided by the Service to MMS by December 31, 2003; the final strategy must be mutually agreed upon by the MMS and Service by April 1, 2004, or a later date that is mutually agreed upon.

c) This strategy applies to all exploratory and delineation structures used after April 1, 2004, because bird avoidance measures that provide unequivocal benefits are not available at this time.

d) Any lighting requirements resulting from strategy need not apply between October 31 and May 1, because listed eiders are not thought to be present in the Beaufort Sea during this period.

e) This strategy will be modified, as appropriate, if significant new information on bird avoidance measures becomes available during activities covered by this consultation. Modifications to the strategy will be developed jointly by MMS and the Service.

The Service believes that no more than five spectacled eider and one Steller's eider will be incidentally taken during the life of the proposed project. The reasonable and prudent measure, with its implementing term and condition, is designed to minimize the impact of incidental take that might otherwise result from the proposed action. If during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The Federal action agency must immediately provide an explanation of the causes of the take and review with the Service the need for possible modification of the reasonable and prudent measure. If Steller's and/or spectacled eiders are encountered injured or killed through collisions with exploration and delineation structures, please contact the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska, at (907) 456-0499 for instruction on the handling and disposal of the injured or dead bird.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We recommend the following actions be implemented during the leasing and exploration phase of this lease sale:

1. The MMS should work with the Service and other Federal and State agencies in implementing recovery actions identified in the spectacled and Steller's eider recovery plans. Research to determine important habitats, migration routes, and wintering areas of spectacled and Steller's eiders would be an important step toward minimizing conflicts with current and future oil and gas development activities.

2. The Service believes that having oil industry employees recognize the presence of listed species during activities associated with exploration would allow the employee to take measures to minimize disturbance and avoid unauthorized incidental take. To this end, the MMS should work with the Service to produce, and work with the industry, to disseminate wallet-size information cards to company and contract employees. Dissemination of cards would preferably occur at employee orientations required in Stipulation 2 of the Lease Sale 186 EIS. These cards could provide information on identifying eiders and distinguishing among eider species as well as contact information for observations relevant to conservation.

3. The oil spill contingency plans for exploration and delineation wells drilled as a result of Lease Sale 186 should include measures and the capability to deploy at least 10 *Breco* buoys (or other similar devices, to be approved by the Service) to haze or scare seaducks from oiled

areas in the event of a marine spill. The spill plans should require that spill response personnel are knowledgeable of the location of available hazing devices and trained in their use.

4. To minimize disturbance of nesting, brood-rearing, and migrating spectacled and Steller's eiders with aircraft, the MMS should work with the Service to cooperatively develop project-specific aircraft flight route strategies for exploration and delineation drilling activities. Any decision regarding aircraft flight routes will comply with all appropriate Federal Aviation Administration (FAA) rules, regulations and policies. This recommendation does not apply to aviation activities conducted when eiders are not present (October 31- May 1).

Additional conservation recommendations may be proposed during subsequent incremental steps of this lease sale. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the MMS's letter received May 29, 2002. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the action agency that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to listed or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your concern for endangered species and for your cooperation in the development of this Biological Opinion. If you have any comments or require additional information, please contact Jonathan Priday at (907) 456-0499 with the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska.

LITERATURE CITED

Alaska Department of Environmental Conservation, Division of Spill Prevention and Response. 1998. Response to comments and decision document for BP Exploration's Northstar Development project. Unpublished report.

Andersen, B., Ritchie, R., Stickney, A., and Wildman, A., 1998. Avian studies in the Kuparuk oilfield, Alaska, 1998. Unpublished report for ARCO Alaska, Inc. and the Kuparuk River unit, Anchorage, AK.

Anderson, W., Havera, P., and Montgomery, R., 1987. Incidence of ingested shot in waterfowl in the Mississippi flyway, 1977-1979. Wildl. Soc. Bull. 15:181-188.

Anderson,W.L., and Havera, S.P. 1986. Blood lead, protoporphyrin, and ingested shot for detecting lead poisoning in waterfowl. *In* Lead Poisoning In Wild Waterfowl. *Edited by* J.S. Feierabend and A.B. Russell. National Wildlife Federation, Washington D.C. 10-18

Anderson, B., Stickney, A., Ritchie, B., and Cooper, B., 1995. Avian studies in the Kuparuk Oilfield, Alaska, 1994. Unpublished report for ARCO Alaska, Inc. and the Kuparuk River Unit, Anchorage, Alaska.

Anderson, B., and Cooper, B., 1994. Distribution and abundance of spectacled eiders in the Kuparuk and Milne Point oilfields, Alaska, 1993. Final Rept. prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, AK by ABR, Inc., Fairbanks, AK, and BBN Systems and Technologies Corp., Canoga Park, CA.

Brackney, A., and King, R., 1993. Aerial breeding pair surveys of the Arctic Coastal Plain of Alaska: Revised estimates of waterbird abundance 1986-1992. Unpubl. Rep. Prepared by U.S. Fish and Wildlife Service, Anchorage, AK.

Brooks, W., 1915. Notes on birds from east Siberia and Arctic Alaska. Bulletin of the Museum of Comparative Zoology 59:359-413.

Cottam, C., 1939. Food habits of North American diving ducks. U.S. Department of Agriculture Technical Bulletin No. 643. Washington, D.C.

Cramp, S., Simmons, K., Ferguson-Lees, I., Gillmor, R., Hollom, P., Hudson, R., Nicholson, E., Ogilvie, M., Olney, P., Voous, K., and Wattel, J., eds. 1977. Handbook of the birds of Europe, the middle East, and North Africa. Vol I. Oxford University Press, Oxford, United Kingdom. 722 pp.

The total population of spectacled eiders is estimated at 375,000 (Larned and Tiplady 1999). From the early 1970s to the early 1990s, numbers of pairs on the Yukon-Kuskokwim Delta declined by 96 percent from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al. 1993, Petersen et al. 1999). On the North Slope, the mean numbers of breeding spectacled eiders estimated from aerial surveys between 1993 and 2001 ranged from a high of almost 9,300 in 1993 to a low of 5,800 birds in 1996 and back up to 7,370 birds in 2001 (Larned et al. 2001b).

Factors known or suspected to affect survival of spectacled eiders have been identified. However, the relative importance of these factors to the species' decline and to recovery are not known. The extent and causes of population declines or extirpations on the breeding grounds are difficult to assess because historical data are lacking for many locations. Several of the following factors are known to affect survival during the nesting season, but it is not clear whether they contributed to the decline of the spectacled eider population.

Lead ingestion from foraging habitat on breeding grounds in the Yukon-Kuskokwim Delta has been confirmed to cause mortality of eiders that ingested lead shot. The proportion of spectacled eiders on the Yukon-Kuskokwim Delta's lower Kashunuk River drainage that contained lead shot in their gizzards is high (11.6 percent, n=112) compared to other waterfowl in the lower 48 states from 1938-1954 (8.7 percent, n=5088) and from 1977-1979 (8.0 percent, n=12,880). The lead exposure rate in spectacled eiders (based on X-rays) is likely biased low (Flint et al. 1997), because lead is retained in the gizzard for only about 3 weeks (Elder 1954, Dieter and Finley 1978, Anderson and Havera 1986, Franson 1986, Anderson et al. 1987). Blood analyses of spectacled eiders indicate elevated levels of lead in 13 percent of pre-nesting females, 25.3 percent of females during hatch, and 35.8 percent during brood rearing. Nine of 43 spectacled eider broods (20.9 percent) contained 1 or more ducklings exposed to lead by 30 days after hatch (Flint et al. 1997). Spent lead shot in the lower Kashunuk River area and on Kigigak Island is causing additive mortality in spectacled eiders, that is, mortality over and above that caused by natural circumstances (Grand et al. in press). It is possible that exposure to lead occurs in small, localized hunting areas on the North Slope as well, however there are no site-specific data on lead contamination in this region.

Predation pressure on spectacled eider eggs, young, and adults may have increased in recent decades. Predators include Arctic foxes (*Alopex lagopus*), red foxes (*Vulpes fulva*), large gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and snowy owls (*Nyctea scandiaca*). Native elders on the North Slope believe that fox numbers have increased in recent decades as a result of reduced trapping. Population sizes of large gulls on the North Slope may have increased as a result of increased food supplies from anthropogenic wastes. Wastes made available from the commercial fishing industry in the Bering Sea and North Pacific, along with an increase in the garbage generated by coastal communities, have increased the year-round food supply for gulls.

Subsistence harvest of spectacled eider eggs and adults is another potential factor in the decline of the spectacled eider population. Alaska Natives have traditionally harvested eiders and their eggs in coastal villages during spring and fall. Although human populations on the Yukon-Kuskokwim Delta and in North Slope communities have grown substantially, changes in the numbers of hunters are unknown. In addition, improved technology for hunting has allowed greater efficiency, but the actual effects of these improvements on harvest levels are unknown.

There are other sources of take such as avicultural egg collecting (until 1991), research activity, and loss of habitat in growing communities and oilfields. Their overall impacts to the spectacled eider population is unknown.

Other potential factors that may affect spectacled eider survival have been suggested but not investigated. These include changes in the invertebrate community structure in their winter habitats, bioaccumulation of contaminants in the marine environment, human harvest for sport and subsistence outside their breeding grounds, disease, parasites, and accidental strikes and/or disturbance of benthic feeding areas by commercial fishing activity.

Steller's Eider

The Alaska-breeding population of Steller's eider was listed as threatened on June 11, 1997 (Federal Register 62(112): 31748- 31757). This action was based on a substantial decrease in the species' nesting range in Alaska, a reduction in the number of Steller's eiders nesting in Alaska, and the resulting increased vulnerability of the remaining breeding population to extirpation. Historically, Steller's eiders nested in Alaska in two general regions: 1) western Alaska, where the species has been nearly extirpated; and 2) the North Slope, where the species still occurs. In western Alaska, Steller's eiders occurred primarily in the coastal fringe of the Yukon-Kuskokwim Delta, where the species was common at some sites in the 1920s, was still present in the 1960s, but was not recorded as breeding from 1976-1994 (Kertell 1991, Flint and Herzog 1999). In 1994 and 1996-1998, 1-2 nests were found at either or both the Tutakoke River and Hock Slough study sites on the Yukon-Kuskokwim Delta (Flint and Herzog 1999).

On the North Slope, Steller's eiders historically occurred from Wainwright east, nearly to the United States-Canada border (Brooks 1915). The species may have abandoned the eastern North Slope in recent decades, but it still occurs at low densities from Wainwright to at least as far east as Prudhoe Bay. The majority of sightings in the last decade have occurred east of Point Lay, west of Nuiqsut on the Colville River, and within 90 km (56 miles) of the coast. Near Barrow, Steller's eiders still occur regularly, though they do not nest annually. In some years, up to several dozen pairs may breed in a few square kilometers.

Contemporary aerial breeding pair surveys conducted in late June indicate a population averaging about 1,000 birds from 1986-2000 (Mallek 2001). A separate set of aerial surveys,

Dau, C., and Kistchinski, S., 1977. Seasonal movements and distribution of the spectacled eider. Wildfowl 28: 65-75.

Dau, C., 1974. Nesting biology of the spectacled eider, *Somateria fischeri* (Brandt), on the Yukon-Kuskokwim Delta, Alaska. M.S. Thesis, Univ. Alaska, Fairbanks, Alaska.

Day, R., 1998. Predator populations and predation intensity on tundra-nesting birds in relation to human development. Unpublished report prepared for Northern Alaska Ecological Services, U.S. Fish and Wildlife Service, Fairbanks, AK.

Dieter, M., and Finley, M., 1978. Erythrocyte *d*-aminolevulinic acid dehydratase activity in Mallard ducks: duration of inhibition after lead shot dosage. J. Wildl. Manage. 42:621-625.

Elder, W., 1954. The effects of lead poisoning on the fertility and fecundity of domestic mallard ducks. J. Wildl. Manage, 18:315-323.

Fay, F., 1961. The distribution of waterfowl on St. Lawrence Island, Alaska. Annual Report of the Wildfowl Trust 12:70-80.

Fischer, B., Tiplady, T., and Larned, W., 2002. Monitoring Beaufort Sea Waterfowl and Marine Birds Aerial Survey Component. Unpublished report prepared for Minerals Management Service (MMS), Anchorage, Alaska

Flint, P., and Herzog, M., 1999. Breeding of Steller's eiders *Polysticta stelleri*, on the Yukon-Kuskokwim Delta, Alaska. Canadian Field-Naturalist 113: 306-308.

Flint, P., Petersen, M., and Grand, J., 1997. Exposure of spectacled eiders and other diving ducks to lead in western Alaska. Canadian Journal of Zoology 75:439-443.

Franson, J., 1986. Immunosuppressive effect of lead. In Lead Poisoning in Wild Waterfowl. *Edited by* J.S. Feierabend and A.B. Russel, National Wildlife Federation, Washington D.C. pp 32-37.

Franson, J., Petersen, M., Meteyer, C., and Smith, M., 1995. Lead poisoning of spectacled eiders (Somateria fischeri) and of a common eider (Somateria mollissima) in Alaska. Journal of Wildlife Diseases 31:268 -271.

Georgette, S., 2000. Subsistence use of birds in the Northwest Arctic Region, Alaska. Technical Paper No. 260, Alaska Department of Fish and Game, Division of Subsistence, Juneau.

Harwood, C., and Moran, T., 1991. Nesting chronology, reproductive success, and brood rearing for spectacled and common eiders on Kigigak Island, 1991. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska.

Harwood, C, and Moran, T., 1993. Productivity, brood survival, and mortality factors for spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1992. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska.

Hunt, G. Jr., 1987. Offshore oil development and seabirds: The present status of knowledge and long-term research needs. Pages 539-586 in D.F. Boesch and N.N. Rabailais, eds. Long-term environmental effects of offshore oil and gas development. Elsevier Applied Science: New York, New York.

Johnson, R., and Richardson, W., 1982. Waterbird migration near the Yukon and Alaska coast of the Beaufort Sea: II. Molt migration of seaducks in summer. Arctic 35(2): 291-301

Johnson, L., 1971. The migration, harvest, and importance of waterfowl at Barrow, Alaska. M.S. Thesis, University of Alaska, Fairbanks.

Jones, R., 1965. Returns from Steller's eiders banded in Izembek Bay, AK. Wildfowl Trust Annual Report 16: 83-85.

Kertell, K., 1991. Disappearance of the Steller's eider from the Yukon-Kuskokwim Delta, Alaska. Arctic 443: 177-187.

King, K., and Lefever, C., 1979. Effects of oil transferred from incubating gulls to their eggs. Marine Pollution Bulletin 10:319-321

Kistchinski, A., and Flint, V., 1974. On the biology of the spectacled eider. Wildfowl 25:5-15.

Kistchinski, A., 1973. Waterfowl in north-east Asia. Wildfowl 24:88-102.

Kondratev, A., and Zadorina, L., 1992. Comparative ecology of the king eider *Somateria spectabilis* and spectacled eider *Somateria fischeri* on the Chaun tundra. Zool. Zhur. 71:99-108. (in Russian; translation by J. Pearce, National Biological Survey, Anchorage, AK).

Larned, W.,. Butler, W., and Balogh, G., 1994. Steller's eider migration surveys, 1992-1993. Unpublished. progress report, U.S. Fish and Wildlife Service, Anchorage, AK. 52 pp.

Larned, W., Balogh, G., Stehn, R., and Butler, W., 1993. The status of eider breeding populations in Alaska, 1992. Unpublished report prepared by U.S. Fish and Wildlife Service, Anchorage, AK.

Larned, W., Platte, R., and Stehn, R., 2001a. Eider breading population survey, arctic coastal plain, Alaska, 1999-2000. Unpublished progress report, U.S. Fish and Wildlife Service, Anchorage, AK. 52pp.

Larned, W., R. Stehn, J., Fischer, and R. Platte. 2001b. Eider breeding population survey, arctic coastal plain, Alaska, 2001. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, AK. 20 pp + figures.

Larned, W., and Tiplady, T., 1999. Late wintering distribution of distribution of spectacled eiders (*Somateria fischeri*) in the Bering Sea 1998. Unpublished report. U. S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK. 9pp.

Larned, W., and Tiplady, T., 1997. Late winter population and distribution of spectacled eiders (*Somateria fischeri*) in the Bering Sea, 1996-1997. Unpublished report prepared for Migratory Bird Management, U.S. Fish and Wildlife Service, Anchorage, Alaska.

Lovvorn, J., 2002, A habitat variability analysis for Spectacled eiders wintering at sea, Unpublished progress report, U.S. Fish and Wildlife Service, Anchorage, AK.

Lovvorn, J., Richman, S., Grebmeier, J., and Cooper, L., 2002(review), Diet and body condition of spectacled eiders wintering in pack ice of the Bering Sea, Unpublished progress report, U.S. Fish and Wildlife Service, Anchorage, AK.

Mallek, E., 2001. Aerial breeding pair surveys of the arctic coastal plain of Alaska-2000. Unpublished report. U.S. Fish and Wildlife Service Fairbanks, AK. 14 pp.

Mayfield, H., 1975. Suggestions for calculating nest success. Wilson Bull. 87:456-466.

Moran, T. 1996. Nesting ecology of spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1995. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska.

Moran, T. 1995. Nesting ecology of spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1994. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska.

Moran, T., and Harwood, C., 1994. Nesting ecology, brood survival, and movements of spectacled eiders on Kigigak Island, Yukon Delta NWR, Alaska, 1993. Unpublished report prepared for U.S. Fish and Wildlife Service, Bethel, Alaska.

National Research Council. 1994. Environmental information for outer continental shelf oil and gas decisions in Alaska. National Academy of Sciences, Washington, D.C.

Obritschkewitsch, T., Martin, P., and Suydam, R., 2001. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1999-2000. Ecological Services Fairbanks, AK, U.S. Fish and Wildlife Service, Technical Report NAES-TR-01-04. 113 pp.

Paige, A., Scott, C., Andersen, D., Georgette, S., Wolfe, R., 1996. Subsistence use of birds in the Bering Strait Region, Alaska. Technical Paper No. 239, Alaska Department of Fish and Game, Division of Subsistence, Juneau.

Palmer, R., (ed.). 1976. Handbook of North American Birds. Vol. 3. Waterfowl. Yale University Press, New Haven, CT.

Peakall, D., Miller, D., and Kinter, W., 1983. Toxicity of crude oils and their fractions to nesting herring gulls 1. Physiological and biochemical effects. Marine Environmental Resources 8:63-71.

Peakall, D., Hallett, D., Bend, J., Foureman, G., and Miller, D., 1982. Toxicity of Prudhoe Bay crude oil and its aromatic fractions to nesting herring gulls. Environmental Resources 27:206-211.

Pearce, J., Esler, D., and Degtyarev, A.,. 1998. Nesting ecology of spectacled eiders on the Indigirka River Delta, Russia. Wildfowl 49:110-123.

Petersen, M., Douglas, D., and Mulcahy, D., 1995. Use of implanted satellite transmitters to locate spectacled eiders at sea. Condor 97: 276-278.

Petersen, M., Larned, W., and Douglas, D., 1999. At sea distribution and abundance of spectacled eiders (*Somateria fischeri*): 120 year-old mystery solved. The Auk. 116(4): 1009-1020, 1999

Petersen, M., 1980. Observations of wing-feather molt and summer feeding ecology of Steller's eiders at Nelson Lagoon, Alaska. Wildfowl 31:99-106.

Petersen, M., 1981. Populations, feeding ecology and molt of Steller's eiders. Condor 83:256-262.

Piatt, J., Lensink, C., Butler, W., Kendziorek, M., and Nysewander, D., 1990. Immediate impact of the "Exxon Valdez" oil spill on marine birds. Auk 107: 387-397.

Quakenbush, L., and Suydam, R., 1999. Periodic non-breeding of Steller's Eiders (*Polysticta stelleri*) near Barrow, Alaska, with speculation on possible causes. Pages 34-40 *in* I.R. Goudie, M.R. Petersen, and G.J. Robertson, eds. Behavior and ecology of sea ducks. Proceedings of the Sea Duck Symposium, 23rd Annual Pacific Seabird Group Meeting.

Quakenbush, L., Suydam, R., Fluetsch, K., and Donaldson, C., 1995. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 1991-1994. Unpublished. report. U.S. Fish and Wildlife Service, Fairbanks, AK. 53 pp.

Quakenbush, L., Suydam, R., Fluetsch, K., and Obritschkewitsch, T., 1998. Breeding habitat use by Steller's eiders near Barrow, Alaska, 1991-1996. Unpublished. draft report. U.S. Fish and Wildlife Service, Fairbanks, AK. 19 pp.

Quakenbush, L., and Cochrane, J., 1993. Report on the conservation status of the Steller's eider (*Polysticta stelleri*), a candidate threatened and endangered species. Unpublished report prepared by U.S. Fish and Wildlife Service.

Richie, R., and King, J., 2002. Steller's eider surveys near Barrow and the Meade River, Alaska, 2001. Unpublished report prepared for North Slope Borough Department of Wildlife Management, Barrow, Alaska

Smith, L., Byrne, L., Johnson, C., and Stickney, A., 1994. Wildlife studies on the Colville River Delta, Alaska, 1993. Unpublished report prepared for ARCO Alaska, Inc., Anchorage, Alaska

Stehn, R., and Platte, R., 2000. Exposure of birds to assumed oil spills at the Liberty Project. Unpublished report for Migratory Bird Management, U.S. Fish and Wildlife Service, Anchorage, Alaska.

Stehn, R., Dau, C., Conant, B., and Butler, W., 1993. Decline of spectacled eiders nesting in western Alaska. Arctic 46(3): 264-277.

Suydam, R., Quakenbush, L., Dickson, L., and Obritschekewitsch, T., 1996. Migration of king, *Somateria spectabilis*, and common, *S. mollissima v-nigra*, eiders past Point Barrow, Alaska, during spring and summer/fall 1996. Unpublished report for U.S. Fish and Wildlife Service, Fairbanks, AK.

Troy Ecological Research Associates (TERA), 2002 review. Spectacled eiders in the Beaufort Sea: Distribution and timing of use. Unpublished report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA, 1999. Spectacled eiders in the Beaufort Sea: Distribution and timing of use. Unpublished report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA, 1997. Distribution and abundance of spectacled eiders in the vicinity of Prudhoe Bay, Alaska, 1991-1993. Unpublished report prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska.

TERA, 1996. Distribution and abundance of spectacled eiders in the vicinity of Prudhoe Bay, Alaska: 1994 status report. Report by Troy Ecological Research Associates, Anchorage, AK, for BP Exploration (Alaska), Inc, Anchorage, AK. 11 p.

Thompson, D., and Person, R., 1963. The eider pass at Point Barrow, Alaska. J. Wild. Manage. 27(3): 348-356.

Trust, K., Cochrane, J., and Stout, J., 1997. Environmental contaminants in three eider species from Alaska and Arctic Russia. Technical Report WAES-TR-97-03. U.S. Fish and Wildlife Service, Anchorage, AK. 44 pp.

Warnock, N., and Troy, D., 1992. Distribution and abundance of spectacled eiders at Prudhoe Bay, Alaska: 1991. Unpublished report. prepared for BP Exploration (Alaska) Inc., Environmental and Regulatory Affairs Department, Anchorage, AK, by TERA, Anchorage, AK.

Weir, R., 1976. Annotated bibliography of bird kills at man-made obstacles: A review of the state of the art and solutions. Unpublished report prepared for Department of Fisheries & Environment, Canadian Wildlife Service-Ontario Region.

Wentworth, C., 2001. Subsistence waterfowl harvest survey. Yukon-Kuskokwim Delta. 2000 results and comparative data, 1991-2000. Unpublished report to U.S. Fish and Wildlife Service, Anchorage, AK.

Woodby, D., and Divoky, G., 1982. Spring migration of eiders and other waterbirds at Point Barrow, Alaska. Arctic 35(3): 403-410.

ATTACHMENT 1

OCS Oil and Gas Lease Sale 186, Beaufort Sea
Consultation History

05/09/02 - MMS requests formal consultation from Service (Washington D.C. Office) for Lease Sale 186, and transmits Biological Evaluation.

05/22/02 - Service (FFWFO staff) and MMS meet to discuss initiating formal consultation Lease Sale 186.

05/23/02 - MMS transmits maps to Service comparing Beaufort Sea Lease Sales 144, 170 and proposed Lease Sale 186.

05/29/02 - The Service's Fairbanks Fish and Wildlife Office (FFWFO) receives MMS's Draft Lease Sale 186 EIS. Service begins reviewing it for completeness.

06/17/02 - Service Washington D.C. Office transmits acknowledgment of receipt of request for formal consultation and agrees to prepare draft Biological Opinion (BO).

07/10/02 - FFWFO receives MMS's completed/bound Draft Lease Sale 186 EIS and accompanying CD-ROM.

09/06/02 - Service and MMS discuss further information needs, potential delivery date for draft BO, and what the Service anticipate including as "Terms and Conditions."

09/10/02 - Service and MMS discuss uncertainties over quantifying number, location, and operational lifetime of potential exploratory and production drilling. Also discuss time lines and potential "Terms and Conditions."

09/11/02 - Service and MMS discuss BO. MMS stated their desire to get a BO by the end of the comment period on the EIS (9/20) so they could finalize the EIS. The Service explained their understanding of the time line and their desire to complete the BO on time.

09/17/02 - Service requests that MMS generate language that provides more refined estimates of total exploration/production activity that will result from Lease Sale 186 (include methodology for estimating number of wells and longevity of operation).

09/17/02 - MMS asks the Service to use their estimates of exploration/delineation activity in the EIS to generate incidental take. The Service explained to them that we can proceed but we would like them to send us something in writing explaining whether their exploration/production numbers in the EIS represent an average or maximum scenario.

09/18/02 - MMS and the Service meet to discuss due dates and scope of Lease Sale 186 BO. MMS stated that the exploration and development scenarios described in the Lease Sale 186 EIS were maximum estimates.

09/19/02 - Service tells MMS that the Service received MMS's request for consultation on May 29, 2002. Therefore, the 135-day clock for the Service issuing its BO terminates on October 10th not on September 21. The Service commits to providing MMS with a draft as soon as possible and prior to deadline.

09/19/02 - Service forwards MMS draft "Reasonable and Prudent Measures", "Terms and Conditions", and "Conservation Recommendations" sections from draft Lease Sale 186 BO.

09/27/02 - Service transmits draft BO to MMS.

10/02/02 - MMS and Service discuss MMS's comments on the Service's draft Lease Sale 186 BO. The Service agrees to consider MMS's comment and get them a revised draft BO by Monday at 5:00 p.m..

10/07/02 - Service transmits revised draft BO via email to MMS.

10/10/02 - MMS transmits comments on revised draft BO via email. MMS states that if their changes are acceptable to the Service, another meeting to further discuss the draft BO is not necessary.

10/17/02 - Service makes changes to draft Biological Opinion and transmits it back to MMS via email.

10/18/02 - MMS transmits comments on revised draft BO via email.

10/18/02 - Service and MMS discuss MMS's comments and agree to language for final BO.

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Washington, DC 20240

MAY 9 2002

Memorandum

To: Assistant Director for Endangered Species
U.S. Fish and Wildlife Service

From: Thomas A. Readinger
for Associate Director for Offshore Minerals Management

Subject: Endangered Species Act Section 7, Consultation Request for the Proposed Beaufort Sea Lease Sales from 2003 Through 2007

The Minerals Management Service has completed the draft Environmental Impact Statement for the proposed multiple oil and gas lease sales in the Beaufort Sea for the time period 2003-2007. The proposed Beaufort Sea oil and gas Lease Sales 186, 195, and 202 are planned for September 2003, 2005, and 2007 respectively.

Under section 7(a)(2) of the ESA, the MMS requests formal consultation with the U. S. Fish and Wildlife Service on leasing and exploration activities associated with these proposed sales. The consultation should address all aspects of activities associated with oil and gas leasing and exploration. We understand that when the FWS issues a biological opinion for the Beaufort Sea proposed oil and gas lease sales, the FWS does not relinquish the opportunity to reconsider and modify that opinion for future proposed sales. Therefore, the MMS will prepare an Environmental Assessment for each subsequent proposed sale covered by this EIS and send those EAs to FWS for review. We also ask that the FWS biological opinion supercede all existing biological opinions for leasing and exploration activities in the Beaufort Sea.

To facilitate completion of this consultation, we are sending copies of this memorandum and attachments to FWS Region 7 Office in Anchorage, Alaska, and the Northern Alaska Ecological Services Office in Fairbanks, Alaska. The draft EIS contains information on the anticipated composition, procedures, execution, and effects of the proposed Beaufort Sea oil and gas lease sales and exploration activities. The draft EIS, which serves as our biological evaluation for the proposed action, satisfies the information requirements specified in 50 CFR 402.12 and 402.14. We request that the biological opinion be prepared in as timely a manner as possible to allow the MMS to include it in the final EIS in January 2003 and to ensure consideration by the Secretary of the Interior during the decisionmaking process for Lease Sale 186.

If you consider recommending measures to minimize impacts to threatened and endangered species or determine a jeopardy situation may exist for all or any part of the proposed action, we ask that you notify us as early as possible, according to 50 CFR 402. 14(g)(5), to allow the MMS and FWS staff time to jointly discuss the findings. We believe that such discussions will facilitate the consultation and ensure effective protection of listed species. These discussions can also ensure that any proposed alternatives are within our authority to control and implement, and are feasible, appropriate, and effective.

If you have any questions on this consultation or require additional information, please contact Ms. Judy Wilson, Minerals Management Service, Mail Stop 4042, 381 Elden Street, Herndon, Virginia 20170-4817 (commercial and FTS telephone: (703) 787-1075), or Mr. Fred King, Minerals Management Service, Alaska OCS Region, Mail Stop 8303, 949 East 36th Avenue, Suite 300, Anchorage, Alaska 99503-4363 (commercial and FTS telephone: (907) 271-6696).

Attachments

cc: (w/attachments)

Regional Director
U.S. Fish and Wildlife Service
Region 7
1011 East Tudor Road
Anchorage, Alaska 99503

Field Office Supervisor
U.S. Fish and Wildlife Service
Northern Alaska Ecological Services
101 12th Avenue, Box 19
Fairbanks, Alaska 99701

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Washington, DC 20240

MAY 9 2002

Mr. Donald Knowles
Director, Office of Protected Resources
National Oceanic and Atmospheric
Administration Fisheries
1315 East-West Highway, SSMC3
Silver Spring, Maryland 20910

Dear Mr. Knowles:

The Minerals Management Service has completed a draft Environmental Impact Statement for the proposed multiple oil and gas lease sales in the Beaufort Sea for the time period 2003-2007. This is the first multiple-sale EIS the MMS has prepared for the Beaufort Sea Planning Area. The proposed Beaufort Sea oil and gas Lease Sales 186, 195, and 202 are planned for September 2003, 2005, and 2007 respectively.

On March 10, 2000, under section 7(a)(2) of the Endangered Species Act and 50 CFR 402.16, the MMS requested the National Oceanic Atmospheric Administration Fisheries to reinitiate consultation on the November 23, 1988, biological opinion concerning leasing and exploration activities in the Beaufort Sea. The NOAA Fisheries issued a new non-jeopardy Beaufort Sea biological opinion on May 25, 2001. The biological opinion addressed the incremental step of leasing and exploration in the Alaskan Beaufort Sea Outer Continental Shelf Planning Area. The MMS has determined there is no new information revealing effects of the proposed activities expected as a result of multiple sales that may affect the bowhead whale in a manner or to an extent not previously considered in the May 2001 biological opinion. Nor have the proposed activities been modified to cause an effect to bowhead whales not considered in the May 2001 biological opinion.

Under section 7(a)(2) of the ESA, we request that you uphold the biological opinion issued in May 2001 concerning Beaufort Sea oil and gas leasing and exploration activities for proposed Lease Sales 186, 195, and 202. We request that the results of this consultation be prepared in as timely a manner as possible to allow MMS to include it in the final EIS in January 2003, and to ensure consideration by the Secretary of the Interior during the decisionmaking for Lease Sale 186. We also ask that you affirm that the May 2001 biological opinion supercedes all existing biological opinions for leasing and associated exploration activities the Beaufort Sea Planning Area. We understand that when NOAA Fisheries issues a biological opinion for the proposed oil and gas lease sales in the Beaufort Sea Planning Area, NOAA Fisheries does not relinquish the opportunity to reconsider and modify that opinion for future proposed sales. Therefore, the MMS will prepare an Environmental Assessment for each subsequent proposed sale covered by this draft EIS and send those EAs to NOAA Fisheries for review.

We submit for your review the draft EIS for Beaufort Sea Lease Sales 186, 195, and 202 in hard copy and CD format to assist you in completing this consultation. The draft EIS contains information on the anticipated composition, procedures, execution, and effects of the proposed Beaufort Sea oil and gas lease sales and associated exploration. The draft EIS, which serves as our biological evaluation for the proposed action, satisfies the information requirements specified in 50 CFR 402.12 and 402.14. We are glad to provide any additional information that you may find necessary for your deliberations. To facilitate completion of this consultation, we are sending a copy of this letter and enclosures to the NOAA Fisheries Alaska Regional Office in Juneau, Alaska, and the Anchorage Field Office.

If you have any questions on this consultation, please address them to Ms. Judy Wilson, Minerals Management Service, Mail Stop 4042, 381 Elden Street, Herndon, Virginia 20170-4817 (commercial and FTS telephone: (703) 787-1075), or Mr. Fred King, Minerals Management Service, Alaska OCS Region, Mail Stop 8303, 949 East 36th Avenue, Suite 300, Anchorage, Alaska 99508-4363 (commercial and FTS telephone: (907) 271-6696).

Sincerely,

Michael Hunt

Thomas A. Readinger
for Associate Director for
Offshore Minerals Management

Enclosures

cc: (w/enclosures)
Mr. James Balsiger
Administrator, Alaska Region
National Oceanic Atmospheric
Administration Fisheries
P.O. Box 21668
Juneau, Alaska 99802-1668

National Oceanic Atmospheric
Administration Fisheries
Anchorage Field Office
Federal Building
222 West 7th Avenue, Box 43
Anchorage, Alaska 99513-7577

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

July 23, 2002

Thomas A. Readinger
Associate Director for Offshore Minerals Management
Minerals Management Service
Washington, D.C. 20240

Dear Mr. Readinger:

Thank you for your letter concerning the need for consultation under section 7 (a)(2) of the Endangered Species Act of 1973 (ESA), as amended, for the proposed multiple oil and gas lease sales in the Beaufort Sea for the time period 2003-2007. Your letter has been forwarded to my attention. In your letter, you request that the National Marine Fisheries Service (NMFS) uphold the May 25, 2001, biological opinion for oil and gas leasing and exploration activities in the Beaufort Sea by determining that the opinion satisfies the consultation requirements of the ESA for the following proposed sales; Sales 186, 195, and 202. These sales would occur in the years 2003, 2005, and 2007, respectively. In June, 2002, the Minerals Management Service prepared a draft Environmental Impact Statement (EIS) for these three sales. A supplemental EIS or Environmental Assessment will be prepared for Sales 195 and 202 in order to determine whether or not the information and analysis in the 2002 EIS remains valid for those future dates.

NOAA Fisheries has reviewed the EIS and other information relative to the effects of the proposed sales on ESA species and/or critical habitats under our jurisdiction. We find the May 2001 opinion addresses these sales, in terms of the listed species and habitats present, the legal status of these species under the ESA having been unchanged, the anticipated actions associated with these sales being consistent with those actions considered in the opinion, and the sale area being consistent with that previously assessed. We also affirm that the May 2002 opinion supercedes all existing biological opinions for leasing and associated exploration activities in the Beaufort Sea Planning Area. In view of this finding, NOAA Fisheries believes the section 7 consultation requirements of the ESA have now been met for Sale 186. We have not applied this conclusion to Sales 195 and 202 at this time however, as the logic which MMS has used in determining the need for supplemental analysis under NEPA for these sales would also extend to ESA consultation. The applicability of the May 2002 opinion will be reconsidered prior to these subsequent sales.

Please direct any questions to Mr. Brad Smith at the Anchorage, Alaska, office, NMFS, at (907) 271-5006.

Sincerely,

P. Michael Payne
Assistant Administrator
for Protected Resources
Alaska Region

cc: Brad Smith, AKR, NMFS

APPENDIX D

APPLICABLE FEDERAL LAWS
REGULATORY RESPONSIBILITIES,
AND
EXECUTIVE ORDERS

APPLICABLE FEDERAL LAWS, REGULATORY RESPONSIBILITIES, AND EXECUTIVE ORDERS

APPLICABLE FEDERAL LAWS, REGULATORY RESPONSIBILITIES, AND EXECUTIVE ORDERS

This appendix briefly explains or summarizes only those portions of Federal public laws enacted by Congress (see the list of legal mandates in Section I.B of this EIS) and other applicable Federal regulatory responsibilities, executive orders, and stipulations (mitigating measures) as they relate directly or indirectly to Minerals Management Service's (MMS's) management of mineral leasing, exploration, and development and production activities on leases located in the submerged lands of the Outer Continental Shelf (OCS). Additionally, this section includes responsibilities and jurisdictions of other Federal Agencies and departments involved in the regulatory process of oil and gas lease sales and operations on the OCS. This is not intended to be a comprehensive summary or explanation of all the laws associated with proposed leasing, exploration, and development and production activities that might significantly affect the OCS. References, explanations, or summaries are given only to acquaint the reader with the law and are not meant as legal interpretations. Readers always should consult the entire text of the laws for updates and additional requirements and information.

D.1. Federal Laws and Regulatory Responsibilities

D.1.a. The Outer Continental Shelf Lands Act

A jurisdictional dispute concerning the ownership of coastal submerged lands arose as new technology became available for developing offshore oil resources in increasingly deeper waters. This dispute was resolved in 1953 by two congressional statutes that clarified Federal and State rights and responsibilities for the "continental shelf" (the submerged lands extending from the coastline to the edge of the continental slope). The first statute, the Submerged Lands Act of 1953 (43 U.S.C. § 1331 et seq.), affirmed the coastal states' assertion of ownership of the submerged lands and resources within a 3-mile belt seaward of the line of low tide. The second statute, the OCS Lands Act of 1953, as amended (43 U.S.C. § 1331 et seq.), established that the submerged lands and resources of the OCS or beyond 3 miles, "appertained to the United States and [were] subject to its jurisdiction, control, and power of disposition." The OCS Lands Act authorizes the Secretary of the U.S. Department of the Interior (USDOI) to issue mineral leases and grant rights-of-way and to prescribe regulations governing oil and gas activities on OCS lands.

The OCS Lands Act defines the OCS as:

> ...all submerged lands lying seaward and outside of the areas lands beneath navigable waters as defined in section 2 of the Submerged Lands Act and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control.

The pertinent provision of the Submerged Lands Act defines "navigable waters" as:

> ...all lands permanently or periodically covered by tidal waters up to but not above the line of mean high tide and seaward to a line three geographical miles distant from the coast line of each such State and to the boundary line of each such State where in any case such boundary as it existed at the time such State became a member of the Union, or as heretofore approved by Congress, extends seaward (or into the Gulf of Mexico) beyond three geographical miles....

Under the OCS Lands Act, the Department of the Interior is required to:
- make Federal OCS resources available to meet the Nation's energy needs;
- conduct, develop, and manage the orderly leasing, exploration, development, and production of mineral resources on the Federal OCS;
- balance orderly energy resource development while ensuring the protection of the human, marine, and coastal environments;
- ensure that the public receives a fair and equitable return for Federal OCS resources; and
- ensure that free-enterprise market competition is preserved and maintained.

The Secretary of the Interior has delegated the responsibility of managing and regulating the development of OCS oil and gas resources in accordance with the provisions of the OCS Lands Act to the MMS.

The MMS leasing regulations are presented in Chapter 30, Code of Federal Regulations (CFR) part 256. The MMS operating regulations governing exploration, development, and production on OCS leases are presented in 30 CFR parts 250 and 270.

The OCS Lands Act extends the authority of the Secretary of the Army, through the Corps of Engineers, to the OCS to prevent obstruction to navigation in U.S. navigable waters.

The OCS Lands Act grants authority to the U.S. Coast Guard to promulgate and enforce regulations covering lighting and warning devices, safety equipment, and other safety-related matters pertaining to life and property on fixed OCS platforms and drilling vessels.

In accordance with the OCS Lands Act (43 U.S.C. § 1354) and the Export Administration Act of 1969 (50 App. U.S.C. 2405(d)), oil that is produced on the U.S. OCS must go to a U.S. port.

D.1.b. The National Environmental Policy Act of 1969 and the Council on Environmental Quality

The National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. § 4321 et seq.), is the foundation of environmental policymaking in the U.S. Recognizing the profound impact of human activity on the interrelations of all components of the natural environment, the Congress declares in NEPA that it is the continuing policy of the Federal Government, in cooperation with State and local governments and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare; to create and maintain conditions under which humans and nature can exist in productive harmony; and fulfill the social, economic, and other requirements of present and future generations of Americans. The Congress authorizes and directs that, to the fullest extent possible, the policies, regulations, and public laws of the U.S. shall be interpreted and administered in accordance with the policies set forth in NEPA. The NEPA process is intended to help Federal officials make decisions based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment.

The NEPA established two primary mechanisms for this purpose:
1. The Council on Environmental Quality (CEQ) was established to advise Federal Agencies on the environmental decisionmaking process and to oversee and coordinate the development of Federal environmental policy.
2. Federal Agencies must include an environmental review process early in the planning for proposed actions.

Congress first established the CEQ as part of the NEPA. Additional responsibilities were provided by the Environmental Quality Improvement Act of 1970. The CEQ established uniform procedures by issuing regulations (40 CFR, parts 1500 through 1508) to implement the procedural provisions of NEPA. These regulations include procedures to be used by Federal Agencies for the environmental review process. The regulations provide for the use of the NEPA process to identify and assess reasonable alternatives to proposed Federal actions that avoid or minimize adverse effects of these actions on the quality of the human environment.

The NEPA requires all Federal Agencies to use a systematic, interdisciplinary approach to protect the human environment. Such an approach ensures the integrated use of natural and social sciences in any planning and decisionmaking that may have an impact on the environment. The NEPA also requires the preparation of a detailed environmental impact statement (EIS) on any major Federal action that may have a significant impact on the environment. The EIS must address any adverse environmental effects that cannot be avoided or mitigated, alternatives to the proposed action, the relationship between short-term resources and long-term productivity, and irreversible and irretrievable commitments of resources. Environmental assessments (EA's) are prepared to determine if significant impacts may occur. If an EA finds that significant impacts may occur, NEPA requires the preparation of an EIS. The briefest form of NEPA review is the categorical exclusion review, which verifies that neither an EA nor an EIS is needed before making a decision on the activity being considered for approval.

For compliance with the NEPA, see 40 CFR, parts 1500 through 1508.

D.1.c. The Clean Air Act of 1970 and the Clean Air Act Amendments of 1990

The Clean Air Act of 1970 (42 U.S.C. § 7401 et seq.), authorizes the U.S. Environmental Protection Agency (USEPA) to establish National (primary or secondary) standards within air-quality-control regions of each state in addition to National emission standards for hazardous air pollutants (National Ambient Air Quality Standards [NAAQS]). The Act requires Federal departments or agencies that have jurisdiction over any property or facility or that are engaged in any activity resulting from the discharge of air pollutants to comply with all Federal, State, interstate, and local requirements in the control and abatement of air pollution. Section 5(a)(8) of the OCS Lands Act requires MMS, through the Secretary of the Interior, to ensure that OCS regulations incorporate and comply with NAAQS.

The 1990 Clean Air Act Amendments (CAA) delineate jurisdiction of air quality between the USEPA and the U.S. Department of the Interior (USDOI), MMS and affect the attainment and maintenance of NAAQS (Title I), motor vehicles and fuel reformulation (Title II), hazardous air pollutants (Title III), acid deposition (Title IV), facility operating permits (Title V), stratospheric ozone protection (Title VI), and enforcement (Title VII).

Section 328 of the CAA transfers authority for air quality on the OCS to the USEPA. Under the CAA, the Secretary of the Interior is required to consult with the USEPA "to assure coordination of air pollution control regulations for OCS emissions and emissions in adjacent onshore areas." On September 4, 1992, the USEPA promulgated requirements (40 CFR, part 55) to control air pollution from OCS sources to attain and maintain Federal and State air-quality standards and to comply with CAA provisions for the Prevention of Significant Deterioration. The promulgated regulations require OCS sources to comply with applicable onshore air-quality rules in the corresponding onshore area.

On November 30, 1993, the USEPA instituted final rules for determining general conformity of Federal actions with Federal and State air-quality implementation plans. Section 176(c) of the CAA, the General Conformity Rule, requires Federal Agencies to ensure that actions undertaken in nonattainment or maintenance areas are consistent with the applicable implementation plan. A Federal Agency must make a determination that a Federal action conforms to the applicable implementation plan before the Federal action is taken.

To comply with the CAA, the MMS established regulations to address air quality concerning OCS operations. These regulations are found under 30 CFR 250.302, 250.303, and 250.304. The regulated pollutants include carbon monoxide, particulates, sulfur dioxide, nitrogen oxides, and volatile organic compounds (as a precursor to ozone). In areas where hydrogen sulfide may be present, OCS operations are regulated by 30 CFR 250.417. The MMS regulations allow for the collection of information about potential sources of pollution for the purpose of determining whether the projected emissions of air pollutants from a facility could result in ambient onshore air-pollutant concentrations above maximum levels provided in the regulations. These regulations also stipulate appropriate emissions controls considered necessary to prevent accidents and air-quality deterioration.

D.1.d. The Federal Water Pollution Control Act and Clean Water Act

The Federal Water Pollution Control Act (FWPCA) of 1972, as amended (33 U.S.C. § 251 et seq.), established water-pollution-control activities to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The Clean Water Act (CWA) of 1977 (91 Stat. 1566) amended the FWPCA. Most activities are administered by the USEPA.

Title III of the CWA requires the USEPA to establish national effluent limitation standards for existing point sources of wastewater discharges that reflect the application of the best practical control technology currently available. These standards apply to existing OCS exploratory drillships, semisubmersible vessels, and jackup rigs used in exploration activities. The CWA also requires the USEPA to establish regulations for effluent limitations for categories and classes of point sources that require the application of "best available control technology economically achievable."

Section 311 of the CWA (33 U.S.C. § 1321), as amended, prohibits the discharge of oil or hazardous substances into the navigable waters of the U.S. that may affect natural resources, except under limited circumstances, and establishes civil penalty liability and enforcement procedures to be administered by the Coast Guard.

Title IV of the CWA establishes requirements for Federal permits and licenses to conduct an activity (including construction or operation of facilities) that may result in any discharges into navigable waters. Section 402 of the CWA (33 U.S.C. § 1342) gives the USEPA the authority to issue National Pollutant Discharge Elimination System (NPDES) permits for discharges of any pollutant from a point source into navigable waters. The NPDES permits are issued in compliance with USEPA's guidelines for determining the degradation of marine waters, and they apply to all sources of wastewater discharges from exploratory vessels and production platforms operating on the OCS.

Section 404 of the CWA (33 U.S.C. § 1344) authorizes issuance of permits, under certain criteria, for discharge of dredged or fill material into navigable waters at specified disposal sites. The Secretary of the Army, acting through the Corps of Engineers, has the authority to administer Section 404. Permits may be issued only after a determination is made that the activities involving discharges of dredged or fill material are similar in nature, will cause only minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effects on the environment.

Pursuant to the 1984 Memorandum of Understanding between the USEPA and the USDOI concerning the coordination of NPDES permit issuance with the OCS oil and gas lease program, the MMS Alaska OCS Region and the USEPA Region 10 entered into a Cooperating Agency Agreement to prepare EIS's for oil and gas exploration and development and production activities on the Alaskan OCS. Section 402 of the CWA authorizes the USEPA to issue NPDES permits to regulate discharges to waters of the U.S., including the territorial seas, contiguous zone, and oceans. The NPDES permits for OCS oil and gas facilities many contain effluent limitations developed pursuant to sections of the CWA, including sections 301, 302, 306, 307, and 403. With the offshore subcategory under the CWA, the USEPA may have NEPA responsibilities for permits issued to new sources (Section 306 of the CWA), that overlap with those of the MMS. The USEPA's primary role in the Cooperating Agency Agreement is to provide expertise in those fields specifically under its mandate.

In conjunction with the issuance of an NPDES permit, the USEPA is responsible for publishing an Ocean Discharge Criteria Evaluation (ODCE) that evaluates the impacts of waste discharges proposed for oil and gas projects. The purpose of the ODCE is to demonstrate whether or not a particular discharge will cause unreasonable degradation to the marine environment.

For multiple-use conflicts, see the USEPA listing of ocean-dumping sites found under 40 CFR part 228.

The MMS pollution prevention and control regulations are found under 30 CFR 250.300.

D.1.e. The Coastal Zone Management Act and the Coastal Zone Reauthorization Amendments

Congress passed the Coastal Zone Management Act (CZMA) of 1972, as amended (16 U.S.C. § 1451 et seq.) and created the Coastal Zone Management Program to improve the management of the Nation's coastal areas. Both the Coastal Zone Reauthorization Amendments of 1990 (P.L. No. 101-508), enacted November 5, 1990, and the Coastal Zone Protection Act of 1996 (P.L. No. 104-150), enacted June 3, 1996, amended and reauthorized the CZMA. The Program, a voluntary partnership between the Federal Government and the coastal states and territories, is administered at the Federal level by the National Oceanic and Atmospheric Administration (NOAA) within the U.S. Department of Commerce (USDOC). The Program's goal is to reduce conflict between environmental and economic interest in the coastal area through the use of federally approved coastal management programs (CMP's). Each state's CZM program sets forth objectives, policies, and standards regarding public and private use of land and water resources in that state's coastal zone.

The CZMA allows a coastal state or territory with a federally approved CMP to review Federal activities for Federal consistency. Consistency applies whenever a Federal activity initiates a series of events where coastal effects are reasonably foreseeable (see H.R. Rep. No. 1012, 96th Cong., 2d Sess. 4382). The CZMA requirement that all Federal activity, including OCS oil and lease sales, regardless of location (in or outside the coastal zone) that is reasonably likely to affect any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of a state's/territory's CMP. Section 307 of the CZMA (16 U.S.C. § 1456) contains the following Federal consistency provisions that impose certain requirements on Federal Agencies to comply with enforceable policies detailed in the federally approved CMP's:

> Section 307(c)(1) requires that Federal Agencies must conduct their activities, regardless of location, if coastal effects are reasonably foreseeable, that affects any land or water use or natural resources of the coastal zone in a manner that is fully consistent to the maximum extent practicable with enforceable policies of the affected state's coastal zone management (CZM) program. This section applies to OCS lease sales. On May 3, 1995, the MMS Regional Director, Alaska OCS Region, and the Director, Alaska Division of Governmental Coordination signed a Memorandum of Understanding Between State of Alaska Division of Governmental Coordination and USDOI, MMS Alaska OCS Region. This document facilitates and coordinates both agencies' efforts with respect to consistency determination procedures prior to MMS Alaska OCS Region's oil and gas lease sales.
>
> Section 307(c)(3)(A) requires that any Federal licenses/permits affecting any land or water use or natural resources of the coastal zone be consistent with enforceable policies of the state's CMP. This section applies to geological and geophysical permits. Additionally, this section prohibits the Federal Agency from issuing the license/permit until the affected state(s) has concurred with or presumed to concur with the applicant's consistency certification or until the Secretary of Commerce has overridden the state's consistency objection to the licensed/permitted activity.
>
> Section 307(e)(3)(B) requires that activities affecting any land or water use or natural resources of the coastal zone, described in detail in OCS exploration or development and production plans, be consistent with enforceable policies of the state's CMP. The MMS is prohibited from approving an OCS plan until the affected state(s) has concurred with or is presumed to concur with the applicant's consistency certification, or until the Secretary of Commerce has overridden the state's consistency objection. On August 7, 1980, a Memorandum of Understanding Between Division of Policy and Development and Planning and U.S. Geological Survey was signed between the State of Alaska and MMS (formerly USGS). This document establishes procedures for coordinating plans and programs for consistency review and includes procedures for approvals of

exploration plans, development and production plans, and other licenses and permits for OCS activities.

On December 8, 2000, NOAA revised the regulations that implement the Federal consistency provisions of the CZMA with federally approved CMP's. These regulations are found under 15 CFR § 930.

The MMS regulations for CZMA consideration affecting OCS lease sales are found under 30 CFR 256.20. The MMS regulations for CZMA consideration affecting OCS operations and/or permit activities are found under 30 CFR 250.203, 250.204, 250.414, and 250.417.

D.1.f. The Energy Policy and Conservation Act

The Energy Policy and Conservation Act of 1975 (42 U.S.C. § 6213 et seq.) prohibits joint bidding by major oil and gas producers. Bidders submitting bids on OCS leases are subject to the provisions of 18 U.S.C. 1860, prohibiting unlawful combination or intimidation of bidders (30 CFR 256.46(f)).

The MMS authority and regulations for compliance with the Energy Policy and Conservation Act of 1975 are found under 30 CFR 256.4, 256.41, and 256.44.

D.1.g. The Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972, as amended (16 U.S.C. § 1361 et seq.) was enacted to ensure that marine mammals are maintained at or, in some cases, restored to healthy population levels. Jurisdiction and regulatory responsibility for the conservation and protection of these marine mammals under the MMPA is split between two Federal Agencies. The Secretary of the Interior is responsible for walruses, polar bears, sea otters, manatees, and dugongs and has delegated this responsibility to the Fish and Wildlife Service (FWS). The Secretary of Commerce is responsible for the protection of all other marine mammals (cetaceans and pinnipeds [except walruses]) and has delegated the authority for implementing the MMPA to the National Marine Fisheries Services (NMFS).

The Marine Mammal Commission is responsible for reviewing and advising Federal Agencies on the protection and conservation of marine mammals. The commission has a Committee of Scientific Advisors that provides advice on actions needed to fulfill the purposes of the MMPA. The commission is authorized to make recommendations on the prohibition of taking and importing marine mammals and marine mammal products, except as expressly provided for by an international treaty, convention, or agreement to which the U.S. is a party.

The MMPA established a moratorium on the taking or importing of marine mammals in waters under U.S. jurisdiction except during certain activities that are regulated and permitted. Such activities include scientific research, public display, and the incidental take of marine mammals in the course of commercial-fishing operations. The MMPA defines "take" to mean "hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal." "Harass" is defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns including, but not limited to, migrating, breathing, nursing, breeding, feeding, or sheltering.

The moratorium may be waived when the affected species or population stock is within its optimum sustainable population range and would not be disadvantaged by the authorized taking (for example, be reduced below its maximum net productivity level), which is the lower limit of the optimum sustainable population range. On request, the Secretary (of either the USDOI or the USDOC, depending on jurisdiction) can authorize the unintentional taking of small numbers of marine mammals incidental to activities other than commercial fishing (for example, offshore oil and gas exploration and development) when, after notice and opportunity for public comment, the Secretary finds that the total of such taking during the 5-year (or less) period would have a negligible impact on the affected species. Also, the Secretary will withdraw, or suspend for a specified time, permission to take marine mammals incidental to oil and gas production, and other activities if the applicable regulations concerning the methods of taking, monitoring, or reporting are not being complied with, or the taking is having, or may be having, more than a negligible impact on the affected species or stock.

In 1994, a new subparagraph (D) was added to Section 101(a)(5) of the MMPA to simplify the process of obtaining "small take" exemptions when unintentional taking is by incidental harassment only. Specifically, the incidental take of small numbers of marine mammals by harassment can now be authorized for periods of up to 1 year without the rulemaking as required by Section 101(a)(5)(A), which remains in effect for other authorized types of incidental taking.

To ensure that activities on the OCS adhere to MMPA regulations, the MMS must actively seek information concerning impacts of OCS activities on local species of marine mammals. The MMPA provides exemptions to taking of certain marine mammals by Alaskan Natives under certain conditions. The MMS coordinates with the FWS and NMFS to ensure that the MMS and offshore operators comply with the MMPA and to identify mitigation and monitoring requirements for permits or approvals for OCS activities, such as seismic surveys and platform removals.

D.1.h. The Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA), as amended (16 U.S.C. § 703-712), is the domestic law that affirms, or implements, the United States' commitment to four international conventions with Canada, Japan, Mexico, and Russia for the protection of shared migratory bird resources.

The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts and nests. The take of all migratory birds is governed by the MBTA's regulation of taking migratory birds for educational, scientific, and recreational purposes and requiring harvest to be limited to levels that prevent overutilization. Section 704 of the MBTA states that the Secretary of the Interior is authorized and directed to determine if, and by what means, the take of migratory birds should be allowed and to adopt suitable regulations permitting and governing take. The Secretary in adopting regulations is to consider such factors as distribution and abundance to ensure that take is compatible with the protection of the species.

The provisions of the MBTA apply equally to Federal and non-Federal entities and prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit (50 CFR 21.11). Certain exceptions apply to employees of the Department of the Interior to enforce the MBTA and to employees of Federal agencies, State game departments, municipal game farms or parks, and public museums, public zoological parks, accredited institutional members of the American Association of Zoological Parks and Aquariums (now called the American Zoo and Aquarium Association) and public scientific or educational institutions.

D.1.i. The International Convention of the Prevention of Pollution from Ships and Marine Plastics Pollution Research and Control Act

In 1978, the International Convention of the Prevention of Pollution from Ships (MARPOL) was updated to include five annexes on ocean dumping. By signing onto MARPOL, countries agree to enforce Annexes I and II (oil and noxious liquid substances) of the treaty. Annexes III (hazardous substances), IV (sewage), and V (plastics) are optional. The U.S. is signatory to two of the optional MARPOL Annexes (III and V). Annex V is of particular importance to the maritime community (for example, shippers, oil-platform personnel, fishers, and recreational boaters) because it prohibits the disposal of plastics at sea and regulates the disposal of other types of garbage at sea. The Coast Guard is the enforcement agency for MARPOL Annex V within the U.S. Exclusive Economic Zone (EEZ) (within 200 miles of the U.S. shoreline).

The Marine Plastic Pollution Research and Control Act (MPPRCA) of 1988 (33 U.S.C. § 1901 et seq.) is the Federal law implementing MARPOL Annex V in all U.S. waters. Under the MPPRCA, it is illegal to throw plastic trash off any vessel within the EEZ. It also is illegal to throw any other garbage (for example, orange peels, paper plates, glass jars, and monofilament fishing line) overboard while navigating in inland waters or within 3 miles offshore. The greater the distance from shore, the fewer restrictions apply to nonplastic garbage. However, dumping plastics overboard in any waters anywhere is illegal at anytime. Fixed and floating platforms, drilling rigs, manned productions platforms, and support vessels operating under a Federal oil and gas lease are required to develop waste management plans and to post placards reflecting discharge limitations and restrictions. Garbage must be brought ashore and properly disposed of in a trash can, dumpster, or recycling container. Docks and marinas are required to provide facilities to handle normal amounts of garbage from their paying customers. Violations of MARPOL or MPPRCA may result in a fine of up to $50,000 for each incident. If criminal intent can be proven, an individual may be fined up to $250,000 and/or imprisoned up to 6 years. If an organization is responsible, it may be fined up to $500,000 and/or receive 6 years of imprisonment.

D.1.j. The Marine Protection, Research, and Sanctuaries Act

The Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972, as amended (33 U.S.C. § 1401-1445 and 16 U.S.C. § 1431-1445) regulates ocean dumping of waste, provides for a research program on ocean dumping, and provides for the designation and regulation of marine sanctuaries. Also known as the Ocean Dumping Act, the MPRSA regulates the ocean dumping of all material beyond the territorial limit (3 miles from shore) and prevents or strictly limits dumping material that "would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." Material includes, but is not limited to, dredged material; solid waste; incinerator residue; garbage; sewage; sewage sludge; munitions; chemical and biological warfare agents; radioactive materials; chemicals; biological and laboratory waste; wrecked or discarded equipment; rocks; sand; excavation debris; and industrial, municipal, agricultural, and other waste. The term does not include sewage from vessels or oil, unless the oil is transported via a vessel or aircraft for the purpose of dumping. Disposal by means of a pipe, regardless of how far at sea the discharge occurs, is regulated by the CWA through the NPDES permit process. Permits under Section 103 of this Act for dumping dredged material into ocean waters are issued by the Corps of Engineers.

Title III of the MPRSA, later called the National Marine Sanctuaries Act, charged the Secretary of Commerce to identify, designate, and manage marine sites based on conservation and ecological, recreational, historical, aesthetic, scientific, or educational value within significant national ocean and Great Lakes waters. Twelve national marine sanctuaries, representing a wide variety of ocean environments, have been designated. The National Marine Sanctuary Program is administered by USDOC, NOAA.

The regulations regarding designation and management of marine sanctuaries are found under 15 CFR § 922.

D.1.k. The National Fishing Enhancement Act

The National Fishing Enhancement Act of 1984 (33 U.S.C. § 2101 et seq.), also known as the Artificial Reef Act, established broad artificial reef development standards and a national policy to encourage the development of artificial reefs that will enhance fishery resources and commercial and recreational fishing. The national plan identifies oil and gas structures as acceptable material of opportunity for artificial reef development. The MMS adopted a rigs-to-reefs policy in 1985 in response to this Act and to broaden interest in the use of petroleum platform as artificial reefs.

D.1.l. The Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (FCMA) of 1976 (16 U.S.C. § 1801 et seq.) established and delineated an area from the states' seaward boundary to approximately 200 nautical miles out as a fisheries conservation zone for the U.S. and its possessions. The Act created eight regional Fishery Management Councils (FMC's) and mandated a continuing planning program for marine fisheries management by the FMC's. The Act, as amended, requires that a Fishery Management Plan (FMP) (50 CFR 600), based on the best available scientific and economic data, be prepared for each commercial species (or related group of species) of fish in need of conservation and management within each respective region.

The FCMA was reauthorized by Congress through passage of the Sustainable Fisheries Act of 1996. This reauthorization implements a number of reforms and changes. One change required the NMFS to designate and conserve Essential Fish Habitat (EFH) for those species managed under an existing FMP. By designating EFH's, Congress hoped to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or nonfishing activities and to identify other actions to encourage the conservation and enhancement of such habitat. The phrase "essential fish habitat," as defined in the Sustainable Fisheries Act of 1996, encompasses "those waters and substrate necessary to fishes for spawning, breeding, feeding, or growth to maturity." As a result of this change, Federal Agencies must consult with NMFS on those activities that may have direct (for example, physical disruption) or indirect (for example, loss of prey species) effects on EFH.

Of the FMP's for Alaskan fisheries, only the plan for salmon designates EFH present within the Alaska OCS Beaufort Sea Planning Area. The FMP's are amended and updated as new information from studies and public input is received and assessed. For OCS activities in the Alaska Region's Beaufort Sea Planning Area, the MMS consults with NMFS at each project stage individually (for example, the lease sale, the exploration plan, and the development and production plan). The MMS will enter into formal consultation with NMFS for EFH as part of this EIS process.

D.1.m. The Endangered Species Act

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), establishes the National policy for the protection and conservation of threatened and endangered species and the ecosystems on which they depend. The ESA is administered by USDOI, FWS and the USDOC, NMFS. Section 7 of the ESA (16 U.S.C. § 1536) governs interagency cooperation and consultation requiring Federal Agencies to formally consult with the NMFS and FWS, when there is a reason to believe that a species listed (or proposed to be listed) as endangered or threatened may be affected by an action, such as an OCS lease sale. Section 7 mandates Federal Agencies to consult with the FWS or NMFS to ensure that any agency action is not likely to jeopardize the continued existence of any endangered or threatened species, and/or destroy or adversely modify an endangered or threatened species' critical habitat.

Formal endangered species consultation is required to provide a threshold examination and to allow both the FWS and NMFS to each prepare a biological opinion on the likelihood that the proposed activity will or will not jeopardize the continued existence of the resource, and on the effect of the potential activities on the endangered species. The biological opinion may include recommendations for modification of the proposed activity. If, as a result of the threshold examination, insufficient information is available to conclude that the proposed activity is not likely to jeopardize the species or its habitat, the Federal Agency (i.e., MMS) is notified in writing by the FWS or NMFS. In such cases, the Federal Agency must obtain additional information and, if recommended by the FWS or NMFS, conduct appropriate biological surveys or studies to determine how the proposed activity may affect the endangered species or its critical habitat. After such additional information is received, FWS or NMFS usually concludes the consultation process by issuing a formal biological opinion.

As needed during the early stages and throughout prelease processes, the MMS will formally consult with both FWS and NMFS to ensure that the Federal activities proposed in the Beaufort Sea Planning Area do not jeopardize the continued existence of threatened or endangered species and/or result in adverse modification or destruction of their critical habitat. This consultation covers only the proposed OCS lease sales and exploration activities scenarios. A separate Section 7 consultation is conducted for development, production, and decommissioning phases for OCS activities. The FWS and NMFS make recommendations regarding modifications to proposed OCS activity to minimize adverse environmental impacts; however, it remains the responsibility of the MMS to ensure that proposed actions do not impact threatened or endangered species.

Joint regulations published in 50 CFR § 402 by the USDOI (FWS) and the USDOC (NMFS) establish procedures and rules governing interagency consultation under Section 7 of the ESA.

Section 9 of the ESA (16 U.S.C. § 1538) contains prohibitions (except as provided in law) with respect to any endangered species of fish, wildlife, and plant. For example, it is unlawful for any person subject to the jurisdiction of the U.S. to (1) take any species within the U.S. or the territorial seas of the U.S. and (2) take any species upon the high seas. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.

The regulations that provide the rules for determining and listing endangered and threatened species and designating their critical habitats are found under 50 CFR § 424.

D.1.n. The National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. § 470 et seq.), established a program for the preservation of historic properties throughout the U.S. and established the Advisory Council on Historic Preservation. This Act requires the head of any Federal Agency possessing licensing authority or having direct or indirect jurisdiction over a proposed Federal or federally assisted activity to consider the proposed activity's effect on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historical Places (30 CFR 60.4 or its successor). The historic properties (i.e., archaeological resources) on the OCS include historic shipwrecks, sunken aircraft, lighthouses, and prehistoric archaeological sites that have become inundated due to the 120-meter rise in global sea level since the height of the last ice age (about 19,000 years ago).

Because the OCS is not federally owned land and the Federal Government has not claimed direct ownership of historic properties on the OCS, the MMS has the authority under Section 106 of the NHPA only to ensure that any MMS funded and permitted actions do not adversely affect significant historic properties. Beyond avoidance of adverse impacts, the MMS does not possess the legal authority to manage the historic properties on the OCS.

The MMS has conducted archaeological baseline studies of the OCS to determine where known historic properties may be located and to outline areas where presently unknown historic properties may be located. These baseline studies are used to identify "archaeologically sensitive" areas that may contain significant historic properties. When proposing a Federal action (i.e., an oil and gas lease sale), the MMS may request comments concerning geological conditions, including archaeological sites on the seabed or nearshore (30 CFR 256.24).

Before approving any OCS exploration or development activities within an archaeologically sensitive area, the MMS requires the lessee to conduct a marine remote-sensing survey and to prepare an archaeological report (30 CFR 250.194).

Archaeological surveys are required both onshore and offshore in areas where there is the potential for archaeological resources to exist, so that potential impacts to archaeological resources from physical disturbance could be mitigated. If the marine remote-sensing survey indicates any evidence of a potential historic property, the lessee must either:

> move the site of the proposed lease operations a sufficient distance to avoid the potential historic property, or conduct further investigations to determine the nature and significance of the potential historic property. If further investigation determines that there is a significant historic property within the area of proposed OCS operations, NHPA consultation procedures are followed.

The MMS Alaska Region and the State of Alaska Historic Preservation Office have an agreement regarding procedures for invoking Section 106 of the NHPA.

The MMS responsibilities in archaeological resource management and protection on the OCS are found under 30 CFR 250.203(b)(15), 250.203(o), 250.204(b)(8)(v)(A), 250.204(s), 250.1007(a)(5), and 250.1009(c)(4).

D.1.o. The Oil Pollution Act

The Oil Pollution Act of 1990 (OPA 90), as amended (33 U.S.C. § 2701 et seq.), establishes a single uniform Federal system of liability and compensation for damages caused by oil spills in U.S. navigable waters. The OPA 90 requires removal of spilled oil and establishes a national system of planning for and responding to oil-spill incidents. The OPA 90 includes provisions to:

- improve oil-spill prevention, preparedness, and response capability;
- establish limitations on liability for damages resulting from oil pollution;
- provide funding for natural resource damage assessment;
- implement a fund for the payment of compensation for such damages; and
- establish an oil pollution research and development program.

The U.S. Coast Guard is responsible for enforcing vessel compliance with OPA 90. The U.S. Coast Guard regulations on the oil-spill liability of vessels and operators are found under 33 CFR §§ 132, 135, and 136.

Section 1016 of OPA 90 (33 U.S.C. § 2716), as amended by the Coast Guard Authorization Act of 1996, supersedes the offshore oil-spill financial-responsibility provision of Title III of the OCS Lands Act Amendments of 1978, previously administered by the U.S. Coast Guard. Under OPA 90 and Executive Order 12777 (October 18, 1991), the Secretary of the Interior is given authority over covered offshore facilities and associated pipelines (except deepwater ports) for all Federal and State waters, including responsibility for spill prevention, oil-spill-contingency plans, oil-spill-containment and -cleanup equipment, financial-responsibility certification, and civil penalties. The Secretary delegated this authority to the MMS.

The MMS regulations found under 30 CFR § 253 that implement Title I of the OPA 90 establish the requirements for demonstrating oil-spill financial responsibility for covered offshore facilities requiring responsible parties to demonstrate they can pay for cleanup and damages caused by facility oil spills. These regulations govern financial responsibility requirements for oil spills for covered offshore facilities and related requirements for certain crude oil wells, production platforms, and pipelines located in the OCS and certain State waters became effective in October 1998. Responsible parties can be required to demonstrate as much as $150 million in oil-spill financial responsibility if the MMS determines that it is justified by the risks from potential oil spills from the covered offshore facilities. The minimum amount of oil-spill financial responsibility that must be demonstrated is $35 million for covered offshore facilities located in the OCS, and $10 million for covered offshore facilities located in State waters. The regulations exempt persons responsible for facilities having a potential worst-case, oil-spill discharge of 1,000 barrels or less, unless the risks posed by a facility justify a lower threshold.

D.1.p. The Rivers and Harbors Appropriation Act

The geographic jurisdiction of the Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.) includes all navigable water of the U.S. (defined in 33 CFR § 329) as "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce." This jurisdiction extends seaward to include all ocean waters within a zone 3 nautical miles from the coastline (the "territorial seas"). Limited authorities extend across the OCS for artificial islands, installations, and other devices (43 U.S.C. § 333 (e)).

Various sections of the Act establish permit requirements to prevent unauthorized obstruction or alteration of any navigable water of the U.S. The Corps of Engineers, through the Secretary of the Army, has permitting authority for any structure work conducted in or affecting U.S. navigable waters and for construction of artificial islands, fixed structures, and other installations on the OCS. This authority arises from a provision in the OCS Lands Act (43 U.S.C. § 1333(e)) that extends the Secretary of the Army's authority to prevent obstruction to navigation in U.S. navigable waters from structures located on the OCS that are used for exploring, developing, producing, or transporting natural resources.

In addition, Section 10 of the Act (33 U.S.C. § 403) authorizes the Corps of Engineers, through the Secretary of the Army, to issue permits for all offshore construction in U.S. navigable waters, including pipelines, exploratory drilling vessels, fixed and mobile platforms, piers, wharves, bulkheads, or other works. Permits also must be issued for onshore facilities that involve dredging, filling, and excavating in U.S. navigable waters.

D.1.q. The Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C. § 6901 et seq.), and as amended through 1996, provides a framework for the safe disposal and management of hazardous and solid wastes. Most oil-field wastes have been exempted from coverage under the RCRA hazardous-waste regulations. Any hazardous wastes generated on the OCS that are not exempt must be transported to shore for disposal at a hazardous-waste facility.

D.1.r. The Ports and Waterways Safety Act

The Ports and Waterways Safety Act of 1972, as amended (33 U.S.C. § 1221 et seq.), authorizes the U.S. Coast Guard to designate safety fairways, fairway anchorages, and traffic separation schemes to provide unobstructed approaches through oil fields for vessels using ports. The Coast Guared regulations provide listings of these designated areas along with special conditions related to oil and gas production. In general, no fixed structures such as platforms are allowed in fairways. Temporary underwater obstacles such as anchors and attendant cables or chains attached to floating or semisubmersible drilling rigs may be placed in a fairway under certain conditions. Fixed structures may be placed in anchorages, but the number of structures is limited.

The Coast Guard regulations on port access routes are found under 33 CFR § 164.

D.1.s. The Merchant Marine Act of 1920 (Jones Act)

The Merchant Marine Act of 1920, commonly referred to as the Jones Act (P.L. 66-261), regulates coastal shipping between U.S. ports and inland waterways. The Act provides that "no merchandise shall be transported by water, or by land and water…between points in the United States…in any other vessel than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States…" The Act requires that all goods shipped between different ports in the U.S. or its territories must be:

- • carried on vessels built and documented (flagged) in the U.S.,
- • crewed by U.S. citizens or legal aliens licensed by the U.S. Coast Guard, and
- • owned and operated by U.S. citizens.

The rationale behind the Jones Act and earlier sabotage laws was that the U.S. needed a merchant marine fleet to ensure that its domestic waterborne commerce remains under government jurisdiction for regulatory, safety, and national defense considerations. The same general principles of safety regulations are applied to other modes of transportation in the U.S. While other modes of transportation can operate foreign-built equipment, these units must comply with U.S. standards. However, many foreign-built ships do not meet the standards required of U.S.-built ships and, thus, are excluded from domestic shipping.

The U.S. Customs Service has determined that facilities fixed or attached to the OCS for the purpose of oil exploration, as described under 43 U.S.C. § 333(a), are considered points within the U.S. The OCS oil facilities are considered U.S. sovereign territory and fall under the requirements of the Jones Act. This carries the implication that all shipping to and from these facilities related to oil exploration on the OCS can be conducted only by vessels meeting the requirements of the Jones Act. Therefore, OCS facilities can be legally served only by U.S.-registered vessels and aircraft that are properly endorsed for coastwise trade under the laws of the U.S.

D.1.t. The Federal Oil and Gas Royalty Management Act

The Federal Oil and Gas Royalty Management Act (FOGRMA) of 1982 (30 U.S.C. § 701 et seq.), was enacted to ensure that all oil and gas originating on public land and on the OCS are properly accounted for under the direction of the Secretary of the Interior. This Act defines the responsibilities and obligations of lessees, operators, and other persons involved in the transportation of oil and gas from Federal, Indian, and OCS lands. The Secretary of the Interior has the responsibility to maintain a royalty management system and enforce the prompt collection and disbursement of oil and gas revenues owed to the U.S., Indian lessors, and the states.

The Secretary of the Interior oversees a comprehensive inspection and collection system with fiscal and production accounting and auditing system to accurately determine oil and gas royalties, interest, fines, penalties, fees, deposits, and other payments owed and to collect and account for the payments in a timely manner.

The FOGRMA requires a lessee, operator, or other person directly involved in the developing, producing, transporting, purchasing, or selling of oil and gas to establish and maintain records, make reports, and provide information as required by the Secretary of the Interior.

Regulations at 30 CFR 201 through 243 were published by the MMS to implement the provisions of the FOGRMA. For royalties, net profit shares, and rental payments on Federal OCS leases, see 30 CFR 218.150 through 156.

D.1.u. The Arctic Research and Policy Act

The Arctic Research and Policy Act of 1984 (15 U.S.C. § 4101 et seq.) provides national policy, priorities, and goals and a Federal program plan for basic and applied scientific research with respect to the Arctic, including natural resources and materials, physical, biological and health sciences, and social and behavioral sciences.

The Arctic Research Commission, in cooperation with the Interagency Arctic Research Policy Committee, both established under this Act, were directed to develop a national arctic research program plan to implement the arctic research policy and facilitate cooperation between the Federal Government and State and local governments with respect to research in the Arctic. The Commission guides the Interagency Arctic Research Policy Committee in the performance of its duties and submits to the President and Congress a report each year describing the activities and accomplishments of the Commission during the immediately preceding fiscal year.

The Interagency Arctic Research Policy Committee, with the National Science Foundation as lead agency, works with the Commission in developing and establishing an integrated National Arctic Research Policy that guides Federal Agencies in developing and implementing their research program in the Arctic. The public is provided with an opportunity to participate in the development and implementation of National Arctic Research Policy through public meetings. The Committee is directed to submit to Congress, through the President, a biennial statement of activities and accomplishments of the Interagency Committee and a description of the activities of the Commission with respect to Federal activities in arctic research.

Section 201 of the Arctic Research and Policy Act is cited as the National Critical Materials Act of 1984. The purpose of this section is to (1) establish National Critical Material Council, (2) establish a national

Federal program for advanced materials research and technology, and (3) to stimulate innovation and technology use in basic as well as advanced materials industries.

D.2. EXECUTIVE ORDERS

D.2.a. Executive Order 13212 - Actions to Expedite Energy-Related Projects (May 18, 2001)

Executive Order 13212 states that "… in order to take additional steps to expedite the increased supply and availability of energy to our Nation …," it is necessary to improve the Federal Government's internal management of actions associated with energy-related projects. In general, the executive order directs executive departments and agencies to take appropriate actions to expedite projects that will increase the production, transmission, or conservation of energy. Departments and agencies must expedite their review of permits or take other actions as necessary to accelerate the completion of such projects while maintaining safety, public health, and environmental protections. Agencies must take such actions to the extent permitted by law, theregulations, and where appropriate.

D.2.b. Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 11, 1994)

Executive Order 12898 on environmental justice provides that each Federal Agency must make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

Agencies are required to incorporate into their NEPA documents analysis of the environmental effects of their proposed action on minorities and low-income populations and communities. The environmental justice issues encompass a broad range of impacts covered by NEPA, and concerns may arise from impacts on the natural or physical environment or from interrelated social, cultural, and economic effects. These effects must be considered in EIS's and EA's.

The Department of the Interior has developed guidelines in accordance with Executive Order 12898 on environmental justice. The MMS participated in the development of these guidelines. In August 1994, the Secretary of the Interior directed the Department's bureaus to include environmental justice in NEPA documentation and, in February 1998, the CEQ issued guidance to assist Agencies in addressing environmental justice.

Environmental justice concerns are considered anywhere (including the MMS Pacific and Gulf of Mexico regions) where OCS projects and associated NEPA documentation take place; however, issues concerning Alaska OCS-related impacts primarily have focused on the subsistence hunting, fishing, and gathering activities that occur in coastal areas.

The MMS's existing process of involving all affected communities, Native Alaskans, and minority groups in the NEPA compliance process meets the intent and spirit of Executive Order 12898. Scoping and review for the EIS is an open process that provides an opportunity for all participants, including minority and low-income populations, to express concerns that can be addressed in the EIS. It should be emphasized that the reason the MMS holds scoping meetings is to encourage and facilitate public involvement into the EIS process. Valuable public input ensures that the EIS will be thorough and will address all pertinent issues that affect the quality of the human environment to the fullest extent possible and that will contribute a major role in the MMS's planning and final decisionmaking. The MMS will continue to identify ways to improve the input from all Alaskan residents, not only in commenting on official documents but also contributing their knowledge to the scientific and analytical sections of the EIS.

D.2.c. Executive Order 13175 - Consultation and Coordination With Indian Tribal Governments (November 6, 2000)

The United States has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions. Since the formation of the Union, the United States has recognized Indian tribes as domestic dependent nations under its protection. The Federal Government has enacted numerous statutes and promulgated numerous regulations that establish and define a trust relationship with Indian tribes.

To strengthen the United States government-to-government relationships with Indian tribes (Indian tribe is defined as Indian or Alaska Native tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian tribe pursuant to the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479a), Executive Order 13175 requires the Secretary of the Interior to establish regular and meaningful consultation and collaboration with Indian tribal officials in the development of Federal policies that have tribal implications. Policies that have tribal implications refers to regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes. The United States continues to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, tribal trust resources, and Indian tribal treaty and other rights.

D.2.d. Executive Order 13007- Indian Sacred Sites (May 24, 1996)

The Indian Sacred Sites executive order directs Federal land-managing agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. It is MMS's policy to consider the potential effects of all aspects of plans, projects, programs, and activities on Indian sacred sites, and to consult, to the greatest extent practicable and to the extent permitted by law, with tribal governments before taking actions that may affect Indian sacred sites located on Federal lands.

D.2.e. Executive Order 12114 - Environmental Effects Abroad(January 1979)

Executive Order 12114 requires that Federal officials be informed of environmental considerations, and take those considerations into account when making decisions on major Federal actions that could have environmental impacts anywhere beyond the borders of the U.S., including Antarctica. Such Federal actions include the following:

- All major Federal actions significantly affecting the environment outside the jurisdiction of any nation (the oceans or Antarctica). This would apply to proposals that result in actions within the U.S. that, because of ocean currents, winds, stream flow, or other natural processes, may affect parts of the oceans not claimed by any nation (high seas). Included in this category would be an OCS project that, because of ocean currents, could result in effluents or spilled oil reaching fishing grounds or areas not claimed by another nation.
- All major Federal actions significantly affecting the environment of a foreign nation not involved in the action. This would apply to proposals that result in actions within U.S. territory, or within the EEZ that, because of ocean currents, winds, stream flow, or other natural processes, may affect parts of another nation, or seas or oceans within the jurisdiction of other nations. This category would include an OCS project located upcurrent from the Mexican coastline that could affect Mexico's territory in the

event of an oil spill. Also in this category are all major Federal actions in which a foreign nation is a participant and that normally would be covered by the EIS addressing the U.S. part of the Proposal. An example would be an OCS right-of-way pipeline bringing Canadian energy resources to the northeast U.S.

- All major Federal actions providing a foreign nation with a product or involving a project that produces an emission or effluent prohibited or regulated by U.S. Federal law because of its effects on the environment or the creation of a serious public health risk.

Federal actions causing significant impacts on environments outside the U.S. are to be addressed in:

- • EIS's (generic, program [5-year OCS programmatic EIS]), and project-specific (OCS lease-sale EIS);
- • documents prepared for decisionmakers containing reviews of environmental issues involved in Federal actions, or summaries of environmental analyses (for example, OCS lease-sale decision documents, Records of Decision); and
- • environmental studies or research prepared by the U.S. and one or more foreign nations, or by an international body in which the U.S. is a member or participant.

The U.S., Canada, and Mexico are negotiating a Transboundary Environmental Impact Assessments (TEIA) Agreement through the North Atlantic Free Trade Agreement (NAFTA) Commission on Environmental Cooperation (CEC). The CEC deals with a wide range of environmental and natural resource protection issues common to Canada, the U.S., and Mexico. Developing a TEIA process is one of the requirements of the 1991 North American Agreement on Environmental Cooperation. Under this agreement, a transboundary environmental impact is any impact on the environment within the area under the jurisdiction of Canada, the U.S., or Mexico caused by a proposed project, the physical origin of which is situated wholly or in part within the area under the jurisdiction of one of the three countries. For example, a proposed project on the U.S. OCS that, because of ocean currents, winds, or proximity to the Mexican coastline, could affect Mexican waters (fishing industry, fish resources, etc.) or the Mexican coastline (oil-spill contacts, etc.) would be a project considered to have the potential to cause transboundary environmental impacts. The agreement recognizes that there is a significant bilateral nature to many transboundary issues and calls upon the three countries to develop an agreement to:

- • assess the environmental impacts of proposed projects in any of the three countries party to the agreement (NAFTA) that would be likely to cause significant adverse transboundary impacts within the jurisdiction of any of the other parties;
- • develop a system of notification, consultation, and sharing of relevant information between countries with respect to such projects; and
- • give consideration to mitigating measures to address the potential adverse effects of such projects.

Negotiations are under way between the three parties to the agreement, but the final language has yet to be worked out. Because the requirements of the assessment portion of the agreement are somewhat similar to the requirements imposed by Executive Order 12114 (i.e., impacts to foreign territory must be addressed in NEPA documents), the MMS requires that EIS's prepared on major Federal OCS actions contain an assessment of potential significant impacts to foreign territory.

D.2.f. Executive Order 13158 - Marine Protected Areas (May 26, 2000)

Executive Order 13158 defines Marine Protected Areas (MPA's) as any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.

This executive order directs Federal Agencies to work closely with State, local, and nongovernmental partners to create a comprehensive system of MPA's "representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources." Ultimately, the MPA system will include new sites, as well as enhancements to the conservation of existing sites. Five principal components of this executive order are:

1. **National MPA List**: The USDOC and the USDOI will develop and maintain a National list of MPA's in U.S. waters. Candidate sites for the list are drawn from existing programs for Federal,

tribal, State and local protected areas. When completed, the list and the companion data on each site will serve several purposes such as ensuring that agencies "avoid harm" to MPA's, providing a foundation for the analysis of gaps in the existing system of protections, and helping improve the effectiveness of existing MPA's.

2. **The MPA Web Site**: The USDOC and USDOI will develop and maintain a publicly accessible web site to provide information on MPA's and Federal Agency reports required by Executive Order 13158. Also, the web site will be used to publish and maintain the National MPA List and other useful information, such as maps of MPA's; a virtual library of MPA reference materials, including links to other web sites; information on the MPA Advisory Committee; activities of the National MPA Center; MPA program summaries; and background materials such as MPA definitions, benefits, management challenges, and management tools.
3. **The MPA Federal Advisory Committee**: This committee was created to provide expert advice on, and recommendations for, a national system of MPA's. This advisory committee will include non-Federal representatives from science, resource management, environmental organizations, and industry.
4. **The Mandate to Avoid Harmful Federal Actions**: This mandate directs Federal Agencies to avoid harm to MPA's or their resources through activities that they undertake, fund, or approve.
5. **The MPA Center**: The executive order directs NOAA to create an MPA Center. In cooperation with the USDOI and working closely with other organizations, the MPA Center will coordinate the effort to implement the executive order and will:
   - develop the framework for a national system of MPA's;
   - coordinate the development of information, tools, and strategies;
   - provide guidance that will encourage efforts to enhance and expand the protection of existing MPA's and to establish or recommend new ones;
   - coordinate the MPA web site;
   - partner with Federal and non-Federal organizations to conduct research, analysis, and exploration;
   - help maintain the National MPA List; and
   - support the MPA Advisory Committee.

D.2.g. Executive Order 13112 - Invasive Species (February 3, 1999)

Executive Order 13112 defines an "invasive species" as a species that is not native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. This executive order requires all Federal Agencies to:

- identify any actions affecting the status of invasive species;
- prevent invasive-species introduction;
- detect and respond to and control populations of invasive species in a cost-effective and environmentally sound manner;
- monitor invasive-species populations accurately and reliably;
- provide for restoration of native species and habitat conditions in invaded ecosystems;
- conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species;
- promote public education on invasive species and the means to address them; and,
- refrain from authorizing, funding, or carrying out actions that are likely to cause or promote invasive species introduction or spread, unless the Federal Agency has determined that the benefits of such actions clearly outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize risk of harm will be taken.

Additionally, this executive order established the National Invasive Species Council (Council), cochaired by the Secretaries of Agriculture, Commerce, and the Interior and comprised of the Secretaries of State, Treasury, Defense, and Transportation, and the Administrator of the Environmental Protection Agency. The Council:

- provides national leadership on invasive species;
- sees that Federal efforts are coordinated and effective;
- promotes action at local, State, tribal, and ecosystem levels;
- identifies recommendations for international cooperation;
- facilitates a coordinated network to document and monitor invasive species;
- develops a web-based information network;
- provides guidance on invasive species for Federal Agencies to use in implementing the NEPA; and
- prepares an Invasive Species Management Plan to serve as the blueprint for Federal action to prevent introduction; provide control; and minimize economic, environmental, and human health impacts of invasive species.

The MMS requires that EIS's prepared on major Federal OCS actions (for example, 5-year OCS program and OCS lease sales) contain an assessment of the proposed action's contribution to the invasive species problem.

D.3. MITIGATION MEASURES

D.3.a. Lease Term Stipulations

In each OCS planning area, oil and gas exploration and development activities have the potential for causing adverse environmental impacts. Many measures have been implemented by the MMS to "mitigate" or prevent and lessen possible impacts on environmental resources from both OCS and non-OCS activities. Mitigating measures are protective measures designed to prevent adverse impacts and to lessen and mitigate unavoidable impacts. Some of these protective measures are developed and applied to specific blocks in a planning area before leasing a block. The MMS develops and administers these requirements, which become a part of the lease-term conditions at lease issuance.

If a block is leased as a result of a lease sale, these protective measures are identified as lease-term stipulations and are attached to and become part of the lease and its conditions. These stipulations are designed to protect potentially sensitive resources in the affected block and to reduce possible multiple-use conflicts and are the requirements that the lessee must meet to mitigate adverse impacts. They also may be considered to apply to all activities that occur on the leased area throughout the life of the lease.

All stipulations are considered part of this proposed Federal action. All lease-term stipulations are considered part of this proposed Federal action and all alternatives are discussed in this EIS.

D.3.b. Special Stipulations

To mitigate adverse environmental impacts for actions associated with a specific project (i.e., proposed plans for exploration, development and production plans, and site-clearance activities in an area located on an OCS lease block), mitigating measures may be necessary. Mitigating measures are special stipulations that limit OCS operations and are in addition to the aforementioned lease-term stipulations.

Conditions of plan approval are mechanisms determined by the MMS to control or mitigate potential environmental or safety problems that are associated with a specific proposed Federal action. During the life of the action, these protective measures are applicable specifically to the individual activities proposed in a plan and are imposed following environmental reviews (according to the NEPA) of the OCS lease location and potential resources.

Protective measures for certain resources may be suggested or identified during the scoping process for this EIS and mitigating measures may develop as a result. The MMS will evaluate additional stipulations, if any, that may develop during this EIS process.

APPENDIX E

SCOPING REPORT: BEAUFORT SEA PROPOSED OIL AND GAS LEASE SALES 186 (2003), 195 (2005), AND 202 (2007)

APPENDIX E: SCOPING REPORT: BEAUFORT SEA PROPOSED OIL AND GAS LEASE SALES 186 (2003), 195 (2005), AND 202 (2007)

A. Introduction

A.1. Purpose

This report summarizes scoping comments received and the significant environmental issues, reasonable alternatives for analysis, and potential mitigating measures that will be examined in the Minerals Management Service's (MMS's) environmental impact statement (EIS) for the proposed Beaufort Sea Outer Continental Shelf Lease Sales 186, 195, and 202 in the Beaufort Sea Planning Area.

A multiple-sale prelease process has been implemented for the Beaufort Sea sales in the proposed final 2002-2007 5-year program. From the initial step in the process (the Call for Information and Nominations [Call], and the Notice of Intent to Prepare an EIS [NOI]) through the final EIS/Consistency Determination step, this process covers proposed multiple sales. A multiple-sale EIS will analyze the first proposed sale (Sale 186) and the effects of the subsequent two proposed sales (Sale 195 and Sale 202). There also will be complete National Environmental Policy Act (NEPA) and Coastal Zone Management Act coverage for all sales after the first sale; either an Environmental Assessment (EA) or supplemental EIS, and a Consistency Determination (focusing primarily on new issues or changes in a State's federally approved coastal management plan) will be prepared for each subsequent sale. A proposed and final Notice of Sale will be prepared for each proposed lease sale identified in the draft proposed program.

One of the key features of the prelease process is the preparation of a multiple-sale EIS. One EIS covers three lease sales: Sale 186 scheduled for 2003; Sale 195 scheduled for 2005; and Sale 202 scheduled for 2007, according to the release of the 2002-2007 5-Year proposed final program. This will enable the MMS to conduct the prelease decision processes for subsequent sales (Sales 195 and 202) more efficiently, consistent with the new Executive Order of May 18, 2001, to expedite energy-related projects. Federal regulations (40 CFR 1502.4) allow several similar proposals to be analyzed in one EIS. The EIS will include: (a) an analysis for each of the three Beaufort Sea sales; (b) an analysis of the three sales collectively; and (c) a cumulative analysis of the incremental effects of holding the three sales when added to the other past, present, and reasonably foreseeable State and Federal onshore and offshore oil and gas activities on the North Slope and other activities that could affect the same resources.

This EIS will have a specific analysis for all issues, alternatives, and mitigating measures developed during the assessment process. Issues, alternatives, and mitigating measures that were determined to be insignificant will not be examined in the EIS but are identified in Sections II.B and IV of this report.

B. Summary of the Scoping Process

Scoping for the Beaufort Sea multiple-sale EIS included:

- reviewing the comments received from the Call/NOI;
- reviewing comments from scoping meetings;
- re-evaluating issues raised and analyzed in the EIS's for previous Beaufort Sea Planning Area lease sales (Sales BF, 71, 87, 97, 124, 144, and 170); and
- soliciting staff input.

Scoping comments for the proposed lease sale were requested from the public through newspaper, radio, and television advertisements in the North Slope Borough (NSB) communities of Barrow, Nuiqsut, and Kaktovik, and in Anchorage. The Call/NOI and scoping process provided a forum in which a wide variety of professionals and private citizens representing a broad spectrum of concerned groups had the opportunity to review and comment on areas of concern and appropriate areas for future studies. Environmental Justice was discussed with participants on the North Slope, both in the Government-to-Government meetings and with individual participants at the scoping meetings. The MMS provided an Inupiat translator for scoping meetings held on the North Slope to facilitate communication and comments. A Notice of Intent to prepare an EIS was published in the *Federal Register* on September 19, 2001, and comments were due by November 5, 2001.

B.1. Comments Received in Response to the Call/NOI and the Scoping Process

The MMS received nine written comments through the Call/NOI and scoping process from the following: State of Alaska, Office of the Governor, Division of Governmental Coordination; North Slope Borough, Office of the Mayor; North Slope Borough, Planning Department Director; Alaska Eskimo Whaling Commission, Director; City of Wainwright, Mayor; combined letter from the Sierra Club, Arctic Connections, the Wilderness Society, and Greenpeace; Phillips Alaska Exploration; Shell Oil; and British Petroleum (Alaska) Inc.

Specific Comments: Specific concerns expressed in the letters received in response to the Call/NOI are summarized in the following.

B.1.a State of Alaska, Office of the Governor, Division of Governmental Coordination

- The State supports the deferrals and mitigating measures that have been incorporated into previous outer continental shelf (OCS) lease sales.
- The State supports the Barter Island deferral that was included in Sale 144. This deferral area did not apply in Sale 170.
- The State recommends that the MMS retain the conflict avoidance measures developed for Lease Sale 170, especially in regard to subsistence resources. The Cross Island Stipulation for protection of subsistence resources in the Cross Island area should be retained.
- The Information to Lessees (ITL's) adopted for Sale 170 also should be included for the upcoming sales. The MMS may wish to consider expanding the ITL on polar bear interaction to include brown bears to minimize conflicts between bears and humans that might arise on onshore facilities associated with onshore development.
- The Alaska Department of Natural Resources and the Alaska Department of Fish and Game expressed support for a single EIS covering all three sales. However, the North Slope Borough opposes this change, and the State encourages MMS to work with the North Slope Borough to address their concerns before switching to a multiple-sale process.
- The State recommends that the MMS use the existing process for the coastal consistency review for the upcoming sales.

B.1.b North Slope Borough, Office of the Mayor

- There should be a full public process associated with each sale.
- An EIS should be developed, and a Coastal Management Program Consistency Analysis should be conducted for each sale.
- The MMS and other State and Federal leasing agencies are moving ahead with their plans without a good handle on the cumulative impacts of all of this (other related oil and gas activities) on the environment, wildlife resources, and residents of the North Slope. Serious cumulative impacts already have occurred.
- Areas deferred from past Beaufort Sea sales should be removed permanently from consideration for leasing.
- The spring-lead system and eastern Beaufort Sea should be deferred from leasing in all Beaufort Sea sales under the proposed 2002-2007 OCS leasing program. The spring-lead system around Point Barrow concentrates and renders highly vulnerable a variety of arctic marine resources. It is a critical subsistence-use area.
- The eastern Beaufort Sea is a feeding area for bowheads migrating westward in the fall. The level of industrial activity in waters east of Barter Island is of critical importance to the success or failure of subsistence-hunting efforts. In the past, fall exploratory drilling operations occurring to the east of the subsistence-harvest zone have deflected whales beyond the reach of subsistence hunting.
- The 10-mile distance (around Cross Island) is arbitrary and too small. The zone should be expanded to include a larger area based on the true area used by Nuiqsut in the traditional pursuit, harvest, retrieval, and processing of bowhead whales, in addition to the areas used for transportation and storage of the products of the bowhead whale hunt. This includes the areas to the east where production noise from permanent industrial facilities would have the potential to deflect whales out of reach of subsistence hunters. The goal should be to add protection for the area directly used by subsistence whalers and to the east of that area where noise from permanent industrial facilities would have the potential to deflect whales beyond the reach of subsistence whalers.
- A new whale-deferral zone should be defined in consultation with the Alaska Eskimo Whaling Commission (AEWC) and Nuiqsut and refined as noise-monitoring studies, including those associated with Northstar and Liberty, to produce more accurate information on (bowhead) impacts.

B.1.c North Slope Borough, Planning Department Director

- The NSB finds the lease sales (proposed) by MMS to be inconsistent with the policies of the NSB Coastal Management Plan and the Alaska Coastal Management Program.
- Industrial noise from seismic activities has proven to deter migrating bowhead whales by up to 12 miles.
- The continued availability of these waters for oil and gas exploration and development conflicts with (our) culture and the habitat values of the bowhead whale.
- Our culture is dependent on the continued availability of whales and our being able to hunt them close by. The spring migration area is particularly important.
- Oil-spill-cleanup trials have failed to meet response-planning standards for open-water and broken-ice conditions. The oil industry has yet to come up with a system for mechanical oil recovery that will work in ice-infested waters. It is irresponsible to continue leasing, exploratory drilling, and development in the arctic marine environment until the oil industry has demonstrated definitively that it has the capability to effectively respond to a significant oil spill in the entire range of environmental conditions that it may face in the region.
- If the need arises to provide relief-well operations in cases where a blowout or other catastrophic uncontrolled release should happen, no effective relief-well operations can occur within the unstable ice regimes that exist from 3-60 miles offshore. Completion of a relief well and well control could take 2-3 months under extreme broken-ice conditions.
- We believe that the MMS has underestimated the ice forces of the area, and that these forces could result in a significant release of oil. An ice-override event can occur at anytime when ice is present, subjecting all human activities in the area to great danger.
- The OCS from 3-60 miles offshore has not been extensively explored or studied for exploration or production activities. The placement and protection of fuel tanks, drilling rigs, and other oil and gas activities must be able to withstand the combined forces of current and wind-driven ice. These placements must be based on actual measurements of ice forces and movements.

- Other potential offshore hazards may exist, such as methane hydrate pockets. Historically, methane hydrate is responsible for the sinking of some ships and fires on or toppling of oil platforms.
- Spilled oil could persist in the migration path of the bowhead whale, with the potential to divert the animals from their preferred migratory path, or to subject the whales and other marine wildlife to the harmful effects of hydrocarbon exposure.
- The community of Nuiqsut, which uses the Cross Island area for subsistence, and other subsistence communities that use resources migrating through the Beaufort Sea, would suffer loss of resources, impaired access to resources, or the tainting of resources.
- Any perceived threat to the bowhead whale that results from a spill may elicit action by the International Whaling Commission (IWC). The IWC may reduce subsistence quotas as the only means of enhancing the protection of whale populations at risk.
- The North Slope Borough Planning Department stated that 10-mile no permanent facility area in Stipulation 6 as adopted in OCS Lease Sale 170 cannot now be developed without precluding reasonable subsistence access to fall-migrating bowhead whales.
- A study has not been forwarded to the NSB that concludes that the areas around the lease proposals can or cannot be developed, nor has (there been) any (information on) new technology in recovering oil from arctic waters (as well as) an assessment concerning subsistence-user access to subsistence resources and the effects on the (bowhead) migration path relative to Cross Island.
- The Beaufort Sea lease sales include areas 3-60 miles offshore and are in an area that cannot be developed without harming subsistence activities and the migratory route or feeding areas of the bowhead whale during the life expectancy of a field.
- Given the unpredictability of the arctic environment, opportunities for oil and gas leasing should be focused on land where proven systems exist and more accurate performance predictions can be made.

B.1.d Alaska Eskimo Whaling Commission Director

- The AEWC submitted comments to MMS on the Proposed draft 5-Year OCS Leasing Program 2002-2007 and the related EIS. The AEWC hereby incorporates those comments by reference.
- The present Notice of Proposed Lease Sales by MMS is premature, because the 5-Year OCS Leasing Program 2002-2007 has not been finalized and approved. The Secretary does not have the authority to act on planned leases that are part of a proposed leasing program until the Secretary fully complies with the notice and comment periods of the OCS Lands Act and the leasing program has reached the stage of final approval.
- MMS must address the mitigation of adverse impacts before going any further with OCS leasing in the Beaufort Sea.
- The AEWC claims that Congress gave the grant of authority in the OCS Lands Act and quotes 43 USC 1334(a): “Congress further authorized the Secretary to ‘at any time prescribe and amend such rules and regulations as he determines to be necessary and proper in order to provide for the protection of correlative rights.’” the AEWC contends that their staff time is dominated by OCS-related matters with no Government funding to help them, in spite of repeated requests for assistance. They believe that the MMS has a statutory responsibility to provide for their correlative rights. As such, they request assistance so that they may be able to fully participate in mitigation of adverse effects.
- MMS is required to prepare an EIS for each lease sale it proposes to hold. The AEWC states: that according to NEPA, “the decision whether or not to prepare an EIS comes after the preparation of an EA not before.” (MMS Note: Subsequent to the submission of this comment, the Executive Director of the AEWC acknowledged that this statement was based upon a rather unclear description of the multiple sale EIS process by MMS. MMS interprets this subsequent acknowledgement by the AEWC as a withdrawal of the previous comment)
- Areas used for our bowhead whale subsistence hunt should be permanently removed from any future consideration for OCS leasing. These removal areas must be of a size and configuration that will ensure their effectiveness as a means of mitigating adverse impacts to the bowhead whale subsistence hunt from OCS oil and gas activities.

B.1.e City of Wainwright, Mayor

- The majority of the community is opposed to leasing in the Beaufort Sea. The area available for leasing is in the path of migrating bowhead whales, and any activity in that area would interfere with the whale's migration and related subsistence activities.

B.1.f Sierra Club, Arctic Connection, Wilderness Society, and Greenpeace (joint letter)

- Industry is unable to contain and clean up oil spills in arctic waters during most of the year.
- The new subsea buried pipeline technology has unprecedented risks of oil spills.
- The environment and local communities are experiencing the simultaneous impacts of a massive surge of exploration (seismic surveys and drilling) on the North Slope as well as new offshore oil construction.
- Offshore lease sales jeopardize the integrity of the wilderness, wildlife, and coastal habitats of the Arctic National Wildlife Refuge (ANWR). The Refuge would be degraded from pollution from offshore development, transport and industrial noise, and potential oil spills.
- In the future, there would be intense pressure to construct sprawling onshore airports, pipelines, roads, docks, and other support facilities within the Refuge.
- The last Beaufort Sea Sale 170 set a precedent of not leasing off the coast of ANWR. Among the reasons cited by the Interior Department, was a lack of information on cumulative impacts on the Refuge, emergency response plans, and subsea pipelines. that lack of information still exists.
- They support a deferral requested by the city of Kaktovik, an offshore deferral area from the Canning River to the Canadian border.
- They oppose the streamlining proposal and desire the full process for each sale.
- The cumulative impacts of simultaneous onshore and offshore exploration and development must be considered.
- Areas that were deferred or deleted from past Beaufort Sea sales should be removed permanently from consideration for leasing. The importance and sensitivity of the Barrow-area spring-lead system and the eastern Beaufort Sea has been recognized in recent OCS lease sales, and the areas have been deferred from leasing. The spring-lead system and eastern Beaufort Sea should be deferred from leasing under the proposed 2002-2007 OCS leasing program.

B.1.g Phillips Alaska Exploration

- They support sales every other year covering an area within 30 miles of the shoreline.
- They do not support "discretionary sale deferrals and arbitrary exclusions." "the greater the foreseeable leasing area, the greater the incentive."
- "It is important that all nearshore acreage be included in upcoming sales."
- They encourage the MMS "to set and apply consistent and reasonable lease terms and mitigating measures for all upcoming sales."

B.1.h Shell Oil

- They support leasing the entire nearshore area out to about 15 miles.

B.1.i British Petroleum (Alaska) Inc.

- They applaud MMS's efforts to streamline the environmental review process, and they endorse the proposed Beaufort Sea sale schedule.
- They encourage the MMS to use existing EIS supporting documentation in upcoming work and coordinate information exchanges with the State of Alaska relative to research and studies already conducted in the Beaufort area.

B.2. Scoping Meetings

The Scoping Meeting for the Beaufort Sea multiple-sale EIS were held in Nuiqsut, Barrow, Kaktovik, and Anchorage on October 16, 18, 19, and 26, 2001, respectively. Meetings with the Native Village of Barrow, and the Mayor of the North Slope Borough and Alaska Eskimo Whaling Commission also were held while the scoping team was in Barrow. An additional meeting was requested by the AEWC and the Inupiat Community of the Arctic Slope (ICAS) and held on November 15, 2001. Environmental Justice concerns were accepted during the meeting held on the North Slope and those comments are included in summary of issues and concerns below. The EIS will include an Environmental Justice analysis. Following are the major concerns that were raised at these scoping meetings.

B.2.a Government-to-Government Nuiqsut Tribal Council Meeting, October 16, 2001

The meeting was held in the afternoon; five to six persons attended. The Council is concerned about the following:

- the safety of OCS activities and potential impacts from oil spills;
- the effects to subsistence resources including bowheads, seals, and fish;
- the breadth of the sale, from Barrow to Canada;
- that MMS is not using traditional knowledge when making decisions; and
- that OCS activities are impacting the local sociocultural and health systems.

The Council indicated the following:

- the preparation of a single EIS for all three sales will limit their input into the sale process;
- the MMS needs to look at the cumulative impacts and consequences of offshore leasing when making decisions; locals are not responsible for cumulative effects; and
- they also are requesting local impact assistance.

B.2.b Nuiqsut Public Scoping Meeting, October 16, 2001

The meeting was held in the evening; 31 persons attended.

- Individuals are concerned about the ability of oil companies to clean up oil. They are most concerned that three oil-spill drills have failed to pick up oil in ice-infested water under relatively mild conditions.
- The Mayor of Nuiqsut stated his concern that ice forces are capable of overriding manmade islands and can result in oil spills.
- Some expressed concern about adverse effects to their subsistence lifestyle, especially fish harvests.
- Some stated that they should have more input before the lease-sale decisions, and they feel that MMS is not using local traditional knowledge. They need to protect their natural resources—no drilling on the OCS. They support onshore drilling.
- The people of Nuiqsut want Cross Island completely deferred. The area should be permanently dropped from leasing consideration.
- Those commenting stated that the managing Federal Agencies and the oil companies should share resources found with the village.
- Others stated that:
  - MMS should fund local oversight subsistence programs,
  - bowhead whale feeding areas should be off limits to leasing,
  - industry is offering limited local job opportunities,
  - offshore pipelines which come onshore are restricting caribou movement, and
  - an EIS should be written for each Beaufort Sea sale, otherwise they will have limited input to the process.

B.2.c Government-to-Government Native Village of Barrow Scoping Meeting, October 18, 2001

The meeting was held in the morning; seven persons attended. The commenting expressed concerns about:

- industry's ability to contain a pipeline break and the long-term environmental effects from an offshore pipeline oil spill;
- the potential effects to their subsistence lifestyle;
- the lack of power the locals have to get information and learn the process; they stated that education is power;
- platform types in ice-infested waters and whether they would withstand the arctic winters; and
- circumpolar ice movement and the difficulty it adds to OCS drilling.

B.2.d Barrow Scoping Meeting with the North Slope Borough and AEWC, October 18, 2001

The meeting was held in the afternoon; seven persons attended:

- Those attending stated that they do not support the OCS program, as no efficient oil-spill cleanup technology is available. The Secretary and MMS should permanently remove from leasing and oil and gas activities those areas that are important subsistence areas, such as the spring lead system, the area near Cross Island, and the bowhead whale feeding areas.
- The NSB, AEWC, and Whaling Captains should be consulted and included in the development of mitigation and deferral areas.
- They want impact assistance and local participation in decisionmaking.
- They are concerned about oil-spill cleanup and pipeline design.
- The North Slope Borough wants to protect the food and cultural resources of the residents on the North Slope. The resources from the ocean are vital parts of the Inupiat culture.
- They view leasing, exploration, and development and production as a continuing process; one stage leads to the next with no stopping the momentum once it gets started.
- The Secretary of the Interior needs to approve the 5-year program before the MMS starts the individual lease-sale process under this program. They stated there should be an independent EIS for each lease sale. They want an independent Coastal Zone Consistency evaluation for each sale.
- They expressed concern that seismic vessels working on the northern gas route survey spooked the whales farther offshore this past year.
- MMS needs to be an advocate of the NSB positions. The MMS needs to deal with the NSB and local concerns and issues.
- MMS should require the employment of local NSB residents in OCS activities.
- The OCS Policy Committee recommended (a) funding to locals and (b) NSB oversight of the plans; this is through (1) peer review of studies material and technical material; (2) mitigation, if needed; and (3) impact funding to locals.
- They need mitigation for local economic/social impacts.
- The AEWC is against all offshore leasing, exploration, and development.
- They stated that cumulative impacts are really "snowballing" now. The NSB residents are becoming increasingly frustrated. It seems like cumulative impact is being left up to the locals to address/solve.

B.2.e Barrow Public Scoping Meeting, October 18, 2001

The meeting was held in the evening; six persons attended. Those attending stated the following:

- They are concerned about the potential adverse effects from an oil spill. They want a performance bond for catastrophic spill. They are concerned about adverse effects to fish, bowhead whales, and subsistence lifestyles.
- They wish they could repair Native sovereignty and control their own destiny in their own environment.
- They want oil and gas pipelines to be buried in the road system so pipelines will not impede caribou movement.

- They want impact assistance at the community level.

B.2.f Kaktovik Public Scoping Meeting, October 19, 2001

The meeting was held in the evening; six persons attended:

- They voiced concerns about the extensive barge traffic along the coast this summer bringing in the sewer and water pipes for their village, plus Canadian seismic boats working on the gas pipeline. Indications were that both actions seemed to push their subsistence whaling efforts farther offshore.
- They are against offshore oil and gas activities.

B.2.g Anchorage Public Scoping Meeting, October 26, 2001

The meeting was held in the evening; two persons attended:

- One individual from an environmental organization delivered a group joint letter, which is summarized earlier in this section under B.1.f on page E-5.
- The other individual, an MMS study subcontractor gave his perception of local reactions to OCS oil and gas activities.

B.2.h Barrow Meetings with Inupiat Community of the Arctic Slope and the Alaska Eskimo Whaling Commission on November 15, 2001

- The AEWC provided whale-strike information and two potential deferral alternatives, one near Barrow and one near Nuiqsut.
- The ICAS is against OCS drilling.

C. Environmental Concerns

C.1. Significant Environmental Issues

No entirely new significant environmental concerns were identified during the scoping process that was not identified in the previous Sale 170 final EIS. Since this last sale EIS, Northstar, the first partial OCS jurisdictional development and production island, has been built and has come online. This has raised feelings of environmental uncertainty by local residents, because many do not trust the engineering designs to overcome known North Slope environmental constraints. Many concerns extend to the Liberty Development and Production Project, which was under review.

The following environmental issues are identified for analysis in the EIS, because they are related to important resources, activities, systems, or programs that could be affected by petroleum exploration, development, and production, and transportation activities associated with the proposals for all three sales. The cumulative effects of present and future major activities on each of these resources, activities, systems, or programs will be analyzed.

C.1.a Effects of Spilled Oil on Marine Resources

Contamination and Effects: the likelihood of large oil spills is very small. However, if oil spilled, it could contaminate the affected marine and coastal environments and, depending on the amount and time of the year, have short- to long-term local to regional effects on those resources and sociocultural systems adjacent to the planning area. A hydrocarbon-spill event, especially a large one, could have a significant impact on water quality. In situ burning of spilled oil would affect the air quality of the region. Lower trophic-level organisms within the spill area also would be affected. Marine mammals, including the endangered bowhead whale, could be affected as they migrate through the Beaufort Sea. The bowhead whale is integral to the continuation and survival of the cultural and subsistence lifestyle of the Inupiat. Both the spectacled eider and the Steller's eider are listed as threatened species.

Other resources affected by an oil spill that are crucial to Inupiat subsistence include anadromous fish, including the Arctic cisco, and various marine and coastal birds. The Inupiat are concerned that a spill could adversely affect many of the traditional food sources and, thereby, could affect the economic and cultural well-being of the North Slope. The temporary or permanent elimination of primary subsistence foods would cause North Slope residents to either shift to less desired subsistence resources or replace them with western foods.

C.1.b Fate, Behavior, and Cleanup of Spilled Oil in the Marine Environment

The fate and behavior of spilled oil in the marine and coastal environments and the capability and methods of spill cleanup are of major concern to local communities. Identified concerns include:

- the availability and adequacy of containment and cleanup technologies, especially under broken-ice conditions;
- the ability to detect and clean up pipeline spills and spills under ice;
- the effects of winds and currents on the transport of spilled oil within ice;
- the removal of oil from contaminated water sediments and ice;
- the toxicological properties of fresh and weathering oil; and
- the air pollution that would result from the at-sea evaporation or burning of spilled oil.

This concern has been intensified in recent years, as industry has on three occasions not proved their ability to adequately clean up spilled oil with mechanical equipment in relatively calm environmental conditions in ice-infested waters. Other non-mechanical tactics are available in these periods.

Oil spills and a general discussion of oil-spill contingency plans will be covered in this EIS.

C.2. Habitat Disturbance and Alteration

Habitat disturbance and alteration might result from both offshore and onshore construction activities associated with the operation of petroleum facilities, depending on location of activities.

C.2.a Habitat Disturbance

Habitat disturbance, including noise, might be associated with air traffic, vessel operations, traffic along gravel and ice roads, marine and over-the-ice seismic activities, offshore drilling, dredging, vessels involved in icebreaking and management operations, and facility construction. The primary concern in all communities and by the North Slope Borough is interference with the bowhead whale hunt. Depending on the type of operation and the time of occurrence, these habitat disturbances may have short- to long-term local to regional effects on fishes (particularly anadromous species such as the Arctic cisco), marine and coastal birds, marine mammals, caribou, and endangered and threatened species such as the bowhead whale, Steller's eider, and spectacled eider, all of which will have an effect on subsistence hunting and fishing. Issues related to the above will be evaluated in EIS analysis for new projects when they are submitted to the MMS.

C.2.b Habitat Alteration

Habitat alteration, including reduction, would be associated with both onshore and offshore construction activities that include pipeline and ice- and gravel-road construction, dredging-excavation and dumping of dredge material, removal of gravel from onshore sites, and dumping of onshore gravel in offshore locations. Depending on the type of operation and the time and location of occurrence, they could have short- to-long-term local to regional effects on lower trophic-level organisms; fishes (especially Arctic cisco) and other anadromous species; marine and coastal birds; marine mammals; endangered bowhead whales, especially in the spring-lead system and fall-feeding area; caribou; archaeological resources; and subsistence hunting and fishing activities related to reduced access to the resources. The MMS does not have the authority to mitigate disturbances to wildlife due to onshore pipeline routing.

C.3. Protection of Inupiat Culture and Way of Life

The Inupiat believe their culture and way of life need to be protected from effects associated with petroleum development. As such, activities might lead to social disruption and a change in cultural values through employment changes (further displacement of the subsistence lifestyle by a cash economy), and the alteration of subsistence-harvest patterns as discussed in relation to other significant issues previously noted in this section. The EIS will discuss and evaluate sociocultural and health systems of local communities.

C.4. Other Significant Concerns

Following are other significant issues related to petroleum-development activities that were raised during the scoping process:

- Incorporation of "traditional knowledge" (TK) in the EIS, although acknowledged, still does not seem to satisfy those who criticize this aspect. Concern seems to center around a perception that MMS does not recognize TK on the same level as scientific knowledge. The implication is that although MMS has quoted TK within the EIS text, TK has not been a part of the decisionmaking process. Villages seemed to appreciate the fact that MMS gathered the last 25 years of public testimony and prepared a publicly available searchable CD-ROM. The MMS will continue to communicate with the AEWC and whaling captains to gain insight into local conditions. The TK (for example, about fish species and other subsistence values) will continue to be incorporated into EIS text and provided to MMS decisionmakers.
- Cumulative effects of oil and gas operations on the biological (i.e., caribou migration restricted in relation to pipeline routes, and onshore effects, including fishing in the Colville River) and physical resources and social systems (i.e., development impact to the Inupiat way of life, and no rights to visit family's ancestral ice cellars in Prudhoe Bay) in and adjacent to the planning area from past, present, and future Arctic oil and gas lease sales and other major projects, will be analyzed in the EIS. Criticism still arises from not having a definite database to tier off of before oil and gas operations even occurred on the North Slope. The National Research Council is conducting a 2-year review on cumulative effects of oil and gas operations on the North Slope. Results may be available for incorporation, as applicable, into the final EIS for this lease sale.
- Include all of the mitigating measures-stipulations and notices to lessees from the last lease sale (Sale 170) into this Beaufort Sea multiple-sale EIS.

C.5. Topics and Issues Not Analyzed in the EIS

This includes issues that were identified during the scoping process and that are not analyzed in the EIS.

C.5.a Revenue Sharing/Impact Assistance

One issue, repeatedly identified as being of primary concern to the North Slope Borough and all of the North Slope villages, is the need for revenue-sharing assistance to local communities from OCS receipts. Impact assistance beyond what is provided for under the OCS Lands Act would require congressional action and cannot be addressed or resolved through the EIS process. Under the 1997-2002 5-Year Oil and Gas Leasing Program, recommendations of the OCS Policy Committee for such revenues were passed through MMS to appropriate congressional constituents. However, it is Congress and not MMS that makes this decision. A version of this type of legislation (the CARA bill) was passed by Congress for FY 2001; however, monies derived did not filter down to the local villages. Funding was only at the State and Borough level. Locals do not like to be competing among themselves for monies they feel rightfully belong to them.

C.5.b Participation of Local Communities

The need for active participation and involvement, including decisionmaking authority, of the North Slope Borough and local communities was another issue raised at each of the scoping meetings. Examples are Borough, City, and Native village participation in the review of oil-industry operations, development of monitoring programs, and helping to write the various NEPA documents. Locals would like to be brought to Anchorage and be a part the of internal review process of industry-submitted projects. The MMS did solicit and receive Environmental Justice comments, which are included above, and the EIS will include an Environmental Justice analysis. The MMS will continue to engage local governments and tribes in government-to-government meetings to share information and will meet as often as needed to discuss potential solutions.

C.5.c Process Issues

Several commenters suggested that MMS should wait to start the individual lease-sale process until the Secretary had approved the final 5-year program for 2002-2007. They suggested it was illegal or improper for MMS to start the Beaufort Sea multiple-sale process before a final decision by the Secretary. However, to meet the proposed schedule, MMS must start the preliminary scoping and writing of the EIS based on the draft proposed program, otherwise it would be impossible to hold any sales in the first 2 years of any 5-year program. Once the proposed program is approved, adjustments will be made to any text within the draft EIS. Any 5-year program decisions concerning the Beaufort Sea Planning Area will be incorporated into this EIS and into the potential lease sale decisions for Sale 186, 195, and 202. The current proposed actions for this EIS are to conduct the three sales identified in the 2002-2007 5-Year Draft Proposed Program for the Beaufort Sea: Sale 186 to be held in 2003; Sale 195 to be held in 2005; and Sale 202 to be held in 2007. This will enable the MMS to conduct the prelease decision processes for subsequent sales (Sales 195 and 202) more efficiently, consistent with the new Executive Order of May 18, 2001, to expedite energy-related projects. Federal NEPA regulations allow several similar proposals to be analyzed in one EIS (40 CFR 1502.4). There also will be complete NEPA and Coastal Zone Management Act coverage for all sales after the first sale, either an Environmental Assessment or Supplemental EIS, and a Consistency Determination (focusing primarily on new issues or changes in a State's federally approved coastal management plan) will be prepared for each subsequent sale.

Commenters suggested that areas deferred (i.e., bowhead subsistence-hunt areas) or deleted from past Beaufort Sea sales should be removed permanently from consideration for leasing. The EIS looks at deferrals for each sale and in the areas considered in the 5-year planning process. Any 5-year program decision made by the Secretary whether to exclude or to continue to exclude areas will be incorporated into this EIS.

A suggestion was made that MMS have industry provide job opportunities and training for local communities to help their economy. Under a lease-sale or postlease-sale EIS, the MMS does look at and evaluate the local community in relation to the proposed actions. However, the MMS has no authority to require an operator to provide local hire. We can suggest, but not enforce, such a suggestion.

Some reviewing constituents consider a continuum between leasing, exploration, and eventual production and development phases of the Federal oil and gas-leasing program. They feel that once a decision is made to lease an area, any subsequent decisions are a "done deal" that cannot be stopped or altered. The OCS Lands Act and the regulations consider these as four separate phases, each of which has a separate decision process attached to that phase. Subsequently, there are four NEPA documents prepared for these various phases: (1) a national 5-Year leasing program EIS; (2)a leasing program EA or EIS; (3) an exploration program EA or EIS; and (4) a production and development plan EA or EIS. Each NEPA phase has a different level of analysis, depending on the specificity of the information being submitted for review. This concern is not supported by the history of leasing in the Alaskan OCS and the Beaufort Sea. Thousands of leases have been issued; however, fewer than 100 wells have been drilled and only one project, Northstar, has started production. A second project, Liberty, is under NEPA review.

C.5.d MMS Should Allow Locals to Provide Input in Development of Monitoring and Mitigation Measures and Should Provide Funding to Local Oversight Subsistence Programs

MMS will continue to consult local communities throughout the presale process about possible mitigation measures. Some involvement by locals is being considered separately, as this topic is outside the EIS process. MMS cannot obligate OCS revenues for support of local subsistence program, only Congress can appropriate funds. Please see the previous discussion of impact assistance.

C.5.e MMS and the Oil Companies Should Provide Local Communities with a Reasonable Energy Source

Commenters at the meetings on the North Slope feel that MMS should require the oil companies to provide energy to the residents of nearby local communities, which are the potential recipients of adverse impacts associated with offshore oil and gas development. Both Barrow (Barrow gas field) and Nuiqsut (from Alpine) have nearby natural gas supplies, which have been made available to local residents. Such arrangements are between the operator and the local community.

C.5.f Ice Override

Commenters at meetings in Nuiqsut and Barrow feel that proposed oil and gas activities could be adversely impacts by the movement of ice in the Arctic. A general discussion of known unstable ice regimes and historic ice-override events are included in our lease-sale EIS analysis. Specifics as to placement of fuel tanks, relief wells, and human safety factors relating to these topics are addressed in subsequent exploration plan and development and production plan analysis. The MMS takes traditional knowledge into consideration when evaluating ice forces. This procedure was used for both Northstar and Liberty development and production plans.

C.5.g Gas Hydrates

Some stated that methane-hydrate pockets might be present and a safety hazard to OCS operations. A general discussion of these phenomena is covered under the general geology section of lease sale EIS's. Specifics as to an actual drilling plan are discussed in the exploration plan or development and production plan, and are covered under MMS regulations.

C.5.h Unprecedented Subsea Buried Pipeline Technology

Some commenters stated the subsea buried pipelines are based on unproven technology, and they do not feel that such pipelines are safe. Within the lease-sale EIS, buried subsea pipelines are described and the potential effects from construction or from an oil spill are evaluated. Design criteria are set by Federal and State regulations; the operator can design as they see fit, but they must meet this criteria. The operator submits engineering analysis to back up their design specifications. The development and production plan EIS discusses the environmental effects of the overall pipeline analysis. This procedure was used for both the Northstar and Liberty development and production plans.

C.5.i Critical Habitat Should be Deleted from OCS Leasing

Some comments in Barrow suggested that the ongoing Federal process to identify and designate critical bowhead whale habitat automatically required its exclusion from consideration for future leasing. However, the designation of critical habitat requires additional analysis within the EIS and consultation with the responsible regulatory agency. This does not necessarily mean that the area designated will be automatically deleted from future leasing proposals. Therefore, the MMS suggested that these commenters provide suggestions for deferral alternatives, which they did.

C.5.j Bonding for Operators

The NSB and the AEWC both indicated that locals have required the operator to put up a performance bond for operations on the North Slope to protect their subsistence resources. They stated that local communities should not have to require bonds, because requirements for bonding are an MMS responsibility. MMS regulations do require operator bonding for financial liability on their lease, but the Oil Pollution Act of 1990 covers this.

C.5.k Bury Pipelines in North Slope Roads to Eliminate Visual Pollution and to Eliminate Blockage of Caribou Migration Routes

A commenter in Barrow was concerned that existing onshore pipelines maybe inhibiting the movement of bull caribou. Onshore pipeline routes are under the jurisdiction of the State, not MMS. Cumulative effects to caribou will be evaluated in this EIS and in future NEPA documents for any OCS oil and gas exploration or development.

D. Alternatives Recommended for Inclusion in the EIS

Six alternatives have been identified by MMS, taking into consideration the area identification and scoping process, industry interest, and publicly available information on potential effects of the proposed action on the environment.

D.1. Description of Alternative I (Proposal for Sales 186, 195, and 202)

Alternative I, the proposal for each sale, would offer for lease those blocks selected as a result of the area identification. The Beaufort Sea Multiple-Sale Program Area includes 1,877 whole or partial blocks covering 9,770,000 acres (about 3,954,000 hectares) in the Beaufort Sea, See Map 1 and 2.) This area was identified as being of high and medium interest to industry and is the entire area of the Call. This alternative reflects a range of resource development and activity from 340-570 million barrels of recoverable oil for each sale. There are 55 active leases in this area, 21 of which were leased in Sale 170. Previous sales in this area have resulted in 688 leases; of these, 623 have been relinquished or have expired. A total of 30 wells have been drilled, and 10 wells have been found producible, but only two development proposals (Northstar and Liberty) have been submitted to the MMS. Two Federal leases are part of the Northstar Unit that went into production in November 2001. Recently, British Petroleum (Alaska), Inc. (BPXA) put the plan for development and production of the Liberty Prospect on hold but, because the final EIS essentially was completed, it was published in May 2002.

D.2. Alternative II (No Sale)

This alternative would remove the entire area of the Proposal for Sales 186, 195, and 202 from leasing for a sale.

D.3. Alternative III (Barrow Subsistence Whale Deferral)

This alternative was developed by the MMS in response to comments received in Barrow. This deferral was developed as a potential way to reduce conflicts between bowhead whale subsistence-hunter and offshore oil and gas operations and was based on bowhead whale-strike data provided by the AEWC. This alternative would offer for leasing all of the area described for Alternative I except for a subarea located in the western portion of the proposed sale area. Alternative III would offer 1,851 whole or partial blocks, comprising 9,632,000 acres (about 3,898,000 hectares). The areas that would be removed by the Barrow Subsistence Whale Deferral (see Map 2) consist of 26 whole or partial blocks, approximately 138,000 acres, about 1% of the Alternative I area. This option is being analyzed to estimate potential protection of Barrow subsistence-use zones and wildlife areas, particularly comprising an area in which whales have been taken (based on known whale-strike data). This option analyzes whether the deferral would provide increased protection to bowhead whales from potential noise and disturbance from exploration or development and production activities. The majority of the bowhead whale subsistence-hunting area near Barrow is in an area of the Chukchi Sea, which was already removed from leasing consideration in the proposed final 5-Year Offshore Oil and Gas Leasing Program for 2002-2007.

D.4. Alternative IV (Nuiqsut Subsistence Whale Deferral)

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located off of Cross Island. Alternative IV would offer 1,847 whole or partial blocks, comprising 9,608,000 acres (about 3,888,000 hectares). The areas that would be removed by the Nuiqsut Subsistence Whale Deferral (see Map 2) consist of 30 whole or partial blocks, approximately 162,000 acres, about 2 % of the Alternative I area. This option is being analyzed to assess the effectiveness of potential protection of Nuiqsut subsistence-use zones and wildlife areas where whales have been taken (based on known whale-strike data). Requests for such possible protection were made by the AEWC, the Native Village of Nuiqsut, and the NSB.

D.5. Alternative V (Kaktovik Subsistence Whale Deferral)

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located off of Barter Island. Alternative V would offer 1,849 whole or partial blocks comprising 9,649,000 acres (about 3,905,000 hectares). The area that would be removed by the Kaktovik Subsistence Whale Deferral (see Map 2) consists of 28 whole or partial blocks, approximately 121,000 acres, about 1% of the Alternative I area. This area is being considered for deferral in response to a request by the Native Village of Kaktovik because of the potential disturbance to Kaktovik's traditional known subsistence-whaling areas. The area was delineated using whale-strike maps provided by the AEWC.

D.6. Alternative VI (Eastern Deferral)

This alternative would offer for leasing all of the area described for Alternative I except for a subarea located east of Kaktovik. Alternative VI would offer 1,817 whole or partial blocks, comprising 9,487,000 acres (about 3,839,000 hectares). The area that would be removed by the Eastern Deferral (see Map 2) consists of 60 whole or partial blocks, approximately 283,000 acres, about 3 % of the Alternative I area. It adjoins an area that the State of Alaska has deferred in recent state sales. This option evaluates the need for protection of this area as requested by the Native Village of Kaktovik, the AEWC, and the North Slope Borough regarding the possible importance of the area to bowhead whales and other general concerns about the environment there.

E. Alternatives Not Selected for Inclusion in the EIS

Four general areas in the Beaufort Sea were recommended for deferral in comments to the September 19, 2001, Call and NOI and in the October and November 2001 scoping meetings. These were areas east of Barrow, areas around and to the east of Cross Island, areas near Kaktovik, and areas off the Arctic National Wildlife Refuge the deferrals analyzed in the draft EIS (see Section D of this Scoping Report) respond to some of the specific deferral recommendations. This section responds to the balance of the deferral recommendations. In the following, we first discuss areas recommended for deferral and our conclusions regarding those deferrals for specific parts of the Beaufort Sea. Then we look at other considerations relevant to these recommendations.

Finally, we provide the rationale for our conclusions, on which recommended deferrals are analyzed in the EIS and which are scoped out.

E.1. Areas from Barrow East to Harrison Bay

As indicated in Section B of Appendix E, in written comments, the State of Alaska supports all areas deferred from past sales, the Mayor of the North Slope Borough and the Sierra Club et al., recommended that such deferrals be removed permanently from leasing in the planning area. The Mayor also recommended that the spring-lead system and eastern Beaufort Sea should be deferred from all Beaufort Sea sales in the 2002-07 offshore leasing program. The AEWC recommended that areas used for the bowhead whale subsistence hunt be removed permanently from any future consideration for OCS leasing. Phillips Alaska Exploration opposed discretionary deferrals and arbitrary exclusions, Shell Oil supported leasing the entire nearshore area out to about 15 miles, and BPXA endorsed the sale schedule but did not comment on specific areas of the Beaufort Sea. In verbal comments at the Barrow meeting with the NSB and AEWC, those who spoke wanted MMS to permanently remove from leasing important subsistence-use areas, such as the spring-lead system and areas that might be used by bowhead whales for feeding. In the November meetings, the AEWC provided maps of potential deferral areas that were developed by the Barrow and Nuiqsut Whaling Captains, and ICAS stated their general opposition to all OCS drilling in the Beaufort Sea.

Although it is not the deferral area included in the Barrow Whaling Captains map, we are analyzing the Barrow Subsistence Whaling Deferral on the western edge of the planning area that, although much smaller (26 versus 588 whole or partial blocks), is based on whale-strike data provided by the AEWC. Also, in response to requests by Barrow residents, the NSB, and the AEWC, the Secretary removed other areas. Specifically, in her decision on the 5-Year proposed final program, she removed from leasing consideration portions of the subsistence-use area/spring-lead system to the west of this deferral area in the westernmost part of the Beaufort Sea Planning Area, and the subsistence-use area/spring-lead system in the Chukchi Sea.

Preliminary oil-field analysis of the Beaufort Sea Planning Area indicates that the 588 whole or partial blocks depicted as a candidate for deferral on the map submitted by the AEWC would reduce, by an estimated 18%, the opportunity of discovering and developing an economic oil field, if Alternative I were chosen for one of the three Beaufort Sea sales covered by this EIS. This compares to an estimated reduction of about 1% for the Barrow Subsistence Whaling Deferral.

E.2. Areas Around and East of Cross Island

In written scoping comments (see Section B.1 of Appendix E) applicable to Nuiqsut subsistence whaling, in addition to what appears for Barrow, the State of Alaska recommended that MMS apply a Cross Island Stipulation (No siting of Permanent Facilities within 10 Miles of Cross Island). The Mayor of the NSB believed this 10-mile distance is arbitrary and too small, and the area should be expanded to cover various aspects of the Nuiqsut traditional bowhead whale harvest and expanded more to the east to prevent the potential for whales to deflect due to production noise. The people of Nuiqsut want the Cross Island area permanently dropped from leasing consideration.

Although it is not the deferral recommended by the Nuiqsut Whaling Captains, we do include analysis of a smaller Nuiqsut Subsistence Whale Deferral (30 versus 94 whole and partial blocks) that is based on whale-strike data provided by the AEWC. This deferral option does include some blocks to the east of the 10-mile radius. We also analyze two versions of the no surface occupancy stipulation for Cross Island, one for seaward portions of the 10-mile radius area and one for shoreward portions. Furthermore, access to tracts in the vicinity of Cross Island may be needed, because the State has leased tracts in the adjacent State waters. Should oil be discovered on these State tracts, leasing of the adjacent Federal tracts would prevent drainage of Federal oil.

Regarding production noise from permanent industrial facilities on the OCS, companies will be required to demonstrate to the National Marine Fisheries Service that any such proposed facilities will be in compliance with the Marine Mammal Protection Act and Endangered Species Act as they seek to obtain incidental harassment authorizations and avoid conflicts with subsistence activities.

The 94 whole or partial blocks depicted as a candidate for deferral on the map developed by the Nuiqsut Whaling Captains would reduce, by an estimated 19%, the opportunity of discovering and developing an economic oil field. This compares to an estimated reduction of about 2% for the Nuiqsut Subsistence Whaling Deferral.

E.3. Areas Offshore from the Arctic National Wildlife Refuge

In scoping comments for this EIS, the Mayor of the NSB said that the eastern Beaufort Sea should be deferred from all three sales in the 2002-2007 leasing program. In comments on the 5-year offshore leasing program, the Mayor of the City of Kaktovik expressed a preference for onshore development, recommended that the area off of the Arctic National Wildlife Refuge be excluded from leasing until the Refuge is opened for development, and that all OCS blocks within 50 miles of the city be excluded. Citing these comments from Kaktovik, the Sierra Club et al. said in their scoping comments for this EIS that they supported the City of Kaktovik's request for a deferral area offshore from the Canning River to the Canadian border. This area includes 173 whole or partial blocks. Deferring it would reduce, by an estimated 23%, the opportunity of discovering and developing an economic oil field. The deferrals in Alternatives V (Kaktovik Subsistence Whaling Deferral) and VI (Eastern Deferral) cover 88 of these same blocks and run offshore of about 60% of the coastline of the Arctic National Wildlife Refuge. The selection of Alternatives V or VI would reduce (by an estimated 3% each) the opportunity of discovering and developing an economic oil field.

Although no prohibition on offshore leasing is included in the statutes governing the Arctic National Wildlife Refuge, its Comprehensive Management Plan restricts the use of the Refuge for infrastructure to support any offshore development. Also, any OCS activity or infrastructure (including pipelines to shore) would not be approved without thorough technical and environmental reviews and would have to meet the requirements of the Marine Mammals Protection Act, the Endangered Species Act, and other Federal and State statutes that help protect the natural resources of the area and environment.

The Kaktovik Whaling Captains did not submit a map but indicated that they wanted the area known as the "Barter Island" deferral from Sales 124 and 144 as a deferral for these three sales. The northern part of the "Barter Island" deferral from OCS Sale 144 is excluded from the proposed final 5-year offshore program. Alternative V, the Kaktovik Subsistence Whale Deferral, includes the Sale 144 deferral area plus a few extra blocks on the west side to more fully cover the area where AEWC data show whale strikes were made.

E.4. Other Considerations Relevant to Requests for Deferrals Off Barrow, Cross Island, and the Arctic National Wildlife Refuge

The five stipulations described (Section F) in Appendix E are included as part of all alternatives for Sales 186, 195, and 202. These are mitigating measures that will help protect the bowhead whale. The first four stipulations provide for specific protections, and the fifth is a mechanism to address unresolved conflicts between the oil and gas industry and subsistence activities. This mechanism has proven to be effective in protecting the whale hunt while allowing oil and gas activity to proceed. The mechanism can apply to whatever unreasonable subsistence-related conflicts are not resolved by other means. We also are including a possible addition to a notice of Information to Lessees (ITL 7 Information on the Availability of Bowhead Whales for Subsistence-Hunting Activities) indicating that for development plans, lessees are encouraged to consider noise-abatement methods if needed to reduce activity noise that may occur during and in the vicinity of the migration.

E.5. Rationale for Conclusions on These Three Recommended Deferrals

A primary objective of the OCS Lands Act is to make lands available for oil and gas leasing in an environmentally acceptable manner, taking into consideration protection of the marine, coastal, and human environments. An objective we undertake to meet NEPA requirements is to write an EIS that is as straightforward and as easy to understand as possible, given the inherent difficulty in estimating uncertain potential environmental effects of uncertain potential exploration and development activities based on projections of uncertain potential leasing results of planned future sales. Given the four deferral alternatives already included for analysis, these three deferral options would contribute little in the way of additional analysis to an EIS that must cover an already complicated set of issues.

We consider that the Barrow, Nuiqsut, and Kaktovik Subsistence Whaling Deferral alternatives, when combined with the other mitigating measures (stipulations and ITL's) to be analyzed in the EIS, would provide about the same level of protection of the environment as the preceding three recommended deferral areas, but they would allow at least some oil and gas exploration and development to proceed. Regarding the Arctic National Wildlife Refuge, we believe that the merits of including such a deferral option are in large part covered by analysis of Alternatives V and VI.

Furthermore, the analyses of six alternatives (proposal, no action, and four deferral alternatives), and the mitigation measures cited above for the bowhead whale subsistence hunting and other natural resources possibly affected by offshore exploration and development, meet NEPA requirements and provide alternatives that achieve the objectives of the OCS Lands Act.

F. Mitigation Measures

F.1. Proposed Mitigation Measures to be Evaluated in the EIS

The following mitigation measures (stipulations and Information to Lessees [ITLs]) will be considered as part of all alternatives for the Beaufort Sea multiple-sale EIS process (a copy of proposed Beaufort Sea multiple-sale stipulations and ITLs is attached [Attachment 2]). These measures were analyzed as part of the proposal in Sale 170, expanded and modified during Section 19 consultation, and subsequently adopted. Extensive consultation with affected groups, including the State, the NSB, AEWC, the villages of Nuiqsut and Kaktovik, industry, the Alaska Oil and Gas Association, and the National Marine Fisheries Service resulted in adoption of innovative mitigation and protection stipulations to ensure consultation and cooperation during exploration and development and production activities, for bowhead whale monitoring activities, and for protection of subsistence whaling and other activities. The State of Alaska, the NSB, the Villages of Nuiqsut and Kaktovik, and others recommended in their comments on the Call and through scoping that all measures adopted for Sale 170 be adopted for the proposed Beaufort Sea multiple-sale EIS.

F.1.a Stipulations Included in the Proposed Action

The following stipulations are considered part of all alternatives.
- No. 1 Protection of Biological Resources
- No. 2 Orientation Program
- No. 3 Transportation of Hydrocarbons
- No. 4 Industry Site-Specific Bowhead Whale-Monitoring Program
- No. 5 Subsistence Whaling and Other Subsistence-Harvesting Activities

No.1 Protection of Biological Resources: If biological populations or habitats that may require additional protection are identified in the lease area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

No. 2 Orientation Program: The lessee shall include in any exploration or development and production plans submitted under 30 CFR 250.33 and 250.34 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the RS/FO. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns, including subsistence, that relate to the sale and adjacent areas.

No. 3 Transportation of Hydrocarbons: This measure requires the use of pipelines: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts.

No. 4 Industry Site-Specific Bowhead Whale-Monitoring Program: This stipulation mandates that lessees conduct a site-specific monitoring program during exploratory drilling activities, including seismic activities, to determine when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these activities. The stipulation requires a peer review of monitoring plans and the resulting draft reports. The monitoring plan must include provisions for recording and reporting information on sightings of other marine mammals and must provide an opportunity for an AEWC or NSB representative to participate in the monitoring program. No monitoring program will be required if the RS/FO, in consultation with the NSB and the AEWC, determines that a monitoring program is not necessary based on the size, timing, duration, and scope of the proposed operations.

No. 5 Subsistence Whaling and Other Subsistence-Harvesting Activities: This stipulation mandates that all exploration and development and production operations shall be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and all subsistence activities, particularly the subsistence bowhead whale hunt. It provides a mechanism to address unresolved conflicts between the oil and gas industry and subsistence activities. This stipulation also requires the lessee to show in its exploration or development and production plan how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence areas. The protection provided by this stipulation could reduce potential conflicts between potential subsistence activities and offshore oil and gas operations and provide protection as an option in lieu of the subsistence deferral alternatives.

F.1.b Stipulations to be Evaluated in the EIS

MMS will evaluate the inclusion of other stipulations that will be developed during the EIS process.

This includes two stipulations (Stipulation 6a and 6b) regarding a No Siting of Permanent Facilities in the Vicinity of Cross Island provision. These potential stipulations may reduce effects. They will be evaluated as mitigation and as an option to the aforementioned deferral alternatives.

Sale 170 included a stipulation for No Siting of Permanent Facilities in the Vicinity of Cross Island, which is not included as part of the committed stipulation package at this time. that ITL has been divided into two parts, 6A and 6B. The EIS will develop and evaluate a similar stipulation to reduce potential impacts by potentially limiting permanent facilities in the area. Such a stipulation may reduce potential conflicts between proposed oil and gas operations and subsistence activities. The State of Alaska, the NSB, the Villages of Nuiqsut and Kaktovik, and others recommended its adoption in responses to the Call for Information. The NSB and AEWC also proposed the Nuiqsut Deferral Alternative. In response to similar comments, the MMS also developed the Nuiqsut Subsistence Whale Deferral Alternative for evaluation in the EIS. While the issue and concerns being addressed by these options are the same, the aerial extent covered by each option is different. All three of these options are being evaluated in the EIS as a means of reducing potential effects to subsistence activities. The decision about the best option(s) will be made later in the process.

F.1.c Information to Lessees Included in the Proposed Action

Items 1 through 16 apply to OCS activities in the Beaufort Sea area and are considered part of the all alternatives, including the proposed action. Sale 170 had 21 ITL clauses. Five of them were outdated or superceded by regulations. These 16 ITL clauses provide mitigation for offshore oil and gas activities. We also are considering a possible addition to a notice of Information to Lessees (ITL 7 Information on the Availability of Bowhead Whales for Subsistence-Hunting Activities) indicating that for development plans, lessees are encouraged to consider noise abatement methods if needed to reduce activity noise that may occur during and in the vicinity of the migration.

No. 1 – Information on Community Participation in Operations Planning
No. 2 – Information on Kaktovikmiut Guide *In this Place*

No. 3 – Information on Nuiqsutmiut Paper
No. 4 – Information on Bird and Marine Mammal Protection
No. 5 – Information to Lessees on River Deltas
No. 6 – Information on Endangered Whales and the MMS Monitoring Program
No. 7 – The Availability of Bowhead Whales for Subsistence-Hunting Activities
No. 8 – Information on High-Resolution Geological and Geophysical Survey Activity
No. 9 – Information on Polar Bear Interaction
No. 10 – Information on the Spectacled Eider and the Steller's Eider
No. 11 – Information on Sensitive Areas to be Considered in Oil-Spill-Contingency Plans
No. 12 – Information on Coastal Zone Management
No. 13 – Information on Navigational Safety
No. 14 – Information on Offshore Pipelines
No. 15 – Information on Discharge of Produced Waters
No. 16 – Information on Use of Existing Pads and Islands

No. 1 – Information on Community Participation in Operations Planning: This ITL encourages lessees to bring residents on the North Slope communities into their planning process. Local communities often have the best understanding of how oil and gas activities can be safely conducted in and around their area without harming the environment or interfering with community activities. Community representation on management teams that develop plans of operation and oil-spill-contingency plans that involve local community residents in the earliest stages of the planning process for proposed oil and gas activities can be beneficial to the industry.

No. 2 – Information on Kaktovikmiut Guide *In This Place*: the people of Kaktovik, the Kaktovikmiut, have compiled *A Guide for Those Wishing to Work in the Country of the Kaktovikmiut*. The guide's intent, in part, is to provide information that may promote a better understanding of their concerns. Lessees are encouraged to obtain copies of the guide and to incorporate it into their Orientation Program to assist in fostering sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which they will be operating.

No. 3 – Information on Nuiqsutmiut Paper: the people of Nuiqsut, the Nuiqsutmiut, have compiled a paper that provides information that may promote a better understanding of their concerns. Lessees are encouraged to obtain copies of this guide and to incorporate it into Orientation Programs to assist in fostering understanding and sensitivity to community values, customs, and lifestyles in areas in which they will be operating.

No. 4 – Information on Bird and Marine Mammal Protection: This ITL advises lessees that during the conduct of all activities related to leases issued as a result of this sale, the lessee and its agents, contractors, and subcontractors will be subject to the following laws, among others, the provisions of the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 U.S.C. 1361 et seq.); the Endangered Species Act (ESA), as amended (16 U.S.C. 1531 et seq.); and applicable International Treaties.

No. 5 – Information to Lessees on River Deltas: Lessees are advised that certain river deltas of the Beaufort Sea coastal plain (such as the Kongakut, Canning, and Colville) have been identified by the FWS as special habitats for bird-nesting and fish-overwintering areas, as well as other forms of wildlife. Shore-based facilities in these river deltas may be prohibited by the permitting agency.

No. 6 – Information on Endangered Whales and MMS Monitoring Program: This ITL advises lessees that the MMS intends to continue its areawide endangered whale-monitoring program in the Beaufort Sea during exploration activities. The program will gather information on whale distribution and abundance patterns and will provide additional assistance to determine the extent, if any, of adverse effects to the species.

No. 7– The Availability of Bowhead Whales for Subsistence-Hunting Activities: Lessees are advised that the NMFS issues regulations for incidental take of marine mammals, including bowhead whales. Incidental-take regulations are promulgated only upon request, and the NMFS must be in receipt of a petition prior to initiating the regulatory process. Incidental takes of bowhead whales are allowed only if a Letter of Authorization (LOA) is obtained from the NMFS pursuant to the regulations in effect at the time. An LOA must be requested annually. In issuing an LOA, the NMFS must determine that proposed activities will not have an unmitigable adverse effect on the availability of the bowhead whale to meet subsistence needs by causing whales to abandon or avoid hunting areas, directly displacing subsistence users, or placing physical barriers between whales and subsistence users.

No. 8 – Information on High Resolution Geological and Geophysical Survey Activity: This ITL advises lessees of the potential effects of geological and geophysical (G&G) activity to bowhead whales and subsistence hunting activities, and reminds lessees of the specifics of the bowhead whale-monitoring program. This ITL also informs lessees that MMS intends to treat prelease G&G activities in a manner similar to the post lease G&G activities. The MMS may impose restrictions (including the timing of operations relative to open water) and other requirements (such as having a locally approved coordinator on board) on G&G surveys to minimize unreasonable conflicts between the G&G survey and subsistence whaling activities. Lessees will coordinate any proposed G&G activity with potentially affected subsistence communities, the NSB, and the AEWC to identify potential conflicts and develop plans to avoid these conflicts.

No. 9 – Information on Polar Bear Interaction: Lessees are advised that polar bears may be present in the area of operations, particularly during the solid-ice period. Lessees should conduct their activities in a manner that will limit potential encounters and interaction between lease operations and polar bears, particularly during the solid-ice period. Lessees should conduct their activities in a manner that will limit potential encounters and interaction between lease operations and polar bears. Lessees need to contact the FWS regarding proposed operations and actions that might be taken to minimize interactions with polar bears.

No. 10 – Information on Spectacled Eider and Steller's Eider: Lessees are advised that the spectacled eider (*Somateria fischeri*) and the Steller's eider (*Polysticta stelleri*) are listed as threatened endangered species by the FWS and are protected by the ESA of 1973, as amended, 16 U.S.C. 1531 et seq.

No. 11 – Information on Sensitive Areas to be Considered in the Oil-Spill Contingency Plans: Lessees are advised that certain areas are especially valuable for their concentrations of marine birds, marine mammals, fishes, or other biological resources or cultural resources and should be considered when developing oil-spill-contingency plans.

No. 12 – Information on Coastal Zone Management: Lessees are advised that the State of Alaska will review OCS plans through the review process for consistency with the Alaska Coastal Management Program. Oil-spill-contingency plans will be reviewed for compliance with State standards, the use of best available and safest technologies, and with State and regional contingency plans on a case-by-case basis.

No. 13 – Information on Navigational Safety: Operations on some of the blocks offered for lease may be restricted by designation of fairways, precautionary zones, Anchorage, safety zones, or traffic-separation schemes established by the USCG pursuant to the Ports and Waterways Safety Act (33 U.S.C. 1221 et seq.), as amended.

No. 14 – Information on Offshore Pipelines: This ITL advises lessees that the Department of the Interior and the Department of Transportation have entered into a Memorandum of Understanding, dated December 10, 1996, concerning the design, installation, operation, inspection, and maintenance of offshore pipelines. Bidders should consult both departments for regulations applicable to offshore pipelines.

No. 15 – Information on Discharge of Produced Waters: This ITL advises lessees that the State of Alaska prohibits discharges of produced waters on State tracts within the ten-meter depth contour. It informs lessees that discharges of produced waters into marine waters are subject to conditions of NPDES permits issued by the USEPA, and may also include a zero-discharge requirement on Federal tracts within the 10-meter depth contour.

No. 16 – Information on Use of Existing Pads and Islands: This ITL advises lessees that during the review and approval process for exploration and development and production plans, MMS will encourage lessees to use existing pads and islands wherever feasible.

F.1.d Mitigating Measures Not Recommended for Analysis in the EIS

There are no additional mitigating measures identified by commenters to be considered for analysis in the EIS during scoping.

APPENDIX F

EXPLORATION AND DEVELOPMENT SCENARIOS

Contents of Appendix F

EXPLORATION AND DEVELOPMENT SCENARIOS

Scenarios are conceptual views of the future. In this document, we offer scenarios regarding the timing and extent of future petroleum activities in the Beaufort Sea. The scenarios are based on economic factors, industry trends, and a large dose of professional judgment. The scenarios described here are plausible views of the future, although they project more activities than have occurred in the past in the Beaufort OCS.

Future activities primarily are scaled to assumptions of anticipated oil production. Future oil production will depend on many factors, the most important of which are access to prime areas for exploration, industry spending for leasing and exploration, and oil prices. Although seven lease sales have been held in the Beaufort Sea OCS since 1979, only a small fraction of the tracts offered (10,280 tracts) were leased by industry (692 leases). Thirty exploration wells tested 20 prospects and made 11 discoveries classified as “capable of producing in paying quantities.” However, only one field including Federal acreage (Northstar) has begun production. A summary of historical OCS leasing in the Beaufort Sea is shown in Figure III.A.2 of the EIS.

Although oil production from the Beaufort OCS has fallen short of initial expectations, this offshore province is still considered as one of the most prospective areas in the U.S. Proven geologic plays extend offshore from some of the largest fields in North America on Alaska’s North Slope (Figure III.A.1 of the EIS). The current MMS petroleum assessment indicates that recoverable oil resources could range from 3.6-11.8 billion barrels, of which 1.7-2.3 billion barrels could be economically viable at prices between $18 and $30 per barrel. Most government and industry analysts agree that this province could hold oil fields comparable in size to any frontier area in the world. Past exploration efforts have only partially tested the potential of the Beaufort shelf.

The economic potential of the Beaufort OCS has not yet been realized, because petroleum activities face a number of hurdles. These hurdles, outlined in the following, generally are not accounted for in resource-assessment models, which assume the entire area is available for exploration and funding is not a consideration. Any of the hurdles could stop the process of converting undiscovered resources to producing reserves. Because environmental and political hurdles are especially difficult to overcome in Alaska, it is important to recognize that estimates of anticipated production, and consequent effects, are likely to be overstated in environmental impact statements.

Leasing hurdles

- A lease sale is held (lease sales often are postponed).
- Industry has access to high-potential tracts (prime areas often are placed off-limits in deferrals).
- The tracts containing oil/gas resources are leased (only a small fraction of the offered tracts are leased).

Exploration hurdles

- Companies must drill to test for oil/gas pools (most leases are never drilled).
- Oil/gas pools are present in the prospects tested (most exploration wells are dry holes).
- Discoveries are large enough for commercial development (most discoveries are too small or costly).

Economic hurdles

- Oil and gas prices support commercial development (costs are high and future prices are uncertain).
- Technology is adequate for project location (new technologies may be required).
- Project meets the company’s investment criteria (most companies have other worldwide opportunities).

Legal hurdles

- Necessary permits are approved in a timely manner (permitting delays are common).
- Environmental mitigation could impact project economics (mitigation usually adds to project costs).
- Project survives legal challenges (lawsuits are common).

The MMS resource-assessment model simulates the discovery and development of offshore fields but cannot define where or when production would occur from specific tracts. Each modeling trial is likely to simulate a different development project and set of pool characteristics among the numerous geologic plays. In the real world, future offshore development depends mostly on the effort and financial commitment by industry. The steps leading from leasing to production are complicated by many factors that cannot be accurately predicted such as oil prices, technology breakthroughs, and corporate strategies. For example, higher oil prices could lead to accelerated exploration and production activities. In contrast, low oil prices could prompt industry to abandon the area without a thorough exploration effort.

F.1. Multiple-Sale Methodology

A new approach is taken in this multiple-sale EIS with respect to exploration and development (E&D) scenarios. Although there is a need to base E&D activities using anticipated production, our knowledge of the location and timing of future development activities cannot be defined with accuracy. For purposes of environmental analysis, we assume that 20% of the total available economic resources could be converted to future production for each sale in the 2002-2007 program area. This would seem to imply that after five areawide sales, all of the economic resource base would be discovered. This conclusion is not necessarily true. All of the oil resources would not be discovered in a few lease sales, because new play concepts would emerge from new discoveries. Exploration success would cause future resource estimates to be revised higher. Also, the expansion of infrastructure would lower the costs for remote, marginally uneconomic pools, perhaps allowing them to become viable.

One subjective view of future exploration and development scenarios is summarized in Table F-1. This table lists activities associated with leasing and development for a three-sale schedule in the Beaufort OCS. The table is organized around three geographic zones and three representative sale scenarios. The geographic zones are defined by proximity to the existing North Slope infrastructure and water depths (see Figure III.A.2 in the EIS), with proximity being the primary factor. Water-depth zones were picked mainly on the platform types used for development, and are broadly defined as less than 15 meters (gravel islands), 15-35 meters (bottom-founded platforms), and greater than 35 meters (subsea wells).

The percentages given for leasing and exploration are estimates of temporary activities, such as permit-related studies, seismic surveys, and exploration-well drilling. We expect that leasing would be concentrated in the Near Zone for all three sales, with activities expanding into remote areas in later sales. For example, if a total of 30 leases were issued in the first sale, 21 of these leases are expected to be in the Near Zone, 6 leases would be in the Midrange Zone, and 3 leases would be in the Far Zone. These percentages simply represent possible trends; no one can accurately foresee future leasing patterns, because each participating company could have a different strategy.

Estimates for development projects also are grouped by both sale and location. Development projects are associated with long-term disturbances and potentially higher environmental effects, because these projects last for decades. General implications for long-term activities are indicated by Table F-1. For example, in the third sale, 40% of the leasing could occur in the Near Zone, but the only commercial discovery resulting from this sale is expected to occur on tracts leased in the Far Zone. Note that areas of both shallow and medium water depths occur in remote (far) zones, and the development characteristics could be transitional between adjacent zones.

One important conclusion from this analysis is that tracts could be leased anywhere in the Beaufort Sea Planning Area in each areawide sale. Although both exploration and development are expected to be concentrated in areas near existing infrastructure (Near Zone), activities are likely to expand into more remote zones after opportunities are exhausted in easily accessible areas. This scenario does not mean that only large discoveries would be made in the Midrange and Far zones. Small discoveries could be made in remote areas, but they would be too small for commercial development. Discoveries near existing infrastructure are likely to be developed sooner, because development costs are lower. Oil pools in more remote locations must be larger to support higher development and transportation costs.

F.2. Individual Sale Scenarios

The following is a broad overview of the development scenario for the Beaufort Sea. Oil produced through offshore facilities on manmade gravel islands or bottom-founded platforms is carried by subsea pipelines buried in trenches to the onshore pipeline network connecting to the Trans-Alaska Pipeline System (TAPS). The pipeline carries oil to Valdez and marine tankers carry oil to West Coast refineries.

Associated and solution gas recovered with oil production is used as fuel for facilities or is reinjected to enhance oil recovery. After the oil reservoirs are depleted (decades), reinjected gas could be recovered through oil facilities.

Future gas production from the North Slope to outside markets would be delayed until a transportation system is constructed. Various proposals are being studied at present with no clear favorite or firm timetable for completion. Therefore, large-scale production of natural gas is not likely within the timeframe considered.

For the first Beaufort sale in the multiple-sale program, we assume the discovery/development of smaller fields in the central part of the program area. Some satellite pools could be produced by wells drilled from existing facilities, while others could require new offshore platforms. Generally, these fields would have shorter subsea pipelines through shallow water. The second sale would result in fewer, but somewhat larger, fields located outside the core area. Production from the third sale would come from a single large field in a more remote location (perhaps in deeper water). This remote field would have a longer, larger diameter offshore pipeline and require a new onshore pipeline to connect to the North Slope gathering system. A summary of the new infrastructure estimated for the three-sale program is given in Table F-2. Production profiles for all three sales are given in Figure F-1. More detailed E&D schedules are generated for each OCS sale.

One basic assumption is that the TAPS would remain operable as the regional transportation system. Studies generally have concluded that mechanical limits will be encountered at rates below 200,000 barrels per day. Throughput rates lower than 300,000 barrels per day will require modifications to the pipeline and pump stations. The lower limit for profitable operations is perhaps 400,000 barrels per day to cover the costs of administration, personnel, and continuing maintenance/repairs. Production from North Slope fields has declined since 1988 and, at the present rate of decline, the TAPS could reach an operational limit in the next 10-20 years. Production from new fields is necessary to maintain minimum flow rates through this vital transportation link now carrying approximately 20% of U.S. daily oil production. If the TAPS were to shut down, future oil production would have to rely on tanker transportation to southern markets. It is unlikely that remaining fields in northern Alaska would be able to support this transportation scenario. For purposes of analysis, we assume that the TAPS would continue to carry oil from northern Alaska.

The development scenarios assume adequate funding and effort by industry and no regulatory delays. We acknowledge that the activity schedules are more aggressive than past experience in the Beaufort OCS. If the present economic and regulatory climate continues, the assumed production and associated environmental impacts for the 2002-2007 leasing program probably are overstated.

As previously discussed, the level of activities associated with oil exploration and development is largely dependent on the market price for oil. Because of the many uncertainties associated with generating resource estimates, oil volumes are best represented by a range of possible volumes. In our resource assessment models, the benchmark prices of $18 and $30 per barrel (in 2000$) are linked to production volumes ranging between 340 million barrels and 570 million barrels for each sale. If long-term prices remain below the $18 benchmark, exploration in the Beaufort OCS is expected to be minimal and discoveries may not be developed. This low-price "exploration-only" scenario represents conditions where discoveries are too small or costly for commercial development.

Because most of the potential impacts are not very different for these two resource levels, we use a single production volume of 460 million barrels for each sale. Although the same production volumes are assumed for each sale, there would be differences in activities for the series of lease sales. The working assumption is that activities would progressively expand away from the core infrastructure area (near the existing Prudhoe Bay complex).

F.2.a. Sale 186

F.2.a(1) Exploration Activities

Exploration activity (seismic surveys and drilling) is assumed to begin in the year following Sale 186 (to be held in 2003) and continue at a rate of one exploration well per year for a total of six exploration wells (Table F-3). Our optimistic assumption is that three commercial discoveries would be made (a 50% success rate). When a discovery is made, delineation wells would use the same drilling rig and continue over a 2-year period. Two delineation wells may be drilled in a single season, as rig mobilization has already taken place. Artificial ice islands grounded on the sea bed are likely to be used as drilling platforms in shallow water (less than 10 meters deep), and nearshore operations would be supported by ice roads over the landfast ice. It is unlikely that gravel islands would be constructed to drill exploration wells in OCS waters, although older artificial islands or natural shoals could be used as a base for gravel or ice islands. Bottom-founded platforms (placed on the seafloor or on berms) could be used to drill prospects in water depths of 10-20 meters, and drillships would be used to drill prospects deeper than 20 meters. Because mobile ice conditions make ice roads unfeasible, deeper water operations would take place during the summer open-water season and would be supported by icebreakers and supply boats.

F.2.a(2) Development Activities

The development schedule (Table F-3) assumes that the first commercial discovery would be made 2 years (in 2005) after Sale 186. We assume that three new fields ranging in size from 120-220 million barrels would be discovered in alternate years. Assuming no delays in permitting, production platforms could be installed in 4 years following the discovery well. Because of their relatively small size, fields would be developed by one production platform, perhaps as a satellite with minimal onsite processing facilities. Each platform would contain one rig for development-well drilling and well-workover operations. Gravel islands would be the favored design for production facilities in water depths less than approximately 15 meters, and bottom-founded platforms would be used for production facilities in water depths to 35 meters. It is possible that some oil would be produced from extended-reach wells drilled from existing production islands. However, the volumes of oil developed by extended-reach drilling are likely to represent a minor proportion of the total production from the three new fields.

The route selection and installation of offshore pipelines would take 1-2 years and could occur either in the summer open-water season or during mid- to late winter when landfast ice has stabilized. New onshore pipeline sections would take 1 year to complete, with construction activities taking place simultaneously with the offshore pipeline installation. We assume that offshore pipelines would be trenched as a protective measure against damage by ice in all water depths less than 50 meters. At coastal landfalls, pipelines would be elevated on short, gravel causeways to protect them against shoreline processes. Onshore pipelines would be elevated 2 meters on vertical support members. The onshore pipeline corridor and shore facility construction would be concurrent with the offshore platform installation.

Because of their relatively small size, new offshore projects would use the existing infrastructure (processing facilities and pipeline-gathering systems) wherever possible. Produced oil would be gathered by existing pipeline systems within the Prudhoe Bay/Kuparuk field areas and transported to Pump Station 1 of the TAPS. We assume that Oliktok Point (using the Kuparuk or Milne Point field infrastructure), the Northstar pipeline landfall, West Dock (using the Prudhoe Bay field infrastructure), and the Badami field would be the primary landfalls.

Production rates would quickly ramp up to peak production rates for 3 years before declining. A typical field cycle from discovery to abandonment is 21 years, or approximately 5 years from discovery to startup, A 15-year production life, and 1 year for abandonment. Considering staggered discovery times of the three fields, activities resulting from Sale 186 could last until the year 2033 (Figure F-2).

F.2.b. Sale 195

F.2.b(1) Exploration Activities

Exploration seismic surveys could begin the year after the sale, and drilling is assumed to begin in the second year following Sale 195, which is scheduled for 2005 (Table F-4). We assume one or two exploration wells would be drilled in alternating years for a total of six exploration prospects tested. Our optimistic assumption is that two commercial discoveries would be made (a 33% success rate). Because of operating limitations, it is likely that only one exploration well would be drilled at each site in a year. If a discovery is made, two delineation wells would be drilled in the following season. Artificial ice islands grounded on the seabed are likely to be used as drilling platforms in water depths less than 10 meters. These operations would be supported by ice roads over the landfast-ice zone. It is unlikely that gravel islands would be constructed to drill exploration wells in OCS waters, although older artificial islands or natural shoals could be used to construct short-term exploration islands. Bottom-founded platforms of various designs could be used to drill prospects in water depths of 10-20 meters, and drillships would be used to test prospects in water depths greater than 20 meters. Because of mobile ice conditions, operations in deeper water would be supported by icebreakers and supply boats during the summer open-water season.

F.2.b(2) Development Activities

The development schedule assumes that the first commercial discovery would be made 3 years (in 2008) after Sale 195 (Table F-4). A total of two new fields ranging in size from 120-240 million barrels would be developed on tracts leased in this sale. Assuming no delays in permit approvals, production platforms could be installed in 4-5 years following the discovery well. Each field would be developed by one or two production platforms with full processing facilities. Each platform would contain one rig to drill development wells and would remain on the platform for well-workover operations. Gravel islands probably would be constructed for production facilities in water depths less than approximately 15 meters. From water depths of 15-35 meters, bottom-founded platforms would be used for production facilities and ice management strategies (spray-ice berms) would be used to control ice forces.

The installation of offshore pipelines between production platforms and onshore facilities would take 1-2 years and could occur either in the summer open-water season or during mid- to late winter when landfast ice has stabilized. New onshore pipeline sections would take 1-2 years to complete, with construction activities taking place simultaneously with the offshore pipeline installation. We assume that offshore pipelines would be trenched and buried in the seafloor as a protective measure against damage by ice in water depths less than 50 meters. At coastal landfalls, pipelines would be elevated on short gravel causeways to protect them against shoreline erosion processes. Booster stations may be required at the landfalls to maintain pressure in the onshore oil pipeline sections. Onshore, pipelines would be elevated on vertical support members. Shore facility construction would be concurrent with installation of the offshore platforms.

New offshore projects would tie into existing onshore pipeline-gathering systems at the nearest possible points. Produced oil would be gathered by existing pipeline systems to Pump Station 1 of the TAPS. We assume that landfalls would be Oliktok Point, Northstar pipeline, West Dock, and Bullen Point (A new facility to support development in the Point Thomson unit).

Production would ramp up over several years before peak production rates are achieved. The overall field life from discovery to abandonment is assumed to be 25 years, or approximately 6 years from discovery to startup, an 18-year production life, and 1 year for abandonment. Considering the staggered discovery and startup of several offshore fields, activities related to Sale 195 could last to the year 2036 (Figure F-3).

F.2.c. Sale 202

F.2.c(1) Exploration Activities

Exploration seismic surveys could begin the year after Sale 202 scheduled for 2007 (Table F-5), and drilling is assumed to begin in the third open-water season. We assume that drilling would occur at a rate of one exploration well in each 3-year period. Because of limited operating times, it is likely that only one exploration well would be drilled in a year. We assume that six prospects would be tested by drilling, resulting in the discovery of one commercial-size field (a success rate of 17%). If a discovery is made, delineation wells would be drilled at the rate of two per year. The reservoir beneath each platform site would be evaluated by two or three delineation wells. The type of exploration equipment selected would depend on water depth. Artificial ice islands grounded on the seabed are likely to be employed as drilling platforms in water depths less than 10 meters, and these operations would be supported largely by ice roads over the landfast-ice zone. It is unlikely that gravel islands would be constructed to drill exploration wells, although artificial islands or natural shoals could be used to construct short-term exploration islands. Bottom-founded platforms could be used to drill prospects in water depths of 10-20 meters. Because of mobile ice conditions, these operations would be supported by supply boats during the open-water season. For water depths greater than 20 meters, floating drilling rigs (drillships or floating platforms) would be used in the summer, and these operations would be supported by icebreakers.

F.2.c(2) Development Activities

The development schedule assumes that the discovery of one field of approximately 460 million barrels would be made 5 years (in 2012) after the sale (Table F-5). Assuming no delays in permitting, production platforms could be installed 6-7 years after the discovery well. This large field would be developed from two production platforms with processing facilities on one of the platforms. Each platform would hold one rig that would drill development wells and remain on the platform for well-workover operations. Production facilities in water depths less than 15 meters would be based on artificial gravel islands. In water depths ranging from 15-35 meters, production structures would be contained on bottom-founded platforms designed for pack-ice conditions. Active ice-management strategies (spray-ice berms) and icebreaker support ships also would be required. Oil pools in deeper water (greater than 35 meters) could be tapped by a combination of extended-reach drilled wells or subsea wells tied back to the main production platform. Subsea production technology is well-established in difficult operation areas (very deep water and extreme sea-state conditions) and represents another method of deepwater production in arctic pack-ice conditions.

Installation of offshore pipelines between production platforms and onshore facilities would take 2-4 years, considering that route surveys, trenching, and pipeline laying would take place in the relatively short open-water season. New onshore pipeline sections would take 2-4 years to complete, with construction activities taking place simultaneously with the offshore pipeline installation. We assume that offshore pipelines would be trenched as a protective measure against damage by ice in all water depths less than 50 meters. At coastal landfalls, pipelines would be elevated on short gravel causeways to protect them against shoreline erosion processes. Booster stations at the landfalls would be required to maintain pressure in the long pipeline segments. Onshore, pipelines would be elevated on vertical support members. Construction of the onshore pipeline and shore facility would be concurrent with installation of the offshore platforms.

Because this project is in a remote location, new onshore pipelines would be required to reach the existing North Slope gathering system connecting to Pump Station 1 of the TAPS. Depending on the location of the field, a new landfall would be constructed in Smith Bay (a discovery in the western Beaufort) and traverse south of Teshekpuk Lake through the National Petroleum Reserve-Alaska to the Kuparuk field infrastructure. Existing field infrastructure in the central Beaufort (Oliktok, Northstar, Endicott, Badami) could be used for oil production from deepwater areas offshore from the central Beaufort coastline. If the new field is found in the eastern Beaufort, a new landfall and facility expansion in the Point Thomson area would be constructed. Because only one remote field is expected, there would be only one landfall.

The installation of several platforms and drilling by one rig on each platform would result in a ramp-up period of several years before peak production rates are achieved. The overall field life from discovery to abandonment is 30 years, or approximately 8 years from discovery to production startup, a 20-year production life, and a 2-year abandonment period. Considering the long lead times for exploration and development at remote sites, activities resulting from Sale 202 could last until 2039 (Figure F-4).

F.3. Estimates of Muds and Cuttings for Sales 186, 195, and 202

Geologic studies indicate that exploration and delineation wells generally would test prospects from 3,000-15,000 feet in the subsurface. Based on the characteristics of geologic plays with economic resources, we assume that a representative exploration well depth is 7,000 feet. Also based on economic plays, production wells are assumed to average 10,000 feet (drilled depth), because they would include a mix of near-vertical and lateral-extended wells. We assume that one-third of the total wells would be injection wells (production:injection well ratio of 2:1). Injection wells are used for subsurface waste disposal and to optimize oil recovery (waterflood, gas-cycling, and pressure maintenance).

For these assumed drilling depths, a typical exploration well would use 425 tons (ton = 2,000 pounds) of dry mud and produce 525 tons of dry rock cuttings. We assume that 80% of the drilling mud would be recycled and, therefore, 85 tons of “spent mud” would be discharged at the exploration site. All of the cuttings (525 tons per well) would be discharged at the exploration site. A typical production well would use approximately 650 tons of dry mud and produce approximately 825 tons of rock cuttings. We assume that 80% of the drilling mud would be recycled in the multiple-well program and, therefore, 130 tons per well would be waste. Waste drilling mud, rock cuttings, and produced water would be disposed of in the subsurface by service wells on the production platform. If required, waste products could be transported to land facilities for treatment and subsurface disposal.

Spent drilling mud discharged offshore could have this typical composition:

Component	Weight %
Bentonite	6.5
Lignosulfonate	2.0
Lignite	1.4
Caustic	0.7
Lime	0.3
Barite	75.0
Drilled solids	13.0
Soda ash/Sodium Bicarbonate	0.4
Cellulose Polymer	0.7
Seawater/Freshwater	as needed
Total	100.0

Source: EPA Type 2, Lignosulfonate Mud

F.4. Changes in Activities Because of Area Deferrals

The petroleum resource assessment of the Beaufort OCS is based on geologic and engineering analysis of the entire planning area. As previously discussed, all mapped and inferred prospects are grouped into 14 geologic plays extending over broad areas of the Beaufort shelf. The results of the economic modeling indicate that only 3 or 4 of the 14 geologic plays could contain economically recoverable oil at prices ranging from $18-$30 per barrel. The play areas with economic oil resources (Appendix B, Figures B-1, B-2, B-3, and B-4) broadly define the maximum limits of the play; however, specific portions of each play area could lack any commercial potential (no petroleum traps, reservoirs are too deep, ice conditions too severe, technology is inadequate).

It is impossible to accurately define future production from specific parts of the planning area because (1) the locations of commercial-sized pools are unknown and cannot be determined without drilling; (2) future industry efforts to lease and drill specific tracts cannot be accurately predicted; and (3) commercial oil pools are not uniformly distributed over the broad play areas.

In a frontier area such as the Beaufort OCS, a simple concept often holds true: “area equals opportunity.” Removing areas from leasing certainly would eliminate the chance that commercial production would occur in that area. However, deferring one area could redirect exploration effort into remaining open areas. If excessively large areas are excluded, industry would abandon the Beaufort OCS program area and pursue other worldwide options.

Another important point is that merely leasing tracts in an OCS sale does not mean that commercial discoveries would be made on these tracts. Most tracts leased are never drilled, and many discoveries would be too small to support commercial development. Exploration activities (seismic surveys, exploration well drilling) could cause temporary disturbances, whereas long-term impacts would occur only if a commercial field is present over several decades.

Because commercial oil resources are not uniformly distributed, oil pools covered by only a few tracts could contain all of the economically recoverable reserves in the sale area. The remainder of the area could either lack the geology to produce large oil pools or have environmental conditions that would preclude commercially viability. It is important to note that this analysis reflects MMS's current data and knowledge. Industry groups could have a much different view of the oil potential in the Beaufort OCS. Future leasing patterns may reflect different industry views regarding the possible location of commercial-sized fields in the program area.

Given the inherent uncertainties for the location of future commercial discoveries, we must subjectively rank areas based on the petroleum resource assessment. This method is based primarily on the identification of geologic plays with economic potential and the projection of historical exploration trends. Table II.A-3 provides probabilities for four deferral areas under consideration. The "opportunity index" represents the probability that commercial fields would be leased, drilled, discovered, and developed in a specific deferral area.

Using the Opportunity Index for the deferral areas indicates that if all of these areas were removed from leasing, only 88% of the original petroleum potential would be available to industry. This restriction on exploration opportunity in a high-cost frontier province would affect leasing revenues and the chance for future commercial production.

Table F-1
Representation of Possible Sale-Related Activities

	Near Zone		Midrange Zone		Far Zone		
	Leasing & Exploration	Development Projects	Leasing & Exploration	Development Projects	Leasing & Exploration	Development Projects	Total Projects
Sale 1	70%	2	20%	1	10%	0	3
Sale 2	50%	1	30%	1	20%	0	2
Sale 3	40%	0	30%	0	30%	1	1
Total	53%	3	27%	2	20%	1	6

Notes:
Development zones are broadly defined by distance from the core Prudhoe Bay infrastructure and by water depths.
The Near Zone is less than 50 miles away in water depths less than 15 meters. The Midrange Zone is between 50 and 100 miles away in water depths less than 35 meters. The Far Zone is more than 100 miles away or in water depths greater than 35 meters.

Table F-2
Infrastructure Associated with the Beaufort Sea Sales 186, 195, and 202

Activity	First Sale (2003)	Second Sale (2005)	Third Sale (2007)	Sum of 3 Sales
Oil Production (BBO)	0.46	0.46	0.46	1.38
Gas Production (TCFG)	N/A	N/A	N/A	N/A
Period of Activity	2004-2034	2006-2037	2008-2039	35 years
Number of Fields	3	2	1	6
Number of Platforms	3	3	2	8
Exploration and Delineation Wells	12	12	11	35
Production Wells	69	69	68	206
Injection Wells	33	33	34	100
Offshore Pipelines (miles)	40	40	35	115
New Landfalls	0	1	1	2
New Shore Bases	0	0	1	1
New Processing Facilities	0	1	1	2

Notes:
Exploration success: Sale 186 (3 wet/6 wildcat = .50); Sale 195 (2 wet/6 wildcat = 0.33); Sale 202 (1 wet/6 wildcat = 0.17). We assume each sale will be followed by 6 wildcat tests. Assume 2-3 wet exploration-/delineation wells for each platform. Assume 1/3 of development wells are injection (2:1 production/injection). Average platform holds 34 development wells. Some wells in the third-sale scenario could be subsea wells with flowline tiebacks to production platforms in shallow water or onshore. Offshore pipelines include infield flowlines (less than 10 inches) and sales oil line (greater than 10 inches) shortest distance to landfall. Landfalls include staging areas and pump stations and are likely to be collocated with onshore processing facilities. Shore bases are temporary logistical centers associated with exploration and construction. Shore bases might be expanded to include pipeline landfalls and processing facilities associated with production operations. Abandonment begins in the last year of production and finishes the year following shutdown.

Table F-3
Representative Development Schedule for Sale 186

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (miles)	New Shorebases	Field #1 Oil Production (MMbbl)	Field #2 Oil Production (MMbbl)	Field #3 Oil Production (MMbbl)	Combined Oil Production (MMbbl)	Cumulative Oil Production (MMbbl)
2003	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2004	1	—	1	—	—	—	—	—	—	—	—	—	—	—
2005	1	—	1	—	—	—	—	—	—	—	—	—	—	—
2006	1	2	2	—	—	—	—	—	—	—	—	—	—	—
2007	1	—	1	—	—	—	—	—	—	—	—	—	—	—
2008	1	2	2	—	—	—	—	—	—	—	—	—	—	—
2009	1	—	1	1	3	3	1	10	—	—	—	—	—	—
2010	—	2	1	—	10	4	1	—	—	7.9	—	—	7.9	7.9
2011	—	—	—	1	13	7	2	10	—	15.7	—	—	15.7	23.6
2012	—	—	—	—	10	4	1	—	—	15.7	7.9	—	23.6	47.2
2013	—	—	—	—	10	4	1	—	—	15.7	15.7	—	31.5	78.7
2014	—	—	—	1	3	3	1	20	—	13.0	15.7	—	28.7	107.4
2015	—	—	—	—	10	4	1	—	—	10.7	15.7	13.2	39.6	147.0
2016	—	—	—	—	10	4	1	—	—	8.8	13.0	22.0	43.8	190.8
2017	—	—	—	—	—	—	—	—	—	7.3	10.7	22.0	40.0	230.8
2018	—	—	—	—	—	—	—	—	—	6.0	8.8	22.0	36.8	267.6
2019	—	—	—	—	—	—	—	—	—	5.0	7.3	22.0	34.2	301.9
2020	—	—	—	—	—	—	—	—	—	4.1	6.0	18.9	29.0	330.9
2021	—	—	—	—	—	—	—	—	—	3.4	5.0	16.3	24.6	355.5
2022	—	—	—	—	—	—	—	—	—	2.8	4.1	14.0	20.9	376.4
2023	—	—	—	—	—	—	—	—	—	2.3	3.4	12.0	17.7	394.1
2024	—	—	—	—	—	—	—	—	—	1.9	2.8	10.3	15.0	409.1
2025	—	—	—	—	—	—	—	—	—	—	2.3	8.9	11.2	420.3
2026	—	—	—	—	—	—	—	—	—	—	1.9	7.7	9.5	429.9
2027	—	—	—	—	—	—	—	—	—	—	—	6.6	6.6	436.5
2028	—	—	—	—	—	—	—	—	—	—	—	5.7	5.7	442.1
2029	—	—	—	—	—	—	—	—	—	—	—	4.9	4.9	447.0
2030	—	—	—	—	—	—	—	—	—	—	—	4.2	4.2	451.2
2031	—	—	—	—	—	—	—	—	—	—	—	3.6	3.6	454.8
2032	—	—	—	—	—	—	—	—	—	—	—	3.1	3.1	457.9
2033	—	—	—	—	—	—	—	—	—	—	—	2.7	2.7	460.5
—	**6**	**6**	**—**	**3**	**69**	**33**	**—**	**40**	**—**	**120**	**120**	**220**	**460.5**	**—**

Table F-4
Representative Development Schedule for Sale 195

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (miles)	New Shore Bases	Field #1 Oil Production (Mbbll)	Field #2 Oil Production (MMbbl)	Combined Oil Production (MMbbl)	Year
2003	—	—	—	—	—	—	—	—	—	—	—	—	2003
2004	—	—	—	—	—	—	—	—	—	—	—	—	2004
2005	—	—	—	—	—	—	—	—	—	—	—	—	2005
2006	—	—	—	—	—	—	—	—	—	—	—	—	2006
2007	1	—	1	—	—	—	—	—	—	—	—	—	2007
2008	1	—	1	—	—	—	—	—	—	—	—	—	2008
2009	—	2	1	—	—	—	—	—	—	—	—	—	2009
2010	1	—	1	—	—	—	—	—	—	—	—	—	2010
2011	—	—	—	—	—	—	—	—	—	—	—	—	2011
2012	2	—	2	1	3	3	1	10	—	—	—	—	2012
2013	1	2	2	—	10	4	1	—	—	7.9	—	7.9	2013
2014	—	2	1	—	10	4	1	—	—	15.7	—	15.7	2014
2015	—	—	—	—	—	—	—	—	—	15.7	—	15.7	2015
2016	—	—	—	1	3	3	1	30	—	15.7	—	15.7	2016
2017	—	—	—	1	13	7	2	—	—	13.0	21.5	34.5	2017
2018	—	—	—	—	20	8	2	—	—	10.7	28.6	39.4	2018
2019	—	—	—	—	10	4	1	—	—	8.8	28.6	37.5	2019
2020	—	—	—	—	—	—	—	—	—	7.3	28.6	35.9	2020
2021	—	—	—	—	—	—	—	—	—	6.0	28.6	34.7	2021
2022	—	—	—	—	—	—	—	—	—	5.0	28.6	33.6	2022
2023	—	—	—	—	—	—	—	—	—	4.1	25.2	29.3	2023
2024	—	—	—	—	—	—	—	—	—	3.4	22.2	25.6	2024
2025	—	—	—	—	—	—	—	—	—	2.8	19.5	22.3	2025
2026	—	—	—	—	—	—	—	—	—	2.3	17.2	19.5	2026
2027	—	—	—	—	—	—	—	—	—	1.9	15.1	17.0	2027
2028	—	—	—	—	—	—	—	—	—	—	13.3	13.3	2028
2029	—	—	—	—	—	—	—	—	—	—	11.7	11.7	2029
2030	—	—	—	—	—	—	—	—	—	—	10.3	10.3	2030
2031	—	—	—	—	—	—	—	—	—	—	9.1	9.1	2031
2032	—	—	—	—	—	—	—	—	—	—	8.0	8.0	2032
2033	—	—	—	—	—	—	—	—	—	—	7.0	7.0	2033
2034	—	—	—	—	—	—	—	—	—	—	6.2	6.2	2034
2035	—	—	—	—	—	—	—	—	—	—	5.4	5.4	2035
2036	—	—	—	—	—	—	—	—	—	—	4.8	4.8	2036
2037	—	—	—	—	—	—	—	—	—	—	—	—	2037
—	6	6	—	3	69	33	—	40	—	120	340	460	—

Table F-5
Representative Development Schedule for Sale 202

Year	Exploration Wells	Delineation Wells	Exploration Drilling Rigs	Production Platforms	Production Wells	Injection Wells	Production Drilling Rigs	Offshore Pipelines (miles)	New Shorebases	Field #1 Oil Production (MMbbl)	Cumulative Oil Production (MMbbl)
2003	—	—	—	—	—	—	—	—	—	—	—
2004	—	—	—	—	—	—	—	—	—	—	—
2005	—	—	—	—	—	—	—	—	—	—	—
2006	—	—	—	—	—	—	—	—	—	—	—
2007	—	—	—	—	—	—	—	—	—	—	—
2008	—	—	—	—	—	—	—	—	—	—	—
2009	—	—	—	—	—	—	—	—	—	—	—
2010	1	—	1	—	—	—	—	—	—	—	—
2011	—	—	—	—	—	—	—	—	—	—	—
2012	1	—	1	—	—	—	—	—	—	—	—
2013	1	1	1	—	—	—	—	—	—	—	—
2014		2	1	—	—	—	—	—	—	—	—
2015	1	2	1	—	—	—	—	—	1	—	—
2016	—	—	—	—	—	—	—	—	—	—	—
2017	1	—	1	—	—	—	—	—	—	—	—
2018	1	—	1	1	4	4	1	35	—	—	—
2019	—	—	—	1	14	8	2	—	—	30.8	30.8
2020	—	—	—	—	20	8	2	—	—	38.6	69.4
2021	—	—	—	—	20	9	2	—	—	38.6	108.0
2022	—	—	—	—	10	5	1	—	—	38.6	146.6
2023	—	—	—	—	—	—	—	—	—	38.6	185.2
2024	—	—	—	—	—	—	—	—	—	38.6	223.8
2025	—	—	—	—	—	—	—	—	—	34.0	257.8
2026	—	—	—	—	—	—	—	—	—	29.9	287.7
2027	—	—	—	—	—	—	—	—	—	26.3	314.0
2028	—	—	—	—	—	—	—	—	—	23.2	337.2
2029	—	—	—	—	—	—	—	—	—	20.4	357.6
2030	—	—	—	—	—	—	—	—	—	17.9	375.5
2031	—	—	—	—	—	—	—	—	—	15.8	391.3
2032	—	—	—	—	—	—	—	—	—	13.9	405.2
2033	—	—	—	—	—	—	—	—	—	12.2	417.4
2034	—	—	—	—	—	—	—	—	—	10.8	428.2
2035	—	—	—	—	—	—	—	—	—	9.5	437.7
2036	—	—	—	—	—	—	—	—	—	8.3	446.0
2037	—	—	—	—	—	—	—	—	—	7.3	453.3
2038	—	—	—	—	—	—	—	—	—	6.7	460.0
2039	—	—	—	—	—	—	—	—	—	—	—
—	**6**	**5**	—	**2**	**68**	**34**	—	**35**	**1**	**460.0**	—

APPENDIX G

ESSENTIAL FISH HABITAT
CONSULTATION
AND
COORDINATION

List of Items in Appendix G

MMS letter dated June 20, 2002 to NMFS requesting consultation for Essential Fish Habitat (EFH) for Amendment 5 to the Fishery Management Plan for the Salmon Fisheries in the Environmental Economic Zone (EEZ) off the Coast of Alaska.

NOAA letter dated September 6, 2002 to MMS forwarding comments on the Draft EIS. EFH comment on bottom of page 3, top of page 4.

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
949 East 36th Avenue, Suite 300
Anchorage, Alaska 99508-4363

JUN 20 2002

Dr. Jim Balsiger
Regional Administrator
National Marine Fisheries Service
709 West 9th Street
P.O. Box 21668
Juneau, Alaska 99802

Dear Dr. Balsiger:

The Magnuson-Stevens Fishery Conservation and Management Act requires a Federal Agency to consult on any activity that may adversely affect essential fish habitat (EFH). The Minerals Management Service requests a programmatic consultation for EFH identified in the Environmental Assessment (EA) for Amendment 5 to the Fishery Management Plan for the Salmon Fisheries in the EEZ off the Coast of Alaska. The proposed actions we are consulting on include activities associated with leasing and exploration for oil and gas from proposed Lease Sales 186, 195 and 202 as well as exploration associated with all other existing leases in the Beaufort Sea. This programmatic consultation does not encompass the development and production activities.

Implementing regulations at 50 CFR 600.920(a)(ii) provide for consultation to be conducted programmatically when the National Marine Fisheries Service (NMFS) determines that adverse effects on EFH can be addressed for all projects at a program level. Programmatic consultations provide a mechanism to minimize or reduce the need for numerous project-specific consultations.

The Essential Fish Habitat regulations at 50 CFR 600.920(f) enable NMFS to make a finding that an existing consultation or environmental review procedure can be used to satisfy the Magnuson-Stevens Act consultation requirements.

On March 12, 2002, National Marine Fisheries Service issued a Letter of Finding allowing MMS to incorporate EFH consultations into the NEPA process. MMS may submit to NMFS a lease sale or project specific environmental impact statement (EIS) or EA, as appropriate, in lieu of a stand alone EFH assessment.

As one of the preferred methods indicated in the EFH Final Regulations published at 67 FR 2243-2383 (Federal Register, January 17, 2002), our EFH Assessment is integrated into the enclosed NEPA document (Draft EIS Beaufort Sea Multi-Sale Planning Area Oil and Gas Lease

Sale). The document includes descriptions of the nature of the programs subject to this request, an analysis of the effects of consultation-related activities on EFH and federally managed fisheries, views of the MMS regarding those effects, and identification of existing measures to mitigate potential adverse impacts.

This documentation provides the EFH assessment information as required under 50 CFR 600.920(g). If you have any questions or wish to discuss specific issues, please contact Ms. Kate Wedemeyer at 907-271-6424.

Sincerely,

John Goll

John Goll
Regional Director

Enclosures

cc: Larry Peltz
Habitat Conservation Division
National Marine Fisheries Service
222 West 7th Street
P.O. Box 43
Anchorage, AK 99513

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Assistant Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

September 6, 2002

RECEIVED
SEP 16 2002
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Regional Director
Minerals Management Service (MMS)
Alaska OCS Region
949 East 36th Avenue
Anchorage, Alaska 99508

Dear Sir:

Enclosed are comments from the National Oceanic and Atmospheric Administration (NOAA) on the Outer Continental Shelf Oil and Gas Lease Sales 186, 195, and 2002 in the Beaufort Sea, Alaska. We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

for/ James P. Burgess, III
NEPA Coordinator

Enclosure

cc: Director, Minerals Management Service
Department of the Interior
Mail Stop 4230
1849 C Street, NW
Washington, DC 20240

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

September 3, 2002

MEMORANDUM FOR: Steven Kokkinakis
Office of Strategic Planning

FROM: James W. Balsiger
Administrator, Alaska Region

SUBJECT: DEIS for Beaufort Sea Planning Area: Comments

The Alaska Region has reviewed the June 2002 Draft Environmental Impact Statement (DEIS) prepared by the Minerals Management Service (MMS) Alaska Outer Continental Shelf Region for Lease Sales 186, 195, and 202 in the Beaufort Sea. Please refer any questions to Brad Smith or Jeanne Hanson in our Anchorage office at (907) 271-5006.

General Comments

Seven (7) previous oil and gas lease sales have occurred in this area. Past sales have resulted in the drilling of 30 exploration wells. One development and production facility has been approved and is now operational (Northstar). The Minerals Management Service's proposed action (also described here as Alternative I) consists of offering 1,877 whole or partial blocks for lease, covering 9,770,000 acres of the Beaufort Sea planning area off Alaska. These blocks would be offered through three (3)individual sales which would occur sequentially between 2003 and 2007. Water depths in the sale area range up to 120 feet. Resource estimates indicate the range of potential oil here to be between 340 and 570 million barrels per sale. The DEIS projects 23 exploration and delineation wells would be drilled for these lease sales. The DEIS assumes a total of six new fields would be developed under these sales.

The DEIS offers five (5) additional alternatives; the no action alternative and four (4) alternative deferral areas. While it is not clear whether the DEIS intends for these alternatives to be mutually exclusive, we are recommending the adoption of Alternatives III, IV, V, and VI. These alternatives present small, but potentially valuable, improvements from the proposed action. Alternative III would reduce potential conflicts between bowhead whale subsistence hunters and offshore oil and gas operations by removing an area of 138,000 acres in waters east of the Point Barrow (one percent of the sale area). The deferral area is used by bowhead whales for migration and possibly feeding, and is within the traditional hunting areas of the village of Barrow. The MMS projects this alternative(and the others)would reduce potential effects to subsistence harvest patterns when compared to the proposed plan. While exploratory activities adjacent to the deferral area would continue and may present many of the same impacts expected in the proposed plan, Alternative III offers meaningful benefit to the protection of fish and wildlife and to locally important socio-cultural values (subsistence). We believe support for this alternative is justified. The actual area proposed for this (and all) deferrals may not fully represent the area in which bowhead whales are traditionally hunted, or in which disturbance to these whales may impact subsistence hunting. The recommendations of the AEWC and the North Slope Borough should be considered in refining the boundaries for these deferrals.

Alternative IV would reduce potential conflicts between bowhead whale subsistence hunters and offshore oil and gas operations by removing an area of 200,000 acres in waters near Cross Island (two percent of the sale area). The deferral area is used by bowhead whales for migration and possibly feeding, and is within the traditional hunting areas of the village of Nuiqsut.

Alternatives V and VI would reduce potential conflicts between bowhead whale subsistence hunters and offshore oil and gas operations by removing an area of 400,000 acres in waters north and east of the Kaktovik (four percent of the sale area). The deferral area is used by bowhead whales for migration and feeding, and is within the traditional hunting areas of the village of Kaktovik.

We remain concerned over the individual and cumulative effects of oil and gas activity on the Western Arctic population of bowhead whales. The MMS has responded to these concerns in its environmental studies program; researching many issues and providing decision makers with important data. NMFS, through the Marine Mammal Protection Act, has required comprehensive monitoring of oil and gas activities which result in the incidental take by harassment of bowhead whales and other marine mammals. The issue of industrial noise and its impact on marine mammals, especially bowhead whales, remains a subject of debate and concern. Traditional Native experience has found bowhead whales react strongly to such noise, avoiding seismic sources at distances up to 35 miles. However, research into this matter has provided data which do not suggest avoidance reactions are strong enough to yield population-level impacts to bowheads. Despite problematical limitations in these studies and their relatively brief duration, we feel they support a decision to allow OCS lease sales in the Beaufort Sea, supported by a comprehensive monitoring effort. Both MMS and NMFS (through the small take authorization program) have interests here and we are hopeful future monitoring will extend the information gathered through past research.

This is the first time MMS has written a multi-sale EIS for the Alaskan Outer Continental Shelf. NMFS believes meeting NEPA requirements through this approach is reasonable, although the Environmental Assessments for future sales in the Beaufort Sea must be written carefully and fully document individual and cumulative impacts. One of the most contentious, and potentially harmful, activities associated with leasing of the Beaufort Sea OCS has been marine geophysical (seismic) exploration. These high-energy, low-resolution surveys employ multiple vessels operating an energy source which introduces very high noise levels into the water. NMFS has worked extensively with industry, MMS, the North Slope Borough of Alaska, the Alaska Eskimo Whaling Commission, and the communities of the North Slope of Alaska in the processing of incidental take permits under the Marine Mammal Protection Act for these seismic actions. The potential for seismic activity to disturb (harass) bowhead whales has now been demonstrated through research and monitoring. Displacement of migrating bowhead whales or heightened sensitivity to noise may, in turn, adversely impact traditional subsistence use of these whales by Alaska Natives. While these effects are discussed to a degree in the DEIS (e.g., under the effects of noise on bowhead whales section), geophysical exploration through low-resolution seismic is not specifically documented as one of the actions associated with these lease sales. We believe it is necessary to provide additional detail on this activity, particularly as it concerns the cumulative effects of OCS leases in the Beaufort Sea and any impacts to marine mammals. Just as the DEIS provides projections of the number of exploration wells, production fields, and production platforms for each sale, it should also provide similar information as to geophysical seismic research.

In accordance with the procedures outlined in the May 12, 2002, letter from Rolland A. Schmitten, Director of the Office of Habitat Conservation for NMFS to Thomas A. Readinger, Associate Director for Offshore Minerals Management, MMS has provided information on Essential Fish Habitat (EFH). The DEIS never clearly states whether or not the actions proposed would adversely affect EFH. The trigger for EFH consultation is a Federal action agency's determination that an action may adversely affect EFH. If a Federal action agency determines that an action will not adversely affect EFH, no consultation is required, and the Federal action agency is not required to contact NMFS about their determination. NMFS believes that while the exploration, development and production scenarios generated by MMS are plausible, possible adverse effects to EFH should be identified on a project specific basis. Therefore, no further EFH consultation is necessary at this time. The need for additional EFH consultation should be determined as specific projects are designed.

Specific Comments

Pg I-10, I.C.2.b(1). The second paragraph here indicates the Secretary has previously removed from leasing sections of the Beaufort Sea OCS west of the Barrow deferral area (Alt. III). This represents a positive action by the MMS which responds to concerns over bowhead whales and traditional hunting practices. We believe, then, the area mentioned should be identified in Map 3 and included in the discussion of deferrals.

Pg. I-10, I.C.2.b(2). This defends the need to lease blocks near Cross Island based, apparently, on preventing adjacent State of Alaska tracts from draining oil reserves from Federal OCS areas. This matter should be adjudicated through the courts, and does not seem to be justification for leasing.

Pg.II-11. II.H.1.c. The DEIS does not adequately assess the potential impacts of additional causeways. Therefore, we would consider the DEIS deficient if the proposed activities include additional causeways.

The individual and cumulative effects of causeways on coastal fisheries has long been the focus of controversy. The debate centers on fish passage around the structures and possible adverse changes to habitat which may impact population productivity. Changes to habitat (i.e. changes in temperature and salinity regimes) have been documented to occur as a result of causeway induced deflections of currents and entrained waters away from the coast.[1]

---

[1]. Thorsteinson, L.K., L.E. Jarvela, and D.A. Hale. November 1990. Arctic Fish Habitat Use Investigations: Nearshore Studies in the Alaskan Beaufort Sea, Summer 1988. U.S. Dept. of Commerce and U.S. Dept. of Interior, OCSEAP Final Report, 71: 349-485.

Regardless of whether or not these changes have biological significance, there is implicit agreement that preserving the integrity of the warmer, brackish coastal boundary layer during summer months is crucial in sustaining the biota of the region. We consider the brackish nearshore corridor critical to the success of marine and anadromous fish stocks. In addition, freshwater flows from coastal rivers and streams are important to the creation of the brackish warm zone, and it is essential to sustain natural flows to avoid impacts.

Therefore, we believe that Stipulation No. 3, Transportation of Hydocarbons, should be modified to reflect the MMS's position regarding causeways. This would clarify that no new causeways would be constructed. Extensive causeways have many undesirable impacts on nearshore processes and resources and should be prohibited outright.

Pg.II-12. II.H.1.d. We recommend the third sentence in the second paragraph here, beginning with "Scientific studies" be replaced with the following statement: Monitoring studies of 3-D seismic exploration (6-18 airguns totaling 560-1500 c.i.) in the nearshore Beaufort Sea during 1996-1998 have demonstrated that nearly all bowhead whales will avoid an area within 20 km of an active seismic source, while deflection may begin at distances up to 35 km.

Pg. II-15. II.H.2.a. Stipulations 6a and 6b provide that permanent facilities within 10 miles of Cross Island should not preclude "reasonable subsistence access" to whales. Earlier in the DEIS we learn that noise from such facilities must comport with the small take authorization program under the MMPA. The regulations for that program require these takes "will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses." We recommend that Stipulations 6a and 6b adopt this language in order to bring consistency among these efforts and to clarify intent.

Pg. III-37. III.B.4a(1). The first paragraph on this page mentions the possibility that bowhead whales may occupy the northeastern portion of the Chukchi Sea more often than previously thought, and that these whales may occur regularly along the northwestern coast during summer. Monitoring during the towing of the Steel Drilling Caisson drill rig during summer of 2002 recorded five bowhead whales off Point Barrow on July 21, further supporting these findings.

Pg. III-40. III.B.4.a(1) It is more than unfortunate the final report of the bowhead whale feeding study is not included within this discussion, or available for planning purposes. This multi-year effort represents a comprehensive research effort intended to identify and characterize the use of the eastern Beaufort Sea as feeding habitat for bowhead whales, and to place some perspective on the importance of that habitat. NMFS personnel participated in the Scientific Review Board for this work, and a draft final report on the study was released in December of 2001. We strongly encourage MMS to complete this important work and incorporate its conclusions and data into the final NEPA document.

Pg. IV-4. IV.A.1. The significance threshold described here for threatened or endangered species should be considered further. We believe it is unreasonable to limit this to effects lasting a generation or more; particularly for long-lived animals such as the bowhead whale with a life span possibly exceeding 100 years. Would an activity that displaces bowheads from a traditional feeding area for 50 years then be considered insignificant?

Pg. IV-5. IV.A.2.B. The projections are that a maximum of two drilling rigs would operate at any time under Sale 195 (and one for Sale 202). Are these estimates specific to those sales, or is this an absolute maximum? In other words, could we see two rigs drilling on Sale 195 tracts, and another drilling a Sale 202 tract?

Pg. IV-6. IV.A.2.b(1)(a). As previously stated, we recommend the final EIS present additional discussion on geophysical seismic research, in addition to the site survey seismic work described here.

Pg. IV-13. IV.A.4.a. The spill modeling assumes the oil will be similar to Alaska North Slope crude oil. How typical is this? We understand that Northstar crude is markedly different than that from the Prudhoe Bay field. Is it logical to assume offshore oil from newly developed reservoirs would be more similar to North Slope crude?

Page IV-10. IV.A.2.b(3). Information on the impacts of dredging needs to be included or referenced in this section. While suspended sediments per se have very low direct toxicity values, the composition of sediments should be tested prior to assessing the potential impacts from dredging. In Norton Sound, for example, nearshore sediments contain high background levels of mercury and other metals. Dredging activities may resuspend such materials and make them available to aquatic organisms, with resultant adverse effects.

Page IV-13. IV.A.4.a. On page IV-3, the DEIS states the analyses presented consider whether the mitigation that is proposed as part of the project can reduce or eliminate all or part of the potential adverse effects. Here, however, the analysis of large oil spills assumes there is no clean up or containment. This seems illogical, as oil spill response and preparedness are very much part of the mitigative measures directed at OCS activities.

Page IV-15. IV.A.6. This section should also include a description of dispersants and any considerations or restrictions on their use in the Beaufort Sea.

Page IV-16. IV.A.6.a. Please provide further description of the experience(s) of using the described small-vessel skimming system "successfully" in Cook Inlet amid broken ice.

Page. IV-16. IV.A.6.c. The stated response technology for a spill occurring during late fall freeze-up is to allow the spill to freeze in place, then mining the oil from the pack ice. Is there any reasonable prediction of the efficiency of this technology, or examples of its testing or actual use?

Page IV-21. IV.C.1.a(1). The DEIS states that trace metals would be added to the water by drilling muds and cuttings. It further states that the Environmental Protection Agency (EPA) prohibits the discharge of drilling muds and cuttings in less than 5 meters. Additional discussion regarding the dispersion of these pollutants and the ability to meet water quality criteria at the edge of mixing zones seemingly dismiss the possible impacts from these pollutants. What would be the impact if these pollutants from exploratory activity were re-suspended during activities such as dredging for subsea pipelines? MMS should consider putting this information in their "Information to Lessees" and encourage lessees to discharge of such materials downhole whenever possible.

Page IV-22-23. IV.C.1.a(3). This section discusses the effects of permitted discharges of produced waters. While it is noted that to date for exploration, the EPA has prohibited the discharge of formation waters into waters of less than 10 meters, the section does provide information on the maximum amount of oil and grease in produced waters over the next 21 years. The document goes on to state that if produced waters were discharged for a project, "the effect on water quality would be local, but would last over the life of the field." What would be the cumulative impacts for all the proposed exploration and development projects for all three leases? Also, what kind of impacts could be expected inside the "mixing zone"? By contrast an entire section is spent describing the probable effects of an accidental oil spill on various resources. Should an oil spill occur, presumably it would be a one time event. A discharge of production waters would occur on a consistent basis. What would this mean to resources and habitat?

Page IV-144. IV.C.11.b(3). NMFS is supportive of Stipulation 4, and believe such monitoring is necessary to fully assess the effects of OCS actions on bowhead whales. However, we feel the first sentence on this page (This stipulation helps to reduce effects to subsistence-harvest patterns and to the overall socio-cultural systems which place special value on the bowhead whale harvest and the sharing of this harvest with other members of the community) overstates the benefits of this monitoring. The statement that this stipulation is considered to be a positive action by he Native community under environmental justice should be referenced.

It is not clear why Stipulation 6 is presented in two parts, a and b. Would both apply?

Page IV-146. IV.C.11.c(1)(a). The DEIS states in the second paragraph that potential disturbances to bowhead whales from seismic operations would be limited to areas west of Cross Island, because of the provisions of (past and existing) conflict avoidance agreements. The DEIS should consider that these agreements are primarily for the protection of the subsistence hunt. These agreements often allow for seismic work to proceed once a village has reached its quota, after which the potential for seismic to disturb these whales may be very high.

Page IV-219. IV.I.2.k(1). In describing the potential effects of an oil spill on subsistence uses, this analysis very correctly states that there would be long term effects, often based in part on the perception that a marine mammal could be tainted. This analysis may be somewhat flawed in basing discussions on the results of the oil spill model, which estimates the chance of an oil spill contacting a particular environmental resource, such as Point Barrow. This approach may not fully account for seals and whales which move among these resource areas. If a seal became oiled near Cross Island, and was harvested near Barrow some time later, subsistence use of the area would certainly be affected even though no oil had contacted that resource area.

Page V-1. V. Cumulative Effects. This section seems to confine its analysis to other oil and gas projects, rather than the cumulative impacts of the lease sales when added to <u>all</u> other past, present, and foreseeable future actions.

Page V-5. V.A.7. We believe that repeated exposure of migrating bowhead whales to noise sources may be an example of synergistic impact. While whales may avoid a source by moving further offshore before resuming their normal course, and may make such avoidance movements around several sources (additive impact), there may be a point at which the whales remain offshore after exposure to multiple sources, even once the source is no longer present. Given the many potential noise sources associated with exploration, development, and production on the Beaufort Sea OCS, Natives and scientists have considered this a real possibility.

Page V-28. V.C.5.a(1)(b). The FEIS should present an expanded discussion of development and exploration within the Canadian Beaufort, particularly off the McKenzie delta, as well as vessel movement into and out of Canadian waters necessary to support activities within the Alaskan Beaufort Sea OCS. Expansion of the Canadian fleet to support U.S. development would present several concerns with respect to bowhead whales and subsistence hunting, as late season traffic in the eastern Beaufort Sea would be most likely to encounter, and harass, these whales.

APPENDIX H

FR NOTICE OF JUNE 19, 2002
COMMENTS TO DEIS
AND
LISTING OF E-MAIL

List of Items in Appendix H

Federal Register Notice of June 19, 2002

Comment Letters Received

DEIS Public Hearing Attendees

Information about E-Mail Comments Received to the Draft EIS.

DATES: The meeting will take place June 20, 2002, from 9:00 am to 4:45 pm ET, and June 21, 2002, from 8:30 am to 11:45 am ET.

ADDRESSES: Ritz-Carlton Washington, DC, 1150 22nd Street, NW., Washington, DC 20037.

PUBLIC COMMENTS: The meeting agenda will be posted at *http://www.bioethics.gov.* Written statements may be submitted by members of the public for the Council's records. Please submit statements to Ms. Diane Gianelli (tel. 202/296–4669 or e-mail info@bioethics.gov). Persons wishing to comment in person may do so during the hour set aside for this purpose beginning at 3:45 p.m. ET on Thursday, June 20, 2002. Comments will be limited to no more than five minutes per speaker or organization. Please give advance notice of such statements to Ms. Gianelli at the phone number given above and be sure to include name, affiliation, and a brief description of the topic or nature of the statement.

FOR FURTHER INFORMATION CONTACT: Diane Gianelli, 202/296–4669, or visit our website at *http://www.bioethics.gov.*

Dated: June 11, 2002.

Dean Clancy,

Executive Director, The President's Council on Bioethics.

[FR Doc. 02–15350 Filed 6–18–02; 8:45 am]

BILLING CODE 4110–60–P

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Administration for Children and Families

[Program Announcement No. OCS–2002–10]

Request for Applications Under the Office of Community Services' Fiscal Year 2002 Community Economic Development Program

AGENCY: Office of Community Services (OCS), Administration for Children and Families Department of Health and Human Services.

ACTION: Correction and Clarification.

SUMMARY: This document clarifies and corrects the notice that was published in the **Federal Register** on Tuesday, May 28, 2002, Part IV (67 FR 37274). It corrects a telephone number and the spelling of a street name address. It clarifies the notice by removing subsection points for Criterion VI: Project Evaluation. Also, it clarifies that references to Sub-priority Areas 1.5 and 1.6 in Attachment K, "Guidelines for a Business Plan" do not apply to any Priority Areas for this announcement.

FOR FURTHER INFORMATION CONTACT: Kathren Turner at (202) 260–5683 or the OCS Operation Center at 1–800–281–9519 for referral to the appropriate contact person in OCS for programmatic questions or send an e-mail to *OCS@lcgnet.com.*

Corrections

In the **Federal Register** issue of May 28, 2002 (67 FR 37274), on page 37274, third column, remove "FOR GENERAL QUESTIONS ON THE ANNOUNCEMENT, CONTACT: Mr. Ros Relaford, Technical Assistance Manager, OCS Operations Center, Call: 1–800–281–9516, or E-mail: *OCS@lcgnet.com*" and add: "FOR GENERAL QUESTIONS ON THE ANNOUNCEMENT, CONTACT:" Mr. Ros Relaford, Technical Assistance Manager, OCS Operations Center, Call: 1–800–281–9519, or E-mail: *OCS@lcgnet.com*".

Also, in the **Federal Register** issue of May 28, 2002 (67 FR 37274), on page 37274, in the first column, under "Application Submission", *Mailing and Delivery Address*:, 4th line, in the second column, 2nd paragraph, 8th line, under *Submission Instructions*; and in the 3rd column, under "For A Copy Of Announcement, Contact:" 2nd line, remove "Fort Meyer Drive", and replace with "Fort Myer Drive".

Clarifications

In the **Federal Register** issue of May 28, 2002 (67 FR 37274), on page 37285, remove all the points under the subsections (1–4) as found under "Criterion VI; Project Evaluation"; that is column 2, end of 2nd paragraph of subsection (1), remove "(0–2 points)"; end of subsection (2), remove "(0–2 points)"; column 2, end of paragraph 1, subsection (3), removed "(0–2 points)"; and column 3, end of subsection (4), remove "(0–2 points)".

In the **Federal Register** issue of May 28, 2002 (67 FR 37274), under Attachment K, "Guidelines for a Business Plan," on page 37307, beginning of the second paragraph of the third column and ending on page 37308, end of third column, sections that reads "Applicable to Sub-priority Area 1.5 Only," "Applicable to Sub-priority Area 1.6 only", "Applicable to Sub-priority 2.1" and "e. Significant Beneficial Impact and Other Criteria," do not apply to any Priority Area in this notice.

Dated: June 9, 2002.

Clarence Carter,

Director, Office of Community Services.

[FR Doc. 02–15390 Filed 6–18–02; 8:45 am]

BILLING CODE 4184–01–M

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

Food Advisory Committee Meeting; Cancellation

AGENCY: Food and Drug Administration, HHS.

ACTION: Notice.

SUMMARY: The Food and Drug Administration (FDA) is canceling the meeting of the Food Advisory Committee scheduled for June 20 and 21, 2002. This meeting was announced in the **Federal Register** of May 30, 2002 (67 FR 37844).

FOR FURTHER INFORMATION CONTACT: Constance J. Hardy, Center for Food Safety and Applied Nutrition (HFS–811), Food and Drug Administration, 5100 Paint Branch Pkwy., College Park, MD 20740, 301–436–1433, or FDA Advisory Committee Information Line, 1–800–741–8138 (301–443–0572 in the Washington, DC area), code 10564.

Dated: June 13, 2002.

William K. Hubbard,

Senior Associate Commissioner for Policy, Planning, and Legislation.

[FR Doc. 02–15488 Filed 6–14–02; 4:15 pm]

BILLING CODE 4160–01–S

DEPARTMENT OF THE INTERIOR

Minerals Management Service (MMS)

Outer Continental Shelf (OCS), Alaska OCS Region

AGENCY: Minerals Management Service, Interior.

ACTION: Notice of Availability of the Draft Environmental Impact Statement (EIS) for the Proposed Oil and Gas Lease Sales in the Beaufort Sea, Alaska.

SUMMARY: MMS announces the availability of the draft EIS prepared by MMS for the Proposed OCS Lease Sales 186 (2003), 195 (2005), and 202 (2007) offshore Beaufort Sea, Alaska.

DATES: Comments on the draft EIS are due September 20, 2002. Public hearings will be held in Alaska: Barrow, July 22, 2002; Nuiqsut, July 24, 2002; Kaktovik, July 26; 2002; and Anchorage, July 30, 2002.

FOR FURTHER INFORMATION CONTACT: Minerals Management Service, Alaska OCS Region, 949 East 36th Avenue, Anchorage, Alaska 99508–4363, Atttention: Mr. Paul Lowry, telephone: (907) 271–6574 or toll free 1–800–764–2627.

SUPPLEMENTARY INFORMATION: This draft EIS assesses three lease sales in the Proposed Final 2002–2007 5-Year Oil and Gas Leasing Program for the Beaufort Sea OCS Planning Area. Sale 186 is scheduled for 2003; Sale 195 for 2005; and Sale 202 for 2007. Federal Regulations (40 CFR 1502.4) suggest analyzing similar or like proposals in a single EIS. The proposal for each sale is to offer 1,877 whole or partial lease blocks in the Beaufort Sea Planning Area, covering about 9.8 million acres (3.95 million hectares) for leasing. The proposed sale area is seaward up to 60 miles offshore of the State of Alaska submerged land boundary in the Beaufort Sea. It extends from the Canadian border on the east to near Barrow, Alaska, on the west.

EIS Availability: Persons interested in reviewing the Draft EIS "OCS EIS/EA, MMS 2002–29" (Volumes I and II) can contact the MMS Alaska OCS Region. The documents are available for public inspection between the hours of 8 a.m. and 4 p.m., Monday through Friday at: Minerals Management Service, Alaska OCS Region, Resource Center, 949 East 36th Avenue, Room 330, Anchorage, Alaska 99508–4363, telephone: (907) 271–6070, or (907) 271–6621, or toll free at 1–800–764–2627. Requests may also be sent to MMS at *akwebmaster@mms.gov.* You may obtain single copies of the draft EIS, or a CD/ROM version, or the Executive Summary from the same address. The Executive Summary (MMS 2002–30) is available in English or Native Inupiat languages.

You may look at copies of the draft EIS in the following libraries:

Alaska Pacific University, Academic Support Center Library, 4101 University Drive, Anchorage, Alaska;
Alaska Resources Library and Information Service, U.S. Department of the Interior, 3150 C Street, Suite 100, Anchorage, Alaska;
Alaska State Library, Government Publications, State Office Building, 333 Willoughby, Juneau, Alaska;
Canadian Joint Secretariat Librarian, Inuvikon Northwest Territories, Canada;
Department of Indian and Northern Affairs, Yellowknife, Northwest Territories, Canada;
Fairbanks North Star Borough, Noel Wien Library, 1215 Cowles Street, Fairbanks, Alaska;
George Francis Memorial Library, Kotzebue, Alaska;
Ilisaavik Library, Shishmaref, Alaska;
Juneau Public Library, 292 Marine Way, Juneau, Alaska;
Kaveolook School Library, Kaktovik, Alaska;
Kegoyah Kozpa Public Library, Nome, Alaska;
North Slope Borough School District, Library/Media Center, Barrow, Alaska;
Northern Alaska Environmental Center Library, 218 Driveway, Fairbanks, Alaska;
Tikigaq Library, Point Hope, Alaska;
Tuzzy Consortium Library, Barrow, Alaska;
University of Alaska Anchorage, Consortium Library, 3211 Providence Drive, Anchorage, Alaska;
University of Alaska Fairbanks, Elmer E. Rasmuson Library, Government Documents, 310 Tanana Drive, Fairbanks, Alaska;
University of Alaska Fairbanks, Geophysical Institute, Government Documents, Fairbanks, Alaska;
University of Alaska Fairbanks, Institute of Arctic Biology, 311 Irving Building, Fairbanks, Alaska;
University of Alaska, Southeast, 11120 Glacier Highway, Juneau, Alaska;
U.S. Army Corps of Engineers Library, U.S. Department of Defense, Elmendorf Air Force Base, Anchorage, Alaska;
U.S. Fish and Wildlife Service Library, 1011 East Tudor Road, Anchorage, Alaska;
Valdez Consortium Library, 200 Fairbanks Street, Valdez, Alaska;
Z.J. Loussac Library, 3600 Denali Street, Anchorage, Alaska.

Public Hearings Public hearings on the draft EIS will be held at the following locations on the dates and times listed:

Barrow, Alaska, Monday, July 22, 2002, Inupiat Heritage Center, Multipurpose Room, 7–9 p.m.
Nuiqsut, Alaska, Wednesday, July 24, 2002, Kisik Community Center, 7–9 p.m.
Kaktovik, Alaska, Friday, July 26, 2002, Quargi Community Center, 7–9 p.m.
Anchorage, Alaska, Tuesday, July 30, 2002, 949 East 36th Avenue, 3rd Floor 4–7 p.m.

An Inupiat translator will be available at the public hearings held in Barrow, Kaktovik, and Nuiqsut.

Oral and written comments on the draft EIS will be addressed in the final EIS. If you wish to testify at a hearing, you may register prior to the hearing to schedule a preferred time by contacting the Alaska OCS Region at the above address or Mr. Paul Lowry at (907) 271–6574 or toll free 1–800–764–2627 not later than 5 days prior to the hearing date. Every effort will be made to accommodate individuals who have not pre-registered to testify. Time limitations may make it necessary to limit the length of oral statements to 10 minutes. You may supplement an oral statement with a more complete written statement and submit it to a hearing official at the hearing or by mail until September 20, 2002. Each hearing will recess when all speakers have had an opportunity to testify. If, after the recess, there are no additional speakers, we will adjourn the hearing immediately after the recess. Written statements submitted at a hearing will be considered part of the hearing record. If you cannot attend the hearings, or if you prefer, you may submit your comments in writing to the address below.

Written Comments MMS requests interested parties to submit their written comments on this draft EIS to the Regional Director, Alaska OCS Region, Minerals Management Service, 949 East 36th Avenue, Room 308, Anchorage, Alaska 99508–4363. Our practice is to make comments, including the names and home addresses of respondents, available for public review. An individual commenter may ask that we withhold their name, home address, or both from the public record, and we will honor such a request to the extent allowable by law. If you submit comments and wish us to withhold such information, you must state so prominently at the beginning of your submission. We will not consider anonymous comments, and we will make available for inspection in their entirety all comments submitted by organizations or businesses or by individuals identifying themselves as representatives of organizations or businesses. The comment period ends on September 20, 2002.

Dated: May 29, 2002.

Thomas A. Readinger,

Associate Director for Offshore Minerals Management.

Dated: May 30, 2002.

Terrence N. Martin

Acting Director, Office of Environmental Policy and Compliance.

[FR Doc. 02–15392 Filed 6–18–02; 8:45 am]
BILLING CODE 4310–MR–P

DEPARTMENT OF THE INTERIOR

National Park Service

Application Guidelines for the Rivers, Trails, and Conservation Assistance Program

AGENCY: National Park Service, Department of the Interior.

ACTION: Guidelines for States, local governments and non-profit organizations wishing to receive National Park Service assistance for

Comment Letters Received

Log #	Commentor	Dated	From
L-0001	Mayor, NSB	7/22/02	Barrow, AK
L-0002	Executive Director, AEWC	7/22/02	Barrow, AK
L-0003	No. AK Environmental Ctr.	7/30/02	Fairbanks, AK
L-0004	The Ocean Conservancy	7/26/02	Anchorage, AK
L-0005	Ben Kostival	8/2/02	Rockland, ME
L-0006	ICAS, J. Q. Patkotak	undated	Barrow, AK
L-0007	Pam and Wallace Taylor	8/18/02	Marion, IA
L-0008	William L. Risser	8/26/02	Houston, TX
L-0009	Reggie Joule	9/4/02	Juneau, AK
L-0010	Kathleen Roberts	9/9/02	Chestertown, NY
L-0011	Kimberly Donovan/Bruce Hazen	9/12/02	Ellwood City, PA
L-0012	John Strasenburgh	9/12/02	Talkeetna, AK
L-0013	Terry Cummings	9/16/02	Anchorage, AK
L-0014	K. A. Havlena	9/14/02	Baywood Park, CA
L-0015	K. A. Beckwith	9/14/02	Los Alamitos, CA
L-0016	Jim Havlena	9/14/02	Los Osos, CA
L-0017	Manika Schultz, + others	9/19/02	Indianapolis, IN
L-0018	Jenny Jacobs	9/15/02	Dundee, FL
L-0019	Amy and Chris Gulick	9/15/02	North Bend, WA
L-0020	Alaska Oil & Gas Assc. (FAX)	9/20/02	Anchorage, AK
L-0021	The Ocean Conservancy	9/20/02	Anchorage, AK
L-0022	Greenpeace	9/20/02	Anchorage, AK
L-0023	National Marine Fisheries Service	9/6/02	Washington, DC
L-0024	State of Alaska, DGC	9/20/02	Juneau, AK
L-0025	Pam A. Miller	9/20/02	Anchorage, AK
L-0026	Environmental Defense	9/18/02	Oakland, CA
L-0027	Nancy & Sebastian Sommer	9/18/02	Wenston-Sallem, NC
L-0028	Elizabeth MacGoway	9/18/02	San Francisco, CA
L-0029	The Ocean Conservancy	9/23/02	Anchorage, AK
L-0030	Alexandra Howells	9/17/02	Berkeley, CA
L-0031	George L. Pettit	9/19/02	San Jose, CA
L-0032	Sierra Club, Alaska Task Force	9/17/02	San Francisco, CA
L-0033	Alaska Oil and Gas Assc.(ltr.)	9/20/02	Anchorage, AK
L-0034	Executive Director, AEWC	9/20/02	Barrow, AK
L-0035	Mayor, NSB	9/20/02	Barrow, AK
L-0036	John Van Syoc, Sr.	9/25/02	Grants Pass, OR
L-0037	Fish and Wildlife Service	9/30/02	Anchorage, AK
L-0038	EPA	10/3/02	Seattle, WA
L-0039	Carol Ampel	9/10/02	Medford, OR
L-0040	Robert Franz	9/2/02	Plymouth Mtg., PA

Actual comment letters received and MMS responses are found in Section VII.

DEIS Public Hearing Attendees

* indicates if testified

Nuiqsut, July 24, 2002
Lloyd Ipalook, Sr.
Lloyd Ahvakana
Lucy S. Ahvakana
Jaeb Woods
J. K. Thomas Ahtuangaruak
Lucy Nukapigak
Clyde Sielak
Chris Long
Sarah Helms*
Donald Taleak
David Kasak, Sr.*
Lorraine Akpik
David Kasak, Jr.
Paul Kittick
Lucy Ericklook
Hattie Long
Emily Wilson
James Taalak
Eli Nukapigak*
Ruth Nukapigak*
Frank K. Long, Jr.*
Abraham Woods
Rosie Kaigelak
Willie Sielak, Jr.
Joseph Akpik*
Emily Panigeo
Isaac Nukapigak
Geoff Carroll*
Kenneth Taleak
Sarah Kunaknana*
Susie Kunaknana
Alice Ipalook

Kaktovik, July 26, 2002
Isaac Akootchook*
Susie Akootchook*
Lillian Akootchook*
Daniel Akootchook
Merylin Traynor*
Millie Aishanna

Kaktovik, July 26, 2002 (Continued)
Robert Thompson*
Lon Sonsalla*
Roy Akootchook, Sr.
George Akootchook

Anchorage, July 30, 2002
Bob Weienhold*
Jeremy Miller*
Jim Sykes*
Jessica Cochran
Pam A. Miller*
Jim Tate
Rose Ragsdale
Jenna App*
T. N. Obermeyer*
John Goll
Kate Wedemeyer
Jim Lima
Dick Newman
Frank Wendling

Barrow, August 1, 2002
Diana Gish
Charles Hopson*
Alfrieda Lord*
Tom Browich
Loretta Kenton
Murrell Niashoalod
Mary Lou Leavits
Bertha Leavits
May Akpik*
Todd O'Hara*
Robert Snydam*
Neil Bjornsted*
Bill Tegoseak*
Margaret Tegoseak
Walter Akpik, Jr.
Ralph Davis
Thomas Brower, III*

Information about E-Mail Comments Received to the Draft EIS

Representative copies of e-mail comments received are found in VII.F.

Log #	Name	Location
	8/1/02	
E-0001	Mr. and Mrs. J. L. Denison	Long Beach, CA
E-0002	Rodney E. Parlee	Bolton, CT
	8/2/02	
E-0003	Sergio Monteiro	Los Angeles, CA
	8/4/02	
E-0004	William B. Upholt	West Hartford, CT
	8/5/02	
E-0005	Peter and Naomi Rimbos	Maple Valley, WA
	8/25/02	
E-0006	Elissa Broekema	Anchorage, AK
	9/9/02	
E-0007	Marie Antobenedetto	Natick, MA
E-0008	Frank & Ellen Gallagher	unknown
E-0009	Susan Petersen	Eureka, CA
	9/10/02	
E-0010	Kathleen Roberts	Chestertown, NY
E-0011	James Bender	OR
E-0012	Steven E. Slap	Springfield, MA
	9/12/02	
E-0013	Steven Paulson	Sagle, ID
	9/13/02	
E-0014	Paul M. Konrad	Kulm, ND
E-0015	Scott J. Hed	Sioux Falls, SD
E-0016	Helaine Lerner	New York, NY
E-0017	Tina Herowitz	Philadelphia, PA
E-0018	Patrick Raitt	Silver Spring, MD
E-0019	Chris Krackeler	Arlington, VA
E-0020	Jayne Goocher	Pensacola, FL
E-0021	Craig Pendleton	Kingston, WA
E-0022	Partick Raitt	Takoma Park, MD
E-0023	Mike Stephen	St Joe, AR
E-0024	Sufi Williams	West Linn, OR
E-0025	Melissa Mutter	Dayton, OH
E-0026	Eric Walter	Seattle, WA
E-0027	Jeremy Pearl	Soquel, CA
E-0028	Tonatiuh Trejo	Marina, CA
E-0029	Ken Wanderman	Marina, CA
E-0030	Lucy Joyce	Brooklyn, NY
E-0031	Michael Buist	Denver, CO

Log #	Name	Location
E-0032	Jason Ulrich	St. Paul, MN
E-0033	Steve Jones	Kansas City, MO
E-0034	Robert Anthony	Grand Junction, CO
E-0035	Sharon O'Hara	Greenfield, WI
E-0036	Santiago Munne	Hoboken, NJ
E-0037	Terry Palin	Staten Island, NY
E-0038	Julie Dennis	Santa Cruz, CA
E-0039	Jon Riendeux	Ventura, CA
E-0040	Donald Niren	Whittier, CA
E-0041	David Rouleau	Lakewood, CO
E-0042	Liza DiMartino	Harwood Heights, IL
E-0043	Suzanne Serio	Fair Lawn, NJ
E-0044	Deanna Wiener	St. Paul, MN
E-0045	Erika Sevetson	Madison, WI
E-0046	Carlos Florido	Petaluma, CA
E-0047	Barbara Kurtz	Lexington, IL
E-0048	Michelle Walker	Capitola, CA
E-0049	Lisa Onaga	Arlington, VA
E-0050	Suzanne Lipkin	Philadelphia, PA
E-0051	Rebecca Sutton	Berkeley, CA
E-0052	Keplin Schwick	Yreka, CA
E-0053	Susan Burns	Sausalito, CA
E-0054	Eleanor Burian-Mohr	Los Angeles, CA
E-0055	Lois White	Grants Pass, OR
E-0056	E. Karsten Smelser	Minneapolis, MN
E-0057	Trish Woodard	Shawnee, OK
E-0058	Shawn Nordell	St. Louis, MO
E-0059	Rhett Lawrence	Portland, OR
E-0060	Leah Jones	Reno, NV
E-0061	Benjamin Urquhart	Brooklyn, NY
E-0062	Gregg Schulze	San Francisco, CA
E-0063	Deb Barmichael	Phoenix, AZ
E-0064	Mark Aspelin	Las Cruces, NM
E-0065	Ron Thigpen	Releigh, NC
E-0066	Jen Motley	Womelsdorf, PA
E-0067	Lila Rogers	Hermosa Beach, CA
E-0068	Mary Fleury	Minneapolis, MN
E-0069	Mitsy Silva	Crestline, CA
E-0070	Ilona Gebhard	Albuquerque, NM
E-0071	Maria Scianna	San Jose, CA

Log #	Name	Location
E-0072	Pilar Garofalo	Los Angeles, CA
E-0073	Kathy Gillmore	Maumelle, AR
E-0074	Judith Hallberg	Middletown, NJ
E-0075	Laura Driscoll	Indianapolis, IN
E-0076	Giselle Smith	Fruita, CO
E-0077	Meva Armstrong	Bellingham, WA
E-0078	Janine Wengert	Newbury Park, CA
E-0079	Heidi Sevillano	Palmdale, CA
E-0080	Simone Morton	Aromas, CA
E-0081	Carol Norton	Glendale, AZ
E-0082	Nina Wouk	Menlo Park, CA
E-0083	Meredith Hariton	Missoula, MT
E-0084	Cheryl Rosenfeld	Columbia, MI
E-0085	Jonathan Beck	Portland, OR
E-0086	Tonya Newton	Falls Church, VA
E-0087	Eben Rosenberger	San Diego, CA
E-0088	Lori King	Nuevo, CA
E-0089	Doug Lagally	Madison, WI
E-0090	Nicholas Cymbol	Cockeysville, MD
E-0091	Jane Ball	Minnetonka, MI
E-0092	Susan McIntyre	Derby-Line, VT
E-0093	Susan Kendall	Patchogue, NY
E-0094	Maileen Chaparro	Queens Village, NY
E-0095	Michael Cunningham	Watsonville, CA
E-0096	Althea Thacher	Hagerstown, MD
E-0097	Betty Van Wicklen	Waterviet, NY
E-0098	Ronna Hills	Des Moines, IA
E-0099	Sandra Castro-Nguyen	Milpitas, CA
E-0100	Tom Ballard	Santee, CA
E-0101	JJ Eck	Chandler, AZ
E-0102	Jim Schaefer	New York, NY
E-0103	Laurie Brown	Powder Springs, GA
E-0104	Nick Lavely	Apple Valley, MI
E-0105	L. M. Stevens	Chicago, IL
E-0106	Steve Ulan	Maspeth, NY
E-0107	Gila Wdowinski	Laguna Beach, CA
E-0108	Michael Laird	New York, NY
E-0109	Renee Flower	Santa Cruz, CA
E-0110	June Muller	New York, NY
E-0111	Michelle Risley	Woodstock, GA
E-0112	Dale Anania	Berkeley, CA
E-0113	Bill Evans	Asheville, NC
E-0114	Amy Brzeczek	Tujunga, CA
E-0115	Rebecca Duerr	Davis, CA

Log #	Name	Location
E-0116	Joan Exum	OH
E-0117	Katharina Branch	Salem, OR
E-0118	Shaun Smakal	Byron, MI
E-0119	Sharon Wiebe	Evergreen Park, IL
E-0120	Mark Mauer	Los Angeles, CA
E-0121	Holly Hendrickson	Cambridge Springs, PA
E-0122	Erin Rasmussen	Portland, OR
E-0123	Darlene Sarver	Cincinnati, OH
E-0124	Cordelia Clancy	Santa Cruz, CA
E-0125	Cynthia Beckert	Studio City, CA
E-0126	Zoe Laird	New York, NY
E-0127	Sarah Downey	Des Moines, IA
E-0128	Kristin Reed	San Francisco, CA
E-0129	Ellen Spencer	Brooklyn, NY
E-0130	Lois Evron	Cedarhurst, NY
E-0131	Ernest Goitein	Atherton, CA
E-0132	Celeste Picco	New York, NY
E-0133	Rick Wilson	Aliso Viejo, CA
E-0134	Gina Ferrante	Phoenix, AZ
E-0135	Darcie Sinciline	Oakdale, PA
E-0136	Charles De Paola	Westbrookville, NY
E-0137	Irene Mills	Portland, OR
E-0138	Gustavo Sandoval	San Mateo, CA
E-0139	Sloan Matthews	Menlo Park, CA
E-0140	Beth Horwitz	Glenview, IL
E-0141	Richard DeBadts	Buffalo, NY
E-0142	Michele Di Candia	Pleasanton, CA
E-0143	Andrew Murawa	Claremont, CA
E-0144	Pierre Thavong	Elgin, IL
E-0145	Celeste Johanson	Redmond, WA
E-0146	Bonnie Barclay	Hollywood, CA
E-0147	Yvonne Langnese	San Jose, CA
E-0148	Deborah Verga	Saugas, CA
E-0149	Michael Lavely	White Bear Township, MN
E-0150	Saundra Pendleton	Kingston, WA
E-0151	Gwynne Bauer	Castle Rock, CO
E-0152	James Reid	Lexington, IL
E-0153	Kim Siebert	San Jose, CA
E-0154	Patrick Partridge	Nome, AK
E-0155	Bridget Manley	Los Angeles, CA
E-0156	Diane Dulmage	San Jose, CA
E-0157	Ingrid Leypoldt	Morrison, CO
E-0158	Suzy Wells	Owensboro, KY
E-0159	Joseph Morrissey	Vestal, NY

Log #	Name	Location
E-0160	Charlotte Brody	Chappaqua, NY
E-0161	Karin Moran	San Clemente, CA
E-0162	Sarah Medley	East Windsor, NJ
E-0163	Mercy Drake	Mesa, AZ
E-0164	Barney Schlinger	Los Angeles, CA
E-0165	Harriet Stucke	Philadelphia, PA
E-0166	Jenneffer Prajapati	San Jose, CA
E-0167	Donna Huffer	Columbus, OH
E-0168	Lynn Barris	Durham, CA
E-0169	John Gallo	Otega, NY
E-0170	Beth Couture	Chicago, IL
E-0171	David Athey	Brentwood, MD
E-0172	Phillip Gooch	Quantico, VA
E-0173	Linda Bescript	Tucson, AZ
E-0174	Kim Hunt	Napa, CA
E-0175	Rebecca Hewitt	Washington, DC
E-0176	Tamara Lischka	Portland, OR
E-0177	Jessica Manthey	Indio, CA
E-0178	Tenchi Hamaki	New York, NY
E-0179	Kellie Geldreich	Encinitas, CA
E-0180	Joanna Welch	Bryce Canyon, UT
E-0181	Kim Okamura	Los Angeles, CA
E-0182	Ellen Anderson	Anaheim, CA
E-0183	Laura Herndon	Burbank, CA
E-0184	Barbara Smith	Los Angeles, CA
E-0185	Jason Kramer	Philadelphia, PA
E-0186	Ben Pink	Oakland, CA
E-0187	Jennifer Monahan	San Francisco, CA
E-0188	Kaitilin Gaffney	Santa Cruz, CA
E-0189	Joanne Cooper	Bellevue, WA
E-0190	Chris Han	New York, NY
E-0191	Cory Champagne	Santa Rosa, CA
E-0192	Chunyan Chen	Jamestown, NC
E-0193	Margit Nusser	Poughkeepsie, NY
E-0194	Aaron Turner	Renton, WA
E-0195	Jillian Johnson	La Crescenta, CA
E-0196	Darlene Lendino	Sparks, NV
E-0197	Virginia Brown	Organ, NM
E-0198	Aghaghia Rahimzadeh	Trinidad, CA
E-0199	Jeanette Corsini	Prospect Park, NJ
E-0200	Linda Webb	Denver, NY
E-0201	Bob Mauritsen	Seattle, WA
E-0202	Jacquelyn Baetz	Albany, NY
E-0203	Barbara Cornett	Madisonville, TN

Log #	Name	Location
E-0204	Michael Tackett	Indianapolis, IN
E-0205	Stacy Gustyn	Rochester, NY
E-0206	Andrea Christy	Minneapolis, MN
E-0207	Holly Shellner	Denver, CO
E-0208	Val Huston	IL
E-0209	Lally Saucedo	Sacramento, CA
E-0210	Layah Soiferman	West Hills, CA
E-0211	Dagny SanMiguel	San Diego, CA
E-0212	Angela McKinney	Greenboro, NC
E-0213	David Matsuno	Anchorage, AK
E-0214	Matthew Whilcomb	Thornton, CO
E-0215	Amie Kraus	Petoskey, MI
E-0216	LuAnne Breeden	Leslie, MO
E-0217	Lorie Jean Barnes	Redding, CA
E-0218	John Mohler, III	Catonsville, MD
E-0219	Sheri Murphy	Lynnwood, WA
E-0220	July Kunz	San Francisco, CA
E-0221	Nancy Sullivan	Ft. Thomas, KY
E-0222	Eric Pihl	Arlington Heights, IL
E-0223	Diane Sklensky	Syracuse, NY
E-0224	Erika Shamo	Chicago, IL
E-0225	Margaret Schlicter	Medford, NJ
E-0226	Mim McNulty	Pacifica, CA
E-0227	Jesse Chastain	Thomasville, GA
E-0228	Dean Goodwin	San Francisco, CA
E-0229	Earl Lane	Hannibal, MO
E-0230	Greg Koch	Redding, PA
E-0231	Jason Koopman	East Lansing, MI
E-0232	Kathleen Huse	Van Nuys, CA
E-0233	Pat Testa	Kings Park, NY
E-0234	Nanette Mellgren	Apple Valley, MI
E-0235	Jason Yeager	Guerneville, CA
E-0236	Barb Pruett	Muncie, IN
E-0237	Sandra Mays	Lancaster, PA
E-0238	James O'Connor	Englewood, CO
E-0239	Gerald Marshall	Arvada, CO
E-0240	Alex Saunders	Danviile, CA
E-0241	Donelle Moewes	Seattle, WA
E-0242	Galen Galler	Tuscon, AZ
E-0243	Kerry O'Brien	Oakland, CA
E-0244	Jas Cheshire	Clementon, NJ
E-0246	Linda Nolte	San Diego, CA
E-0247	Richard Gabriel	Eugene, OR
E-0248	Brent Reitze	Fairfax, VA

Log #	Name	Location
E-0249	Lawrence Crowley	Louisville, CO
E-0250	Linda Bartlett	Crystal Lake, IL
E-0251	Jeremy Tabor	Westland, MI
E-0252	Laura Girardeau	Honolulu, HI
E-0253	Frederick Shenkman	Bronx, NY
E-0254	Eleanor Wireman	Richland, WA
E-0255	Sheri Archey	Salem, OR
E-0256	E. Harris	Carrboro, NC
E-0257	Sherry Carr	Arnold, CA
E-0258	Cynthia Reyes	Eureka, CA
E-0259	Shirley Biscotti	Bodega Bay, CA
E-0260	Briana Madden	CA
E-0261	Vinnie Zoccolante	Honolulu, HI
E-0262	Amy Hayes	Maryville, TN
E-0263	Paul Tuff	Salinas, CA
E-0264	Johnny Asia	Phoenicia, NY
E-0265	Scott Nichols	East Palo Alto, CA
E-0266	Spring Manju	Makawao, HI
E-0267	Carla Murray	Canton, IL
E-0268	Stewart Wilber	Lilburn, CA
E-0269	Ariele Belo	Seattle, WA
E-0270	Guru Sadhana Khalsa	Espanola, NM
E-0271	Erin Murphy	Bellingham, WA
E-0272	Walter Pike	Lansing, MI
E-0273	Jenny Widmer	Manhattan, KS
E-0274	Doris Reynolds	Oakland, CA
E-0275	Jennifer Joy Smith	San Francisco, CA
E-0276	Adam Massey	Boulder, CO
E-0277	Betty Combs	Londonderry, OH
E-0278	Patricia Maddox	Chicago, IL
E-0279	Richard Ormos	Marietta, GA
E-0280	Nancy Loeser	Bel Air, MD
E-0281	Shyla Raghav	Irvine, CA
E-0282	Sherry Arnold	Jackson, NJ
E-0283	Tara Byrne	Troy, MI
E-0284	Todd Broeker	Phoenix, AZ
E-0285	Caress Kiere	Redding, CA
E-0286	Barney McComas	San Diego, CA
E-0287	Bryan Thompson	Lisle, IL
E-0288	Debbie Baier	Clive, Iowa
E-0289	Shelia Wilson	South Pittsburg, TN
E-0290	Carole Sue Hess	Gaylord, MI
E-0291	Indra Zuno	Sherman Oaks, CA
E-0292	Vira Confectioner	Sunol, CA

Log #	Name	Location
E-0293	Delana Darrow	Ardmore, OK
E-0294	Sandra Cutter	Martinez, CA
E-0295	Gail Rance	Woodbury, NY
E-0296	Alexandra West	Bend, OR
E-0297	Linda Hes	Olmsted Twp., OH
E-0298	Stephanie West	Costa Mesa, CA
E-0299	Veronica Eckley	UT
E-0300	Bobbie Dee Flowers	New York, NY
E-0301	Kristofer Young	Oak View, CA
E-0302	Caroline Spitzka	Danville, CA
E-0303	Charity Prater	Portland, OR
E-0304	Sarah Hunnewell	Water Mill, NY
E-0305	Kristin Mayer	Ann Arbor, MI
E-0306	Paul Andrade	Berkeley, CA
E-0307	Lynn Styles	Santa Rosa, CA
E-0308	Fred Pospisil	Oak park, IL
E-0309	Myrna Caceres	New York, NY
E-0310	Elizabeth Roberts	Winnetka, IL
E-0311	Elizabeth Fleming	Washington, DC
E-0312	Dawn Wallace	Fair Oaks, CA
E-0313	Cheryl Kucsera	Silver Spring, MD
E-0314	Sue Avey	Gilroy, CA
E-0315	Steven Mercatante	Walled Lake, MI
E-0316	Mapel Howell	Holy Ridge, NC
E-0317	Cynthia H. P. Kennedy	Kailua-Kona, HI
E-0318	Laurie Polivy	Pacificia, CA
E-0319	Larry Smith	Laguna Hills, CA
E-0320	Amber Gaia	San Diego, CA
E-0321	Joseph Grather	Morris Plains
E-0322	June Keil	Escondido, CA
E-0323	Mary Tracy Slusser	Elmwood Park, IL
E-0324	Greg Woodruff	Radford, VA
E-0325	April Thompson	San Francisco, CA
E-0326	Julianna Krolak	Port Hueneme, CA
E-0327	Alan Olander	Nevis, MN
E-0328	Gary Barton	OH
E-0329	Elijah Woolery	Pacific Grove, CA
E-0330	Patricia Mackura	South Euclid, OH
E-0331	John Peterson	Thousand Oaks, CA
E-0332	Sheri Adler	Evanston, IL
E-0333	Neysa Linzer	Staten Island, NY
E-0334	Natalia Morales	Jackson Heights, NY
E-0335	LeAnn Hale	Goodlettsville, TN
E-0336	Mark Reif	Winchester, VA

Log #	Name	Location
E-0337	Ken & Dawn Mettler	Rockbridge, OH
E-0338	Barbara Gregorio	San Diego, CA
E-0339	Matthew Van Den Broeke	Valparaiso, IN
E-0340	Tina Johnson	Sacramento, CA
E-0341	Monika McDole	Bend, OR
E-0342	Elana Allen	Englewood, NJ
E-0343	Stefanie Collins	Norman, OK
E-0344	Martin Schreiber	Lake Oswego, OR
E-0345	Dan Perkins	Kingsford, MI
E-0346	Lulu Yu	Renton, VA
E-0347	Dan Samek	Albuqueraque, NM
E-0348	Roger Zimmerman	Santa Maria, CA
E-0349	Murguerite Lovett	Long Beach, CA
E-0350	Morgen Raney	Lawton, OK
E-0351	Pamela A. Taylor	North Ferrisburgh, VT
E-0352	Janine Perlman	Alexander, AR
E-0353	Tamara Daugherty	York, PA
E-0354	Nancy Miller	Prescott, AZ
E-0355	Matt Walker	Atlanta, GA
E-0356	Robert Field	Santa Cruz, CA
E-0357	Kristen Allbritton	Fayetteville, AR
E-0358	Christina Fullard	Waycross, GA
E-0359	Marie Walz	Olney, MD
E-0360	Jennifer Harding	Boulder, CO
E-0361	Christine Georgiou	Bronx, NY
E-0362	Louise Anne	Clinton Township, MI
E-0363	Brett Cloud	Denver, CO
E-0364	Penny Fry	Carrollton, GA
E-0365	James McDill	Sacramento, CA
E-0366	Anita Vasquez	Victor, MT
E-0367	Diana Carroccia	Lake Ronkonkoma, NY
E-0368	Jennifer Stone	Galveston, TX
E-0369	Tracy Hensley	West Chester, OH
E-0370	Susan Greene	Felton, CA
E-0371	Gregory Wilcox	Candler, NC
E-0372	Christopher Lyons	Henderson, NV
E-0373	Vince Slevin	Petaluma, CA
E-0374	Azalia Aragon	New York, NY
E-0375	Anne Allen	Millsboro, DE
E-0376	Judith Hildenbrand	Lexington, KY
E-0377	Patricia Kubisiak	New Berlin, WI
E-0378	Melani Bolyai	Riverdale, NJ
E-0379	Grady Pettigrew	Cols, OH
E-0380	Lenn Lee	Wheeling, IL

Log #	Name	Location
E-0381	Deb Kavaler	New York, NY
E-0382	Kathy Corcoran	Pasadena, CA
E-0383	Sarah Dugan	Brunswick, OH
E-0384	Merle Neidell	St. James, NY
E-0385	Eileen Bevacqui	Tinton Falls, NJ
E-0386	Gregory Hall	South Pasadena, CA
E-0387	Arthur Kindred	Springfield, IL
E-0388	Margaret Wagguner	Silver Point, TN
E-0389	Lark Kirkwood	Oklahoma City, OK
E-0390	Maxine Griesert	Minneapolis, MN
E-0391	Charles Alvarez	Woodhaven, NY
E-0392	Mary Lou Peltier	Olympia, WA
E-0393	Barbara Levine	Hoffman Estates, IL
E-0394	Sandra Gritz	Mableton, GA
E-0395	Elizabeth Chipman	St. James, MO
E-0396	Lisette Valdes	Signal Hill, CA
E-0397	Dale Krewson	Lebanon, OR
E-0398	Corey Fischer	Mill Valley, CA
E-0399	Sharyn Morris	Urbana, OH
E-0400	Karryn Hart	DeGraff, OH
E-0401	Eugene Williamson	Manning, OR
E-0402	Joe Chasse	Ocean Park, WA
E-0403	Billy Rickards	Waikoloa, HI
E-0404	Greg Zajac	Palmyra, VA
E-0405	Donna Neighbors	Edmonds, WA
E-0406	Kathy Barton	Scharleston, W. VA
E-0407	Betty Jean Herner	Strongsville, OH
E-0408	Pris Thomas	Ukiah, CA
E-0409	Kelly Baldwell	Naperville, IL
E-0410	Joann Barbee	Johannesburg, CA
E-0411	Valery Lavine	Rochester, NY
E-0412	Julie Kucera	Eden Prairie, MN
E-0413	Diane Gonzales	Calimesa, CA
E-0414	Laura Traynham	Fairfax, VA
E-0415	Tammy Robinson	Asheboro, NC
E-0416	Kasey Canton	Christiansted, VI
E-0417	Jay & Sandy Lynch	Bremerton, WA
E-0418	Della Dempsey	San Diego, CA
E-0419	John Boeschen	San Rafael, CA
E-0420	Evelyn Babb	Hibbing, MN
E-0421	Bob Caletti	Menlo Park, CA
E-0422	Rick Brenke	Phoenix, AZ
E-0423	Tristan Raymond	San Diego, CA
E-0424	Steve Callahan	Valatie, NY

Log #	Name	Location
E-0425	Mark Rauscher	San Clemente, CA
E-0426	Jennifer Johnson	Sunnyvale, CA
E-0427	Veronique Cuvillers	Santa Fe, NM
E-0428	Michael Moore	El Cerrito, CA
E-0429	Alexandra Lee	Rhinecliff, NY
E-0430	Ruth Yeomans	Seattle, WA
E-0431	Don Cooney	Westminister, VT
E-0432	Lani J. Adams	Palmdale, CA
E-0433	Cyndi Baumgardner	Seattle, WA
E-0434	Kristine Hansen	Madison, WI
E-0435	Dalton Howland	Spartanburg, NC
E-0436	Mary Bachman/Bill Downing	Belvedere, CA
E-0437	Joan Marlatt	Boise, ID
E-0438	Susan Trivisonno	San Jose, CA
E-0439	Berton Harrah	Marysville, OH
E-0440	Mary Blake	Scarsdale, NY
E-0441	Marguerite Nicholson-Schenk	Philadelphia, PA
E-0442	Audrey Lareau	Redwood City, CA
E-0443	Wallace Berg	Annandale, VA
E-0444	Sandi Fults	Conifer, CO
E-0445	Kimberly Tyda	Sacramento, CA
E-0446	Karen Carroll	Mooresville, IN
E-0447	Cindy Gawne	Gladstone, MI
E-0448	Carlita Matias	Huntington Beach, CA
E-0449	Phil & Susie Kaplan	Soquel, CA
E-0450	Gina Candelori	Bramwell, WV
E-0451	Amber Strangstalien	Baraboo, WI
E-0452	Ann Carranza	Healdsburg, CA
E-0453	Jasmine Bascom	Boulder, CO
E-0454	Lois Pesce	Ridgefield, NJ
E-0455	Sara Kowalke	Baraboo, WI
E-0456	Randi Perkins	Atascadero, CA
E-0457	Tiffany Woznicki	La Mesa, CA
E-0458	Lawrence Bavier	Dearborn, MI
E-0459	Bonnie Mandell-Rice	Lafayette, CO
E-0460	Lisa Poser	Redwood Falls, MI
E-0461	Vera Snyder	Pasadena, CA
E-0462	Gail Cheeseman	Saratoga, CA
E-0463	Vanessa Martino	Vista, CA
E-0464	Tom Lehner	Fond du lac, WI
E-0465	Dee Dunseith	Albuquerque, NM
E-0466	Rayan Manro	Las Vegas, NV
E-0467	Craig Lee Asbury	Springfield, MO
E-0468	David Paz	Brooklyn, NY

Log #	Name	Location
E-0469	Randy Centner	Montgomery, OH
E-0470	Renae Anub	Antelope, CA
E-0471	Gary Boren	San Francisco, CA
E-0472	Jean Blackwood	Carthage, MO
E-0473	Deborah Wininger	Clarksville, IN
E-0474	Paul Vatistas	Tahoe City, CA
E-0475	Kai Poon	Los Angeles, CA
E-0476	Warren West	Bend, OR
E-0477	Catherine Amador-Locher	Kailua Kona, HI
E-0478	Marion Garms	Woodinville, WA
E-0479	David Fannin	Olive Hill, KY
E-0480	Jana Siciliano	Metuchen, NJ
E-0481	Nancy Evans	Los Osos, CA
E-0482	John Pedersen	Nampa, ID
E-0483	Jeff Bridges	Littleton, CO
E-0484	Stephanie Berry	Fort Bragg, CA
E-0485	Kathy Warner	Astoria, NY
E-0486	Karen Kortsch	Lake Bluff, IL
E-0487	Gwen Nolte	Barstow, CA
E-0488	Karla Linn Merrifield	Kent, NY
E-0489	Sophia Roberts	Carmel Valley, CA
E-0490	Kimmi Short	Phoenix, AZ
E-0491	Stacy Hughes	Graham, NC
E-0492	Diane Barnes	Rochester, NY
E-0493	Kate Steele	Burbank, CA
E-0494	Kim Merville	Pittsburgh, PA
E-0495	Kerri Barnhart	Norco, CA
E-0496	Janet Chafe	Canton, OH
E-0497	Taylor Marshall	Atlanta, GA
E-0498	Julie Burkes	Tucson, AZ
E-0499	Sunny Walter	Issaquah, WA
E-0500	Michael Woodsome	Hermosa Beach, CA
E-0501	Sheryl Dunn	San Diego, CA
E-0502	Eric Thompson	Houston, PA
E-0503	B. Jay	Santa Monica, CA
E-0504	Nancy Oliver	Los Angeles, CA
E-0505	Eric Rossman	Poughkeepsie, NY
E-0506	Karen Sewick	Downers Grove, IL
E-0507	David Avrahamson	Independence, MO
E-0508	Barry Abrams	New York, NY
E-0509	Dorothy Batten	Springfield, OR
E-0510	William Shuman	Fayetteville, AR
E-0511	Mariana Yanez	West Covina, CA
E-0512	Lou Detwiler	Pahrump, NV

Log #	Name	Location
E-0513	Sina McGriff	Trabuco Canyon, CA
E-0514	Travis Hylton	Kailua, HI
E-0515	Potter Karen	Elk Grove, CA
E-0516	Pauline Farmer	Euclid, OH
E-0517	Lewis H. Ellmer, Sr.	Virginia Beach, VA
E-0518	Gail Morehead	Reno, NV
E-0519	Andrea Todd	Temecula, CA
E-0520	Jacqueline Gallina	Howell, NJ
E-0521	Erin Fortier	Seattle, WA
E-0522	Robin Colna	Mantua, NJ
E-0523	Terry Barber	San Jose, CA
E-0524	L.B. Ho	San Francisco, CA
E-0525	Sherry Tessensohn	Spokane, WA
E-0526	Melissa Roberts	Seattle, WA
E-0527	Kim Nutting	Oak Creek, WI
E-0528	Ruth Vellensky	Princeton Junction. NJ
E-0529	Paul Greenbaum	Marina Del Ray, CA
E-0530	T. Girardi	Alexandria, VA
E-0531	Kim White	Vallejo, CA
E-0532	Norton and Saran Kirschbaum	Los Angeles, CA
E-0533	Tara Cook	Seattle, WA
E-0534	Julie Starr	So. Francisco, CA
E-0535	Kristov Fir	Hillsboro, OR
E-0536	Charlotte Stahl	Gresham, OR
E-0537	Uschi Gerschner	Portland, OR
E-0538	Alison Kohn	Chicago, IL
E-0539	Kristina Juarez	Ventura, CA
E-0540	Jean Melom	Minneapolis, MN
E-0541	Leslie Nicholson	Bend, OR
E-0542	Mary Sier	Manhattan, KS
E-0543	Cassandra Meyer	Minneapolis, MN
E-0544	Jane Drews	Arlington Hts., IL
E-0545	Mike Sexton	Junction City, KS
E-0546	Thadeus Dziekonski	Buffalo, NY
E-0547	Linda Hendrickson	Canby, MN
E-0548	Hy Libby	Aptus, CA
E-0549	Frank Wheeler	San Diego, CA
E-0550	Durelle Smith	Anchorage, AK
E-0551	Mary and John Harte	Berkeley, CA
E-0552	Tracy Smith	Cumming, GA
E-0553	Doreen Adams	Malibu, CA
E-0554	Jennifer Joray	Superior, CO
E-0555	David Kancsar	Las Vegas, NV
E-0556	Dianna Perrotto	Lexington, NC
E-0557	Sara King	Kent, WA
E-0558	Evelyne-Valerie D’Arnal	Valley Village, CA
E-0559	Steve Robey	Solana Beach, CA
E-0560	Dane Nance	Asheboro, NC
E-0561	Katherine Pierce	Albuquerque, NM
E-0562	Monica Willett	Harrisburg, PA
E-0563	Denee Caterson	Davis, CA
E-0564	James Pluta	Valley Village, CA
E-0565	Rob Seltzer	Beverly Hills, CA
E-0566	Christine Mikalson	Farmington, WA
E-0567	Patrick Hodge	Tulsa, OK
E-0568	Maureen Zeiss	New York, NY
E-0569	Margaret Kent	Lancaster, PA
E-0570	Pamela Dugan	Pikesville, MD
E-0571	Frances Smith	Charlotte, NC
E-0572	Jill Komoto	Santa Barbara, CA
E-0573	Luiz Perez	East Hampton, NY
E-0574	Maya Moiseyev	Palo Alto, CA
E-0575	Laura Murphy	Irvine, CA
E-0576	Steven M. Schroeder	West Bend, WI
E-0577	Sheila Balch	Brattleboro, VT
E-0578	Debbie Maynard	Monroe, OR
E-0579	Stephanie Schalz	Tucson, AZ
E-0580	Charliese Peck	Levittown, NY
E-0581	David Brown	Charlotte, NC
E-0582	James McLennan	Tocoma, WA
E-0583	Jane Olson	Sidney, MT
E-0584	Shirley Vincent	Montclair, NJ
E-0585	Sam E. Asseff, Jr.	Colorado Springs, CO
E-0586	Shelley Gladwin	Ann Arbor, MI
E-0587	William Whitworth	Bryn Mawr, PA
E-0588	Daniel Hatfield	Portland, OR
E-0589	John Beck	Manahawkin, NJ
E-0590	Jed Holtzman	San Francisco, CA
E-0591	Dick Scheible	Palo Alto, CA
E-0592	Deanna Allen	Laguna Niguel, CA
E-0593	Lisa Gunter	El Granada, CA
E-0594	John Melnick	Oakland, CA
E-0595	Reeta Roo	Sebastopol, CA
E-0596	Brett Pohanka	Maryville, TN
E-0597	Jim Gerlach	Winston-Salem, NC
E-0598	Sharon Becker	Osceola, IA
E-0599	Darynne Jessler	Valley Village, CA
E-0600	Philip H. De Felice	Oceanside, NY

Log #	Name	Location
E-0601	Jennifer Grace	Pleasant Hill, CA
E-0602	Lea Harper	Oakdale, PA
E-0603	Andrea Patterson	Vallejo, CA
E-0604	Linda Noriega	Huntington Beach, CA
E-0605	Corinne Jung	Chicago, IL
E-0606	Jeanette Galloway	El Cajon, CA
E-0607	Connie Crusha	El Cajon, CA
E-0608	Sherilyn Jackson	Chatsworth, CA
E-0609	Kristen Weiss	Thousand Oaks, CA
E-0610	Barbara L. Smith	Sweet Home, OR
E-0611	Bennett Callow	Columbia, MD
E-0612	Alice Turney	San Jose, CA
E-0613	Mary O'Connell	Guerneville, CA
E-0614	Sue Zimmerman	Hornell, NY
E-0615	Melissa Santucci	North Hollywood, CA
E-0616	Mary La Rosa	Garden City South, NY
E-0617	John Kuehn	Mayville, WI
E-0618	Lewis-Harris Jacquelyn	St. Louis, MO
E-0619	Dr. Todd Walker	South Milwaukee, WI
E-0620	Lynnette Stewart	Champaign, IL
E-0621	Norma Cumbow	Moreno Valley, CA
E-0622	Abby Harms	Topeka, KS
E-0623	Paul Katan	Long Beach, CA
E-0624	Wendy Lochner	Sayville, NY
E-0625	Charidy Bean	Bauxite, AR
E-0626	Patrick Garnett	Lexington, KY
E-0627	Mary Shaffer	Boyne Falls, MI
E-0628	Susie Weigman	Weston, MO
E-0629	Art Zernis	Rego Park, NY
E-0630	Laura Pakaln	Nyack, NY
E-0631	Priscilla Cloud	Stevensville, MD
E-0632	Michael Crosson	San Rafael, CA
E-0633	Shana Lack	Erlanger, KY
E-0634	Carol Smith	Winnetka, CA
E-0635	Laura Pinedo	El Monte, CA
E-0636	Susan Richards	Del Mar, CA
E-0637	Haley Champion	Palo Alto, CA
E-0638	Elizabeth Johnstan	Denver, CO
E-0639	Jason Trout	St. Paul, MN
E-0640	Robert Dufour	Martinsburg, WV
E-0641	Dianne Grenland	Vacaville, CA
E-0642	Robert Sventy	Edison, NJ
E-0643	Patricia Youngson	Boulder, CO
E-0644	Ed Scerbo	Peekskill, NY
E-0645	Jason Lewis	Toms River, NJ
E-0646	David Judge	Iowa City, IA
E-0647	Jodee Chizever	North Brunswick, NJ
E-0648	Susan and Larry Mudrey	Castleton, NY
E-0649	Benjamin Boorman	Memphis, TN
E-0650	D. William Sinnett	Maryland Heights, MO
E-0651	Keir Mussen	Annandale, VA
E-0652	Margaret Rhoat	Laurel, DE
E-0653	Heather Morrow	Richmond, KY
E-0654	Elaine Dunbar	Crossville, TN
E-0655	Lawrence Chleboski	Los Angeles, CA
E-0656	Rob Croskey	Lawrenceville, NJ
E-0657	Christy Metzner	Marquette, MI
E-0658	Adam Miller	Seattle, WA
E-0659	Jay Gassman	Medford, NY
E-0660	John Kerr	East Hampton, NY
E-0661	Kim Johnson	Livonia, MI
E-0662	David Sorensen	Flushing, NY
E-0663	Mike Pratt	South Woodstock, VT
E-0664	Elizabeth Bradford	St. Louis, MO
E-0665	Heather Allen	Saginaw, MI
E-0666	C. Johnson	Chickasha, OK
E-0667	Rebecca Saunders	Reedsport, OR
E-0668	Susan Goldin	Canaan, NY
E-0669	Michelle Hurd	Coeburn, VA
E-0670	Linda Rubick	CO
E-0671	Susan Silber	San Francisco, CA
E-0672	Arlene Kalinowski	Smithton, PA
E-0673	Nicole Safin	Irvine, CA
E-0674	Celine Nahas	Venice, CA
E-0675	Shawn Rorke-Davis	Phoenix, AZ
E-0676	Rose Wayman	Scotts Valley, CA
E-0677	Wesley Herrin	Boulder, CO
E-0678	Carol Liberatore	Fredericktown, PA
E-0679	Ryan Burkett	Mercer Island, WA
E-0680	Carlos Steffey	Hickory, NC
E-0681	Sharon Rivers	Rockville, MD
E-0682	Faye Krygsheld	Bolingbrook, IL
E-0683	Nancy Booth	West New York, NJ
E-0684	Bob Greenwood, Jr.	Independence, KS
E-0685	Greg Hofmann	San Jose, CA
E-0686	Charlene Root	Whittier, CA
E-0687	Suzanne Westgaard	Boulder, CO
E-0688	Eileen Conner	Gillett, PA

Log #	Name	Location
E-0689	Coralie Benton	Albany, OR
E-0690	Jane Viselli	San Mateo, CA
E-0691	Joan Mc Bride	Washington Township, NJ
E-0692	Maureen Gagnon	Hilton, NY
E-0693	Mary Baumer	Forked River, NJ
E-0694	Mary L. Flores	Milwaukeem WI
E-0695	Joe Rogers	Strafford, MO
E-0696	Annette Yerkovich	Citrus Hgts., CA
E-0697	Daniel Hinds	Indianapolis, IN
E-0698	Paul Belz	Oakland, CA
E-0699	Libby McQuiston	San Rafael, CA
E-0700	Huyen Nguyen	Lawrenceville, GA
E-0701	Daniel Watson	Hillsborough, NC
E-0702	Nancy Jenseth-Walter	Seattle, WA
E-0703	Joan Meijer	Los Angeles, CA
E-0704	Myran Denham	Center Line, MI
E-0705	Rebecca Urban	Vestal, NY
E-0706	Perry Davis	Princeton, NJ
E-0707	Esther M. Petty	San Jose, CA
E-0708	Carolyn Nickels	Gwynedd Valley, PA
E-0709	Pandora George	Manchester, MO
E-0710	Emily Monroe	Columbia, MO
E-0711	Jen Possa	Morgan Hill, CA
E-0712	Cory Brusseau	Sherman Oaks, CA
E-0713	Carrie Kube	Watertown, WI
E-0714	Debra Brinker	Dublin, OH
E-0715	Adrienne Brooks	GA
E-0716	Kanit Cottrell	St. Thomas, VI
E-0717	Judith Owen	Etna, CA
E-0718	Karen Lasher	Salida, CO
E-0719	Gwen Wolverton-Diggs	Williamsberg, VA
E-0720	Linda McElroy	Benicia, CA
E-0721	Erica Jayne Walsh	Perrysburg, OH
E-0722	Shawn Radcliffe	Philadelphia, PA
E-0723	Sarah Jane Hall	Burbank, CA
E-0724	Judy Estrada	Camarillo, CA
E-0725	Jonathan Schwartz	Pickerel, WI
E-0726	Claire Mikalson	Farmington, WA
E-0727	Robert Rinker	Oakland, CA
E-0728	Cathryn Robbins	Columbus, OH
E-0729	Charmaine Clapp	Rosemead, CA
E-0730	Carmen Miner	Medford, NJ
E-0731	Barbara Brown	Goodyear, AZ
E-0732	Catherine Knollmeyer	St. Louis, MO

Log #	Name	Location
E-0733	Sam Ronick	Marietta, GA
E-0734	Shannon Cummins	New Castle, PA
E-0735	Roxann Shadrick	Decatur, IL
E-0736	Diana Wendt	Oakland, CA
E-0737	Terry O'Neal	Virginia Beach, VA
E-0738	A. Delgallo	Monaca, PA
E-0739	Nancy Schafer	Louisa, VA
E-0740	Ellen Hazzard	Seattle, WA
E-0741	David Myers	Mattatuck, NY
E-0742	Adam Triplett	Montpelier, VT
E-0743	Steven Buchman	Red Bank, NJ
E-0744	Eda Da Silva	Sacramento, CA
E-0745	Nandita Shah	Silver Spring, MD
E-0746	Laurent Pacalin	Menlo Park, CA
E-0747	Candida Corbin	Lakeview, MI
E-0748	Susinn Macmerchys	Everett, WA
E-0749	Capt. Honk	Pillar Point, NY
E-0750	David Foster	San Francisco, CA
E-0751	Mara Pina	Seattle, WA
E-0752	Russell Cusick	Garrison, NY
E-0753	Jeanne Marie Wasilik	Brooklyn, NY
E-0754	Steven Loria	Garrison, NY
E-0755	Angela Richards Dona	Brooklyn, NY
E-0756	William DuSold	Arnold, MD
E-0757	Liane Chan	Buena Park, CA
E-0758	Mary Kalil	St. Louis Park, MI
E-0759	Stacey Citraro	Abingdon, MD
E-0760	Sonja Hannon	Albuquerque, NM
E-0761	Garrit Crouse, PhD	Nyack, NY
E-0762	Kayta Tracey	Taos, NM
E-0763	Teresa Wong	San Gabriel, CA
E-0764	Shawn Dicken	Beaverton, MI
E-0765	Kyle Lin	Arcata, CA
E-0766	Judy Stufflebeam	Oregon City, OR
E-0767	Maria Lynn Therese	Lincolnwood, IL
E-0768	Jenny Cappe	Baltimore, MD
E-0769	Ernesto De La Rosa	Chicago, IL
E-0770	Donna Campbell	San Rafael, CA
E-0771	Tukiko Nagayama	Irvine, CA
E-0772	Anita Smallwood	Gladstone, MO
E-0773	Brian Lutenegger	Madison, WI
E-0774	Marc Weber	New City, NY
E-0775	Deb McKinzie	Fort Collins, CO
E-0776	Shayla Paris	Anchorage, AK

Log #	Name	Location
E-0777	Debra Havill	Indianapolis, IN
E-0778	Monty Ellman	Morro Bay, CA
E-0779	Philippa Bergmann	Madison, WI
E-0780	Barbara Hogan	San Francisco, CA
E-0781	Kimberly Christensen	Seattle, WA
E-0782	Anne Warren	University Park, MD
E-0783	Steven Stocker	Germantown, MD
E-0784	Lance Biggers	Claremont, CA
E-0785	Terri Katz	Tuscon, AZ
E-0786	Paul Richard	Fairfax, CA
E-0787	Alice Bullard	Topeka, KS
E-0788	Alesia Vassallo	West Point, PA
E-0789	Susan Johnson	Helena, MT
E-0790	Ruth Jones	Ripon, WI
E-0791	Nelson E. Baumer	Ossining, NY
E-0792	Sylvia Cardella	Hydesville, CA
E-0793	Jonathan Markowitz	Lanaska, PA
E-0794	Nicolette Pawlowski	Chicago, IL
E-0795	Dante Joseph	Mesa, AZ
E-0796	Belinda Masse	Upland, CA
E-0797	John Fischer	Pacific Grove, CA
E-0798	Cathryn Bramble	Encino, CA
E-0799	Roberta Dempsey	Novi, MI
E-0800	Samantha Zabel	Waldorf, MD
E-0801	Linda Rethwisch	San Diego, CA
E-0802	Laura Dame	San Francisco, CA
E-0803	Vicky Ludwig	Lewiston, ID
E-0804	Chrissy Smart	IN
E-0805	Jane Jacobs	Shelton, WA
E-0806	Mark Bender	Indianapolis, IN
E-0807	Carl Pratt	Portland, OR
E-0808	Luana Kyle	Indio, CA
E-0809	Brian Fink	Brooklyn, NY
E-0810	Jessica Ma	Princeton, NJ
E-0811	Pat Guman	Lake Ariel, PA
E-0812	Mary Hope	Harrisburg, PA
E-0813	Michael Kovacs	SeaTac, WA
E-0814	Bettye Binder	Culver City, CA
E-0815	Tannis Phillips	Bartlesville, OK
E-0816	David Carr	El Cerritos, CA
E-0817	Patricia George	Camp Verde, AZ
E-0818	M. Davis	Marshall, VA
E-0819	Melissa Grimm	San Jose, CA
E-0820	Barbara Green	Clatskanie, OR
E-0821	Matthew Lebrato	San Francisco, CA
E-0822	Romona Lione	Fremont, CA
E-0823	Michael McCarty	Plain City, OH
E-0824	Michelle Clark	Nehalem, OR
E-0825	Marleen Dutra	Santa Cruz, CA
E-0826	Deborah Potirala	Chicago, IL
E-0827	Sande Greene	Kihei, HI
E-0828	Peter Tiffany	Fallon, NV
E-0829	Kyle Woodring	Rancho Santa Margarita, CA
E-0830	Jennifer Burkett	Chatham, IL
E-0831	Kristin Kirby	Seattle, WA
E-0832	Laura Harris	Murphy, NC
E-0833	Alan DaKak	Yorba Linda, CA
E-0834	Kathy Rakestraw	Gainesville, GA
E-0835	Jack Dwyer	Saugerties, NY
E-0836	Margarite DeAngelo	Glendale, CA
E-0837	Rebecca Megill	Hightstown, NJ
E-0838	Laura Anderson	Moses Lake, WA
E-0839	Dennis Clark	Escondido, CA
E-0840	S. Dooner	Bensalem, PA
E-0841	Carinne de Ciofalo-Guell	San Francisco, CA
E-0842	Doug Kufus	Palos Verdes, CA
E-0843	Alisa Kosheleff	Yellow Springs, OH
E-0844	Sherri Pickel	Ontario, CA
E-0845	Carrie Lynn Moylan	Springfield, OR
E-0846	Dennis Sweitzer	Coatesville, PA
E-0847	Glenn McGrew, II	Lakewood, CO
E-0848	Suzanne Michalski	Wausau, WI
E-0849	R. Walczyk, Jr.	Mt. Clemens, MI
E-0850	Ruth Bramall	Lake Stevens, WA
E-0851	Gail Harmon	Lima, OH
E-0852	Tom Jackson	Denver, CO
E-0853	William Burgess	Las Cruces, NM
E-0854	Honey Grodt	Des Moines, IO
E-0855	Holly Carpenter	Boise, ID
E-0856	Pat Duf	Chicago, IL
E-0857	Rick Ensminger	Apple Valley, MI
E-0858	John Newton	Carbondale, IL
E-0859	Renene Butler	Sharon, PA
E-0860	Marsha Coleman	Chapin, SC
E-0861	David Adams	Kansas City, MO
E-0862	Debbie Ebersold	Las Angeles, CA
E-0863	Virginia Salvin	Chippewa Falls, WI
E-0864	Steven Dennis	Carmel, CA

Log #	Name	Location
E-0865	Kristin Davis	Pleasanton, CA
E-0866	Linda C. Leghart	Jacobs Creek, PA
E-0867	Kevin Bayhouse	Boise, ID
E-0868	Mel Henshaw	San Diego, CA
E-0869	Jennifer Moffett	Columbus, OH
E-0870	Kym Buchholz	Grand Rapids, MI
E-0871	Shoshanah McKnight	Irvine, CA
E-0872	Emily Church	Louisville, KY
E-0873	Gene & Doris Peters	Mitchell, SD
E-0874	Grant Vecera	Indianapolis, IN
E-0875	Ellen Sweet	Lincoln, NE
E-0876	C. Maxwell, Jr.	Lenoir City, TN
E-0877	Elaine Burton	East Peoria, IL
E-0878	Meghan Mitzel	York, PA
E-0879	Kristina B.	Green Bay, WI
E-0880	Shawn Dugan	Ephrata, PA
E-0881	Matt Moore	Miller Place, NY
E-0882	Karen McAnnally	Bloomfield Heights, MI
E-0883	Patrick Trippany	Albany, NY
E-0884	Amanda Thomas	Hiram, OH
E-0885	Nan Leaman	Oak Harbor, WA
E-0886	April Burns	Michigan City, IN
E-0887	Deborah Engisch-Platt	Point Pleasant, PA
E-0888	Pec Indman	San Jose, CA
E-0889	Charles Mies	Elgin, IL
E-0890	Joel Coons	Redmond, WA
E-0891	Tabatha Scheinost	Oceanside, CA
E-0892	Christa Fairbrother	Langley, WA
E-0893	Glen Wilburn	Burbank, CA
E-0894	Joel Elio	Shirley, NY
E-0895	Cordelia Bowlus	Marina, CA
E-0896	Diane Ostheimer	Sandusky, OH
E-0897	James DeGray	Willowick, OH
E-0898	Norm Cohen	Linwood, NJ
E-0899	Ryan Oldfield	Fullerton, CA
E-0900	Susan Zaborsky	Warren, OH
E-0901	Lee Dillon	Minneapolis, MN
E-0902	Maria Dann	Moravia, NY
E-0903	Robert Blyman	Ronkonkoma, NY
E-0904	Wayne Tustin	Santa Barbara, CA
E-0905	Jennifer Wallace	Seattle, WA
E-0906	Jeff Whitty	La Mesa, CA
E-0907	Ivona Xiezopolski	Kaneohe, HI
E-0908	B. Geary	Tulsa, OK

Log #	Name	Location
E-0909	Angela Schaab	Boulder, CO
E-0910	Timothy Marsh	Walnut, CA
E-0911	D. L. Bostaph	Erie, PA
E-0912	Charlotte Cornwell	Venice, CA
E-0913	Joli Forth	San Leandro, CA
E-0914	Deborah Davenport	Tracy, CA
E-0915	Ulla Sarmiento	Moorpark, CA
E-0916	Jodi Burns	Arvada, CO
E-0917	Edwin & Helen Waerner	Topeka, KS
E-0918	Gina Altamura	Napa, CA
E-0919	Robert M. Lowen, MD	Palo Alto, CA
E-0920	Katy Simmons	Omaha, NE
E-0921	Alfred Gramstedt	Lodi, NJ
E-0922	George Priola	Staten Island, NY
E-0923	Michael Tichenor	Portland, OR
E-0924	Mira Ghoshal	Beacon, NY
E-0925	Debby Bradford	Hopland, CA
E-0926	Sara Jones	Hoboken, NJ
E-0927	Kali Rowe	Tuscon, AZ
E-0928	N. Wicks	Wayne, NJ
E-0929	Mike Ware	Whitestone, NY
E-0930	Jon Wallace	Langley, WA
E-0931	Donna Zoll	CA
E-0932	Janice Foss	Oakland, CA
E-0933	Michael Filipiak	Milwaukee, WI
E-0934	Sherry Strashensky	Johnstown, PA
E-0935	Kzena Ross	Ely, MN
E-0936	Claire Watson	Antioch, CA
E-0937	Maggie Lakota-Ryan	Chicago Heights, IL
E-0938	Connie Schnepp	Van Wert, OH
E-0939	Timothy Johnston	Marina, CA
E-0940	Susanna Isbell	Oneonta, NY
E-0941	Brian Walter	St. Louis, MO
E-0942	John Seider	Oneonta, NY
E-0943	Diann Simmons	Covelo, CA
E-0944	Beth & Carl Gwinn	Goleta, CA
E-0945	Terri Jordan	Bloomington, IN
E-0946	Denise Cronin	Imperial, MO
E-0947	Emily Sharron Thomas	Ukiah, CA
E-0948	Donna Lewalski	AZ
E-0949	Julie Arfsten	Petaluma, CA
E-0950	Kathy Manning	Woodbridge, VA
E-0951	Sharon Shadbolt	Tahuya, WA
E-0952	Ryan Tauber	Eureka, CA

Log #	Name	Location
E-0953	Dennis J. Lenz	Massapequa, NY
E-0954	Anisha, Hyers	Blackbear, GA
E-0955	Denise Lalime	Chester, VA
E-0956	Lauren Ragsac	San Diego, CA
E-0957	Patricia Chang	Indianapolis, IN
E-0958	Mary South	Huntington, WA
E-0959	Jennifer Hickman	Springfield, MO
E-0960	Jeanne Schieferstein	Smithtown, NY
E-0961	Marie Gutkowski	Ridgewood, NY
E-0962	Donna Macro	Auburn, NY
E-0963	Lawrence A. Krantz	Bemidji, MN
E-0964	Pamela Murphy	Ojai, CA
E-0965	Summer Starr	Makawao, HI
E-0966	Glen Zorn	Everett, WA
E-0967	Christopher Pelham	Brooklyn, NY
E-0968	Elyse Coulson	Santa Rosa, CA
E-0969	Louise Morris	Holly, MI
E-0970	Samantha Derr	Sierra Vista, AZ
E-0971	Anita Baekey	Fountain Hills, AZ
E-0972	John Yost	Vallecito, CA
E-0973	Alex Kozubov	Campbell, CA
E-0974	Karine Kerns	Spanaway, WA
E-0975	Danielle Leslie	Rio Grande, NJ
E-0976	Marilyn Rajokovich	San Francisco, CA
E-0977	Beth Yocam	West Linn, OR
E-0978	Karen Bollaert	Brooklyn, NY
E-0979	Jessica Amos	Cambridge, OH
E-0980	Shelley Rothwell	Ypsilanti, MI
E-0981	George David	Claremont, CA
E-0982	Jan Lochner	Sebastopol, CA
E-0983	Tyra Taylor-Bell	Chicago, IL
E-0984	David Dewenter	Keaau, HI
E-0985	Amy Lokensgard	MN
E-0986	Joyce Stenberg	Irvine, CA
E-0987	Brian Camp	Rhododendron, OR
E-0988	Patricia Meyer	San Mateo, CA
E-0989	Erika Miller	Oronogo, MO
E-0990	Richard Artley	Grangeville, ID
E-0991	Patricia Evans	Las Vegas, NV
E-0992	Charles Chun	Bloomington, IL
E-0993	Mikasa Moss	Douglasville, GA
E-0994	Frances M. Pashalian	Washington, MI
E-0995	John Ucciferri	Goleta, CA
E-0996	Rick Esmay	Overland Park, KS

Log #	Name	Location
E-0997	Edwina Ekstrom	Belvidere, NJ
E-0998	Joshua Valecnia	Hemet, CA
E-0999	Lisa Rothweiler	Millersville, PA
E-1000	Stephen Jacobs	Los Angeles, CA
E-1001	Linda Bost	Escondido, CA
E-1002	Kathi Skidmore	North Highlands, CA
E-1003	Teresa McAllister	Burlington, IA
E-1004	Gabriele Lavermicocca	San Diego, CA
E-1005	Nicole Auten	Granada Hills, CA
E-1006	Mohan Attar	Eugene, OR
E-1007	Melanie Sherwinski	Schererville, IN
E-1008	Diana Sonne	Seattle, WA
E-1009	Geoff Kelley	Seattle, WA
E-1010	Joyce Wippler	San Diego, CA
E-1011	Peter Kutra	Vienna, VA
E-1012	Brandon Ballengee	New York, NY
E-1013	L. Daniels	North Little Rock, AR
E-1014	Jim Lethbridge	Seattle, WA
E-1015	Sarah Bexell	Atlanta, GA
E-1016	Carol Mulder	Scottsdale, AZ
E-1017	Linda Linderman	Phoenix, AZ
E-1018	Alan Stewart, DVM	Oakland, CA
E-1019	Jessica Lasky	North Caldwell, NJ
E-1020	Lyn Reed	Corralitos, CA
E-1021	Justine Shaffer	Pleasanton, CA
E-1022	Cheryl Costigan	Athol, ID
E-1023	Shannon, Edwards	Desloge, MO
E-1024	William Linas	San Diego, CA
E-1025	Andy Christenson	Dayton, OH
E-1026	Warren Fieldhouse	San Jacinto, CA
E-1027	Brett Davis	Minneapolis, MN
E-1028	Nana Sato	Long Beach, CA
E-1029	Candace Collins	Chula Vista, CA
E-1030	Andrew Yu	Atlanta, GA
E-1031	Eli Ellsworth	San Jose, CA
E-1032	Audrey Johnson	Azusa, CA
E-1033	Beverly Miller	Lebanon, OR
E-1034	Kate Gervits	Bronx, NY
E-1035	Lisa Choquette	Kailua-Kona, HI
E-1036	Danielle Erwin	Mission Viejo, CA
E-1037	Leslie De Palo	Novato, CA
E-1038	Tony Griglock	Pittston, PA
	9-14-02	
E-1039	Tricia Smith	Eau Claire, WI

Log #	Name	Location
E-1040	Jim Steitz	Logan, UT
E-1041	Laura Derek	CA
E-1042	J. Pfaehler	Crestline, CA
E-1043	Lisa Morrison	Oakland, CA
E-1044	Harriet Helman	Ronkonkoma, NY
E-1045	Karin Leigh Barthold	Mountain Lake Terrace, WA
E-1046	Lauran Gangl	Palos Verdes, CA
E-1047	Alexandra Murray	Okalahoma City, OK
E-1048	Robert Janusko	West Milford, NJ
E-1049	Breana Wheeler	San Francisco, CA
E-1050	T. Monroe	RSM, CA
E-1051	Sheila Swigert	Staten Island, NY
E-1052	Amenounve Follykue	Lome, NY
E-1053	Tim Manring	WA
E-1054	Debbie Fray	Valparaiso, IN
E-1055	Timothy Bruck	Mentor, OH
E-1056	Judy Sandlin	Advance, NC
E-1057	Alexis Blaess	San Francisco, CA
E-1058	Jeannine Coleman	Easley, SC
E-1059	Ellen Perchonock	Haverford, PA
E-1060	Mary Cherry	Bronx, NY
E-1061	Robert E. Klemm	Binghamton, NY
E-1062	Michael McGath	Apple Valley, CA
E-1063	Carmen T. Santasania	State College, PA
E-1064	Jessica Mastrogiovanni	Bound Brook, NJ
E-1065	Ted Nemeth	Forest Hills, NY
E-1066	Cathy Arnett	Fairmont, WV
E-1067	Paul Moss	White Bear Lake, MN
E-1068	Cynthia Armour	Milton, DE
E-1069	Marlena Lange	Middletown, NY
E-1070	Penny Hart	Rio Grande, NJ
E-1071	Susan Musialowski	Big Bay, MI
E-1072	Lois Gorden	Winona, MN
E-1073	William Ryan	Ludlow, VT
E-1074	Barbara Fiedler	Lake Hiawatha, NJ
E-1075	Scott Diehl	South Burlington, VT
E-1076	Jo Vandiver	Lewes, DE
E-1077	Carolyn Sundstrom	PA
E-1078	Joy Loyd	Garner, NC
E-1079	Steven Mann	Lincoln Park, NJ
E-1080	Clare Petosa	Manasquan, NJ
E-1081	Stacy True	Leland, NC
E-1082	Lelia Cosimbescu	Rochester, NY
E-1083	Laura Lindemann	Bogota, NJ

Log #	Name	Location
E-1084	James R. Beilstein	Medford, NY
E-1085	Diana Wittenbreder	Flagstaff, AZ
E-1086	Tybee Collins	Winston Salem, NC
E-1087	Dean Hey, II	Lexington Park, MD
E-1088	Mary Haan	Ann Arbor, MI
E-1089	Tenja Daniels	La Crosse, WI
E-1090	Howard Hunt	Elmira, NY
E-1091	Deb Taylor	PA
E-1092	Scott Hoffman	Cincinnati, OH
E-1093	Chris Freitag	Amity Harbor, NY
E-1094	Kathy Klausing	Cincinnati, OH
E-1095	Diana Hess	Lafayette Hill, PA
E-1096	Cynthia Crouch	Culloden, WV
E-1097	Jeff Phillips	Fredericksburg, VA
E-1098	Melody Westlake	Trimble, OH
E-1099	Patricia Baldwin	Red Mountain, CA
E-1100	Meghan Hope	Falls Church, VA
E-1101	Evie Mendoza	New York, NY
E-1102	Benjamin Nowicki	Chicago, IL
E-1103	Bruce Noll	Blue Point, NY
E-1104	Kristine Norris	Ionia, MI
E-1105	Barbara Rufe	Alexandria, VA
E-1106	Julie Bru	Chevy Chase, MD
E-1107	Jane Adler	Santa Monica, CA
E-1108	Sharon Cairns	Tulsa, OK
E-1109	Eva Huston	New York, NY
E-1110	Diana Kaye	Elizabeth, IN
E-1111	Deborah Pflanz	Medford, OR
E-1112	Daniel Vice	Washington, DC
E-1113	Kelly Carnahan	Charlotte, NC
E-1114	Judy Kempthorn	Cuyahoga Falls, OH
E-1115	Ruth Steffey	Donalds, SC
E-1116	Jeanie Cook	Bettendorf, IA
E-1117	Pam Longobardi	Atlanta, GA
E-1118	Luke Shafnisky	Coplay, PA
E-1119	Janet Hutto	Tulsa, OK
E-1120	Bradley Higgins	Roslyn Heights, NY
E-1121	Glen Thiel	Oak Park, IL
E-1122	Diane Vigilante	Fair Haven, NJ
E-1123	Renee Dolney	Pittsburgh, PA
E-1124	John Commiskey	Ithaca, NY
E-1125	Jessie DeWeese	Columbus, IN
E-1126	Kathleen Moore	Buffalo, NY
E-1127	Venus Rose	Teaneck, NJ

Log #	Name	Location
E-1128	Debbi McMillan	Dillonvale, OH
E-1129	Peggy Witt	Toronto Ontario, Canada
E-1130	Beth Rockwell	Erie, PA
E-1131	Jody Day	Dearborn Heights, MI
E-1132	Donald Slaiter	Pacific Grove, CA
E-1133	Pat Doran	Seattle, WA
E-1134	Brenda Seldin	New York, NY
E-1135	Pam Anderson	Rochester, NY
E-1136	Rita Bogolub	Berwyn, IL
E-1137	Tony Greiner	Stone Mountain, GA
E-1138	Robin Kissinger	Reisterstown, MD
E-1139	Georgia Evans	Pittsford, NY
E-1140	Barbara Stewart	Harrison, NY
E-1141	Michelle Owen	Indianapolis, IN
E-1142	Micheal Pacholski	Toledo, OH
E-1143	Jay Gilchrist	Nashville, TN
E-1144	Stephanie Stone	Kansas City, MO
E-1145	Connie Vakulich	Reno, NV
E-1146	Kim Tostenson	Evansville, MN
E-1147	Lady Terrah Rose Nelson	Marana, AZ
E-1148	Sandy Schepis	Atlanta, GA
E-1149	Jesse Armaline	Lakewood, OH
E-1150	Don Timmerman	Park Falls, WI
E-1151	Robert Korman	Madison, WI
E-1152	Gloria Chacon	Taylor, MI
E-1153	Barb Wilus	Versailles, MO
E-1154	Jeri Grant-Miller	Plymouth, MN
E-1155	Jeanine Clark	St. Charles, IL
E-1156	Elaine, Koplik	Albany, NY
E-1157	Tammy McDonald	Rock Island, IL
E-1158	Mark Koplik	Albany, NY
E-1159	Kathleen Adams	Hamilton, NJ
E-1160	Donna Fetty	Adena, OH
E-1161	Casey Clark	Wellfleet, MA
E-1162	Naima Shea	Grass Valley, CA
E-1163	Carla Madarena	Ashtabula, OH
E-1164	Ray Schraft	Angola, NY
E-1165	Brenda Exline	Green Valley, AZ
E-1166	Laura Hill	Port Jefferson, NY
E-1167	Helen Charbonneau	Marietta, SC
E-1168	Angela Cornelio	Chicago, IL
E-1169	Keith Fisher	Ardsley, PA
E-1170	Leanne Runnals	Burton, MI
E-1171	Sandi Gill	Charleston, WV
E-1172	Rafi Levavy	Maplewood, NJ
E-1173	Randall Collins	New York, NY
E-1174	Lois Kink	Castile, NY
E-1175	Mike Taylor	St. Paul, MN
E-1176	Barbara and Scott Snider	Buena Park, CA
E-1177	Ryan Sunshine	Blacksburg, VA
E-1178	Stephen Fuller	Norfolk, VA
E-1179	Georgina Mueller	Fairfield, CA
E-1180	Thomas Stephenson	St. George, UT
E-1181	Becky Fenske	Chokio, MN
E-1182	Bill Quinlan	Oyster Bay, NY
E-1183	Kathy Pearson	Santa Rosa, CA
E-1184	Sarah Dixon	Beaufort, NC
E-1185	Nancy Jensen Brown	Neenah, WI
E-1186	Elora Gabriel	Ashville, NC
E-1187	Jodi Fuchs	Santa Fe, NM
E-1188	Joy Keithline	New York, NY
E-1189	Martin Stevenson	Santa Barbara, CA
E-1190	M. Zawoyski	Pittsburgh, PA
E-1191	Anita Pesec	Mentor, OH
E-1192	Tera Gandy	Springfield, IL
E-1193	Jonathan Ernst	Oceanside, CA
E-1194	Nany Morgan	Walnut Creek, CA
E-1195	Chris Gargoyle	Atlanta, GA
E-1196	Korina Branson	Fordland, MO
E-1197	John Sullivan	Palo Alto, CA
E-1198	Maria DiFiore	Chicago, IL
E-1199	John van der Does	New York, NY
E-1200	Gina Fedon	Olathe, KS
E-1201	Holly Dyer	Troy, MI
E-1202	Gloria Miller	Sarnia, Canada
E-1203	Elza Behrens	Saluda, NC
E-1204	Jonathan Rigule	Rochester Hills, MI
E-1205	D. Timothy Shoup	San Diego, CA
E-1206	Mary Krane Derr	Chicago, IL
E-1207	Trisha Towanda	Olympia, WA
E-1208	Lauren Lawson	Richmond, KY
E-1209	Ashley Neece	Clinton, IA
E-1210	Jo Ann Van Meter	Topeka, KS
E-1211	Leon Trumpp	SE Dalia, MO
E-1212	Theresa Boedeker	St. Charles, MO
E-1213	Janet Pearson	Oneonta, NY
E-1214	Susan Evilsizer	Elyria, OH
E-1215	Cynthia Ortiz	Hackensack, NJ

Log #	Name	Location
E-1216	Lynn Kisinger	Arapaho, OK
E-1217	Holly Eaton	West Windsor, NJ
E-1218	Jim Mays	Load, KY
E-1219	Terrell Wexler	Aston, PA
E-1220	Jennifer Leano	Louisville, KY
E-1221	Eadie Kelly	Sewaren, NJ
E-1222	James Tinsley	Linn Creek, MO
E-1223	Janine Alderete	Beale AFB, CA
E-1224	Knute Horwitz	Chicago, IL
E-1225	James Salter	Minneapolis, MN
E-1226	Alfredo Kuba	Mt. View, CA
E-1227	Lenore Rodah	South Pasadena, CA
E-1228	Matt Kress	Laguna Beach, CA
E-1229	Kimberly Funk	Westminister, MD
E-1230	Rae Bauman	Boise, ID
E-1231	Maria Helscel	Massillon, OH
E-1232	Karl Hunting	Succasunna, NJ
E-1233	Yolanda Guevara	Jamaica, NY
E-1234	Ed Guevara	Jamaica, NY
E-1235	Rosalie Hewitt	Norwich, NY
E-1236	Rhiaman Shae	Toledo, OH
E-1237	Farrah Kusmin	Philadelphia, PA
E-1238	Mary Dyer	Troy, MI
E-1239	Andrew York	New York, NY
E-1240	Rebecca Weinschel	Norfolk, VA
E-1241	Ferdinand Kutheis	O’Fallon, MO
E-1242	Christina Ross	Beachwood, OH
E-1243	Emily Hoel	Libertyville, IL
E-1244	John Morgan	Charlottesville, VA
E-1245	Ron Pearson	Grayslake, IL
E-1246	Sarah Davis	Salton City, CA
E-1247	Emily van der Harten	Las Vegas, NV
E-1248	Dorothy Fersch	Lyndhurst, NJ
E-1249	Laura Andras	Strongsville, OH
E-1250	Gayle Eddy	Mount Holly, NJ
E-1251	Mark Ziff	New Hope, PA
E-1252	Katie Pritchett	Grand Junction, CO
E-1253	William Kellner	Valley Center, CA
E-1254	Jesse Counterman	Sioux City, IA
E-1255	Theresa Perenich	Athens, GA
E-1256	Catherine Barron	Ellisville, MO
E-1257	Ellen Bohles	Fairview, OR
E-1258	Alison Petretti	Jekyll Island, GA
E-1259	Jennifer Blair	Los Angeles, CA
E-1260	Sheryl Griffiths	Marietta, GA
E-1261	Lisette Rushing	Covington, GA
E-1262	Craig Peden	Redwood City, CA
E-1263	Holly Dyer	Troy, MI
E-1264	Jim Toth	Walton Hills, OH
E-1265	Sara Deyo	Nederland, CO
E-1266	Gloria Mason	Ferrum, VA
E-1267	Barbara Lau	San Francisco, CA
E-1268	Mark Bishton	Bloomfield, IN
E-1269	Kathleen Kelly-Hoffman	Green Bay, WI
E-1270	John Murphy	Great Falls, VA
E-1271	Sebastian Mork	Santa Barbara, CA
E-1272	Judith Springer	Exton, PA
E-1273	Clas Fiskerud	Edgewater, NJ
E-1274	Joan Kent	Sonoma, CA
E-1275	Richard Uniszkiewicz	Astoria, NY
E-1276	Paula Chihill	Greenville, SC
E-1277	Sandy Slichter	Mill Valley, CA
E-1278	Heidi Packard	Maple Shade, NJ
E-1279	Stephen Jones	Walkersville, MD
E-1280	Carlos Alberto Soria	Linden, NJ
E-1281	Michael Weintraub	Goleta, CA
E-1282	Dana Atnip	Oak Park, MI
E-1283	Steph English	Duke Center, PA
E-1284	Kristin Kiefer	Pacific Palisades, CA
E-1285	Sauwah Tsang	North Hollywood, CA
E-1286	Connie Boitano	Seattle, WA
E-1287	Peter Brunette	Walnut Creek, CA
E-1288	Katherine Babiak	New York, NY
E-1289	Kevin Sims	New York, NY
E-1290	Rachel Wolf	Santa Cruz, CA
E-1291	Albert Albanece	Chicago, IL
E-1292	Amy Prieskorn	Englewood, CO
E-1293	James & Cathryn Morrow	State College, PA
E-1294	Bobbie Murr	Portland, OR
E-1295	N. Ashton	Haddonfield, NJ
E-1296	Paula Flanagan	Hacienda Heights, CA
E-1297	Ann Drechsler	Halewia, HI
E-1298	Sharon Midcap	Dover, DE
E-1299	Jacqueline Mohan	Hillsborough, NC
E-1300	Heidi Holeman	Norman, OK
E-1301	Jorden Woods	San Jose, CA
E-1302	Alexandra Brenda Wing	WA
E-1303	Maria Ikola	Manassas, VA

Log #	Name	Location
E-1304	Sandy Gubin	North Bergen, NJ
E-1305	Hugh Harkins	Kent, WA
E-1306	Tina Schvejda	North Haledon, NJ
E-1307	Cynthia Merrow	Inkster, MI
E-1308	George Kretschmer	Elgin, IL
E-1309	Pam Bixter	Chicago, IL
E-1310	Natasha & Noah Brenner	Jericho, NY
E-1311	Emma Gib	White Plains, NY
E-1312	Dirk van Putten	Half Moon Bay, CA
E-1313	Katharine Treap	Asheville, NC
E-1314	Maxine Jones	Barbourville, KY
E-1315	Darryl Braun	Inkster, MI
E-1316	Matthew McGuire	Cheshire, CT
E-1317	Elaine Matthews	Burbank, CA
E-1318	Kathy Kowalchick	Gaithersburg, MD
E-1319	Ann Fonfa	New York, NY
E-1320	Ellen Kolasky	Ann Arbor, MI
E-1321	Jill Helwig	Denver, CO
E-1322	Michael Meyers	Kawkawlin, MI
E-1323	Syd Southworth	Syracuse, NY
E-1324	Christine Lewis	KY
E-1325	Ashley D'Angelo	Midway, PA
E-1326	Kat Cirelli	Bullhead City, AZ
E-1327	Kent Wallace-Meggs	Los Angeles, CA
E-1328	Philip Meininger	New Brighton, MN
E-1329	Holly Schmidt	Machesney Park, IL
E-1330	Kristen Snyder	Depew, NY
E-1331	Martine Ferguson	Laurel, MD
E-1332	Jill Strawder-Bubala	Eugene, OR
E-1333	Dorothy A. Roux	Magalia, CA
E-1334	Kari Forrest	Chapel Hill, NC
E-1335	Laura Callier	Denver, CO
E-1336	Jan Major	New York, NY
E-1337	Julian Kesterson	Glasgow, VA
E-1338	Christina Babst	West Hollywood, CA
E-1339	Rachael Manning	Mechanicsburg, PA
E-1340	Frederic Noyes	Syracuse, NY
E-1341	Barb Wold	Albuquerque, NM
E-1342	Andrew Vetter	Canon City, CO
E-1343	Kevin Brinkofski	Tecumseh, MO
E-1344	Mikki Chalker	Binghamton, NY
E-1345	Bethany Sanders	Murray, KY
E-1346	Robert J. Parra	Lansdale, PA
E-1347	Leah Hockenbrouch	Geneva Township, OH
E-1348	Adam Johnson	Ann Arbor, MI
E-1349	Harmony Wilkins	Bethleham, PA
E-1350	Leslie Peckler	Wausau, WI
E-1351	Rev. Debra Lippitt	Collingdale, PA
E-1352	Tara Deutsch	Burlington, WA
E-1353	Vivian Blevins	Silver Spring, MD
E-1354	Judy Maloy	Winston Salem, NC
E-1355	Mark Smith	Covina, CA
E-1356	Janet Feutz	Reston, VA
E-1357	Stephen Baker	York, PA
E-1358	Gena Muller	Newport, MI
E-1359	Janice Wilfing	Springfield, OH
E-1360	Bernadette McNally	Columbia, NJ
E-1361	Nia Sopiwnik	Minneapolis, MI
E-1362	Don Steinke	Franksville, WI
E-1363	Laura Seraso	La Crescenta, CA
E-1364	Steve Phillips	Napa, CA
E-1365	Nicholas Lubofsky	Highlands Ranch, CO
E-1366	Marilyn McDowall	East Lansing, MI
E-1367	Shawn Janzen	Carpentersville, IL
E-1368	Florence O'Brien	Issaquah, WA
E-1369	Pattee Gregory	Keystone, SD
E-1370	So Young Park	New York, New York
E-1371	Kate Watson	Wayne, PA
E-1372	Cynthia Hogan	Salem, OR
E-1373	Mary Baran	Oakland, CA
E-1374	David Potter	Klamath Falls, OR
E-1375	Michael McFarland	Fresno, CA
E-1376	Stephen Sylvester	Chicago, IL
E-1377	Harry Quade	Baltimore, MD
E-1378	Carlin Howe	Ellicott City, MD
E-1379	Amy Elbert	Castro Valley, CA
E-1380	Jennifer Elrod	Buchanan, MI
E-1381	Amy Bodmann	Washington, DC
E-1382	Susan Folsom	Lawndale, CA
E-1383	Linda Wilson	Sitka, AK
E-1384	Rita Ryan	Madison, TN
E-1385	Adam Smith	Norman, OK
E-1386	Kim LaBadie	East Stroudsburg, PA
E-1387	Victoria Velinski	Chicago, IL
E-1388	Pam Allee	Portland, OR
E-1389	Amber Stonik	Bellingham, WA
E-1390	Ralph Holm	Seattle, WA
E-1391	Angee Tigner	Columbus, OH

Log #	Name	Location	Log #	Name	Location
E-1392	Ted Kraynick	San Jose, CA	E-1436	V e-c	Chicago, IL
E-1393	Andrew Reich	Los Angeles, CA	E-1437	Ross Ingram	Milwaukee, WI
E-1394	Jennifer Ball	Arcata, CA	E-1438	Pam Christie	North Ridgeville, OH
E-1395	Victoria Bookstein	Davis, CA	E-1439	Mizpah Thomas	Woodland Park, CO
E-1396	Whitney Helms	Woodbury, MN	E-1440	Jim Plezia	Cleveland, OH
E-1397	Martin Burwell	St. Clair Shores, MI	E-1441	Destiny Browning	Hazel Crest, IL
E-1398	Kathryn Morgan	Oak Creek, WI	E-1442	Azel Beckner	Bowling Green, KY
E-1399	Matthew Schweitzer	Richland Center, WI	E-1443	Carole M. Johnson	Bridgewater, NJ
E-1400	Kerry Burkhardt	Kenmore, NY	E-1444	Colin Burt	Odessa, MI-Canada
E-1401	Robin DeWeese	Villas, NJ	E-1445	Mike Axelrod	Fairport, NY
E-1402	Beau Kayser	Capitola, CA	E-1446	Harriette Frank	Durham, NC
E-1403	Monnie Efross	Pinole, CA	E-1447	B. Baumann	Washington, DC
E-1404	Haldane Morris	Santa Monica, CA	E-1448	Mary Alicia	Wheeling, WV
E-1405	Kathy C. Oppenhuizen	West Olive, MI	E-1449	Marcei Renaud	Oka Qu, Canada
E-1406	Farid De La Ossa	Chicago, IL	E-1450	Lisa Ann Berry	Pasadena, CA
E-1407	Jeff Pollack	Atlantic Beach, NC	E-1451	Teresa Doran	Batavia, NY
E-1408	Mark Sweitzer	Louisville,CO	E-1452	Michelle Palladine	Palm Springs, CA
E-1409	Lana Graff	Roseburg, OR	E-1453	Rachel Meltzer	New York, NY
E-1410	Russell Kamin	Toledo, OH	E-1454	Marjorie Hass	Hartshorne, OK
E-1411	Michelle Katja Werlich	Westlake Village, CA	E-1455	Brittany Scott	Oregon, OH
E-1412	Heather Casssara	Huntington Beach, CA	E-1456	Carrie Sweetnam	Manhattan Beach, CA
E-1413	Kim Farris	Studio City, CA	E-1457	Kristin Summerlin	Two Rivers, AK
E-1414	Kristin Stiff	Santa Barbara, CA	E-1458	Michael Chihill	Greenville, SC
E-1415	Jay Walton	Arboles, CO	E-1459	Geraldine Huffer	Crestwood, MO
E-1416	Jeanne Minor	Gaithersburg, MD	E-1460	Caitlin Higgins	Stone Harbor, NJ
E-1417	David Lester	Albuquerque, NM	E-1461	Patrick Moctezuma	Arlington, VA
E-1418	Arthur Moss	Honolulu, HI	E-1462	Andy Lynn	Douglasville, GA
E-1419	Tess Pillay	Minneapolis, MN	E-1463	Jennifer Griffiths	Chittenongo, NY
E-1420	Beth Long	Tuscon, AZ	E-1464	Jeanne Moskal	Syracuse, NY
E-1421	Paul Mirkarimi	Sunol, CA	E-1465	Kristen Lauzon	Seattle, WA
E-1422	Holly Owen	Goleta, Ca	E-1466	Pamela A. Miller	Anchorage, AK
E-1423	Douglas Montgomery	San Francisco, CA	E-1467	Sue DiCara	El Paso, TX
E-1424	Ellen Daugherty	Niagara Falls, NY	E-1468	Thomas Aldridge	San Jose, CA
E-1425	Juliann Rule	Avon, MN	E-1469	Dwight Crandell	Town & Country, MO
E-1426	Heidi Evans	La Center, WA	E-1470	Virginia Crawford	Westminister, CO
E-1427	Bill DeBoer	Jenison, MI	E-1471	Nancy Smith	Folly Beach, SC
E-1428	Mr. & Mrs. James Denison	Long Beach, CA	E-1472	Ashley Tekuelve	Georgetown, OH
E-1429	Suzanne Piper	Sevierville, TN	E-1473	Jesalyn Eatchel	Carlsbad, CA
E-1430	Mark Rogers	Fort Collins, CO	E-1474	Ar Nem	Portland, OR
E-1431	Pat Hickey	Raleigh, NC	E-1475	Alicia Gallego	Succasunna, NJ
E-1432	Jennifer Spence	CA	E-1476	Judy D'Amore	Port Townsend, WA
E-1433	Jackie Raven	New York, NY	E-1477	Carolina Diaz	Seattle, WA
E-1434	Kimberly Blake	Radford, VA	E-1478	Kathie Opon	IL
E-1435	Jo Ann Miller	East Lansing, MI	E-1479	Sara Crosby	South Bend, IN

Log #	Name	Location
E-1480	Natalie Olivas	Pinole, CA
E-1481	Amanda Welch	Muncie, IN
E-1482	Gerald R. Brookman	Kenai, AK
E-1483	Jim & Susan Geear	Medford, OR
E-1484	Agatha Zurawska	Indianapolis, IN
E-1485	Kimberley Graham	Coronado, CA
E-1486	Dana Clark	Pomona, CA
E-1487	Ariel Nessel	West Bloomfield, MI
E-1488	Rae Ann Gustafson	Boise, ID
E-1489	Emily Rieber	Santa Rosa, CA
E-1490	M. K.	Toms River, NJ
E-1491	Marlene Roberts	Toledo, OH
E-1492	Edwenna Earnheart	Silver City, NM
E-1493	April Collier	Pacifica, CA
E-1494	Patricia LeBaron	Medford, OR
E-1495	Doug Jewell	Trout Lake, WA
E-1496	Rosanne Halliday	Webster City, IA
E-1497	Hanne J. Nielsen	New York, NY
E-1498	Brighton Flaus	Santa Cruz, CA
E-1499	Shasha Jhaveri	Irvine, CA
E-1500	Jen Owens	New York, NY
E-1501	James Miller	Westminster, MD
E-1502	Anne Glimpse	Alexandria, VA
E-1503	Kellie McGettigan	Winfield, WV
E-1504	Dr. Mha Atma S. Khalsa	Los Angeles, CA
E-1505	Joannehope Johnson	Tempe, AZ
E-1506	Stephanie Hazlett	Westerville, OH
E-1507	Judy Nill	Kent, WA
E-1508	Molly Hauck	Kensington, MD
E-1509	Dalisey Moore	Piedmont, OK
E-1510	Elandriel Martin	Littlerock, CA
E-1511	Lorrie Ogren	Minneapolis, MN
E-1512	William T. Atkins	Merlin, OR
E-1513	Kelley McAdon	Fairhaven, CA
E-1514	Cynthia Fabian	Prescott, AZ
E-1515	Anna Kaltenbach	Denver, CO
E-1516	Adam Kron	Portland, OR
E-1517	Ingrid Modaresi	Rock Hill, SC
E-1518	Erin Steurer	Hyattsville, MD
E-1519	Linda Sanders	Warsaw, IN
E-1520	Valentina Hecker	Los Angeles, CA
E-1521	Katherine Robertson	Durango, CO
E-1522	Van Vibber	Malibu, CA
E-1523	Miranda Leonard	Woodland Hills, CA

Log #	Name	Location
E-1524	Burnis Tuck	Fresno, CA
E-1525	Stephen Sloane	Washington, DC
E-1526	Regina Pilozzi	San Diego, CA
E-1527	Rita Stang	Waukegan, IL
E-1528	Vicki Johnson	Kansas City, MO
E-1529	Jennie Lopez	San Diego, CA
E-1530	Stacey Rice	Lindenhurst, NY
E-1531	Lindsey Ward	Rancho Palos Verdes, CA
E-1532	Betty Rice	Spencer, NC
E-1533	Peter Svensson	Santa Cruz, CA
E-1534	Paul Chasman	Waldport, OR
E-1535	Robyn Rhudy	Marriottsville, MD
E-1536	Mary Loretta Beier	Leavenworth, KS
E-1537	Debora Deschene	Kent, WA
E-1538	Jill Weinstein	New York, NY
E-1539	Sarah Slocum	San Mateo, CA
E-1540	Frances Cone	Marietta, GA
E-1541	Matt Chagnon	La Mesa, CA
E-1542	Sunny West	Sacramento, CA
E-1543	Demelza Costa	Sweet Home, OR
E-1544	Kevin Bond	Centreville, VA
E-1545	Michael Hansen	Deerfield, IL
E-1546	Wendy Knothe	Hatboro, PA
E-1547	Audrey Woodson	Herndon, VA
E-1548	Nan Dahringer	Lansing, MI
E-1549	Robin Halbert	Lawrence, KS
E-1550	Ruth Ann Dunn	Gaylord, MI
E-1551	Ezshwan Winding	Ashland, OR
E-1552	Kathy Lane	Vancouver, WA
E-1553	James Schley	New York, NY
E-1554	Summer Knowlton	Redlands, CA
E-1555	Josh Wittmer	Pittsburgh, PA
E-1556	Gary Carrao	Venice, CA
E-1557	Kimberly Peterson	Los Angeles, CA
E-1558	Peter Weiner	Burbank, CA
E-1559	Jeremy Schwartz	East Meadow, NY
E-1560	Barb Watts	Louisville, KY
E-1561	Rollin Dalpiaz	Carmichael, CA
E-1562	Susan Pemberton	Brooklyn, NY
E-1563	James Stephens	Hopeville, GA
E-1564	Mark Hull	Langlios, OR
E-1565	Christine Potts	CA
E-1566	Marie Ostrander	Fairview, NC
E-1567	Lorraine Mason	Oxford, PA

Log #	Name	Location
E-1568	Rowena Vaca	Kailua-Kona, HI
E-1569	Sherri Kaiser	Riverside, WA
E-1570	Aaron Roe	Rolla, MO
E-1571	Robert Robinson	Sacramento, CA
E-1572	Karen Dingmon	Everett, WA
E-1573	Troy Lester	Arcade, NY
E-1574	Dustin Sulak	Bloomington, IN
E-1575	Terresa Giacomini	Ashland, OR
E-1576	Earl Thomas	SC
E-1577	Robbie Heier	Brooklyn, NY
E-1578	Alana Disney	Mooresville, IN
E-1779	Sarah Webb	Durham, NC
E-1580	Angela McLeod	Midland, VA
E-1581	Tamara Cole	Belfast, NY
E-1582	Kristin Haley	Kettle Falls, WA
E-1583	Gwen Atkinson	East Olympia, WA
E-1584	Judy Hopper	Columbia, SC
E-1585	Scott Parmer	Santee, CA
E-1586	Fred Henke	York, PA
E-1587	Deborah Smith	Oklahoma City, OK
E-1588	D. Scanlon	Kansas City, MO
E-1589	Amy Ramsey	Edmond, OK
E-1590	Ann McGlashen	Green Valley, AZ
E-1591	Bruce Marsh	Madison, WI
E-1592	Arlene Gemmill	San Francisco, CA
E-1593	Linda Lirette	Eastpointe, MI
E-1594	Elizabeth Dunne	Arlington, VA
E-1595	Bobbie Phelps	Westminster, MD
E-1596	Elizabeth MacDonald	Bloomfield Hills, MI
E-1597	Claudia Johnson	Cambridge, MD
E-1598	Charles & Sherry Lewis	Albuquerque, NM
E-1599	Jessy Broniarczyk	Palos Park, IL
E-1600	Damien Wilkinson	Milledgeville, GA
E-1601	Katie Welter	Denver, CO
E-1602	John Biglow	Atherton, CA
E-1603	April McKay	Lilburn, GA
E-1604	Jennifer Milton	Clearlake, WA
E-1605	David Antonio Gurule	Denver, CO
E-1606	C. Michael Brown	Raleigh, NC
E-1607	Arleen Wiley	Mena, AR
E-1608	Mary Wilkinson	Loveland, CO
E-1609	Paul Williams	Atlantic City, NJ
E-1610	Lauren Lewis	Irvine, CA
E-1611	Janet Kuciejczyk	St. Louis, MO

Log #	Name	Location
E-1612	Bette Shelton	Indianapolis, IN
E-1613	Jason Kishineff	Chico, CA
E-1614	Sandra Saitz Cewballos	Mexico
E-1615	Elam Blackman	San Rafael, CA
E-1616	Jeff Lerner	Pacific Grove, CA
E-1617	David Burkhart	Salem, OR
E-1618	Amy Prisco	Washington, NJ
E-1619	Carol Betts	Berea, OH
E-1620	Jessica Parker	Temecula, CA
E-1621	Meg McDonald	Baltimore, MD
E-1622	Jeri Alexis Rosenthal	Klawock, AK
E-1623	Rose Griffin	Cortland, NY
E-1624	Kamal Fox	Martinez, CA
E-1625	Matthew Coate	University Heights, OH
E-1626	Doug Couchon	Elmira, NY
E-1627	Amy Haines	Racine, WI
E-1628	Peggy Schreiner	Vernon Hills, IL
E-1629	Kay Louise Cook	Seattle, WA
E-1630	Howard Lazzarini	Everett, WA
E-1631	Evalyn Segal	Philadelphia, PA
E-1632	Sherry Rock	Rineyville, KY
E-1633	Mark A. Giordani	Van Nuys, CA
E-1634	Martha Vitale	Los Angeles, CA
E-1635	Phil Mayfield	Wanette, OK
E-1636	Ernest Hopkins	Chula Vista, CA
E-1637	Paul Escamilla	Brooklyn, NY
E-1638	Dinda Evans	San Diego, CA
E-1639	Nicole Masaluso	Rancho Santa Fe, CA
E-1640	Pam Marcum	Tempe, AZ
E-1641	Rachel Fahrig-Richards	Baltimore, MD
E-1642	Kristin Summer	Midland, MI
E-1643	Sharane Stevenson	Redding, CA
E-1644	Annaka Dodd	Traverse City, MI
E-1645	Sandra Walter	Tucson, AZ
E-1646	Nancy Ward	Portland, OR
E-1647	Linda Tran	Portland, OR
E-1648	Morona Madsen	Loa, UT
E-1649	Linda Hartge	Brookeville, MD
E-1650	Peter Burnside	Avon, MN
E-1651	Myrna Mincey	NJ
E-1652	Enid Gilham	Santa Monica, CA
E-1653	Alice Ermlich	Seattle, WA
E-1654	Dolores Pietrzak	Albuquerque, NM

Log #	Name	Location
	9/15/02	
E-1655	Austin Leach	La Jolla, CA
E-1656	Randi Miller	Puyallup, WA
E-1657	Anna Barrows	Connersville, IN
E-1658	Frank Smith	Bluff City, KS
E-1659	Bret Schacht	Beatrice, NE
E-1660	Grethen Grimm	Guam
E-1661	Nichole Bouwens	Douglasville, GA
E-1662	Carol Schlapo	Warrenton, VA
E-1663	Margaret Wood	Suffolk, VA
E-1664	Sharon Rambo	EHT, NJ
E-1665	Sandy Crooms	Gary, IN
E-1666	Carol Wagner	Williston, VT
E-1667	Martha Morton	Greensboro, NC
E-1668	Jason Rossow	Johnson City, NY
E-1669	Anthony Donnici	Kansas City, MO
E-1670	Jennifer Hunter	Jewett, NY
E-1671	Summer Restrepo	Stockbridge, GA
E-1672	Bethany Bulgrin	Altoona, WI
E-1673	Nancy Johnstone	Columbus, OH
E-1674	Kimmi Short	Phoenix, AZ
E-1675	Glen Berger	New York, NY
E-1676	Lia Friedman	Jersey City, NJ
E-1677	William Freeto	Chicago, IL
E-1678	H. Dubuisson	Denver, CO
E-1679	Linda Axman	Newport Beach, CA
E-1680	William Dugan	Lancaster, PA
E-1681	Victoria Ramirez	Butler, OH
E-1682	Larry Trutter	Springfield, IL
E-1683	Kim Cartwright	Greensboro, NC
E-1684	Jessica Sawchuk	Ronkonkoma, NY
E-1685	Anne W. Phillips	Mercer Island, WA
E-1686	Rosemary Fox	Rhinecliff, NY
E-1687	Jennifer Willis	Cincinnati, OH
E-1688	Mary Ann Keefer	Denver, CO
E-1689	Steve Green	Sedro Woolley, WA
E-1690	Joseph P. Gaby	Denver, CO
E-1691	Tony Massarello	Oak Park, IL
E-1692	Jennifer Olive	Bay Village, OH
E-1693	Dana Reed	Corona del Mar, Ca
E-1694	Karen Mitchell	Columbia, MD
E-1695	Amanda Yaggy	Chapel Hill, NC
E-1696	Kevin Crosier	San Pedro, CA
E-1697	Julene Cole	Corona, CA

Log #	Name	Location
E-1698	Alison Megger	Tinley Park, IL
E-1699	Melissa Donley	Glen Bernie, MD
E-1700	Linda Schwarz	Santa Anna, CA
E-1701	Mary 0’Connor	Chicago, IL
E-1702	L. Lynn Bolin	Crossville, TN
E-1703	Charlotte Meyer	Tokoma Park, MD
E-1704	Jason Wells	Tempe, AZ
E-1705	Stacie Duncan	South Royalton, VT
E-1706	Shannon Dillon	San Leandro, CA
E-1707	Audrey Blumeneau	Santa Cruz, CA
E-1708	Melissa Arnold	Bellmore, NY
E-1709	Angela Duffer-Vargas	Annapolis, MD
E-1710	Melissa Foley	Chattanooga, TN
E-1711	Gina Novak	Philadelphia, PA
E-1712	Gwen Ilaban	Kailua-Kona, HI
E-1713	Valerian Anderson	Hiram, OH
E-1714	Ashley Gronek	Chicago, IL
E-1715	Anna Leach	Muncy Valley, PA
E-1716	Molly Skaer	Clarkston, MI
E-1717	Trisha Jachlewski	Amherst, NY
E-1718	Ellen Cox	Helena, MT
E-1719	Jennifer Hausler	Watertown, NY
E-1720	Wendy Howell	Montpelier, VT
E-1721	Shannon Bell	Mansfield, OH
E-1722	Michele Anderson	Scandia, MN
E-1723	Chris Beetley-Hagler	Davis, CA
E-1724	Seth Pogue	Hamilton, MT
E-1725	Betsy Munro	Madison, WI
E-1726	Shelley Berlincourt	Rifton, NY
E-1727	John Hartman	Endicott, NY
E-1728	Jill Whitney	Avon-By-The-Sea, NJ
E-1729	Eleanor Conger-Milnes	Denver, CO
E-1730	Lora Donnelly	Ft. Collins, CO
E-1731	Raymond Paynter	Belmont, CA
E-1732	Jenn Zwart	Wallkill, NY
E-1733	Cindy Russo	Villa Park, IL
E-1734	John Pearce	San Francisco, CA
E-1735	Randy Davis	Baltimore, MD
E-1736	Mike Hart	Aurora, IL
E-1737	Joyce Storm	Roesmount, MN
E-1738	Val Porter	Bloomington, IN
E-1739	Mary Hitchcock	Toledo, OH
E-1740	Robert Warner	Poway, CA
E-1741	Anne Allison	Franklin, NC

Log #	Name	Location
E-1742	Frank Cannon	South Lake Tahoe, CA
E-1743	Renee Gayk	St. Francis, WI
E-1744	Regina Holt	Elkridge, MD
E-1745	Aubry Bennett	Kincaid, WV
E-1746	Donna Strong	Carmel, CA
E-1747	Gary Bennett	Royal Oak, MI
E-1748	Keeta Cox	Huxley, IA
E-1749	William Word	Eureka, CA
E-1750	Sarah Eberhardt	Chester, NJ
E-1751	Yochanan Zakai	Rockville, MD
E-1752	Marcia Cooperman	Portland, OR
E-1753	Brett Rogers	South Orange, NJ
E-1754	Esther Cover	Ranchester, WY
E-1755	Miriam Garcia	Rio Piedras, Puerto Rica
E-1756	Freeda Goldberg	Eastport, NY
E-1757	Meredith Calvert	Charlottesville, VA
E-1758	Diana Brownell	Somerset, NJ
E-1759	Angelo Frigo	Chicago, IL
E-1760	Kristina Kordulak	Virginia Beach, VA
E-1761	Patricia Porter	Yardley, PA
E-1762	Nathan Boddie	LaGrange, GA
E-1763	Kathy FitzJefferies	Salisbury, NC
E-1764	Rev. Diane Russell	Santa Rosa, CA
E-1765	Angel Phillips	Napa, CA
E-1766	Hilary Caws-Elwitt	Friendsville, PA
E-1767	Johathan Caws-Elwitt	Friendsville, PA
E-1768	Carolyn Jackson	Mountain Home, NC
E-1769	Linda Lyerly	Cardiff, CA
E-1770	Rose Shulman	Charlotte, NC
E-1771	Nancy Ritthamel	Northridge, CA
E-1772	Rebecca Jamieson-Pugh	Springfield, MO
E-1773	Michael Maslanek	Congers, NY
E-1774	Brenda Stouffer	Dana Point, CA
E-1775	Kathy Galligan	Bridgewater, NJ
E-1776	Shannon O'Laughlin	Inverness, IL
E-1777	Suzanne Staples	Hawthorne, NJ
E-1778	Carol Blumenthal	Millsboro, DE
E-1779	Katherine Kautz	Northglenn, CO
E-1780	Andrea Hackett	Atlanta, GA
E-1781	Patti Laursen	Los Angeles, CA
E-1782	Danine Murphy	Colorado Springs, CO
E-1783	Anna Przybylski	Golden Valley, MN
E-1784	Meg Oldman	Davis, CA
E-1785	Kathleen Leenerts	Loveland, CO

Log #	Name	Location
E-1786	Siobhan Maty	Chapel Hill, NC
E-1787	Elizabeth Pabon	Bronx, NY
E-1788	Diana Weber	Albany, NY
E-1789	Jessica Aldrich	Windsor, NY
E-1790	C. J. McPherson	Gig Harbor, WA
E-1791	Ravi Grover	Chicago, IL
E-1792	Laura Kahn	Sparland, IL
E-1793	Lin Silvan	Eugene, OR
E-1794	Teresa Heying	Saint Peters, MO
E-1795	Christopher Pielli, J.D.	West Chester, PA
E-1796	Jean Lee	Chicago, IL
E-1797	Miriel Hope Collins	Denver, CO
E-1798	Chris Striegel	Philadelphia, PA
E-1799	Shelly Lemon	Tucson, AZ
E-1800	Laura Davis	Albany, NY
E-1801	Sarah Montague	New York, NY
E-1802	Ed Abril	Tucson, AZ
E-1803	Sophie Keller	Kirkland, WA
E-1804	Martha Hannah	Ann Arbor, MI
E-1805	Stephen Funk	Oakland, CA
E-1806	Delores Mays	St. Louis, MO
E-1807	Ronald Holland	New York, NY
E-1808	Diane la Chusa	National City, CA
E-1809	Helen Kopp	Grafton, OH
E-1810	Denise Cutrell	Medford, OR
E-1811	Mollie Tubbs	Webster, NY
E-1812	Patti Motter	Venus, PA
E-1813	Deborah Bancroft	Onalaska, WA
E-1814	Luca Van Der Kraan	Oxnard, CA
E-1815	Shermi Parikh	Chicago, IL
E-1816	Ursa Rose	Florence, AZ
E-1817	Gwen Carlson	Richland, WA
E-1818	Sandra O'Rourke	East Chatham, NY
E-1819	Terry Sario	Phoenix, AZ
E-1820	Sarah Keech	Rancho Palos Verdes, CA
E-1821	Adrian Tremayne	Mt. Morris, NY
E-1822	Shawn Linderman	Mt. Morris, NY
E-1823	Mary Zimmerman	San Jose, CA
E-1824	Brian James	Independence, MO
E-1825	Diane Caldwell	Crescent City, CA
E-1826	Anita Soper	Gettysburg, SD
E-1827	Lone Rhodes	New York, NY
E-1828	Denise Speicher	Rochester, NY
E-1829	Marisa Brandstetter	Cincinnati, OH

Log #	Name	Location
E-1830	Sarah Tromp	Eau Claire, WI
E-1831	Tereza Marks	Arlington, VA
E-1832	Connie Turner	Massillon, OH
E-1833	Joan Bush	Thousand Oaks, CA
E-1834	Geri Acker	La Crosse, WI
E-1835	Scott Snibble	San Francisco, CA
E-1836	Matt Cox	Anchorage, AK
E-1837	Harold Rapp	Ewing, NJ
E-1838	Sheila Chambers	Brookings, OR
E-1839	Marilyn Capello	Orange, CA
E-1840	Jan McCreary	Silver City, NM
E-1841	David Orr	Heleiwa, HI
E-1842	Frank Jr. Marrero	New York, NY
E-1843	Dan Elder	Santa Barbara, CA
E-1844	Carrie Johnson	Tahoe City, CA
E-1845	Anne Clarke	Atlantic Beach, NC
E-1846	Jeri Pollock	Tujunga, CA
E-1847	Linda Hoyt	St. Louis, MO
E-1848	LaRee Nelson	Chouteau, OK
E-1849	Timothy McDermond	Eureka, CA
E-1850	Bonita Early	Littleton, CO
E-1851	Anthony Villagomez	Trout Lake, WA
E-1852	Stefanie Schmidt	Whittier, CA
E-1853	Linda Hunt	North East, MD
E-1854	Albert Iannacone	Knoxville, TN
E-1855	Christopher Mattias	Fort Wayne, IN
E-1856	Mary Dugan	Chatham, NY
E-1857	Kyle Smith	Long Beach, CA
E-1858	Christie Walker	Atlanta, GA
E-1859	Heather Ritter	Glen Head, NY
E-1860	James Holley	Santa Cruz, CA
E-1861	Jessica Gilmartin	Jordanville, NY
E-1862	Terry Bunch	San Diego, CA
E-1863	Monica Speck	Gibsonia, PA
E-1864	Emily Bjonnes	Hillsborough, NJ
E-1865	Robert Holder	Mt. Sinai, NY
E-1866	Scott Baker	Chicago, IL
E-1867	Jennifer Gilmartin	Jordanville, NY
E-1868	Lars Olsen	Haleiwa, HI
E-1869	Elaine Chismar	Brick, NJ
E-1870	Diane Buccheri	Avon, NC
E-1871	Marian Anderson	Mechanicsburg, PA
E-1872	Jeri Cheraskin	Ithaca, NY
E-1873	Rachael Stanford	Mackiaw, IL
E-1874	Lauren Throop	Lander, NY
E-1875	Kai Eichert	San Diego, CA
E-1876	Melissa King	Eau Claire, WI
E-1877	Betsy Newman	Columbia, SC
E-1878	Melissa Pierce	West Chester, PA
E-1879	Bret Glass	Columbia, MO
E-1880	Alexandra Glazer	Thousand Oaks, CA
E-1881	Chris Heintzelman	Fairfax, CA
E-1882	Jenae Neiderhiser	Middleburg, VA
E-1883	Chad Halsey	Lansing, MI
E-1884	Emily Sherman	Los Angeles, CA
E-1885	Arleen Becker	Tarzana, CA
E-1886	Leah Haury	Reedley, CA
E-1887	Nancy Crom	Albany, NY
E-1888	Carol Bellavia	Thornton, CO
E-1889	Joanna Huitt	Mentone, CA
E-1890	Ashley Skakie	Renton, WA
E-1891	Sherri Bray	La Habra Heights, CA
E-1892	Lisa Pacheco	Santa Fe, NM
E-1893	Linda Burton	Lexington, KY
E-1894	Mildred	Lexington, KY
E-1895	Doug Wallace	Minneapolis, MN
E-1896	Stephen Tillotson	Winston-Salem, NC
E-1897	Sharon Augenstein	Huntington Beach, CA
E-1898	John Hayden	Avalon, CA
E-1899	T. Hart	Stillwater, OK
E-1900	Lee Frank	Sherman Oaks, CA
E-1901	Katherine Dineen	Loudonville, NY
E-1902	Renee Tiesler	New York, NY
E-1903	Pete MacGregor	Secane, PA
E-1904	Lisa Velez	Round Lake Beach, IL
E-1905	Davydd Contarino	Power Springs, GA
E-1906	Greg Maloney	Pitman, NJ
E-1907	Claire Salyards	Manassas. VA
E-1908	Cathy Villalobos	Gainesville, GA
E-1909	Julie Osborn	Moab, UT
E-1910	Amanda Hoffman	Fort Wayne, IN
E-1911	Patricia Fogarty	Atlanta, GA
E-1912	Lisa Warden	New Brunswick, NJ
E-1913	Julie Danton	Huntingdon Valley, PA
E-1914	Amy McDaniel	Lynchburg, VA
E-1915	Cassie Schmitz	Fairfield, IA
E-1916	G. D.	New York, NY
E-1917	Dean Paul	O’Fallon, MO

Log #	Name	Location
E-1918	Michelle Yakel	Turtle Creek, PA
E-1919	Trudy Deutsch	Ringoes, NJ
E-1920	Danielle Stumbo	Oak Hill, OH
E-1921	Adam Michel	Tucson, AZ
E-1922	Lori Werba	New Paltz, NY
E-1923	Carolyn Doswell	Studio City, CA
E-1924	Randy Sailer	Beulah, ND
E-1925	Traci Hamilton	Charlotte, NC
E-1926	Brian Walker	Paterson, NJ
E-1927	Jenna Feinstein	Columbus, OH
E-1928	Dennis Hendren	La Plata, MO
E-1929	Hilary Field	Belgrade, MT
E-1930	Patricia St. August	Okanogan, WA
E-1931	Gordon Butt	Lakewood, CO
E-1932	Richard Salmon	Green Bay, WI
E-1933	David Randall	Port Jefferson, NY
E-1934	Stacie Dullmeyer	El Segundo, CA
E-1935	Gimone Hall	Ottsville, PA
E-1936	Geoff Newman	Ithaca, NY
E-1937	Chris Young	Chattanooga, TN
E-1938	Venus Cheng	Madison, WI
E-1939	Barbara Ann Dembek	East Meadow, NY
E-1940	Gina Cardinal	Philadelphia, PA
E-1941	Shaun & ReNae Gardner	Clancy, MT
E-1942	Ray Hancock	Colbert, WA
E-1943	Louis Deere	Villas, NJ
E-1944	Pat Quinn	Paterson, NJ
E-1945	Virginia Velasquez	Las Vegas, NV
E-1946	Kristin Peterson	Kutztown, PA
E-1947	Debra McGraw	Douglasville, GA
E-1948	Lisa Furman	Albany, GA
E-1949	Melissa Jones	South Pasadena, CA
E-1950	Lisa Monda	Placitas, NM
E-1951	Betty & Curt Cureton	Pebble Beach, CA
E-1952	Kevin Barry	Carlsbad, CA
E-1953	Eliana Garcia	Staten Island, NY
E-1954	Gail Lee Van Heel	Inver Grove Heights, MI
E-1955	Laura Bucher	New York, NY
E-1956	Karen Vahling	Hot Sulphur Springs, CO
E-1957	Theodore Pasquali	Princeton, NJ
E-1958	Theresa Media	Sacramento, CA
E-1959	Janine Panna	Greentown, PA
E-1960	Crystal Hawthorne	Redwood Shores, CA
E-1961	C. Reeves-Rutledge	Medford, OR

Log #	Name	Location
E-1962	Jeffre Rosenfeld	Santa Monica, CA
E-1963	Linda Lace	Mesa, AZ
E-1964	Courtney Bonnell	Phoenix, AZ
E-1965	Marcie Holst	Canyon Country, CA
E-1966	Thomas Urani	Kansas City, MO
E-1967	Michael Boucher	Los Angeles, CA
E-1968	Jane Cothron	Newport, OR
E-1969	Steve Gaias	Chandler, AZ
	9/16/02	
E-1970	Krista Finlay	Santa Barbara, CA
E-1971	James Malecki	Seattle, WA
E-1972	Amanda Nelson	Arlington, WA
E-1973	Lisa Tricoli	Buffalo, NY
E-1974	Adrian Herrera-Fuentes	New York, NY
E-1975	Ken Goldsmith	London, United Kingdom
E-1976	Kara Cunningham	Honolulu, HI
E-1977	Vincent Zoccolante	Honolulu, HI
E-1978	Marcus Carpenter	Charlottesville, VA
E-1079	Elliot Lebediker	Buffalo, NY
E-1980	Robin Karnatz	San Jose, CA
E-1981	Harold Harris	New York, NY
E-1982	Monika Willisegger	Gaithersburg, MD
E-1983	Chris Gross	Doylestown, PA
E-1984	Evelyn Phillips-Gutchell	Colonie, NY
E-1985	Fran Dickenshied	Stroudsburg, PA
E-1986	Lee Horne	Mt. Bethel, PA
E-1987	Andrew McMaster	Hazelwood, MO
E-1988	Robert Braeges	Angola, NY
E-1989	Jennifer Neault	Harrison Township, MI
E-1990	John Mohler	Catonsville, MD
E-1991	Cam Holmes	Baltimore, MD
E-1992	Lance Polya, PhD	Jericho, VT
E-1993	Matt Hils	Lakewood, OH
E-1994	Diane Connors	New York, NY
E-1995	Glenn Hennessee	Raleigh, NC
E-1996	James Snyder	Hogansburg, NY
E-1997	Linda Brown	South Euclid, OH
E-1998	Michael Leuthold	Spokane, WA
E-1999	Brie Kessler	Charleston, SC
E-2000	Mary Lynn Fisher	Kensington, MD
E-2001	Don Conway-Long	Webster Groves, MO
E-2002	Dennis Toppel	McAllister, MT
E-2003	Nicole Pawelski	Holly Springs, NC
E-2004	Ann Marie Kotlik	Pittsburgh, PA

Log #	Name	Location
E-2005	Sue Shawl	Coulter, PA
E-2006	Teri Fittro	Winston-Salem, NC
E-2007	Lynne Sidey	Pittsford, NY
E-2008	Avis Campbell	New Brighton, MI
E-2009	Mark Sidey	Pittsford, NY
E-2010	N. Simmons	Massapequa, NY
E-2011	Peter Poppe	Syracuse, NY
E-2012	Ellen Fisher	Knoxville, TN
E-2013	Ericka Wietecha	Chicago, IL
E-2014	Michele Morgen	Williamsport, PA
E-2015	Jessica Gunter	Saddle Brook, NJ
E-2016	Heidi Blackwell	Guilderland, NY
E-2017	Craig R. Beach	Reisterstown, MD
E-2018	Nicole Stefan	Baltimore, MD
E-2019	Carolyn Faulkner	Holly Springs, NC
E-2020	Patti Tomasello	Waxhaw, NC
E-2021	Bruce Schaffer	Huntsburg, OH
E-2022	Sonali Gokhale	Marietta, GA
E-2023	Aine-Theresa Melvin	North Brunswick, NJ
E-2024	Kara Cassels	Clarkston, GA
E-2025	Shane Tanner	Belgrade, MT
E-2026	Richard Heinlein	Oakbrook Terrace, IL
E-2027	Virginia Boynton	Macomb, IL
E-2028	Marty Feczko	Pittsburgh, PA
E-2029	Marjorie Haizlip	Canadaigua, NY
E-2030	Benjamin Francis	Rock Hill, SC
E-2031	Audra Schrader	WI
E-2032	Joanna Markessinis	Selkirk, NY
E-2033	James Mitchell	Winston-Salem, NC
E-2034	Gitana Chunyo	Baltimore, MD
E-2035	Bree Brostko	Arlington, VA
E-2036	Cynthia Steinberger	Lakewood, OH
E-2037	Lisa A. Monk	Virginia Beach, VA
E-2038	Jennifer Thompson	Ball Ground, GA
E-2039	Suzanne Sliger	Clinton Township, MT
E-2040	Tonya Fisher	Raymore, MO
E-2041	Stacy Albritton	St. Thomas, VI
E-2042	Vivienne Sturgill	Athens, GA
E-2043	Robert Blankenship	Charlotte, NC
E-2044	Rick Scheffert	Calmar, IA
E-2045	Suzanne Stewart	Rutledge, PA
E-2046	Philip Batty	Memphis, TN
E-2047	Tammy Johnson	Granada Hills, CA
E-2048	Jena Sleboda	Chicago, IL

Log #	Name	Location
E-2049	Katherine Stukel	Eagan, MN
E-2050	Barbara Warner	Lebanon, KY
E-2051	Michael Cavanaugh	Redondo Beach, CA
E-2052	Maria Betancourt	Atlanta, GA
E-2053	Caroline King	New York, NY
E-2054	Emily Carr	Murray, KY
E-2055	Chad Wawrzyniak	Northfield, VT
E-2056	Todd O'Buckley	Chapel Hill, NC
E-2057	John Savlove	North Bennington, VT
E-2058	Suzanne Brier	New York, NY
E-2059	Stephanie Crease	Northfield, VT
E-2060	John Venezia	Arlington, VA
E-2061	Chris Phillips	Denver, CO
E-2062	Shannon Kresse	Hudson, OH
E-2063	Christine Hughes	Blue Springs, MO
E-2064	Bronwyn Bleakley	Ellettsville, IN
E-2065	Phil Gross	Oakland, CA
E-2066	Vicki Gore	Brentwood, TN
E-2067	Coy Christensen	Lafayette, CO
E-2068	Tonya Dreher	Astoria, NY
E-2069	Heather Saxon	San Diego, CA
E-2070	Donna Hopper	Benton, AR
E-2071	Rinda Tisdale-Hesis	Loveland, CO
E-2072	Amy Carter	Washington, DC
E-2073	Amy Grubert	St. Louis, MO
E-2074	Bryanna Carroll	Chicago, IL
E-2075	Dawn Garcia	Minneapolis, MN
E-2076	Melissa Chisena	Pine Bush, NY
E-2077	Debra Collins	Mountain Home, AR
E-2078	Wendi Wright	Levittown, PA
E-2079	Rachael Alvarez-Jett	Torrance, CA
E-2080	Regina Dunn	Douglasville, GA
E-2081	Andrew Katkin	Washington, DC
E-2082	Sarah Mackinney	New York, NY
E-2083	Ben Smith	Baltimore, MD
E-2084	Pamela Hahler	Denver, CO
E-2085	Jerry Crossan	Rising Sun, MD
E-2086	Kelly Parfitt	Grosse Point Farms, MI
E-2087	Jaclyn Faber	Hazelwood, MO
E-2088	Sandy Lynn	St. Louis, MO
E-2089	Terri Fish	Charlotte, NC
E-2090	Sharon Shinas	Mountainside, NJ
E-2091	Theresa Pauline	Lexington, KY
E-2092	Robert Moore, II	New York, NY

Log #	Name	Location
E-2093	Denise Rosmerman	New York, NY
E-2094	Elizabeth Weiner	Brooklyn, NY
E-2095	Jan Siplon	Savannah, GA
E-2096	Sara Kube	Philadelphia, PA
E-2097	Athba Hammed	Baltimore, MD
E-2098	Karen Gana	Bardstown, KY
E-2099	Mauricio Mejia	Long Beach, CA
E-2100	Melissa Wagner	West Leyden, NY
E-2101	Kieran Alcumbrac	San Jose, CA
E-2102	Donna Foote	Atlanta, GA
E-2103	Lisa Graham	Oak Park, MI
E-2104	Amanda Goodner	Porum, OK
E-2105	Mary Ramos	Sacramento, CA
E-2106	Rebecca Nadel	Ann Arbor, MI
E-2107	Grady McCallie	Raleigh, NC
E-2108	Mike Racette	Fountain, CO
E-2109	Deborah Bush	Littleton, CO
E-2110	John Bresding	San Francisco, CA
E-2111	Stacey Galarza	Alpharetta, GA
E-2112	Brandie Withrow	Fairborn, OH
E-2113	Lynne Multen	Encino, CA
E-2114	Shawn Broadhead	Renton, WA
E-2115	Kirk Schaeffer	Huntington Beach, CA
E-2116	Val Huston	Chicago, IL
E-2117	James Stevenson	Waterville, OH
E-2118	Stacy Hammond	Sullivan, IN
E-2119	Mark Lesher	Leavenworth, KS
E-2120	Maxwell & Teri Sobel	Indianapolis, IN
E-2121	Heidi Recksiek	North Charleston, SC
E-2122	Angela Winholtz	Blue Springs, MO
E-2123	Christopher Robinson	Seattle, WA
E-2124	Elizabeth Brill	Corning, NY
E-2125	Greg Holder	Fall Creek, OR
E-2126	Alice Edwards	Milford, OH
E-2127	Melissa McDaniel	Glenside, PA
E-2128	Lynn Bobicka	Haworth, NJ
E-2129	Alisia Wixom	Seattle, WA
E-2130	Thrower Starr	Atlanta, GA
E-2131	Dina Zainy	Golden, CO
E-2132	Chris Geremia	Government Camp, OR
E-2133	David Wick	Minneapolis, MN
E-2134	Alex Mistuloff	Redondo Beach, CA
E-2135	Matthew McCloskey Wolfe	Columbus, OH
E-2136	Brienne Carpenter	Portland, OR
E-2137	Rita Martinez	Colorado Springs, CO
E-2138	Lynne Van Treeck	Neenah, WI
E-2139	Laura Ellison	Fort Collins, CO
E-2140	Monica Brazel	Las Vegas, NV
E-2141	Julia Kaufmann	Napa, CA
E-2142	Silvie Celiz	Los Angeles, CA
E-2143	Jody Parker	Chillicothe, OH
E-2144	Chrisley Pickens	Durham, NC
E-2145	Joyce Tompkins	Spokane, WA
E-2146	Peggy Schramm	Waukegan, IL
E-2147	Cynthia Jaffe	Louisville, CO
E-2148	Lisa Crummett	Fullerton, CA
E-2149	Tara Sieber	Wilmington, DE
E-2150	Amy Daugherty	Monkton, MD
E-2151	Natalie Van Dyke	Addison, IL
E-2152	Susan Lane	Raleigh. NC
E-2153	Charmaine Oakley	Woodside, NY
E-2154	Kanchana Rimnongrua	Erie, PA
E-2155	Barry Robbins	Morris Plains, NJ
E-2156	Florence Cattin	Los Angeles, CA
E-2157	Jeff A. Jones	Raleigh, NC
E-2158	Melissa Sanderson	Durham, NC
E-2159	Alison Monk	Mishawaka, IN
E-2160	Kenneth Roberts	West Hollywood, CA
E-2161	David Rosenstein	Santa Monica, CA
E-2162	Boomer Mitzel	Lancaster, PA
E-2163	Elizabeth Walker	New York, NY
E-2164	Marguerite Porter	Lilburn, CA
E-2165	Michelle Waters	Santa Cruz, CA
E-2166	Clarice Haigh	Ballwin, MD
E-2167	Cathy Hobbs	Ararat, VA
E-2168	Tia Triplett	Los Angeles, CA
E-2169	Chris Greene	Ypsilanti, MI
E-2170	Margaret Yarbrough	Chicago, IL
E-2171	Kari Stamm	Groton, NY
E-2172	Helen Voris	Chicago, IL
E-2173	Staci Roth	Victorville, CA
E-2174	Brian Kelly	Sea Bright, NJ
E-2175	Brian Symington	Schaumburg, IL
E-2176	Bridgette Hagerty	Reno, NV
E-2177	Karen Scott	Greenville, NC
E-2178	Rodney Hedrick	Wilmington, NC
E-2179	Tenchi Hamaki	New York, NY
E-2180	Angela Burbage	Eugene, OR

Log #	Name	Location
E-2181	Yasaman Golban	San Francisco, CA
E-2182	Eva Grey	Sacramento, CA
E-2183	Shannon Teders	Worthington, OH
E-2184	Janet Smith	Portland, OR
E-2185	William Ralph	Narrows, VA
E-2186	Charles Miller	Highland, NY
E-2187	James Galsterer	Sebastopol, CA
E-2188	Erika Kayea	Greensville, SC
E-2189	Nancy Hey	Bethesda, MD
E-2190	Glenn Cronick	Staten Island, NY
E-2191	Eric Branson	Chicago, IL
E-2192	Amy LaFary	Indianapolis, IN
E-2193	Debbie Moewes	Laramie, WY
E-2194	Pete Falic	New York, NY
E-2195	Marshall Kavanaugh	Ewing, NJ
E-2196	Charlotte Jones	Indianapolis, IN
E-2197	David Kratz Mathies	Malden, MA
E-2198	Margaret Stone	Oakland, CA
E-2199	Darice Shumway	Hastings, MI
E-2200	Mami Nomura	Larkspur, CA
E-2201	Peggy Goddard	La Jolla, CA
E-2202	Oliver Burgess	Columbia, SC
E-2203	Kim Schlittler	Oklahoma City, OK
E-2204	Beatrice Stone	Reading, MI
E-2205	Laurel Haines	Chicago, IL
E-2206	Jennifer Johnson	Fairfield, OH
E-2207	Barbara Workman	Elizabeth City, NC
E-2208	John Kremer, PhD	Madison, WI
E-2209	Darcy Fisher	Albuquerque, NM
E-2210	Mary Gail Decker	Hyde Park, NY
E-2211	L. Langford	Spokane, WA
E-2212	Jesse Wilson	San Francisco, CA
E-2213	Janet Decker	Glengary, WV
E-2214	Kathleen Callahan	Howell, NJ
E-2215	Leslie Bober	Pittsburgh, PA
E-2216	Tom Brown	Tinton Falls, NJ
E-2217	Carol Maehr	Monterey, CA
E-2218	Julie Heffington	Santa Cruz, CA
E-2219	Bill Hensley	Kenosha, WI
E-2220	Bill Bradlee	Seattle, WA
E-2221	Michael Kirby	Northfield, MN
E-2222	Sherri Glebus	Richmond, VT
E-2223	Mariely Carvajal	Queens, NY
E-2224	Joan A. Lahmon	South Holland, IL

Log #	Name	Location
E-2225	William Ashman	Powell, OH
E-2226	Avvaiyar Kamari	New York, NY
E-2227	Lin Simpson	Vashon, WA
E-2228	Delia Barrett	East Berlin, PA
E-2229	April Adams	Fort Lewis, WA
E-2230	Paula von Weller	Warrenton, OR
E-2231	Timothy Rhone	Astoria, NY
E-2232	Kimberly Lowe	Gahanna, OH
E-2233	Lori Whitney	Mesa, AZ
E-2234	Wayne Williams	Signal Mountain, TN
E-2235	Gina Marie Robinson	Valley Village, CA
E-2236	Sandra Barnett	Springfield, MO
E-2237	Eleanor Tudor	Charlottesville, VA
E-2238	Martina Coronado	Woodbridge, VA
E-2239	Peggy Torres	Floyds Knobs, IN
E-2240	Michelle Muir	Nashville, TN
E-2241	Tina Carter	Ingleside, IL
E-2242	Sarah Berman	Washington, DC
E-2243	Jennifer Kim	Holmdel, NJ
E-2244	Melissa Mahoney	Monterey, CA
E-2245	Heather Thomas	Pasadena, MD
E-2246	Wendy Brown	Nova Scotia, Canada
E-2247	Kathryn Simmons	Aiken, SC
E-2248	Gail Rains	Sacramento, CA
E-2249	Sandra Douglass	WA
E-2250	Mike Williams	Princeton, MN
E-2251	Susan Alter	Shoreline, WA
E-2252	Lauren Phipps	Richmond, VA
E-2253	Amalia Collins	Toledo, OH
E-2254	Eliet Brookes	Milwaukee, WI
E-2255	Adrianna Buonarroti	Ann Arbor, MI
E-2256	Sienna Wagner	Annapolis, MD
E-2257	Joe Menniti, Jr.	Bellmore, NY
E-2258	Kari Wouk	Raleigh, NC
E-2259	Astrid Eglitis	Columbia Heights, MN
E-2260	Jennifer Price	Charleston, IL
E-2261	Rhonda Depue	Portland, OH
E-2262	Steven Damm	Akron, OH
E-2263	Kelly Roberts	Honolulu, HI
E-2264	Marisol Rojo	Fresno, CA
E-2265	Anjanette Forte	Ahwahnee, CA
E-2266	Andy Bunnell	Graton, CA
E-2267	John Dukes	Tucson, AZ
E-2268	Cristina Hipp	Springfield, OH

Log #	Name	Location
E-2269	Dawn Hegger	Honolulu, HI
E-2270	Kristina Gabriel	Gaithersburg, MD
E-2271	Ronald Galbavy	Agoura Hills, CA
E-2272	Nick Andrews	North Little Rock, AR
E-2273	Bonnie Bross	Kansas City, MO
E-2274	Yvonne Helms	Atascadero, CA
E-2275	Ky Carnell Russell	San Francisco, CA
E-2276	Linda de Soto	Manhattan Beach, CA
E-2277	David Block	Columbus, GA
E-2278	Jennifer Durkin	Columbia, MD
E-2279	Susan LoFurno	Webster, NY
E-2280	David Roberts	Kamuela, HI
E-2281	Lisa Feldkamp	Warrenton, MO
E-2282	Matthew Prince	Chandler, AZ
E-2283	Susan Robertson	Floyd, VA
E-2284	Jean Parkinson	Florence, AZ
E-2285	Jane Schultz	Riverside, CA
E-2286	Daniel Phipps	Washington, DC
E-2287	Memriy Miene	Huntingtown, MD
E-2288	Virginia Goolsby	Morristown, TN
E-2289	Anne-Marie Batchelor	San Francisco, CA
E-2290	Maximilian Sims	Arcadia, CA
E-2291	Lorraine Pacheco	Millbrae, CA
E-2292	Marc Rayburn	Sunbury, OH
E-2293	Candice Richards	Richmond, VA
E-2294	Heather Harrison	Tocoma, WA
E-2295	Hannah Beadman	Los Angeles, CA
E-2296	Leslie Howard	Manheim, PA
E-2297	Wonil Kim	Riverside, CA
E-2298	Jason Bean	Dublin, OH
E-2299	Caren Quay	Albany, CA
E-2300	Stuart Hutchings	Ypsilanti, MI
E-2301	Denise Templeton	Shoreview, MN
E-2302	Leo Melena	Escondido,CA
E-2303	Jeremy Millen	Anchorage, AK
E-2304	Niels Versfeld	Ft. McMurray, AK
E-2305	Jessica McGettigan	Wernersville, PA
E-2306	Kelly McMillan	Stockton, CA
E-2307	Suzanne Lepple	Alexandria, VA
E-2308	Manata Gerald	Santa Barbara, CA
E-2309	Jenna Hains	Westerville, OH
E-2310	Jessica King	Madison, WI
E-2311	Toni Chan	Vacaville, CA
E-2312	Heather Danskin	Tacoma, WA

Log #	Name	Location
E-2313	Celine Foy	Fargo, ND
E-2314	L. Aument	Philadelphia, PA
E-2315	Linda Ballou	Sherman Oaks, CA
E-2316	Maria Fellin	Stevens Point, WI
E-2317	Susan Savia	Glenville, PA
E-2318	Rebecca Koo	San Jose, CA
E-2319	Jeff Milner	Kansas City, KS
E-2320	Lenore Krasner	Chicago, IL
E-2321	Dorothy Adams	Boyds, MD
E-2322	Shannon Taylor	Lakewood, CO
E-2323	Kathleen Kalil	St. Louis Park, MN
E-2324	Jason Lambert	Artesia, CA
E-2325	Ronald Sandler	Edwardsville, IL
E-2326	Jimmy Sugahara	South San Francisco, CA
E-2327	Jenni Kovich	Leon, WV
E-2328	Sequoaih Wachenheim	Berkeley, CA
E-2329	Leslie Marshall	Iowa City, IA
E-2330	Brian Smith	Tacoma, WA
E-2331	Jacquelyn Styrna	Kalamazo, MI
E-2332	Patrick Reilly	Annapolis, MD
E-2333	Anne Brennan	Saginaw, MI
E-2334	Ann Rich	Saline, MI
E-2335	Catherine McLean	Alexandria, VA
E-2336	Galen Davis	San Francisco, CA
E-2337	Frank DeSantis	Staten Island, NY
E-2338	Sarah Emmerson	Westminister, CA
E-2339	Effie Fox	Warrenton, VA
E-2340	Kelly Livernois	Riverview, MI
E-2341	Tammy Morgan	Upland, CA
E-2342	Dana Wullenwaber	Redding, CA
E-2343	Michael Gonzales	Raleigh, NC
E-2344	Henry Tang	Fremont, CA
E-2345	Bettina Bickel	Glendale, AZ
E-2346	Rosanne Benavides	Phoenix, AZ
E-2347	Alice & Hans Hartwig	Acampo, CA
E-2348	Cristen Megdanis	Pearl River, NY
E-2349	Sandra Wiley	Eugene, OR
E-2350	Brice Fukumoto	Chicago, IL
E-2351	Jean Moran	Wethersfield, CT
E-2352	Erline Fernandez	Mesa, AZ
E-2353	Douglas Clayton Uptain	Rapid City, SD
E-2354	Chelsea Doepp	Charleston, SC
E-2355	Nileen Shadow Hawk	Creola, OH
E-2356	Gerald Worrall	Cardiff, CA

Log #	Name	Location
E-2357	Jonathan Roman	Stamford, CT
E-2358	Nicole Killebrew	Sammamish, WA
E-2359	Laurie Mollo-McLain	Brooklyn, NY
E-2360	Sheila Ward	San Juan, PR
E-2361	Mary Lou Long	Chesterland, OH
E-2362	Emily Bishton	Seattle, WA
E-2363	Dr. Jill Anne Quick	Longmont, CO
E-2364	J. Roberts	Portland, OR
E-2365	Peggy-Jo Schulte	Chicago, IL
E-2366	Thad Miller	Malverne, NY
E-2367	Sandra Schroth	Denver, CO
E-2368	Sara Schmidt	Cape Girardeau, MO
E-2369	Suzanne Summerfelt	Saint Francis, WI
E-2370	Brian & Suzie Henning	Bronx, NY
E-2371	M. Bradshaw	Kaneohe, HI
E-2372	Anna Ball	Santa Paula, CA
E-2373	Cheryl Cady	San Mateo, CA
E-2374	Ben Vitale	Barrington, IL
E-2375	Claire Johnson	Santa Barbara, CA
E-2376	Karen Kavanaugh	Ewing, NJ
E-2377	Carol Artz	Hagerstown, MD
E-2378	Francis Fanelli	Brooklyn, NY
E-2379	Montana Rohrback	Springfield, OR
E-2380	Troy Lambert	CA
E-2381	Marie Reyes	San Francisco, CA
E-2382	Emma Hilt	Cambridge, MA
E-2383	Arthur Meeder	Bluffton, SC
E-2384	Dianna Wentink	Ogdensburg, NJ
E-2385	Rutz Karen	IL
E-2386	Justus D'Addario	Asheville, NC
E-2387	David Pillette	York, PA
E-2388	Jo Ann Arcarese	Rochester, NY
E-2389	Dorothy Teola	Canoga Park, CA
E-2390	Josh Legere	Long Beach, CA
E-2391	Helen Schafer	Jackson, NJ
E-2392	Chris Jacobs	Craftsbury Common, VT
E-2393	Robert Lesko	New York, NY
E-2394	Deborah Cassady	Naperville, IL
E-2395	Teri, Garrett & Megan Hunt	Greenwood, MO
E-2396	Debra Rainey	Aurora, IL
E-2397	Jezabel Morton	Gahanna, OH
E-2398	Abby Harms	Topeka, KS
E-2399	Mary Mooney	New York, NY
E-2400	Melinda Z.	Dekalb, IL

Log #	Name	Location
E-2401	Karen Fredrickson	Wappingers Falls, NY
E-2402	Bryan Chauveau	Port Hueneme, CA
E-2403	Steven Luo	San Leandro, CA
E-2404	Heidi Boettger	Long Beach, CA
E-2405	Laura Hansen	Carson City, NV
E-2406	Christy Rose	Salt Lake City, UT
E-2407	Patricia Dray	British Columbia, Canada
E-2408	Othilia Figueroa	Richmond, CA
E-2409	K. L. Matlock	San Jose, CA
E-2410	Judith Willour	Mentor, OH
E-2411	Susan Dougherty	Renton, WA
E-2412	Alan Vogan	San Luis Obispo, CA
E-2413	Rose Wessels	O'Fallon, MO
E-2414	Grace Holden	Arlington, VA
E-2415	Nadya Trytan	Manhattan, KS
E-2416	Jenny Gerding	Kailua, HI
E-2417	Katherine Jarrell	Wilmington, NC
E-2418	Lisa Danz	Los Altos, CA
E-2419	Linda Sommer	Ashtabula, OH
E-2420	Diana Dexter	Overland Park, KS
E-2421	Gary Rejsek	Bolingbrook, IL
E-2422	Rick Williams	Orem, UT
E-2423	Brenda Osterlye	Pacific Grove, CA
E-2424	Seanna Williams	Orem, UT
E-2425	Janice Meyer	San Mateo, CA
E-2426	Richard Wen	Chino, CA
E-2427	Anne Robison	Sherman Oaks, CA
E-2428	Jody Conrad	Oregon City, OR
E-2429	Susan Danberg	Seattle. WA
E-2430	Jared Franz	New York, NY
E-2431	Nicole Gonowon	Champaign, IL
E-2432	Lana Wilson	Tucson, AZ
E-2433	C. J. Dupont	La Mesa, CA
E-2434	Kathryn Greeson	Englewood, CO
E-2435	Craig Usher	Sacramento, CA
E-2436	Peter Cooper	Honolulu, HI
E-2437	Deniz Bolbol	Redwood City, CA
E-2438	Deniz Bolbol (repeat)	Redwood City, CA
E-2439	Chuck Flacks	San Diego, CA
E-2440	Austin King	Madison, WI
E-2441	Ana Maria Giliberti-Ippel	Haleiwa, HI
E-2442	Jozlyn Heine	Lindenhurst, IL
E-2443	Andrew Platner	Madison, NJ
E-2444	Lango Deen	Columbia, MD

Log #	Name	Location
E-2445	Lisa Bailey	Poca, WV
E-2446	Kathie Healy	Milwaukee, OR
E-2447	Sue Williams	Forest Ranch, CA
E-2448	Dana Palka	Lincoln City, OR
E-2449	Corinne Rhae	Scottsdale, AZ
	9/17/02	
E-2450	Kat Tullett	Allenton, MI
E-2451	Lynn Craig	Waterford, MI
E-2452	Melanie Konrad	Sand Lake, MI
E-2453	Jim & Jeanne Deller	Issaquah, WA
E-2454	Hannah Dul	NY
E-2455	Phyl Morello	Albrightsville, PA
E-2456	Kent Harris	Reston, VA
E-2457	Elaine Casey	New York, NY
E-2458	Jessica Lasky	Essex Falls, NJ
E-2459	Kathlynn Breinich	Davenport, IA
E-2460	Codie Hellman	Las Vegas, NV
E-2461	Susan E. Chapman	Lawrenceville, GA
E-2462	Lorie Burris	Ft. Oglethorpe, GA
E-2463	Janice Zinkl	Denver, CO
E-2464	Laurie Tuttle	Greensboro, NC
E-2465	Marilyn Depew-Hillman	Willits, CA
E-2466	Barbara Cashman	Greensboro, NC
E-2467	Patty Majors	Petersburg, MI
E-2468	Cheryl Saum	Blaine, MN
E-2469	Melissa Smith	Greenbelt, MD
E-2470	Keith Carlton	Columbia, MO
E-2471	Pamela Raya-Carlton	Columbia, MO
E-2472	Michelle Dunn	Whitmore Lake, MI
E-2473	Janice Burr	Talent, OR
E-2474	Victoria Francis	Rock Hill, SC
E-2475	Richard Goodman	King of Prussia, PA
E-2476	Bree Yednock	Mt. Vernon, WA
E-2477	Mirella Trantham	Moorpark, CA
E-2478	Brian McConville	Fairfax, VA
E-2479	Todd Gartner	Baltimore, MD
E-2480	Guy J. de Baere	New York, NY
E-2481	Turner Jeanette	Seattle, WA
E-2482	Roxanne Warren	New York, NY
E-2483	Deborah Thomas	Indianola, WA
E-2484	Lynne Batlan Levine	Mount Sinai, NY
E-2485	Marilin Engelman	Coram, NY
E-2486	Joel Jensen	Boulder, CO
E-2487	Lisa Meyer	Antioch, TN

Log #	Name	Location
E-2488	George Kinyon	Hedgesville, WY
E-2489	Mary Boyer	Minneapolis, MN
E-2490	Anne O'Neill	Kansas City, MO
E-2491	Steven Adcock	Portland, OR
E-2492	John P. Nelson, PhD	McKenzie, TN
E-2493	Genevieve Adell	Silver Spring, MD
E-2494	Bryce Bulgrin	Stevens Point, WI
E-2495	John Love	Bellevue, WA
E-2496	Melanie Oxley	Silverado, CA
E-2497	Susan Pierce	Park Ridge, IL
E-2498	Maria Graciela Ceballos Ruiz	Mexico, NM
E-2499	Mary Rita Neal	Detroit, MI
E-2500	Cheryl Johncox	Richwood, OH
E-2501	Samantha Blake	Corona, CA
E-2502	Analisa Drew	West Allis, WI
E-2503	Michelle Page	Eugene, OR
E-2504	Karen Watt	Fort Collins, CO
E-2505	Bill Cronin	Minneapolis, MN
E-2506	Lorna Soroko	Tucson, AZ
E-2507	Theresa Hendricks	Washington, DC
E-2508	Pamela J. Jensen	Mount Vernon, WA
E-2509	Jill Gambino	Holly Springs, NC
E-2510	Anna Wilson	Pittsburg, KS
E-2511	Melissa Bulkowski	Byron Center, MI
E-2512	Pamela Yeaton	Eugene, OR
E-2513	Craig Taylor	Santa Barbara, CA
E-2514	Thaddeus Kozlowski	Portland, OR
E-2515	Jessica Simms	Santa Cruz, CA
E-2516	David Mikkelsen	Princeton, NJ
E-2517	Adam Atherton	Columbus, OH
E-2518	Phyllis Hasty	Snellville, GA
E-2519	Christine Witschi	Bandon, OR
E-2520	Sue Carroll	Charlotte, NC
E-2521	Audrey Temelini	Los Angeles, CA
E-2522	Twila Slind	Colbert, WA
E-2523	Nicole & Adam Robinson	Gazelle, CA
E-2524	Tra Fra	Cadiz, KY
E-2525	Christian Ambrose	Atchison, KS
E-2526	Cherie Rees	Vienna, VA
E-2527	Melynda Millard	River falls, WI
E-2528	Kristin Otto	Willits, CA
E-2529	Kristi Kashmer	Columbus, OH
E-2530	Fiona Wilmot	Big Pine Key, FL
E-2531	Martin Byhower	Palos Verdes Peninsula, CA

Log #	Name	Location
E-2532	Sue Boulton	St. Paul, MN
E-2533	Bob Jackson	Lilburn, GA
E-2534	Kimberly Wright	San Diego, CA
E-2535	Holly Dyer	Troy, MI
E-2536	Connie Duchinsky	St. Louis, MO
E-2537	Ashley Norton	Gaylord, MI
E-2538	Micandra C.	PA
E-2539	Patricia M. Mace	Charleston, OR
E-2540	Carolyn McCord	Phoenix, AZ
E-2541	John Riddell	Chino, CA
E-2542	Adrienne Sutton	Madison, MD
E-2543	Erin Holland	Collingswood, NJ
E-2544	Elizabeth Holloway	Warren, OH
E-2545	Annmarie Parmenter	Belleville, NJ
E-2546	Teresa Nemeth	Santa Clara, CA
E-2547	Cynthia Parker	Temecula, CA
E-2548	Jill Morrison	Manhattan Beach, CA
E-2549	Tera James	Breckenridge, CO
E-2550	Sherwin Harris	Hayward, CA
E-2551	Joe Jennings	Columbus, OH
E-2552	Jeffrey Charles Beane	Raleigh, NC
E-2553	Don & Pat Rathmann	Cincinnati, OH
E-2554	Tulasi Higginbottom	Princeville, HI
E-2555	Thomas Steines	Stow, OH
E-2556	Jennifer Hickman	Eden Prairie, MN
E-2557	Carlotte Palumbo	Lakebay, WA
E-2558	Andrea Brown	Santee, CA
E-2559	Meris Untalan	Des Moines, WA
E-2560	Jeff Gwin	Colora Del Mar, CA
E-2561	Lauren Brown	Denver, CO
E-2562	Shawn Duke	Los Feliz, CA
E-2563	Jennifer Craigen	Nesconset, NY
E-2564	Layla Holguin-Messner	Decatur, GA
E-2565	Carol S. Bostick	Eugene, OR
E-2566	Terryl Todd	Pacific Grove, CA
E-2567	Ron Horton	Salt Lake City, UT
E-2568	Roselyn Weil	Rockville, MD
E-2569	Maryam Khorram	Newbury Park, CA
E-2570	Ruth Moorberg	Estherville, IA
E-2571	Aviva Gutin	Caldwell, NJ
E-2572	Christine Cyriacks	Astoria, NY
E-2573	Kelly Reice	Moorestown, NJ
E-2574	Elisse De Sio	Redwood City, CA
E-2575	Cary Marie Jack	San Diego, CA

Log #	Name	Location
E-2576	Kyle Pauley	Seattle, WA
E-2577	Loretta Hollings	Tuscon, AZ
E-2578	Matthew Donatoni	Aptos, CA
E-2579	Cory Harden	Hilo, HI
E-2580	Catherine Brickell	Mason City, IL
E-2581	Cynthia Chavez	Eagle Rock, CA
E-2582	Sean Ryan	Roselle Park, NJ
E-2583	Patricia Dishman	Nashville, TN
E-2584	Constance Malone	San Francisco, CA
E-2585	Breen Casey	Pittsburgh, PA
E-2586	Jennifer Rosenberg	Boulder, CO
E-2587	Josephine Burke	Merrionette Park, IL
E-2588	Biancka Jimenez	Mission, KS
E-2589	Linda Anderson	Olathe, KS
E-2590	Randy Burton	Franklin, TN
E-2591	Amy Prisco	Washington, NJ
E-2592	Meghan Allen	Denver, CO
E-2593	David Pray	Anchorage, AK
E-2594	Robert Obrien	Anacortes, WA
E-2595	Airton M. Junior	Porto Alegre, Brazil
E-2596	Jennifer Hafner	Portsmouth, NH
E-2597	Erin Sexton	Cincinnati, OH
E-2598	Jessica White	Farmers Branch, TX
E-2599	Cathy Patterson	Boynton Beach, FL
E-2600	Heather Bent	New Brunswick, NJ
E-2601	Peter Belden	Palo Alto, CA
E-2602	Brittany Lang	Houston, TX
E-2603	Michael McCurdy	Marion. IA
E-2604	Karine Kerns	Spanaway, WA
E-2605	Sharon Warren	Fountain Hills, AZ
E-2606	Ruud Hoemakers	Netherlands
E-2607	Woodson Spring	Iowa City, IA
E-2608	Marianne Manock	Tarzana, CA
E-2609	Susan Thompson	San Antonio, TX
E-2610	Andrea Mancuso	Kingwood, WV
E-2611	Sarah Peck	La Selva Beach, CA
E-2612	Beverly Drucker	Tuckahoe, NY
E-2613	Amanda H.	Orlando, FL
E-2614	Melissa Judge	Tampa, FL
E-2615	Mary Lynch	Fairbanks, AK
E-2616	Juliana Mujica	New Orleans, LA
E-2617	Renee Stefferud	Racine, WI
E-2618	Susan Burgenbauch	Mt. View, CA
E-2619	Marsha Holbrook	Anchorage, AK

Log #	Name	Location
E-2620	Teresa Knezek	Fairbanks, AK
E-2621	Morton Fallick	Encino, CA
E-2622	Lionel Baron	Canada
E-2623	Dotty Cunnington	Key West, FL
E-2624	David Bell	Kingwood, TX
E-2625	Kathy Martin	Port Charlotte, FL
E-2626	Iris Delgado	Sacramento, CA
E-2627	Ellory Laval Rhone	Monona, WI
E-2628	Matthew Rutledge	Whitemore Lake, MI
E-2629	Morgen Crawford	Keystone Heights, FL
E-2630	Samuel Fowler	Delaware, OH
E-2631	Sanura Jackson-Diaz	Avon Lake, OH
E-2632	Rauf Amirli	Little Rock, AR
E-2633	Josh Treadwell	New York, NY
E-2634	Mami Nomura	New York, NY
E-2635	Ellen Tulles	Denver, CO
E-2636	Juliana Barwig	Santee, CA
E-2637	Natalie Ban	Vancouver, Canada
E-2638	Calder Lorenz	Vancouver, Canada
E-2639	Katherine Stuber	Kirkland, WA
E-2640	Floris van Geel	Netherlands
E-2641	Paul Fellegy	Somerville, MA
E-2642	Jane Liebschutz	Jamaica Plain, MA
E-2643	Michael Austin	No. Topsail Beach, NC
E-2644	Tracy Jordan	Galivants Ferry, SC
E-2645	Dana McPhall	Sherman Oaks, CA
E-2646	Rick Wilson	Aliso Viejo, CA
E-2647	Ted Williams	Ralls, TX
E-2648	Mark O'Callaghan	Doraville, GA
E-2649	Catherine Melnicki	Brooklyn, NY
E-2650	Tim Blundell	Australia
E-2651	Marcie Kimball	Baton Rouge, LA
E-2652	Melani Weber	Minneapolis, MN
E-2653	Jaime Bloom	Orlando, FL
E-2654	Francesca Ling	Roseville, CA
E-2655	Victoria C. Faeo	Wasilla, AK
E-2656	Christine Gakovich	Santa Cruz, CA
E-2657	Luba Muzichenko	San Francisco, CA
E-2658	Bridget Shirey	Indiana, PA
E-2659	Patricia Saddler	United Kingdom
E-2660	Linda Laws	Boulder, CO
E-2661	Sandra Grepling	Peoria, AZ
E-2662	Heather Perkins	League City, TX
E-2663	Carrie West	Worcester, MA

Log #	Name	Location
E-2664	Anita Newman	Naperville, IL
E-2665	Ricky Soonagrook	San Francisco, CA
E-2666	Gina Goad	Conway, AR
E-2667	Lori Cushner	Allentown, PA
E-2668	Kenna Davis	Indianapolis, IN
E-2669	Geoffrey Hofman-Frethem	St. Paul, MN
E-2670	Jean E. Hughes	Avondale Estates, GA
E-2671	Scott Kasten	Hudson, WI
E-2672	M. C. Finn	Madison, NJ
E-2673	William Walker	Theodore, AL
E-2674	Garren Watkins	Portland, OR
E-2675	Vera Snyder	Pasadena, CA
E-2676	Kimberly Kones	Teaneck, NJ
E-2677	Rebekah Walker	Hollywood, FL
E-2678	Rosa Temes	Anacortes, WA
E-2679	Natelie Quan	San Jose, CA
E-2680	Philip Thomas	Clute, TX
E-2681	Susan Krahn	Westfield, NJ
E-2682	Jan Clifford	New Orleans, LA
E-2683	Leanna Erickson	Wayzata, MN
E-2684	Poulette Whitfield	Tampa, FL
E-2685	Lee Sonmor	Houston, TX
E-2686	Erica Broome	Alexandria, VA
E-2687	Marie Gutkowski	Ridgewood, NY
E-2688	Kim Berg	Duluth, MN
E-2689	Judy Lyman	Martinez, CA
E-2690	Lisa Hughes	Australia
E-2691	Tom Ford	Marina Del Rey, CA
E-2692	Christina Rivera	Napa, CA
E-2693	Martyn Williams	Santa Fe, NM
E-2694	Andy Ervin	Albuquerque, NM
E-2695	Naomi Kane	Brooklyn, NY
E-2696	Heather Cobb	Dunbar, WV
E-2697	B. Hugh McPeck	Anchorage, AK
E-2698	Joan E. Bork	Maplewood, NJ
E-2699	Nicole Sugarman	Westport, CT
E-2700	Geri Tomat	Lyndhurst, NJ
E-2701	Tom Phelan	Ann Arbor, MI
E-2702	Alison Simpole	United Kingdom
E-2703	John Wallack	Ft. Bragg, CA
E-2704	Paul Hunt	Flint, MI
E-2705	Libby Cornett	Asheville, NC
E-2706	Libby Roderick	Anchorage, AK
E-2707	Eric Ward	Fort Wayne, IN

Log #	Name	Location
E-2708	Jose Garcia	Bronx, NY
E-2709	George T. Roberts	Keizer, OR
E-2710	Raed Ayyad	Fort Worth, TX
E-2711	Sarah Olivo	Alhambra, CA
E-2712	Merry Kay Protheroe	Valley Center, KS
E-2713	Thunderr Wolf	Pennsauken, NJ
E-2714	Nancy Sheridan	St. Petersburg, FL
E-2715	Michael Brand	San Antonio, TX
E-2716	Becky Harris	Medford, MA
E-2717	France Perlman	West Paris, ME
E-2718	Michael Sterns	St. Petersburg, FL
E-2719	Richard Gibbons	Portland, TX
E-2720	Johnna Flahive	Oakton, VA
E-2721	Linda Rodriguez	Chula Vista, CA
E-2722	Andrea Bureman	Locust Grove, VA
E-2723	Laura Lundy	New York, NY
E-2724	Teresa Cambrelen	Miami, FL
E-2725	Lisa Hopkins	Turtle Creek, PA
E-2726	Darin Murray	Saugerties, NY
E-2727	Xan Rubey	Boulder, CO
E-2728	Michele Flood	Fairbanks, AK
E-2729	Chris Or Nai	TX
E-2730	Zulma Henneberger	Crofton, MD
E-2731	Mike Ebert	Vista, CA
E-2732	Rose Mann	Forest City, PA
E-2733	Karna Barquist	Kansas City, MO
E-2734	Maria Gusek	Ft. Worth, TX
E-2735	Sarah Bond	Driftwood, TX
E-2736	June Brown	Stafford, TX
E-2737	Jesse Armaline	Lakewood, OH
E-2738	Brooke Smith	Australia
E-2739	Sky Aisling	Murphy, OR
E-2740	Emily Darlington	Gainesville, FL
E-2741	Cat Widders	Martinez, CA
E-2742	Kathy Kerr	Erie, MI
E-2743	Tammy Searles	Blowing Rock, NC
E-2744	Gary Waters	Lake Wales, FL
E-2745	Nancy Dunn	Poolesville, MD
E-2746	Troy Freund	Milwaukee, WI
E-2747	Rhonda Alfaro	Joliet, IL
E-2748	Sue Clouser	Ukiah, CA
E-2749	Deborah Johnson	Ferndale, MI
E-2750	Peter & Mary Alice Belov	Underwood, WA
E-2751	Paige Sullivan	Urbana, IL

Log #	Name	Location
E-2752	Kristi Ciener	Kernersville, NC
E-2753	Stephen Gerrish	Hailey, ID
E-2754	Sarah Julian	Clarkston, MI
E-2755	Cynthia Gibson	Bailey, CO
E-2756	Matthew Cloner	Tukwila, WA
E-2757	Marie Ostrander	Fairview, NC
E-2758	Don Hirth	Gulfport, MS
E-2759	Dorothy Vollans	Siasconset, MA
E-2760	Lisa Dobias	Mill Valley, CA
E-2761	Nicholas Boeschen	Charleston, SC
E-2762	Melissa Bauer	Marietta, GA
E-2763	Kristine Campbell	Westfield, NY
E-2764	Shakirah Bey	Kutztown, PA
E-2765	Steve & Basia Boos	Canada
E-2766	Cynthia Cotton	Windham, ME
E-2767	Greg Joder	Boulder, CO
E-2768	Mary Page	Charlotte, NC
E-2769	J. Barlow	Cocoa, FL
E-2770	Kliff Hopson	Fairbanks, AK
E-2771	Ezshwan Winding	Ashland, OR
E-2772	Lois Dunn	Roslyn, PA
E-2773	Gudrun Hansen	Ovlla, TX
E-2774	Keth Luke	New Port Richey, FL
E-2775	B. J. Powell	Chattanooga, TN
E-2776	Sherrie Bedard	Sarasota, FL
E-2777	Kelly, Carr	Westminster, CO
E-2778	Catherine Farrell	Los Angeles, CA
E-2779	June Nesmith	Murrells Inlet, SC
E-2780	Gage Hansen	Newburyport, MA
E-2781	Karin McEvoy	Los Angeles, CA
E-2782	Teelyn Mauney	Lincoln, NE
E-2783	Miranda Dwyer	Clearwater, MN
E-2784	Phyllis Sanford	Las Vegas, NV
E-2785	Jack Harmell	Novato, CA
E-2786	Konrad Bis	Chicago, IL
E-2787	Laurie Small	Dillingham, AK
E-2788	Jennifer Maxwell	Oakville, CT
E-2789	Mark Ball	Cardiff, CA
E-2790	Rebecca Paska	Chantilly, VA
E-2791	Tom Clavin	New York, NY
E-2792	Carol DeLisle	Encino, CA
E-2793	Sophia Letournea	Margate, FL
E-2794	Stefanie Freckelto	Joliet, IL
E-2795	Laila Kinnunen	Juneau, AK

Log #	Name	Location
E-2796	Reid Betz	New York, NY
E-2797	MaryJane Buchan	Warsaw, IN
E-2798	Dale Harlow	Bandon, OR
E-2799	Melody Kolb	Medford, OR
E-2800	Yvette LeFevre	Nashville, TN
E-2801	Deb Courtney	Port St. Lucie, FL
E-2802	Joy Leet-Mullins	Lexington, KY
E-2803	Ernest Jacques	Palm Bay, FL
E-2804	Velda Nasal	Westland, MI
E-2805	Nancy Walther	Denver, CO
E-2806	Katherine Davis	Peculiar, MO
E-2807	Anna Suojanen	Medfield, MA
E-2808	Diana Netland	Corona, CA
E-2809	Irene Jones	Richmond, MA
E-2810	Carly Pratt	Portland, OR
E-2811	Elizabeth Martin	LaCanada, CA
E-2812	Laurene Cormier	Windsor, VT
E-2813	Jennifer Johnson	Reno, NV
E-2814	Susan Young	Costa Mesa, CA
E-2815	Peggy Donahue	Allenspark, CO
E-2816	Jennifer Loomis	Appleton, WI
E-2817	Karen Hoffman	Rolla, MO
E-2818	Norma Dehn	Crystal River, FL
E-2819	Sarah Griffith	Gainesville, FL
E-2820	Dawn Thompson	Surfside Beach, SC
E-2821	Tara Troisi	Stony Brook, NY
E-2822	Arthur Trupp	Nanuet, NY
E-2823	Barbara Roth	Las Vegas, NV
E-2824	Adriana Mourad	Plantation, FL
E-2825	Kelleigh Shepard	Richmond, VA
E-2826	David Nettleton	Sacramento, CA
E-2827	Heidi Smith	Albuquerque, NM
E-2828	Phyllis Henderson	Liverpool, NY
E-2829	Millie Gearhart	Muncy, PA
E-2830	Sarah Snyder	Connellsville, PA
E-2831	Allen Sim	Covesville, VA
E-2832	Vasiliki Kyriakakis	Sunnyvale, CA
E-2833	Angelia Nunley	Cross Lanes, WV
E-2834	Deb Gehl	Chicago, IL
E-2835	Kirk Dubose	Portland, OR
E-2836	Nancy Velazquez	Sarasota, FL
E-2837	Erica Glatting	Milwaukee, WI
E-2838	Melissa Bordelon	Lafayette, LA
E-2839	Helen Lembeck	Chula Vista, CA

Log #	Name	Location
E-2840	Joseph Holmes	Kensington, CA
E-2841	John Zuffante	Holbrook, MA
E-2842	Matthew Stein	Clarks Summit, PA
E-2843	Mea Cadwell	Eau Claire, WI
E-2844	Samantha Goodman	Los Angeles, CA
E-2845	Doris Lubonovich	Tovey, IL
E-2846	Deann Russell	Porter, TX
E-2847	Lauren Padawer	Cordova, CA
E-2848	Corinne Myers	Lafayette, LA
E-2849	Linda Kozak	Clearwater, FL
E-2850	Marcia Ruland	Flanders, NY
E-2851	Daniel Guaqueta	Hattiesburg, MS
E-2852	Nancy Robbins	Wasilla, AK
E-2853	Sandra Hutchison	Rock Hill, SC
E-2854	Andreya Edge	Las Vegas, NV
E-2855	Michael Mc Nally	Irvine, CA
E-2856	Noreen Parks	Keaau, HI
E-2857	Elyse Kline	Asheville, NC
E-2858	Diana Bledsoe	Appalachia, VA
E-2859	Jerry Adams	Crofton, MD
E-2860	Dolores McCoy	Saginaw, MI
E-2861	Paige Vallee	Sunnyside, GA
E-2862	Nancy McClintock	Potomac, MD
E-2863	Chris White	Anchorage, AK
E-2864	Jason Graham	Anchorage, AK
E-2865	Gonzalo A. R. Galanes	Argentina
E-2866	Martha Bradshaw	Monterey Park, CA
E-2867	Dianne Sullivan	Kent, WA
E-2868	Natalie Fryman	Poughkeepsie, NY
E-2869	Ruth T. Lerow	West Palm Beach, FL
E-2870	Amanda Schwartz	Studio City, CA
E-2871	Mary Lyon	Los Angeles, CA
E-2872	Doyle Sebesta	Georgetown, TX
E-2873	Amanda Cunningham	Westminster, CA
E-2874	James Shafer	Tucson, AZ
E-2875	Claude Guillemard	Baltimore, MD
E-2876	Kathy Tobiassen	Belchertown, MA
E-2877	Martin Beam	Damascus, MD
E-2878	Dee Matkowski	Carrollton, OH
E-2879	Michael Finley	Wauconda, IL
E-2880	Jessica Moore	Jacksonville, FL
E-2881	Peter Holck	Anchorage, AK
E-2882	David Prawel	Loveland, CO
E-2883	Debby Bender	Eureka, CA

Log #	Name	Location
E-2884	Micah McConochie	Raleigh, NC
E-2885	Emily Hays-Newman	Marietta, OH
E-2886	Susan McDonald	Frostburg, MD
E-2887	Carol Hambrecht	Middleton, WI
E-2888	Sharon Rosenberger	Youngstown, FL
E-2889	Dorothy Anacleto	Harbor, OR
E-2890	Deborah Anthony	Kansas City, MO
E-2891	Charles Patti	South Euclid, OH
E-2892	Wendy Proulx	Canada
E-2893	Maureen Main	Burbank, CA
E-2894	Dee Scarr	Conifer, CO
E-2895	Liz Veazey	Morganton, NC
E-2896	Robert Loucks	Big Bear Lake, CA
E-2897	Anne Callace	Bethel, CT
E-2998	Darryl Carstensen	West Lafayette, IN
E-2899	Kara Hodgson	Fairbanks, AK
E-2900	Yllyse Yang	Aurora, CO
E-2901	Mansfield Christopher	Trinidad, Tobago
E-2902	Bonnie Callahan	Tucson, AZ
E-2903	Judith Hallberg	Middletown, NJ
E-2904	Catherine Steichen	Glendale, AZ
E-2905	Margaret Hedderman	Cimarron, NM
E-2906	Bob Hedderman	Cimarron, NM
E-2907	Margaret Stein	Scottsdale, AZ
E-2908	Lawrence Nader	Canonsburg, PA
E-2909	Patricia Heiden	Dousman, WI
E-2910	Vince Scialabba	Merchantville, NJ
E-2911	Jessica Uze	Arlington, VA
E-2912	Cheryl Works	Jasper, AL
E-2913	John Viglione	Erie, PA
E-2914	Jacquelyn Sheehan	Barnesville, MD
E-2915	Richard Takagi	Cypress, CA
E-2916	Leigh Hedderman	Cimarron, NM
E-2917	Cheryl Wisniewski	Milton, FL
E-2918	Lisa Weber	San Mateo, CA
E-2919	George Lyne	Lowell, AR
E-2920	Nydia Cabrera	Miami Beach, FL
E-2921	Pam Dinuuci	Hillside, IL
E-2922	Cheryl Somers	Egg Harbor Township, NJ
E-2923	Jacob Snider	Alanson, MI
E-2924	Kristen Rollo	Winnie, TX
E-2925	Adam Sokool	La Mirada, CA
E-2926	Eddie Filer	Naples, FL
E-2927	Rebecca Deering	Newton, MA

Log #	Name	Location
E-2928	Anisha Shankar	Newark, DE
E-2929	Glen Young	Camp Hill, PA
E-2930	Shelly Edwards	Odessa, TX
E-2931	Mike Stoakes	Overland Park, KS
E-2932	Melissa Vernon	Ann Arbor, MI
E-2933	Leah Marx	Beverly Hills, MI
E-2934	Sarah Thornton	Fairbanks, AK
E-2935	Jane Engel	Taos, NM
E-2936	Diana Carnahan	Clarksville, TN
E-2937	Oliver Hardin	Perkins, OK
E-2938	Robin Gustus	Jacksonville, FL
E-2939	Christine Maggi	Myrtle Beach, SC
E-2940	Albina Vazquez	Puerto Rica
E-2941	Claudette Schiratti	Shawnee, KS
E-2942	Betty Jean Herner	Strongsville, OH
E-2943	Susan Stephens	Safety Harbor, FL
E-2944	Sally Gillette	Palo Alto, CA
E-2945	Jeanne St. John	Newport, OR
E-2946	Steve M. Wood	Summerville, SC
E-2947	Kate Brandt	Burbank, CA
E-2948	Brenda Lewis	Rockdale, TX
E-2949	Toni M. Belski	Bentleyville, PA
E-2950	Diane Pelke	Spanaway, WA
E-2951	J. B. Wilson	Greenwood, SC
E-2952	Stacey Lawless	Asheville, NC
E-2953	Mike Fortune	Brevard, NC
E-2954	Fred Cepela	Traverse City, MI
E-2955	Charlotte Brody	Chappaqua, NY
E-2956	Hee Cheon Park	South Korea
E-2957	Carol Hernandez	Huntington Park, CA
E-2958	R. Schraft	Angola, NY
E-2959	Theresa Wilcox	Rodanthe, NC
E-2960	Dee Daza	Johnston, RI
E-2961	Judy Soto	South Gate, CA
E-2962	Carol Mylant	Willowick, OH
E-2963	Elise Henline	Key Largo, FL
E-2964	Janice Farnsworth	Jacksonville, FL
E-2965	Tamara Travis	Miami Beach, FL
E-2966	Agnes Rambeck	Sauk Rapids, MN
E-2967	Dick Jones	New York, NY
E-2968	Jill Sullivan	Hamden, CT
E-2969	Kristi Turner	Prescott Valley, AZ
E-2970	Amy Miller	Tyler, TX
E-2971	Joann Tippett	Apopka, FL

Log #	Name	Location
E-2972	Lara Rusch	Ann Arbor, MI
E-2973	Tibitha Harrison	Lewisburg, TN
E-2974	Kimberly Jarvis	Merritt Island, FL
E-2975	Megan Young	Charlotte, NC
E-2976	Eugenia Zhurbinskaya	South Plains, NJ
E-2977	Krist Bussart	Columbus, OH
E-2978	Kamyar Marashi	Novato, CA
E-2979	Gaynell Farmer	Shaker Heights, OH
E-2980	Blerina Xeneli	Bronx, NY
E-2981	Dwight Hayden	Danville, IN
E-2982	Emily Zabor	Santa Fe, NM
E-2983	Susan Nicoll	Frazier Park, CA
E-2984	Anna Kirkpatrick	Jamaica Plain, MA
E-2985	Cayce Leithauser	Levering, MI
E-2986	Michael Williams	Baltimore, MD
E-2987	Sandra Isabel Rodrigue	Ann Arbor, MI
E-2988	Christie Boudreaux	Portland, IN
E-2989	Janis Prinslow	Temecula, CA
E-2990	Mary Ann Kim	Santa Rosa, CA
E-2991	Sarah Ansley	Hickory, NC
E-2992	Lyla Lampson	Milton-Freewater, OR
E-2993	Jutta Bruegel-Sasse	Temple Terrace, FL
E-2994	Dorothea Caltabiano	Clayton, NC
E-2995	Kristin Fischer	Waltham, MA
E-2996	Jennifer Rosenberg	Boulder, CO
E-2997	Betty Whitmer	Vancouver, WA
E-2998	Karla Nicolasora	Phillippines
E-2999	Molle McCurnin	San Antonio, TX
E-3000	Heidi Sowers	Salisbury, MD
E-3001	Sarah Brady	Los Angeles, CA
E-3002	Tanya McNeil	Cass City, MI
E-3003	Phoebe Wray	Ayer, MA
E-3004	John Nichols	Carson City, NV
E-3005	Robert Prevallet	North Fort Meyers, FL
E-3006	Judy Paley	Lawrence, KS
E-3007	Davin Holen	Anchorage, AK
E-3008	Stephen Betgen	Houston, TX
E-3009	Jeff Lantos	Marina del Ray, CA
E-3010	Judith Hutchison	Washington, DC
E-3011	Leslie Wagner	Houston, TX
E-3012	Melinda Disque	Home, PA
E-3013	Steven Quigley	Virginia Beach, VA
E-3014	Bet Alwin	Northhampton, MA
E-3015	Melody Schatz	Townsend, DE
E-3016	William Meyer	San Francisco, CA
E-3017	Debra Sparque	Yukon, OK
E-3018	Tammy Ballard	Portland, OR
E-3019	Lyn Bradford	Los Angeles, CA
E-3020	Dan & Hilary Walker	Southfield, MI
E-3021	Alan Frankel	Truro, MA
E-3022	Morris Leibowitz	Leeds, MA
E-3023	Sherry Pridemore	Norman, IN
E-3024	Rammohan Rao Errabelli	Hyderabad, AL
E-3025	Lynn Lynch	Newport, NH
E-3026	Nicole Paul	Asheville, NC
E-3027	Rachel Edwards	Franklin, TN
E-3028	Debi Hamlin	Eudora, KS
E-3029	Laurie Glaser	St. Paul, MN
E-3030	Erik Vahl	Soquel, CA
E-3031	Allan Campbell	San Jose, CA
E-3032	Marjorie Gerhart	Panama
E-3033	Richard & Mary Chaisson	Oxford, CT
E-3034	Dianna Johnson	San Diego, CA
E-3035	Sydney Wallace	Ellicott City, MD
E-3036	Amy Levine	Dorchester, MA
E-3037	Danielle Seyfarth	Brighton, MI
E-3038	Gloria Bucco	Lincoln, NE
E-3039	Yale Feder	Berkeley, CA
E-3040	Warren Mutter	York, PA
E-3041	Jan Lowe	Australia
E-3042	Emmett Blankenship	Marietta, GA
E-3043	Al Dwyer	Louden, NH
E-3044	Sister Letitia	Mukwonago, WI
E-3045	Barbara Malley	Weymouth, MA
E-3046	Sharon Mitchell	Davisburg, MI
E-3047	Clara Fuchsman	Seattle, WA
E-3048	Cheryl Ebbing	Hamilton, OH
E-3049	Ralph Van Dusseldorp	Kenai, AK
E-3050	Bill Culpepper	South Daytona, FL
E-3051	Mary Piacquadio	Margate, FL
E-3052	Peter W. Beuttell	Vero Beach, FL
E-3053	Darlene Jackson	Minneapolis, MN
E-3054	John Thornton	Grants Pass, OR
E-3055	Joanne Proffitt	Rockport, TX
E-3056	Steven Wehling	Rapid City, SD
E-3057	Brian Milbrandt	Aurora, IL
E-3058	Rick Partridge	Nome, AK
E-3059	A. Wynn	Hendersonville, NC

Log #	Name	Location
E-3060	Theresa Borsodi	Wayland, MA
E-3061	Linda Cameron	New York, NY
E-3062	Cathy Runge	Lovettsville, VA
E-3063	Carol Biggs	Juneau, AK
E-3064	Alex Carmichael	Bedford Corners, NY
E-3065	Anthony D. Diana	Phoenix, AZ
E-3066	Rosanne Minich	Bethel Park, PA
E-3067	Tom Hutchins	Santa Rosa, CA
E-3068	Gloria Garcia	Miami, FL
E-3069	Barbara Fleury	Brooklyn, NY
E-3070	Tara Bellefontaine	Uxbridge, MA
E-3071	Jonathan Sabel	Boonton Township, NJ
E-3072	Stacey Forrester	Spring Hill, FL
E-3073	Elyse D'Angelo	Big Sur, CA
E-3074	Erin Bishop	Louisville, KY
E-3075	Yvette Latiolais	Broussard, LA
E-3076	Nazen Merjian	Charlottesville, VA
E-3077	Aric Blitch	Salt Lake City, UT
E-3078	Scot Charles	Seattle, WA
E-3079	Jessica King	Madison, WI
E-3080	Maggie Breitenstein	Tigard, OR
E-3081	Agnes Jung	Budapest, Hungery
E-3082	Kristin Killian	San Diego, CA
E-3083	Nicole Orengo	Asheville, NC
E-3084	Steve Hunt	North East, MD
E-3085	Linda Patten	Port St. Lucie, FL
E-3086	Robert Harrison	Homer, AK
E-3087	Kathy Daniels	WV
E-3088	Douglas Collura	New York, NY
E-3089	Dian Hardy	Sebastopol, CA
E-3090	Alex Sowl	LaPointe, WI
E-3091	Deb Conner	Warrensburg, MO
E-3092	Jessica Pitre	Green Bay, WI
E-3093	Steve & Patti Devine	Fox Island, WA
E-3094	Greg Woodruff	Radford, VA
E-3095	Virginia Arnette	Brevard, NC
E-3096	Stacy Clark	Allen, TX
E-3097	Ellen Tavares	Tiverton, RI
E-3098	Linda Woodcock	Huntsville, AL
E-3099	R. David Speller	Peachtree City, GA
E-3100	Anna Hautzinger	Chicago, IL
E-3101	Deborah Poole	Watkinsville, GA
E-3102	Cherie Cannaday	Muskegon, MI
E-3103	David Platt	Hollywood, FL

Log #	Name	Location
E-3104	Jo Camas	Bronx, NY
E-3105	Paul Davis	Anchorage, AK
E-3106	Marilyn Teberio	Warrior Run, PA
E-3107	Valarie Wagner	Cathedral City, CA
E-3108	Pam Young	Chevy Case, MD
E-3109	Yueli Gan	Malaysia
E-3110	Karen Retford	Modesto, CA
E-3111	Virginia Salvin	Chippewa Falls, WI
E-3112	Amy Dawn	Fresno, CA
E-3113	Cindy Beckner	Hanover, PA
E-3114	Paul Rettig	Chicago, IL
E-3115	Kathryn Barnes	Sherwood, MI
E-3116	K. C. Curry	San Angelo, TX
E-3117	Gene Hanson	Chester, NJ
E-3118	Renee Burkhead	Everett, WA
E-3119	Jo Clark	Hong Kong
E-3120	Peter Mulshine	Phillipsburg, NJ
E-3121	Kent Mijangos	Salt Lake City, UT
E-3122	Elizabeth LaPosta	Salisbury, MD
E-3123	Bob Patterson	Eagle River, WI
E-3124	Emily Duval	Lake Worth, FL
E-3125	Bonnie Melton	Mission, TX
E-3126	Gary Boyd	Dayton, TN
E-3127	Charles Langelier	Salt Lake City, UT
E-3128	Robert Reinhardt	Los Angeles, CA
E-3129	Dwight Buck	Mammoth Lakes, CA
E-3130	Paula Simmons	Cookeville, TN
E-3131	Julee Spangler	Nashville, TN
E-3132	Phyllis Hyde	Bethesda, MD
E-3133	Lloyd Johnson	Corning, CA
E-3134	Cher Houston	Anaheim, CA
E-3135	Megan Marion Shea	Sitka, AK
E-3136	Albert Huebner	Canoga Park, CA
E-3137	Karen Miller	Warminster, PA
E-3138	Robert Seyko, MD	St. Clair, MI
E-3139	Kathy Brown	Pahrump, NV
E-3140	Sandra Track	Elkhart, IN
E-3141	Rossi Peralta	Mexico
E-3142	Amanda Burrows	Brooklyn, NY
E-3143	Jean Fox	Racine, WI
E-3144	Rose Toh	Singapore
E-3145	Dawn Saunders	Patterson, NY
E-3146	Marcus Petrelli	Pittsburgh, PA
E-3147	Lori P. Warren	Belleville, MI

Log #	Name	Location
E-3148	Seth Collins	Johnson, VT
E-3149	Shelly Partridge	Orlando, FL
E-3150	Rebecca Adams	Jacksonville, FL
E-3151	Jonathan Baker	Greensboro, NC
E-3152	Jen Smith	York, PA
E-3153	Gina Rocchio	Denver, CO
E-3154	Christine Dellert	St. Petersburg, FL
E-3155	Joy Fortunato	Coconut Creek, FL
E-3156	Jerry Link	Nashville, TN
E-3157	Dorothy Keeler	Anchorage, AK
E-3158	Ron Sonntag	Snohomish, WA
E-3159	Edgar Wayburn, MD (see L-0032)	San Francisco, CA
E-3160	Glen Weber	Endicott, NY
E-3161	Nicolette Crone	Clearlake Oaks, CA
E-3162	Michael Jarvis	Newark, DE
E-3163	Vivienne Handy	Lithia, FL
E-3164	Judy Desreuisseau	Gill, MA
E-3165	Kathy Bayles	Jacksonville, OR
E-3166	David Holderread	Euclid, OH
E-3167	Arnette Dulyea-Curley	Grand Rapids, MI
E-3168	Jessica Barry	Garden City, KS
E-3169	Chris Dunford	South Newfane, VT
E-3170	Donna Pollock	Hope, AR
E-3171	Christina Turnes	Red Bluff, CA
E-3172	Elaine Swain	Tallahassee, FL
E-3173	Julie Shoemaker	Kenvil, NJ
E-3174	Remy Tankel	Lynn, MA
E-3175	Manual Cruz	Puerto Rico
E-3176	Lloyd Downs	Magalia, CA
E-3177	Connie E. Turner	Massillon, OH
E-3178	Barbara Nelson	Pelham, NY
E-3179	Victoria Wormell	Vernon, CT
E-3180	Jacob Pedroza	Castle Rock, CO
E-3181	Joey Gilbert	Livingston, TX
E-3182	Carol Meyer	California, MO
E-3183	Russell Deatherage	Wake Forest, NC
E-3184	Margaret Pigman	Pasadena, CA
E-3185	Janna Hall	Santa Ana, CA
E-3186	Jimmy Sinton	Fairfield, IA
E-3187	Robert Allen	Galesburg, IL
E-3188	Victoria Chichester	Middleburgh, NY
E-3189	Joann Harrison	Hamilton, GA
E-3190	Emily Kornik	Signal Hill, CA
E-3191	Autumn Thomas	Levittown, PA

Log #	Name	Location
E-3192	Cindy Maier	Saginaw, MI
E-3193	Cheryl Marriage	Madison, IN
E-3194	Mary Miceli	Chugiak, AK
E-3195	Heather Chatwin	Canada
E-3196	Erin Rose Carrico	Little Rock, AR
E-3197	Rick F.	Holyoke, MA
E-3198	Rick Phillips	Corunna, MI
E-3199	Jay Patel	Reisterstown, MD
E-3200	James Kovacs	Upper Lake, CA
E-3201	Frank Polites	Aston, PA
E-3202	Elizabeth Freedman	Lancaster, PA
E-3203	Michelle Ford	Biloxi, MS
E-3204	Jeremiah Holes	Titusville, PA
E-3205	Sharron James	Tuolumne, CA
E-3206	Terence McNamara	Burlington, NC
E-3207	Christopher Connor	Santa Barbara, CA
E-3208	Risa Spindler	Scarsdale, NY
E-3209	Kendra Lipinski	Albuquerque, NM
E-3210	Christine Moreno	Davie, FL
E-3211	Jeannine Eldridge	Elizabeth, NJ
E-3212	Catherine Hutchinson	Calgary, Canada
E-3213	Elizabeth Davis	Sebastopol, CA
E-3214	Jean Gregas	Roebling, NJ
E-3215	Annette Albert	Revere, MS
E-3216	Niki Scott	Orange City, FL
E-3217	George Thomas	Nederland, CO
E-3218	Don Tilleman	Longmont, CO
E-3219	Andrea Wensley	Middleville, MI
E-3220	Mel Laubach	Missoula, MT
E-3221	Lisa DeOrnellas	Lemoyne, PA
E-3222	Cheryl Cullen	Seattle, WA
E-3223	Kay Bedingfield	Chapel Hill, NC
E-3224	Grantham Thomas	New Windsor, NY
E-3225	Dana Cole	Tampa, FL
E-3226	Eric Sundquist	Decatur, GA
E-3227	Robert Mull	Davie, FL
E-3228	Brion J. Dodson	Wyandotte, MI
E-3229	Patricia Collins	Garner, NC
E-3230	Jesse Czekanski-Moir	Hamilton, NY
E-3231	Mike Acton	Hudsonville, MI
E-3232	Erin Boydstun	Gainesville, FL
E-3233	Kara Legault	Montreal, Canada
E-3234	Karin Haussen	Brazil
E-3235	Ana Maria Velasco	Crown Point, IN

Log #	Name	Location
E-3236	Jennifer Apple	Sammamish, WA
E-3237	Phil West	Wenatchee, WA
E-3238	Teresa Brown	Conshohocken, PA
E-3239	Kelly Arnold	Fairbanks, AK
E-3240	Tom Williams	Hollywood, CA
E-3241	Nicole Groch	Melbourne, Australia
E-3242	Jacqui Nuttall	Auckland, Australia
E-3243	Ali Kittle	Dallas, TX
E-3244	Randall Johnston	Little Rock, AR
E-3245	Garrett Smith	Tempe, AZ
E-3246	Nina Kelly	New York, NY
E-3247	Rosalin Chrest	Fridley. MN
E-3248	Rebecca Forbath	San Francisco, CA
E-3249	Jackie Moore	Santa Clara, CA
E-3250	Joseph Ramcheck	Green Bay, WI
E-3251	Doug Dickson	Calgary, Canada
E-3252	Joanne Smith-Hileman	Victorville, CA
E-3253	J. J. Kapkin	Los Gatos, CA
E-3254	Sandra Blackburn	La Puente, CA
E-3255	Henry Neal Camp	Tempe, AZ
E-3256	Leslee Goodman	Santa Barbara, CA
E-3257	Ruth Adam	Whitemore Lake, MI
E-3258	Dr. & Mrs. Jonathan S. Levy	Eugene, OR
E-3259	Jon Huls	Scottsburg, IN
E-3260	Shaney Frey	Summerland Key, FL
E-3261	Jackie Hendrix	Canada
E-3262	Rebecca English	Colorado Springs, CO
E-3263	J. Johnson	Anchorage, AK
E-3264	Elaine Costeas	Lombard, IL
E-3265	Diana Bozell	Omaha, NE
E-3266	Carol Duchamp-Katz	Bolinas, CA
E-3267	Lesa M. Chambers	Anchorage, AK
E-3268	Ginger Smith	Tolar, TX
E-3269	Yvonne Smith	Dearing, GA
E-3270	Vicky Ludwig	Lewiston, ID
E-3271	Linda Everett	Correctionville, IA
E-3272	Kalleena Dove	Gilbertsville, PA
E-3273	Deborah Manning	Indianapolis, IN
E-3274	Nancy Miller	Baltimore, MD
E-3275	William Claytor	Bloomington, IN
E-3276	Joey Sutton	Chocowinity, NC
E-3277	Lisa Dantonio	Wellington, FL
E-3278	Carlotte Grenard	Orting, WA
E-3279	Claire Rogers	Webster, NY

Log #	Name	Location
E-3280	Claudia Dikinis	Santa Monica, CA
E-3281	Rebecca Abbott	Lake Park, FL
E-3282	Michael & Judith Wheeler	Cana, VA
E-3283	Janelle Higgins	Chesapeake City, MD
E-3284	Doree Grossman	Ann Arbor, MI
E-3285	Carmen Silvers	Columbia Heights, MN
E-3286	Kristen Landolt	Pullman, WA
E-3287	Kathleen Byrnes	Vineyard Haven, MA
E-3288	Coreen Kendrick	Canada
E-3289	Sara Kleinbaum	Hackensack, NJ
E-3290	Gregory Henderson	Belle Plaine, KS
E-3291	Carol Millard	Apopka, FL
E-3292	Susan Fruth	Madison, WI
E-3293	Madalena Hutcheson	Portland, TN
E-3294	Lorraine King	Uncasville, CN
E-3295	Jerry R. Landers	Austin, TX
E-3296	Virgie McKeague	Honolulu, HI
E-3297	Jeannette Geib	Pittsburgh, PA
E-3298	Betty Lee	Hong Kong
E-3299	Jonathan Stephenson	Lyndeborough, NH
E-3300	Jerry Rasmussen	Waco, TX
E-3301	Anand Seemangal	Hollis, NY
E-3302	Margaret Lydecker	New York, NY
E-3303	Roland Hackenberg	Germany
E-3304	Tracy Swenson	Logan, UT
E-3305	Jenni Cortinas	Oshkosh, WI
E-3306	Kathryn Wood	Sartell, MN
E-3307	Janice Hodghead	Hayfork, CA
E-3308	Merni Lindquist	Willmar, MN
E-3309	Kenji Takakashi	Newark, DE
E-3310	Luis Rivers	La Jolla, CA
E-3311	David Adams	Jersey City, NJ
E-3312	Ronald Grubb	Rockford, IL
E-3313	Ella Yanok	Bridgeport, OH
E-3314	Debby Lamey	Fayetteville, NC
E-3315	Sarah E. J. Cohen	Berkeley, CA
E-3316	Adam Yates	Fairbanks, AK
E-3317	Diana Weber	Albany, NY
E-3318	Tauseef Quraishi, PhD	Madison, WI
E-3319	Dan Semler	Colton, WA
E-3320	Richard Gabriel	Eugene, OR
E-3321	Chris Gardos	Burbank, CA
E-3322	Carroll Dana	Kalaheo, HI
E-3323	Ruth Barrett	Toronto, Canada

Log #	Name	Location
E-3324	Kate Merrick	Jacksonville, FL
E-3325	Amie Coomer	Cincinnati, OH
E-3326	Paige McKee	Fort Collins, CO
E-3327	Charmaine Slaven	Seattle, WA
E-3328	Sonnia Smith	Tallahassee, FL
E-3329	Marina Baker	Glendale, CA
E-3330	Ed Mass	Naples, FL
E-3331	Ellen Matheson	Salisbury, NH
E-3332	Beth Lewis	Baltimore, MD
E-3333	Jennifer Kovel	Pittsburgh, PA
E-3334	Pam Connally	Thomson, GA
E-3335	Gregg Kuehl	Muncie, IN
E-3336	Caroline Casey	Cabin John, MD
E-3337	Zelda Block	Larchmont, NY
E-3338	Kimberlee James	Phoenix, AZ
E-3339	Linda Devendorf	Fremont, CA
E-3340	Chantal Gutierrez	Austin, TX
E-3341	Jennifer Matas	Coral Gables, FL
E-3342	Michael Lombard	Denver, CO
E-3343	Charlene Murphy	Dade City, FL
E-3344	Bill Benson	Taipei, Taiwan
E-3345	Brina Ingraham	Orange Park, FL
E-3346	Mary Doyle	Xenia, OH
E-3347	Susan Pepperwood	Ukiah, CA
E-3348	Heather Reich	Hayward, CA
E-3349	Gabrielle Guhl	Santa Barbara, CA
E-3350	Megan Oglevie	Mill Valley, CA
E-3351	Charmain McAdory	North Pole, AK
E-3352	D. Anthony Breed	Chicago, IL
E-3353	James Bowling	Martinsville, VA
E-3354	Alyson South	Anchorage, AK
E-3355	Linda Molnar	East Palestine, OH
E-3356	Paul Corogin	Gainesville, FL
E-3357	Kate Stead	Westminster, CO
E-3358	Dr. Richard Woerpel	Simi Valley, CA
E-3359	Janine Ireland	Macon, GA
E-3360	Robin Nadeau	St. Augustine, FL
E-3361	Scott Wilson	San Carlos, CA
E-3362	Sacha Dowell	Christchurch, New Zealand
E-3363	Jennie McLaughlin	Blue Bell, PA
E-3364	Zelta Burnette	Toronto, SD
E-3365	Paula Scheuering	Miles City, MT
E-3366	Leanne Droke	Ketchikan, AK
E-3367	Yvonne Wilder	Fairbanks, AK

Log #	Name	Location
E-3368	Bob Sommer	San Francisco, CA
E-3369	Mary Alice Marcial	Blairstown, NJ
E-3370	Jennifer Kim	Holmdel, NJ
E-3371	Jacqueline Gelfuso	El Paso, TX
E-3372	Shawn Nelson	Costa Mesa, CA
E-3373	Kimberly Villalobos	Los Angeles, CA
E-3374	Alyson Wiedrich	Beulah, ND
E-3375	James Blue	Ft. Collins, CO
E-3376	Cat Koehn	Fall Creek, OR
E-3377	Mark Finn	Florissant, MO
E-3378	Ximena Sanchez	Santiago, Chile
E-3379	Cassandra Suarez	Albuquerque, NM
E-3380	Jodi Groberg Hodrov	Israel
E-3381	Karen Roberts	Nashua, NH
E-3382	Colleen Weiler	Davison, MI
E-3383	Amy McAnlis	King of Prussia, PA
E-3384	Martha Wade	Arlington Heights, IL
E-3385	Arvind Kumar	San Jose, CA
E-3386	Shannon Cragg	Halifax, Canada
E-3387	Linda Lanz	Anchorage, AK
E-3388	Katherine Lillejord	Tacoma, WA
E-3389	Gail Gardener	Sebastopol, CA
E-3390	Meg Blanchet	Eugene, OR
E-3391	Jamie Minnaert-Grote	Waverly, IA
E-3392	Ariel Graham	Coronado, CA
E-3393	Frerderick Wen	Houston, TX
E-3394	Sandra Barni	Kirkland, WA
E-3395	Riv Tukiainen	Finland
E-3396	Annie Morris	Eufaula, OK
E-3397	Peter Wilcox	Rodanthe, NC
E-3398	Alisa Moffat	Anchorage, AK
E-3399	Alice Arnesen	Roy, WA
E-3400	Theodora Haughton	Sandwich, NH
E-3401	Zazie Lucassen	Escondido, Mexico
E-3402	Marissa Anderson	Minneapolis, MN
E-3403	Paige Layne	Hanford, CA
E-3404	Lynne Stanford	Canyonlake, TX
E-3405	John Kafkaloff	Lakeport, CA
E-3406	Katherine Burke Brand	Anchorage, AK
E-3407	Susan Sommers	Aurora, CO
E-3408	Karen Shoop	Long Beach, CA
E-3409	Dusty Young	St. Augustine Beach, FL
E-3410	Jakara Hubbard	Charlottesville, VA
E-3411	Weeping Willow	Katy, TX

Log #	Name	Location
E-3412	Timea Kesztyus	Kosovo
E-3413	Sonja Staes	Antwerp, Belgium
E-3414	Inger Bjorkman	Australia
E-3415	Barbara Carmichael	Ramona, CA
E-3416	Dianna Morris	Bakersfield, CA
E-3417	Alison Hill	Aurora, CO
E-3418	Vilmarie Roura	San Francisco, CA
E-3419	Courtney Larson	Weed, CA
E-3420	Janette Jakobs	Belleville, IL
E-3421	Jenna Berg	Santa Barbara, CA
E-3422	Dorothy Bennett	Tucson, AZ
E-3423	Laurie Moss	Huntsville, AL
E-3424	Sheila Edwards	Dubai, United Arab Emirates
E-3425	Ellen Peterson	Berkeley, CA
E-3426	Phyllis Mandell	Great Neck, NY
E-3427	Patrice Blain	Auckland, New Zealand
E-3428	Ruth Niswander	Davis, CA
E-3429	Ronald Johnson	Fremont, WI
E-3430	Nicole Navarro	Concord, CA
E-3431	Jeffrey Workman	Pittsburgh, PA
E-3432	Lauri Kero	Tampere, Finland
E-3433	Kristin Hanson	Anchorage, AK
E-3434	Laura Parker	Eugene, OR
E-3435	David Cann	Oakland, CA
E-3436	John Lazzareschi	South San Francisco, CA
E-3437	Gordon Taft	Mesa, AZ
E-3438	Diane Caldwell	Crescent City, CA
E-3439	George L. Pettit	San Jose, CA
E-3440	Linda Heath	Sheridan, CA
E-3441	Tina Walters	Dillsburg, PA
E-3442	Irmtraud Roth	Muenchen, Germany
E-3443	Agah Ugaz	Bursa, Turkey
E-3444	Merrill Frank	New York, NY
E-3445	John Makinen	Haines, AK
E-3446	Carol Vila-Young	Dallas, TX
E-3447	Mike Cluster	Concord, CA
E-3448	Angie Turner	Greenfield, MA
E-3449	Joesph Martinez	El Paso, TX
E-3450	Dennis Sturm	Jayville, OR
E-3451	Eve Himmelhaber	Oro Valley, AZ
E-3452	Sara Berggren	Bandhagen, Sweden
E-3453	Anissa Tai	Amsterdam, Netherlands
E-3454	D. J. Lubonovich	Franklin, PA
E-3455	Karen Barrows	Nordland, WA

Log #	Name	Location
E-3456	Adrian Pisica	Bucharest, Romania
E-3457	Sandro Di Domenico	Zurich, Switzerland
E-3458	Miquel Camps	Mao, Spain
E-3459	K. Paige Seek	Alburquerque, NM
E-3460	Zeb Nole	Las Vegas, NV
E-3461	Jeff Dowden	Newport Beach, CA
E-3462	Rose Mari	Point Arena, CA
E-3463	Linda Knight	San Francisco, CA
E-3464	Hylke de Vries	Amsterdam, Netherlands
E-3465	Ole Sol	Copenhagen, Denmark
E-3466	Liana Sonne	Ostrander, OH
E-3467	Kathi Skidmore	North Highlands, CA
E-3468	Manuel Zapater	Zaragoza, Spain
E-3469	John Pearce	San Francisco, CA
E-3470	Sophie Crouch	United Kingdom
E-3471	Gail & Robert Stagman	Mercer Island, WA
E-3472	Janis Ohmstede	Ester, AK
E-3473	Jennifer Pawlitschek	Long Beach, CA
E-3474	Olena, Lana	Denver, CO
E-3475	Bob Wright	Goodfish Lake, Canada
E-3476	Kat Cirelli	Bullhead City, AZ
E-3477	Hailey Barger	Altoona, PA
E-3478	Jean Selmes	United Kingdom
E-3479	Gloria Vasco	Caceres, Spain
E-3480	Judy Dodson	CA
E-3481	James McElroy	Ft. Myers, FL
E-3482	Michael Keith	West Covina, CA
E-3483	Anthony Horth	Gothenburg, Sweden
E-3484	Michael Strbac	Rancho Cucamonga, CA
E-3485	Lars Schmidt	Copenhagen, Denmark
E-3486	Marisa Besteiro	Western Cape, South Africa
E-3487	Aaron Bodnar	San Francisco, CA
E-3488	Thomas McGovern	Dubuque, IA
E-3489	Joyce Wippler	San Diego, CA
E-3490	Zoe Goad	United Kingdom
E-3491	Helmuth Glutzberger	Taufkirchen, Germany
E-3492	Sherry Harper	Frederick, MD
E-3493	Joe Pandya	United Kingdom
	9/18/02	
E-3494	Sara Adams	Duluth, MN
E-3495	Jacqueline Lasahn	Richmond, CA
E-3496	Amber Bey	Pittsburgh, PA
E-3497	Lan Vuong	Houston, TX
E-3498	Terumi Terao	Japan

Log #	Name	Location
E-3499	Dale Bates	Eugene, MO
E-3500	Gerardo Garcia Rosales	Calexico, CA
E-3501	Juletta Adinda Vruggink	Utrecht, Netherlands
E-3502	Anita Beardsley	United Kingdom
E-3503	Patricia Brown	South Africa
E-3504	Cynthia Wischow	Columbia, SC
E-3505	Andrew Walsh	London, United Kingdom
E-3506	Nicola Kerridge	London, United Kingdom
E-3507	John Edwards	United Kingdom
E-3508	Katie Alipranti	Athens, Greece
E-3509	Joy Jones	Cincinnati, OH
E-3510	Maria Romeiro	Fatima, Portugal
E-3511	Maro Charalambides	Nicosia, Cyprus
E-3512	Maureen Soares	United Kingdom
E-3513	Mary Lou Lewis	Charlotte, NC
E-3514	Elise Villemaire	Healdsburg, CA
E-3515	Robert Smith	Garden City Park, NY
E-3516	Caroline Mac Caughey	Bray, Ireland
E-3517	Jamie Martin	Erie, PA
E-3518	Scheryl Fulkerson	New Castle, PA
E-3519	Bob Martling	Richmond, VA
E-3520	Andrea Griffiths	Kent, United Kingdom
E-3521	Sandy Allenson	Miramar, FL
E-3522	Alison Lewis	Liverpool, United Kingdom
E-3523	Robert Ernest	Port St. Lucia, FL
E-3524	Nancy C. Anderson	Falmouth, MA
E-3525	Phyl Morello	Albrightsville, PA
E-3526	Donna Nelson	Roseville, MI
E-3527	Susan Sweitzer	Windsor, VT
E-3528	N. L. Ashton	Haddonfield, NJ
E-3529	John Schommer	Ann Arbor, MI
E-3530	Jessica Kirk	Leeds, United Kingdom
E-3531	Diane Reed	Statesboro, GA
E-3532	Bruce Williams	McGrath, MN
E-3533	Joe Bauer	Stillwater, MN
E-3534	Jo Ann Thomas	Fairgrave, MI
E-3535	Sari Jutila	Turku, Finland
E-3536	Delmos Stone	Macon, GA
E-3537	Robert Mulligan	Melville, NY
E-3538	Robert A. Foster	Bethesda, MD
E-3539	George Van Sickle	Petersburg, MI
E-3540	Thomas Charles	Greenville, NC
E-3541	Simon Harlock	Bristol, United Kingsom
E-3542	Sarina Huntington	Copiague, NY
E-3543	Michaella Stefanescu	Bucharest, Romania
E-3544	Lori Taft	Louisville, KY
E-3545	John Stone	Wheaton, IL
E-3546	Elizabeth Sprague	Chicago, IL
E-3547	Laura Hanke	Las Cruces, NM
E-3548	Robert Conlogue	Dublin, CA
E-3549	Mary Greer	Aransas Pass, TX
E-3550	Rick Krapf	Naples, FL
E-3551	Anna Bagnall	Brooklyn, NY
E-3552	Sally Koziol	Maine, NY
E-3553	Fran Kelsey	Boone, NC
E-3554	Sheila Lewis	Forest, OH
E-3555	Lee Meggison	Sleepy Hollow, NY
E-3556	Ron Roberts	Tacoma, WA
E-3557	Shannon Brown-Perez	Reynoldsburg, OH
E-3558	Anna Barrows	Connersville, IN
E-3559	Grechen Pruett	Stockton, NJ
E-3560	Amie Pounds	Danville, IL
E-3561	Catherine Wendell	Ocala, FL
E-3562	Kim Spalding	Durham, NC
E-3563	Janine Panna	Greentown, PA
E-3564	Marty Gerace	Upper Darby, PA
E-3565	Judy Stauffer	Auburn, NY
E-3566	Andrea Scrivener	Moscow, PA
E-3567	Henry Robert Kolb	Gainesville, FL
E-3568	Karen Tuthill	Raleigh, NC
E-3569	Lyle McRae	North Bend, WA
E-3570	Corey Paul Mondello	Boston, MA
E-3571	Sandra Kauffman	Brunswick, MA
E-3572	Bob Parcelles, Jr.	Pinellas Park, FL
E-3573	Laura Urich	Raleigh, NC
E-3574	Linda Nicholson	Lake Ariel, PA
E-3575	Ann Dinino	Burlington, VT
E-3576	Peter Kneisel	Framingham, MA
E-3577	Eric Lachance	Palm Beach Gardens, FL
E-3578	Valyrie Ellis	Fredrick, MD
E-3579	Timothy Burris	Portland, ME
E-3580	Nikki Banfield	Shavertown, PA
E-3581	Phyllis Moffo	Sewell, NJ
E-3582	Judy Winsett	Green Sulphur Springs, WV
E-3583	Barnaby Green	Cambridge, United Kingdom
E-3584	Thomas Parker	Asheville, NC
E-3585	Diane Post	Ashland, MA
E-3586	Janet Nirenberg	Holliston, MA

Log #	Name	Location
E-3587	Julia Valigore	Chesterland, OH
E-3588	Gerry Francis	Meriden, CT
E-3589	Denise Olle	East Lansing, MI
E-3590	John Saylor	South Bend, IN
E-3591	Joe Jacobson	Sarasota, FL
E-3592	Denise Srekric	Cleveland, OH
E-3593	Natalia Fernandez	United Kingdom
E-3594	Ted Ludzik	Toronto, Canada
E-3595	Mary Nordkvelle	London, United Kingdom
E-3596	Michelle Arsenault	Toronto, Canada
E-3597	Lara Schalbury	Sumerduck, VA
E-3598	Marty Wisott	Chicago, IL
E-3599	AnnMarie Johnson	Oshkosh, WI
E-3600	Corey Mesler	Memphis, TN
E-3601	Elizabeth Coulard	Guilford, Ct
E-3602	Mathieu Valcke	Montreal, Canada
E-3603	Karin LaMothe	Belleville, MI
E-3604	Mark Berkheimer	Reston, VA
E-3605	Dedra Johnson	New Orleans, LA
E-3606	John Cheney	Henderson, NV
E-3607	Robert Freid	Cincinatti, OH
E-3608	Enrique Guerra	Mexico
E-3609	Erika DeCarlo	Aurora, IL
E-3610	Kathy Rucinski	Stevens Point, WI
E-3611	Jose V. Padilla-Lopez	Ft. Myers, FL
E-3612	Deborah Sweet	West Plains, MO
E-3613	E. Stanley	Albany, NY
E-3614	Cynthia Gearld	Leavenworth, KS
E-3615	Cindy Ellis	Mt. Zion, IL
E-3616	Esena Doyle	Clinton, NY
E-3617	Bill Rubenstein	Hollywood, FL
E-3618	Lorie Morgan	Birmingham, MI
E-3619	Patty Majors	Petersburg, MI
E-3620	Eileen A. Mulholland	Franklinville, NJ
E-3621	Kim Iwanicki	Marquette, MI
E-3622	Ruth Mitchell	Gloucester, United Kingdom
E-3623	Karen Guthrie	Brazil, IN
E-3624	Hedvig Olander	Jarlasa, Sweden
E-3625	Valar Deimosa	Malaysia
E-3626	Colleen Sanderson	Tampa, FL
E-3627	Brooke Dumain	New York, NY
E-3628	Taunya Harrill-Orazio	Bangor, ME
E-3629	Nilesh Rao	Mumbai, India
E-3630	James Tasker	Sudbury, MA

Log #	Name	Location
E-3631	Dianne Fannin	Williamsburg, VA
E-3632	Cheryl Mullins	Alamogordo, NM
E-3633	Kathryn Kenney	Lava Hot Springs, ID
E-3634	Richard Carstens	Denver, CO
E-3635	Clark James	Crystal Lake, IL
E-3636	Kristine Flannery	Rochester, NY
E-3637	Debbie Beane	Owensboro, KY
E-3638	Lindsay Spratt	Asheville, NC
E-3639	Rich Pascall	Newark, NJ
E-3640	Marianne Alme	Vienna, VA
E-3641	Susan Mullinax	Greenvile, SC
E-3642	Annette DeFeo	Paterson, NJ
E-3643	Tony Bailey	North Chili, NY
E-3644	Darren Misenko	Washington, DC
E-3645	Olivier Humblet	Cambridge, MA
E-3646	Rick Lane	Jefferson City, TN
E-3647	Ana Rodriquez	Orlando, FL
E-3648	Joshua Trepczyk	Racine, WI
E-3649	Richard Ambrosio	Wall, NJ
E-3650	Phil DeFabio	Silver Spring, MD
E-3651	Daniel Schuller	Miami, FL
E-3652	Sari Koshetz	Miami, FL
E-3653	Julia Hanline	Garner, NC
E-3654	Ron Johnson	San Bruno, CA
E-3655	Linda Espenschied	Dayton, NJ
E-3656	Janet Lewis	Bowling Green, MO
E-3657	Teresa Stockman	Sterling, VA
E-3658	Judie Scalfano	Brooklyn, NY
E-3659	Karen Algiers	Hartford, WI
E-3660	Jennifer Coleman	Brooklyn, NY
E-3661	Dan Ritzman	Anchorage, AK
E-3662	Manorita Singh	Gurgaon, India
E-3663	Stephen David Walter	Hopewell, NJ
E-3664	Kathleen Boislard	Victoriaville, Canada
E-3665	Bobette Eckland	Chapel Hill, NC
E-3666	Melissa Metcalf	Newark, DE
E-3667	Cindy Lemek	Wethersfield, CT
E-3668	Vicki D. Gore	Brentwood, TN
E-3669	Daphne Mascioli	Orlando, FL
E-3670	Alexis Naydenov	Everett, MA
E-3671	Kristy Apostol	Lansing, MI
E-3672	Judith Modak	Flowery Branch, GA
E-3673	Jennifer Pann	Harrison Township, MI
E-3674	Edward Stetson	Kansas City, MO

Log #	Name	Location
E-3675	Greg Dimitroff	Canton, MI
E-3676	Nicole Meese	Arlington, VA
E-3677	Dia Redman	North St. Paul, MN
E-3678	Ann Jacobs	St. Louis, MO
E-3679	Therese Davies	Nashville, TN
E-3680	Ann Jacobs	St. Louis, MO
E-3681	Vicky Campbell	Faber, VA
E-3682	Sylvia Ross	Hayden, AL
E-3683	Leslie Miceli	Flushing, NY
E-3684	Aileen Seldes	New York, NY
E-3685	Aino Inkinen	Edinburgh, United Kingdom
E-3686	Anne Coker	Georgetown, SC
E-3687	Christine Knapp	Philadelphia, PA
E-3688	Donna Hampson	Ayer, MA
E-3689	Alexander Charez	Arcadia, CA
E-3690	Dawna Mendall	Franklin, MA
E-3691	Bonnie Sonder	Merion Station, PA
E-3692	Julea Cheshire	Madison, WI
E-3693	Ally Karge	Orlando, FL
E-3694	Angela Ichigui	North East, MD
E-3695	John Drury	Bon Aqua, TN
E-3696	Rebecca Killa	United Kingdom
E-3697	Liz Boon	Broomfield, CO
E-3698	Jack Hawkins	Milwaukee, WI
E-3699	Marlowe Mager	Charlotte, NC
E-3700	Irene Kharag	Beds, United Kingdom
E-3701	Jody Sloan	Tucker, GA
E-3702	Deanne Hart	Walpole, MA
E-3703	One Alm	Marlboro, VT
E-3704	Jaime Wykle	Athens, WV
E-3705	Michelle De Uriar	San Antonio, TX
E-3706	Priscilla Freeman	San Antonio, TX
E-3707	Richard Sinclair	Schertz, TX
E-3708	Connie Brown	Tatum, TX
E-3709	Vernon Newhous	Bryn-Mawr, PA
E-3710	Sarah Chapman	Murray, KY
E-3711	Lindsay Townsen	Parkland, FL
E-3712	Denyce Berg	Tucson, AZ
E-3713	Jackie Eller	Tecumseh, KS
E-3714	Ellen Stringer	Blythewood, SC
E-3715	KimberlyDeLaurentis-Cohen	Enfield, CT
E-3716	Nicola Gonzalez	Poughkeepsie, NY
E-3717	Galicia Outes	New Rochelle, NY
E-3718	Jim D'Angelo	Red Creek, NY

Log #	Name	Location
E-3719	Maurice Hernandez	Chattanooga, TN
E-3720	Roger Foster	Santa Monica, CA
E-3721	P. Tellekamp	New London, CT
E-3722	Pauline Slane	United Kingdom
E-3723	Glenn Cronick	Staten Island, NY
E-3724	Phyllis Howard	Austin, TX
E-3725	Debra Albin	Hudson, FL
E-3726	Jan Christopher	Foster, RI
E-3727	Sarah MacDonald	Inter Grove Heights, MN
E-3728	Sarah Clark	Nokomis, FL
E-3729	Pat Doran	Seattle, WA
E-3730	Scott Mullins	Shelbyville, TN
E-3731	Gail McAllister	Avon, NC
E-3732	Cheryl McPherron	Orlando, FL
E-3733	Leta Dally	Alexandria, VA
E-3734	Martha Larsen	Charlotte, NC
E-3735	Terilee Peavler	Jones Borough, TN
E-3736	Gerolyn Jenkins	Palm Beach Gardens, FL
E-3737	Todd Tarrant	East Lansing, MI
E-3738	Ann McAlister	West Valley City, UT
E-3739	Wendy Buffett	Pittsburgh, PA
E-3740	Thin Lo	Malaysia
E-3741	Patricia Scrimgeour	Pensacola, FL
E-3742	Judy Christy Maqueda	Aitkin, MN
E-3743	Robert Funk	Jersey City, NJ
E-3744	Jamie Thomas	Montgomery, PA
E-3745	Melani Wineburner	Colman, SD
E-3746	Toni Siegrist	Cambridge, MA
E-3747	Page Winters	Metairie, LA
E-3748	Nathan Snyder	Kodak, TN
E-3749	Joanna Ball	Asheville, NC
E-3750	Valerie Lane	Clearwater, FL
E-3751	Kelli Howerin	Virginia Beach, VA
E-3752	Jenna Pridemore	Cleves, OH
E-3753	Cherie Snyder	Palm Bay, FL
E-3754	Cathy Higbee	Egg Harbor Township, NJ
E-3755	Emma Stayduhar	Washington, DC
E-3756	Janis Aldridge	Irving, TX
E-3757	Tim McConville	Libertyville, IL
E-3758	Miranda Swanson	West Palm Beach, FL
E-3759	Siobhan Wolf Shaffer	Lewis Center, OH
E-3760	Tobias Ryen	Gothenburg, Sweden
E-3761	Thomas M. Seidl	White Bear Lake, MN
E-3762	Donna Walter	Spring House, PA

Log #	Name	Location
E-3763	Melody Brown	Danielson, CT
E-3764	Jack Burdick	Centerbrook, CT
E-3765	Kimberly Chow	Elmhurst, NY
E-3766	Kelly Carlisle	Santa Fe, NM
E-3767	Flora Rummel	Hollsopple, PA
E-3768	Russell Bezette	LaVerkin, UT
E-3769	Brenda Morgan	Winston Salem, NC
E-3770	Katherine Babiak	New York, NY
E-3771	John J. Link	Fremont, CA
E-3772	Heidi Cheatham	Ceres, CA
E-3773	Ali Ozgene	Rochester, NY
E-3774	Nancy L. Guido	Tampa, FL
E-3775	Cyndi May	Washborn, WI
E-3776	Annette Gingerich	Minnetonka, MN
E-3777	Deb Kilgore	Sylvan Springs, AL
E-3778	Donna Jean Brenaman	Lexington, NC
E-3779	Deborah Wertz	Lafayette, IN
E-3780	Dianne Bradford	Dublin, OH
E-3781	Laura Phillips	Highland, IN
E-3782	Todd Brayton	Riverside, RI
E-3783	Waveney Bowman	Stony Brook, NY
E-3784	Christine Vitiello	Saddle Brook, NJ
E-3785	Lindsey Springer	Marinette, WI
E-3786	Robin Orliner	Glenside, PA
E-3787	Touche Guimaraes	Salvador, Brazil
E-3788	Yvonne Moore	Janesville, WI
E-3789	Marvin Holder	Castle Hayne, NC
E-3790	Aguilar Veronica	Mexico
E-3791	Alexandra D. Pappano	Mattawamkeag, ME
E-3792	Holly Sletteland	Templeton, CA
E-3793	Lucy Erickson	Atlanta, GA
E-3794	Natalie Talbot-Shatas	Miami, FL
E-3795	Akilah Prout	Washington, DC
E-3796	James Parker	Atlanta, GA
E-3797	Patricia Gallo	Tucson, AZ
E-3798	Jonathan Monsen	Miami, FL
E-3799	Melissa Rowland	Plano, TX
E-3800	Kim Fuentes	Azle, TX
E-3801	Erik & Lori Booth	Ironwood, MI
E-3802	Ray & Louise Compere	Norfolk, VA
E-3803	Chris Seabrooke	Hayden, ID
E-3804	Heather Ferguson	Albuquerque, NM
E-3805	Arthur Saarinen	Gainesville, FL
E-3806	K. Marks	Los Angeles, CA

Log #	Name	Location
E-3807	Lori Esquibel	St. Petersburg, FL
E-3808	Luanne Semler	Pullman, WA
E-3809	Raymond Riley	United Kingdom
E-3810	Rose Izikoff	Goffstown, NH
E-3811	Tara Treasurefield	Rohnert Park, CA
E-3812	Liza Goldberg	Parlin, NJ
E-3813	Neesha Patel	New York, NY
E-3814	Carla Blair	Brooklyn, NY
E-3815	DianaLee Behr-McIntire	Wichita, KS
E-3816	Laura Hake	Natick, MS
E-3817	Yuenne Walter	Mukilteo, WA
E-3818	Michael White	Yorktown, VA
E-3819	Heidi Hunt	Rockport, ME
E-3820	Erin Severi	Little River, CA
E-3821	Terry Frewin	Santa Barbara, CA
E-3822	Thomas Best	Roswell, GA
E-3823	Kimberly Farmer	Warrenton, VA
E-3824	Lynn E. Alden	St. Louis, MO
E-3825	Julia Johns	McMurray, PA
E-3826	Richard Davis	Kansas City, MO
E-3827	Nick Ardinger	Chicago, IL
E-3828	Bea Osapai	Brooklyn, NY
E-3829	Shelly Ferris	Burdett, NY
E-3830	William E. Bruce	Key Largo, FL
E-3831	Vicki Brown	Creston, IA
E-3832	Mary Beth Garvin	Olean, NY
E-3833	Polly Endreny	Sleepy Hollow, NY
E-3834	Sandra Brinker	Randolph, NJ
E-3835	Sharon Herzberg	Columbus, WI
E-3836	Sonia Ng	New York, NY
E-3837	Christopher Stillm	Jamaica Plain, MS
E-3838	Shelly Chirico	Tampa, FL
E-3839	Lana Branch	Leo, IN
E-3840	Jane Baker	Rockville, MD
E-3841	Elizabeth Rheault	Minneapolis, MN
E-3842	Audrey Cheng	Arlington, VA
E-3843	Nicole Way	Spokane, WA
E-3844	Randolph Barton	Wilmington, DE
E-3845	Chelsey Ward	Vacaville, CA
E-3846	Michael Pappano	Mattawamkeag, ME
E-3847	Sue M. Watkins	Fulton, MS
E-3848	Carlos Negron	Bayamon, Puerto Rico
E-3849	Sharon Witt	Lakeland, FL
E-3850	Shelby Reeser	Madison, WI

Log #	Name	Location
E-3851	Irawan Asaad	Makassar, Indonesia
E-3852	Johathan Wetzel	Homer, AK
E-3853	Claire Bean	Old Orchard Beach, ME
E-3854	Philip Gibson	Marysville, WA
E-3855	Roseann Marulli	New York, NY
E-3856	Jan Van Sickle	Sonoma, CA
E-3857	Nicholas Romano	New York, NY
E-3858	Lally Saucedo	Sacramento, CA
E-3859	Amanda Terpstra	Holland, MI
E-3860	Beverly Nadelma	Brooklyn, NY
E-3861	John Yale	New York, NY
E-3862	Jamie Arbuckle	Point Harbor, NC
E-3863	Rose Kesten	Santa Barbara, CA
E-3864	Patrice Humke	Canal Zone
E-3865	Alyssa Schwartz	Daly City, CA
E-3866	Zachary Henige	Cambridge, MA
E-3867	Schuyler Greenleaf	El Portal, CA
E-3868	Deb Nykamp	Holland, MI
E-3869	Fran Recht	Depoe Bay, OR
E-3870	Mr. & Mrs.James D. Pollock	Silverton, OR
E-3871	Christopher Root	Venice, CA
E-3872	Patricia Baker	Rockville, MD
E-3873	Thyme Curtis	San Diego, CA
E-3874	Carmen Young	Chicago, IL
E-3875	Peter Bennett	Langley, WA
E-3876	Virginia Hood	Birmingham, AL
E-3877	Naomi Tillison	Farmington Hills, MI
E-3878	Shawn Dugan	Ephrata, PA
E-3879	Mary King	Norcross, GA
E-3880	Mary Hall Matson	Enumclaw, WA
E-3881	Jenna Sunderlin	Grand Island, NY
E-3882	Elizabeth Morton	Sebastopol, CA
E-3883	Mariah Bellello	San Francisco, CA
E-3884	Marijo Ahnger	San Diego, CA
E-3885	David Bunde	Urbana, IL
E-3886	D. Jessup	Hamilton, Canada
E-3887	David Kratz Mathies	Malden, MA
E-3888	Daniel M. Portwood	Sterling, VA
E-3889	Susan Usher	Seattle, WA
E-3890	Natalie Abram	Bardstown, KY
E-3891	Judy Dunn	DesAllemands, LA
E-3892	Delia Barrett	East Berlin, PA
E-3893	Yvonne Merck	Charlotte, NC
E-3894	George Bostick	Victorville, CA

Log #	Name	Location
E-3895	Marie McRae	Freeville, NY
E-3896	Tom Yarish	Mill Valley, CA
E-3897	Senyo Adjabeng	Accra, Ghana
E-3898	Matthew Schult	West Newton, PA
E-3899	Ina Ross	Seattle, WA
E-3900	Katherine Himes	Minneapolis, MN
E-3901	Lori Bailey	PA
E-3902	Richard Rowland	Springfield, OH
E-3903	Gloria Bando	Culver City, CA
E-3904	R. Romaker	Ann Arbor, MI
E-3905	Bobbie Johnson	Canon City, CO
E-3906	Gretchen Weddig	Stevens Point, WI
E-3907	Jill Ellicott	Seattle, WA
E-3908	Francesca Taylor	San Francisco, CA
E-3909	Andrea Fournier	Oakland, CA
E-3910	Tenzin Gyaltsen	Salt Lake City, UT
E-3911	Ed Carter	Nederland, CO
E-3912	Victor Raymond	Wilson, WY
E-3913	April Sconyers	West Palm Beach, FL
E-3914	Sharon Cruz	Orange Park, FL
E-3915	Rhodia Mason	Chicago, IL
E-3916	Alice Bartholome	Elmira, NY
E-3917	Alice Yoe	Huntingtown, MD
E-3918	Julie Lucente	Netcong, NJ
E-3919	Eileen Murray	Windsor, CO
E-3920	Sandra Bernard	Forest Hills, NY
E-3921	Catherine Schults	Kerhonkson, NY
E-3922	Elizabeth Albert	Somerville, MA
E-3923	Claire Wynters	Winter Springs, FL
E-3924	Lynn Means, Ph.	Rockville Centre, NY
E-3925	John Robert Jack	Panama City, FL
E-3926	Alison Burrows	Astoria, NY
E-3927	Mike Monroe	Batavia, IL
E-2928	Kate Hare	Princeton, NJ
E-3929	Felicia Day	Santa Monica, CA
E-3930	Cynthia Delafield	Ft. Lauderdale, FL
E-3931	Ellen Bourgault	Industry, ME
E-3932	Sarah Wyllie	Sherwood Park, Canada
E-3933	Larry Orzechowski	Phoenix, AZ
E-3934	Laura Lee Fairchild	San Jose, CA
E-3935	Brian Thompson	Huntington, WV
E-3936	M. Mass	Santa Barbara, CA
E-3937	Tatiana Medina	Bogota, Columbia
E-3938	Katherine Cadury	Bazel, Switzerland

Log #	Name	Location
E-3939	Erin Emerson	Ann Arbor, MI
E-3940	Rose Nichols	Ft. Collins, CO
E-3941	Jake Kheel	Ithaca, NY
E-3942	Barbara Kurtz	Lexington, IL
E-3943	Kim Garber	Mount Pleasant, MI
E-3944	Jaeson Boyers	Duluth, MN
E-3945	Jacob Reichard	Richmond Hills, Canada
E-3946	Don Dial	Bellevue, WA
E-3947	Emily Lopez	Pensacola, FL
E-3948	Glenda Gessay	Black Creek, WI
E-3949	Gloria Shelley	Dudley, NC
E-3950	Brandi Hoter	Keller, TX
E-3951	Richard Charter (see L-0026)	Oakland, CA
E-3952	Susan Carter	Hammond, IN
E-3953	Connie Yarborough	Santa Monica, CA
E-3954	Twyla Wolfe	Stoughton, MA
E-3955	Lynne Humkey	Franklin, TN
E-3956	Colleen Threlfall	Middleburg, CT
E-3957	Irene Stemler	Chicago, IL
E-3958	David Jaffe	Irvine, CA
E-3959	John Waz	Pensacola, FL
E-3960	Niamb Corbett	Boca Raton, FL
E-3961	Stacie Gallenstein	San Diego, CA
E-3962	Kelly Rose	Los Angeles, CA
E-3963	Vanessa Metcalf	Bodega Bay, CA
E-3964	Matt Madia	Saddle Brook, NJ
E-3965	Gina Allen	Springfield, MA
E-3966	Michael Roedema	Saddle Brook, NJ
E-3967	Susan Workman	Winston-Salem, NC
E-3968	Sarah McLean	Sedona, AZ
E-3969	Annie Pepper	Williamsburg, VA
E-3970	Karen Ha	Fresh Meadows, NY
E-3971	Connie Reeves	Lakeland, FL
E-3972	Susan Haberkorn	Naples, FL
E-3973	Julie Milliren	Oconomowoc, WI
E-3974	Patricia Guenther	Girard, OH
E-3975	Anna Brenna	Lakeville, MN
E-3976	Robin Skees	Watertown, MA
E-3977	Joel Aggerholm	Lakeville, MN
E-3978	Lisa Chaudhry	Grand Prairie, TX
E-3979	Charles Hornaday	Santa Monica, CA
E-3980	Tanya Smith	Johannesburg, South Africa
E-3981	Deborah Asch	El Cerrito, CA
E-3982	Scarey Martin	Mamaroneck, NY

Log #	Name	Location
E-3983	Matt Walker	Atlanta, GA
E-3984	Sam Malone	Bourne, United Kingdom
E-3985	Jason Hotchkiss	Austin, TX
E-3986	Matt Fitzgibbons	Auburn, MA
E-3987	Sharlene White	Escondido, CA
E-3988	Joseph DeGregorio	Portland, OR
E-3989	Leslie Hafemeister	Fairbanks, AK
E-3990	Ginger Young	Spring, TX
E-3991	Michele Cincotta	Ocean View, NJ
E-3992	Kevin Lamonia	Bethesda, MD
E-3993	German Herrera	San Andres Iland, Colombia
E-3994	Jennifer Banoczy	Los Angeles, CA
E-3995	Tarek Maassarani	Washington, DC
E-3996	J. Pfaehler	Hemet, CA
E-3997	Adi Fairbank	Eugene, OR
E-3998	Deborah Siemer	Los Angeles, CA
E-3999	Sarah Tromp	Eau Claire, WI
E-4000	Jackie Finch	Oak Park, IL
E-4001	Cherie Jones	Bradenton, FL
E-4002	Sarah Piechuta	Brunswick, OH
E-4003	Alexandra Manion	Sausalito, CA
E-4004	Maryellen Oman	Anchorage, AK
E-4005	Julio Calle	Jackson Heights, NY
E-4006	Coleman Tanner	Winston-Salem, NC
E-4007	Eden Robertson	New York, NY
E-4008	Peter Buck	Alexandria, VA
E-4009	Pamela Turner	Orinda, CA
E-4010	Lyrae Emerson	Sechelt, Canada
E-4011	Glenn Sisson	San Francisco, CA
E-4012	Richard Brandes	Marina Del Rey, CA
E-4013	A. Ayers	Olathe, KS
E-4014	Alyson Mohan-Lucas	Minneapolis, MN
E-4015	Kymberli Martinez	Winters, CA
E-4016	Jamie Miller	San Diego, CA
E-4017	Gary Stuart	Studio City, CA
E-4018	Danielle Tocco	Mt. Laurel, NJ
E-4019	Sharon Carraway	Riverside, NJ
E-4020	Sara Bush	Costa Mesa, CA
E-4021	Omar Monzon	Canovanas, Puerto Rico
E-4022	Cassie Long	Lawrenceville, GA
E-4023	Mary LaPlant	Everett, MA
E-4024	Lara Martin	Los Angeles, CA
E-4025	Toben Dilworth	Sebastopol, CA
E-4026	Erica Brodman	Reading, PA

Log #	Name	Location
E-4027	Jennifer Stewart	Nederland, CO
E-4028	Anthony Niether	Kalispell, MT
E-4029	Meghan Jones	Raleigh, NC
E-4030	Cindi Labbe	Alstead, NH
E-4031	Terry Everett	Holstein, IA
E-4032	Chandra McGee	Fairbanks, AK
E-4033	Ei Ei Nyane	Falls Church, VA
E-4034	Peter Zadis	Jamaica, NY
E-4035	Sandi Burland	Burnaby, Canada
E-4036	Yara Ghrewati	London, United Kingdom
E-4037	Melissa Cruze	Northfield, MN
E-4038	Sarah Peterson	University Place, WA
E-4039	Peter Sandoval	Brooklyn, NY
E-4040	Julie Weber	Livonia, MI
E-4041	Kristin Sands	Wylie, TX
E-4042	Andrea Moore	Cols, OH
E-4043	Elaine Fischer	Branford, CT
E-4044	Erin McVay	Troy, OH
E-4045	Julio Y. Sanchez	Point St. Lucie, FL
E-4046	Fred L. Metcalf	Drummond, MT
E-4047	Lola Misirlic	Beograd, Yugoslavia
E-4048	Cassandra Jackson	Cobourg, Canada
E-4049	Hilary Masson	Gabriola Island, Canada
E-4050	Tina Marie Winders	Gulf Breeze, FL
E-4051	Dr. Richard Boylan	Sacramento, CA
E-4052	Molly Coeling	Ann Arbor, MI
E-4053	Douglas Johnson	Burbank, CA
E-4054	Bill Stokes	St. Petersburg, FL
E-4055	Rachel Kinder	McFarland, WI
E-4056	Daniel Broersma	Holland, MI
E-4057	Michael Bessanette	Fairfax, CA
E-4058	Marion Pittelli	Massapequa, NY
E-4059	Claudia Pruitt	Springfield, IL
E-4060	Suzanne Powell	Pittsburgh, PA
E-4061	Abhijit Banerjee	Newark, DE
E-4062	Lee Hackenberger	Anchorage, AK
E-4063	Joy Hoeppner	Magnolia, DE
E-4064	Mary Ann DellaRocco	Indianapolis, IN
E-4065	Kelly Foster	Philadelphia, PA
E-4066	Autumn Stubbs	Memphis, TN
E-4067	Chloe Metz	Durham, NC
E-4068	Sarah Rohn	Normal, IL
E-4069	Mary Ann DellaRocco	Indianapolis, IN
E-4070	Jessica Isenman	Kenai, AK
E-4071	Shawna Williams	Taos, NM
E-4072	Vicki Garay	Tucson, AZ
E-4073	Ciana Olson	Green Bay, WI
E-4074	Ann Hannigan-Breen	Pamplona, Spain
E-4075	Michael Rotter	Greenville, MI
E-4076	Tracy Griffin	Moore, OK
E-4077	Jamie Shohan	Lee, MA
E-4078	Taylor Attaway	Pompano Beach, FL
E-4079	Anna Sgarlato	Athens, GA
E-4080	Kim Causey	Dayton, TX
E-4081	Sindy Cho	San Francisco, CA
E-4082	Kristine Gillis	Encinitas, CA
E-4083	Cherie Jagodrinski	Apollo, PA
E-4084	Louise Fry	New York, NY
E-4085	Mark Nielson	Santa Barbara, CA
E-4086	Pamela St. John	Chapel Hill, NC
E-4087	Sebastian Muccilli	Lake Park, FL
E-4088	Maddie McKeller	Brevard, NC
E-4089	Linda Linderman	Phoenix, AZ
E-4090	Peggy Sowden	Shakopee, MN
E-4091	James Polhemus	London, United Kingdom
E-4092	Scott Rappold	East Moriches, NY
E-4093	Jolene Richard	Youngsville, LA
E-4094	Sarah Pukala	Chicago, IL
E-4095	Christen Don	Seattle, WA
E-4096	Jane Olson	Sidney, MT
E-4097	Michael Hodgson	Lafayette, IN
E-4098	Mary Schmuck, RSM	Nazareth, KY
E-4099	Judith Carter	Phoenix, AZ
E-4100	Kalli MaRee	Greeley, CO
E-4101	Kathy Johnston	Fairfield, CA
E-4102	Sophia Hughes	Charlottesville, VA
E-4103	Liz Leavens	Memphis, MI
E-4104	Joe Lazarsky	Alexandria, VA
E-4105	Georgia Donovan	Doylestown, PA
E-4106	Robert Savidge	Annapolis, MD
E-4107	Veronica Aceved	Cabo Rojo, Puerto Rico
E-4108	Georgia Donovan	Buckingham, PA
E-4109	Robert Savidge	Annapolis, MD
E-4110	Anna Tritschler	Gulf Breeze, FL
E-4111	Tracy Erchul	New Berlin, WI
E-4112	Alora Windsor	Magndia, TX
E-4113	Karl Neufville	Phoenix, AZ
E-4114	Gayle Nicholson	Gainesville, FL

Log #	Name	Location
E-4115	Mare Rachmuth	Oxnard, CA
E-4116	Karen Gormley	Winsloe, Canada
E-4117	Arnold Brown	Milwaukee, WI
E-4118	Siobhan Doyle	Dublin, Ireland
E-4119	Tina Twito	Lehigh, IA
E-4120	Jennifer Hawkes	Georgetown, DE
E-4121	Cheryl Vigoda	Coconut Creek, FL
E-4122	Richie Transou	Lowgap, NC
E-4123	Stacy Stiegleiter	Cottage Grove, TN
E-4124	Lisa Etherington	Gustavus, AK
E-4125	Paul Bickmore	Austin, TX
E-4126	Michelle Kwon	North Arlington, NJ
E-4127	Andrea Cornett	Columbus, OH
E-4128	Sarah Peterson	Rohnert Park, CA
E-4129	Shelly Dunn	Independence, MO
E-4130	Alice Hesselrode	Detroit, MI
E-4131	David Wachtel	Columbus, OH
E-4132	Edmond Wright	Bradenton, FL
E-4133	Melody Stewart	Rockbridge, OH
E-4134	Craig Edelman	Los Angeles, CA
E-4135	Lewis Rifkind	Whitehorse, Canada
E-4136	Abigail Hutson	Andersonville, TN
E-4137	Jane Bryant	Mauldin, SC
E-4138	Fredrick Swords	Pendleton, OR
E-4139	Jeannine Coleman	Easley, SC
E-4140	Jeffrey Wiles	Hopkins, MN
E-4141	R. Weinschel	Norfolk, VA
E-4142	Teresa Cox	Cane Beds, AZ
E-4143	Elizabeth Dunham	Mount Arlington, NJ
E-4144	Andrea Polk	Antioch, CA
E-4145	Patricia Piazza	Albany, NY
E-4146	Danielle Tannourji	Glendora, CA
E-4147	Sarah Manock	Fresno, CA
E-4148	David Reiner	Carrboro, NC
E-4149	Nancy Bates	Tyler, TX
E-4150	Laura Pinedo	El Monte, CA
E-4151	Thomas Bressani	Deltona, FL
E-4152	Anthony Lyons	Lamar, MO
E-4153	Heather Maus	Glennie, MI
E-4154	Susan Murray	Orange, CA
E-4155	Lisa Temmen	Newtown, CT
E-4156	Lynette Smith	Zeeland, MI
E-4157	Virginia Ferriero	Clearwater, FL
E-4158	Jennifer Wolf	Cardiff, CA

Log #	Name	Location
E-4159	Wendy Jean Gehring	Portland, OR
E-4160	Chas Jewett	Rapid City, SD
E-4161	Devon Werble	Sherman Oaks, CA
E-4162	Barbara Jenkins	Odenton, MD
E-4163	Shannon Scheidell	Port St. Lucie, FL
E-4164	Peter Vachuska	West Bend, WI
E-4165	Sagi Nahor	Chicago, IL
E-4166	Jeremiah Steidl	Albuquerque, NM
E-4167	Julia Withington	Leon, KS
E-4168	Linda Tran	San Diego, CA
E-4169	Michael Backer	Brooklyn, NY
E-4170	Corina St. Martin	Richmond, IN
E-4171	Sheila O'Keefe	Corvallis, OR
E-4172	Kathie Blair	Portland, OR
E-4173	Nina Baker	Tacoma, WA
E-4174	Ida-Maria Ramling	Hridovre, Denmark
E-4175	Jillian Aronson	Orlando, FL
E-4176	Terry Nieves	Comptche, CA
E-4177	Nicolas Fancher	Deltona, FL
E-4178	Natalie Ko	Thornhill, Canada
E-4179	Heather Rowe	Lowell, MA
E-4180	Tammara Maines	Tacoma, WA
E-4181	Michael Tucker	Costa Mesa, CA
E-4182	Jaclyn Gurule	Grants Pass, OR
E-4183	Tulare Adams	Las Vegas, NV
E-4184	Cheris Hoffmann	Hanna City, IL
E-4185	Kathi Tammick	Allston, MA
E-4186	Amin Arikat	Larkspur, CA
E-4187	Sharon Richards	Kansas City, MO
E-4188	Tavia Bachert	Tamaqua, PA
E-4189	Therese Yelk	Sun Prairie, WI
E-4190	Sandra Archer	Deltona, FL
E-4191	Mark Jenkins	Deltona, FL
E-4192	Tiare Wesley	Paia, HI
E-4193	Harold Brown	South Euclid, OH
E-4194	Carol McIntosh	North Branch, MI
E-4195	Robert Billetdeaux	Palm Coast, FL
E-4196	Andrea Saunders	Rockland, MA
E-4197	Leslieann Duncan	Cedar Rapids, IA
E-4198	Mattie Horine	Asheville, NC
E-4199	Maria Boggiano	Villa Park, IL
E-4200	Carlos Barcat	Buenos Aires, Argentina
E-4201	Renae Beeker	Salisbury, NC
E-4202	Tim Joyce	Versailles, KY

Log #	Name	Location
E-4203	Melodi Jenkins	Deltona, FL
E-4204	Tiffany Tom	Mesa, AZ
E-4205	Rainah Goldfeath	Alachua, FL
E-4206	Sarah Fecht	Cicero, NY
E-4207	Ingrid Enthoven	Oxnard, CA
E-4208	Ms. K. A. Ravenburg	East Olympia, WA
E-4209	Cristina Irizarry	Pompano Beach, FL
E-4210	Ben Keller	Pawtucket, RI
E-4211	Kelly Mulchay	Berkeley, CA
E-4212	George Dorman	Thornton, CO
E-4213	Sharon Vander Pool	Bonney Lake, WA
E-4214	Jim Curland	Moss Landing, CA
E-4215	Tomi Phillips	The Woodlands, TX
E-4216	Emily Johnson	Missoula, MT
E-4217	Linda Frances	Nathrop, CO
E-4218	Lisa Gust	Bayside, CA
E-4219	Paula Kamps	Hilbert, WI
E-4220	Jeff Dempsey	Little Rock, AR
E-4221	Joshua Frederick	Danville, KY
E-4222	J. M. Giles	Sandia Park, NM
E-4223	Kate Ludwig	Columbus, OH
E-4224	Eleanor Dickey	New York, NY
E-4225	Dawn Jones	Tinley Park, IL
E-4226	Candace Johnson	Chelmsford, MA
E-4227	Christine Wilson	West Suffield, CT
E-4228	Dale Godfrey	Oglethorpe, GA
E-4229	Audrey Edwards	Milan, MI
E-4230	Dianne Beal	Martinez, CA
E-4231	Jean Williams	Wakefield, RI
E-4232	Jan Charvat	Alpine, CA
E-4233	Arika S. Grace-Kelly	Portland, OR
E-4234	James R. Massa	Fairbanks, AK
E-4235	William Stevens	Cotopaxi, CO
E-4236	Karina Mancini	Miami, FL
E-4237	Marie Miller	Cocoa Beach, FL
E-4238	Marilyn Unger	Desert Hot Springs, CA
E-4239	Chris Wrinn	Milford, CT
E-4240	Alfred Rieger	Marathon, FL
E-4241	Henry Boyle	Carpinteria, CA
E-4242	Kathy Poynter	Cedar Rapids, IA
E-4243	Deborah Setzer	High Bar Harbor, NJ
E-4244	Robyn Reichert	Lake Worth, FL
E-4245	Rachael Smith	Glendale, AZ
E-4246	Anita Gale	Covington, KY
E-4247	Marguerite Joan Galimitakis	Clinton, CT
E-4248	Bonnie Dolan	Somerville, NJ
E-4249	Hannah Bourdo	Plainwell, MI
E-4250	Lisa Jackson	Encinitas, CA
E-4251	Judy Dalton	Lihue, HI
E-4252	Gary Moss	LaGrange, KY
E-4253	Adriana Maria Correa	Medellin, Colombia
E-4254	Kelly Wisniewski	East Brunswick, NJ
E-4255	Nancy Freyer	Houston, TX
E-4256	Deb Elliott	Anchorage, AK
E-4257	James Jason Ylanan	Cebu City, Philippines
E-4258	A. J. Heidmann	Silver Spring, MD
E-4259	Elizabeth Case	San Jose, CA
E-4260	Jay Albrecht	Tarrytown, NY
E-4261	Roni Siegel	New York, NY
E-4262	John Perry	Whitley City, KY
E-4263	Dorothy Quit	Deerfield Beach, FL
E-4264	Sue Albert	Wyoming, PA
E-4265	Aileen Jeffries	Winthrop, WA
E-4266	Jon Moore	Bellingham, WA
E-4267	Barbara Robbins	Madison, ME
E-4268	Lydia Adam	Whitmore Lake, MI
E-4269	Sarah Bupp	New York, NY
E-4270	Jackie Moreau	Portland, ME
E-4271	Karen & Richard Rodriguez	Deerfiield Beach, FL
E-4272	Keith McMahen	Bradenton, FL
E-4273	Annie Sanders	Chicago, IL
E-4274	Nicole Goodrow	Houston, TX
E-4275	Gerald Neff	Pleasant Valley, IA
E-4276	Chris Kirker	Eldersburg, MD
E-4277	Nicole Kalas	Santa Barbara, CA
E-4278	Suzannah Schmid	Almond, WI
E-4279	Robert Jones	Las Cruces, NM
E-4280	Angela Korpar	Henrietta, NY
E-4281	Rhoda Schlamm	Woodside, NY
E-4282	Kristin Otto	Fallbrook, CA
E-4283	Vickie Stuckey	Denver, CO
E-4284	Lynda McKeown	Sydney, Australia
E-4285	Jocelyn Harimon	Hampton Bays, NY
E-4286	Nick Hedlund	Portland, OR
E-4287	Shelly Rice	Murphys, CA
E-4288	Kristal Lewandowski	Cameron, NC
E-4289	Sunda Wooley	Modesto, CA
E-4290	Laura Savard	Norton, MA

Log #	Name	Location
E-4291	Brianna Es	Sunrise, FL
E-4292	Joanie Locey	Columbus, GA
E-4293	Jessica Wolf	Windsor, Canada
E-4294	Stephanie Norman	Madison, WI
E-4295	Michael Mayo	Syracuse, NY
E-4296	Laura Oldenburg	IN
E-4297	David Pedraza	Cocoa, FL
E-4298	Jayne Haverfield	Mansfield, OH
E-4299	Jon Drucker	Albuquerque, NM
E-4300	Fredda Mesick	Wharton, NJ
E-4301	Kristin Barker	Washington, DC
E-4302	Elaine Sartoris	Beulah, CO
E-4303	Jacki Fromme	Mill Valley, CA
E-4304	Kay Phipps	Omaha, NE
E-4305	David Ferrari	Boston, MA
E-4306	Timothy Richerson	Charleston, SC
E-4307	Susan O'Reilly	Riverside, CA
E-4308	Jerry Hamelink	Hudsonville, MI
E-4309	Terry Degerstrom	Moose Lake, MI
E-4310	Dolores Duchesne	Richardson, TX
E-4311	Alex Hyde	Eastsound, WA
E-4312	Kevin Gilnack	Glastonbury, CT
E-4313	Victoria Campbell	Wanganui, New Zealand
E-4314	Shana Gross	Quincy, CA
E-4315	Barbara Dersch	Bend, OR
E-4316	Paul Jacobson	Idyllwild, CA
E-4317	RaVen Sequoia	Portland, OR
E-4318	Adele Myers	Meadow Valley, CA
E-4319	Katie McHenry	Houston, TX
E-4320	Shannon DiGenova	Hometown, IL
E-4321	Kristin Sullivan	Capitola, CA
E-4322	Pam Kelly	Coweta, OK
E-4323	Claire Mikalson	Farmington, WA
E-4324	M. Abbey	Painted Post, NY
E-4325	Herbert Rodrigo	Bakersfield, CA
E-4326	Barbara Cohen	Port Elizabeth, South Africa
E-4327	Alejandro de la Torre	Mexico
E-4328	Celeste Dubois	Manchester, NH
E-4329	Barbara M. Heer	Philadelphia, PA
E-4330	Marianna M. Rivinus	Altadena, CA
E-4331	Kathy Godlewski	London, Canada
E-4332	Nicole Hayworth	Chickasha, OK
E-4333	Wendy Morris	San Clemente, CA
E-4334	Joey Beckenholdt	Conroe, TX

Log #	Name	Location
E-4335	Tonya Hale	Henderson, KY
E-4336	Dan Unger-Weiss	La Mesa, CA
E-4337	Rachel Pattillo	Humble, TX
E-4338	Anthony Lopez	Los Angeles, CA
E-4339	Jennifer Wolfe	Elwood, Australia
E-4340	Olawale Ayodele	Newhall, CA
E-4341	Bryan Milne	Jersey City, NJ
E-4342	Tristen Tuckfield	Sacramento, CA
E-4343	Johan Janse van Rensburg	Pretoria, South Africa
E-4344	Greg Holston	Longmont, CO
E-4345	Michael Hawthorne	Salinas, CA
E-4346	Daniel Ochoa	Paramount, CA
E-4347	Jonathan Bauer	Valparaiso, IN
E-4348	Aaron Henne	Minneapolis, MN
E-4349	Stephanie Corona	Downey, CA
E-4350	Velene Campbell	Van Nuys, CA
E-4351	David Robinson	New York, NY
E-4352	Glen Carner	Holualoa, HI
E-4353	Sharon Saad	Orland Park, IL
E-4354	Ahmed D. Pathan	Kalol, India
E-4355	Martina Beverly	Urbana, IL
E-4356	Keegan Roberson	Chula Vista, CA
E-4357	Diana Singleton	Glendale, CA
E-4358	Raven Bernstein	Los Alamos, NM
E-4359	Christina Gadbury	Galesburg, IL
E-4360	Terri Huyen Thi Nhu Mai	Chino, CA
E-4361	Matt Peeples	Bremerton, WA
E-4362	Lynne Mahlstedt-Burley	Cayce, SC
E-4363	Susan Munson	Galesburg, IL
E-4364	L. Vannessa Frazier	Howardville, MO
E-4365	Karen Clifford	Mississauga, Canada
E-4366	Donna Mae Travis-Morgan	Round Rock, TX
E-4367	Karien Joubert	Vredehoek, South Africa
	9-19-02	
E-4368	Alvaro Ruiz	Needham, MA
E-4369	Patrick Kerber	Fairbanks, AK
E-4370	Gaie Sebold	London, United Kingdom
E-4371	Jenny Jefferies	London, United Kingdom
E-4372	Carla Korch	Hightstown, NJ
E-4373	Curtis Freeman	Kent, WA
E-4374	Barbara Schmiedtova	Nijmegen, Netherlands
E-4375	Kaye Batzko	Milwaukee, WI
E-4376	Dr. Ken Schoolmeester	Charlotte, SC
E-4377	Jayme Foulk	Cochranton, PA

Log #	Name	Location
E-4378	Jim Piecione	New London, CT
E-4379	Nicola Lueke	Duesseldorf, Germany
E-4380	Lia Wadick	Preston, Australia
E-4381	Pamela A. Turner	Hemosassa, FL
E-4382	Paulette Walters	Newport, MI
E-4383	Angela Timmons	New York, NY
E-4384	Marta Moreira	Harpers Ferry, WV
E-4385	Daniel Zak	Downers Grove, IL
E-4386	Asiel Norton	Cambria, CA
E-4387	Catrina Fales	Baltimore, MD
E-4388	Whitney Sigholtz	Baltimore, MD
E-4389	Cindy Bogan	Cary, NC
E-4390	Daphne Morgan	Bath, ME
E-4391	Michelle Schunck	Esbjerg, Denmark
E-4392	Alyona Apelgants	Johannesburg, South Africa
E-4393	Melissa Parker	Candler, NC
E-4394	Lisa Almaraz	Sylva, NC
E-4395	Andrea K. Cherpako	Dugald, Canada
E-4396	Paul Van Steenberghe	Old Town, ME
E-4397	Anna Escott	Knoxville, TN
E-4398	Dana Schwartz	Hopkins, MN
E-4399	Marika Base	St. Louis, MO
E-4400	David Hoops	Chardon, OH
E-4401	Jeff Banner	Sarasota, FL
E-4402	Katherine Holzman Golblatt	Hopkinton, MA
E-4403	Jo Hartog	Sparks, NV
E-4404	Sandra Blessing	Waterloo, IA
E-4405	Nathan Gillmore	Maumelle, AR
E-4406	Christine Hansen	Broomfield, CO
E-4407	Stuart G. Clark	Waterford, MI
E-4408	Heather Carpenter	Orlando, FL
E-4409	Kristine Royal	Mansfield, MA
E-4410	Sheila Coughtry	Fountain, CO
E-4411	Debbie Nassau	MD
E-4412	Amy Sloan	Silver Spring, MD
E-4413	Nariman Mistry	Ithaca, NY
E-4414	Connie Sherbino	Cape Coral, FL
E-4415	Jenny Goodwin	Leicester, United Kingdom
E-4416	Bernice Lavin	Buffalo, NY
E-4417	Georgia Hinton	Norco, CA
E-4418	Krista Johnson	New Haven, CT
E-4419	Koh Lay Ling	Singapore
E-4420	Nan Weed	Eugene, OR
E-4421	Dalra Chauncey	Harrison, TN

Log #	Name	Location
E-4422	Tracy Da Lomba	Livermore, CA
E-4423	Phillip Stamos	Endicott, NY
E-4424	Tatiana Len-Bork	Barrington, IL
E-4425	Amanda Schoeps	Bronx, NY
E-4426	Kyrsten Stalheim	Oslo, Norway
E-4427	Michelle Gonzales	New York, NY
E-4428	Alexis Woodrow	Denver, CO
E-4429	Ruma Singh	Monticello, GA
E-4430	Dale Ellen Mayer	Norwalk, CT
E-4431	Allan Archer	Chester, United Kingdom
E-4432	Harry Hart-Browne	Topanga, CA
E-4433	Cristin Lieske	Davie, FL
E-4434	Bob Gunn	New York, NY
E-4435	Bruce Hanke	Lime Springs, IA
E-4436	Gary Lee Eisenhuth	Radiant, VA
E-4437	Mike Preston	Yellowknife, Canada
E-4438	Lisa Anderson	Asheville, NC
E-4439	Roseann Winkler	Fords, NJ
E-4440	Michelle Panzrino	Austin, TX
E-4441	Shay McDonald	Fairfax, VA
E-4442	Melissa Hood	Blaine, MN
E-4443	Robin Mink	Ash Fork, AZ
E-4444	Cathy Woodrow	Denver, CO
E-4445	Paul Bourdeau	New York, NY
E-4446	Shree Ram	Chicago, IL
E-4447	Jeremy Dion	Golden, CO
E-4448	Monica Bonner	Cincinnati, OH
E-4449	Corlean Payne	Renton, WA
E-4450	Fatima Somani	Oshawa, Canada
E-4451	Stephanie Seery	Sacramento, CA
E-4452	Christopher Lanski	Lancaster, CA
E-4453	Viola Henning	Southampton, NY
E-4454	Cassy Marichal	Tallahassee, FL
E-4455	Denise Hetzel	Sugar Land, TX
E-4456	Mary Rita Neal	Detroit, MI
E-4457	Ferdinand Kutheis	O'Fallon, MO
E-4458	Wynn McGrenera	King City, CA
E-4459	Sondra Gearner	Gainesville, FL
E-4460	G. Sprague	Chicago, OH
E-4461	John & Nancy Arnold	Green Valley, AZ
E-4462	Robert Loucks	Big Bear Lake, CA
E-4463	Melanie Kavanaugh	Ewing Township, NJ
E-4464	Costas Manganiotis	Vega Alta, Puerto Rico
E-4465	Jude Gassaway	Edgewater, CO

Log #	Name	Location
E-4466	Jodie Manganiotis	Corpus Christi, TX
E-4467	Darla Wacnik	LaPorte, IN
E-4468	Sarah Olson	Waukesha, WI
E-4469	Christine Aurilia	Sayreville, NJ
E-4470	Priyanka Monga	Pune, India
E-4471	Jayne Matthews	Lancaster, PA
E-4472	B. T. Dorit	Tel-Aviv, Israel
E-4473	Dana Steeples	Littleton, CO
E-4474	Megan O'Neal	Marshall, VA
E-4475	Karen Christie	Covington, VA
E-4476	Umar Karim Mirza	Lahore, Pakistan
E-4477	Tessa Peltier	Vero Beach, FL
E-4478	Beth Jones	Salzburg, Austria
E-4479	Dan Hamilton	Phoenix, AZ
E-4480	Daniel Herzberg	Millbrae, CA
E-4481	Christopher Johnson	Austin, TX
E-4482	Niels Versfeld	Ft. McMurray, AK
E-4483	Caroline Porter	Hebron, MD
E-4484	Jessica Cucchi	Evergreen, CO
E-4485	Kathy Smith	New York, NY
E-4486	Staci Hutsell	Aiken, SC
E-4487	Philip Ratcliff	Cloverdale, CA
E-4488	Linda Garcia	San Marcos, CA
E-4489	Jon Clark	York, PA
E-4490	Kathy Forney	Stillwater, OK
E-4491	Cecilia Galup	Crawfordville, FL
E-4492	Trinja Rogers	Boone, NC
E-4493	Sharon Brunet	Mariapolis, Canada
E-4494	Dana Sterling	Indianapolis, IN
E-4495	Katrina Stechler	Breckenridge, CO
E-4496	Paul Bonatz	Raleigh, NC
E-4497	R. C. Cooper	Huachuca City, AZ
E-4498	Betty Pulfer	Bowling Green, KY
E-4499	Beverly Riverwood, J.D.	Sebastopol, CA
E-4500	Stephanie Descoteaux	Montreal, Canada
E-4501	Daemon Shalom	Jeffersonville, IN
E-4502	Erik Bouthillier	Rancho Cucamonga, CA
E-4503	Lisa Root	Santee, CA
E-4504	Gemma Dehnbostel	Herndon, VA
E-4505	Mrs. Robert A. Knapp	Lemon Grove, CA
E-4506	Lynda Capps	Gastonia, NC
E-4507	Robert Smithfield	San Anselmo, CA
E-4508	Ketil Rogn	Oslo, Norway
E-4509	Paula Sjunneson	Seattle, WA

Log #	Name	Location
E-4510	Del Bailey	Sharpsburg, GA
E-4511	Karin Wilson	Santa Monica, CA
E-4512	Nichole Lorusso	Branchville, NJ
E-4513	Rising Solari	Black Earth, WI
E-4514	Christy Bruce	Boulder, CO
E-4515	Laura Withrow	Dearing, GA
E-4516	Valeria Verme	Lima, Peru
E-4517	Kass Nesbitt	Moravia, NY
E-4518	Brian Symington	Schaumburg, IL
E-4519	Betty Lyon	Schuylerville, NY
E-4520	Sara Pratte	Springfield, OH
E-4521	Cheryl Rorabeck-Siler	Nehalem, OR
E-4522	Joanne Munderloh	Elwell, MI
E-4523	G. J. van Zuijlen	Sassenheim, Netherlands
E-4524	Carla Littleton	Pittsburgh, PA
E-4525	Jan Jewell	NE
E-4526	Christine Dupre	Crestone, CO
E-4527	Katherine Daniels	Minneapolis, MN
E-4528	Ryan Teelander	Kalamazoo, MI
E-4529	Ruth Collins	East Sussex, United Kingdom
E-4530	Nichole Lorusso	Branchville, NJ
E-4531	Marie Hebert	Falmouth, Canada
E-4532	Eileen Kopec	Colchester, CT
E-4533	Benjamin Short	Felton, CA
E-4534	Jeff Stein	Beverly Hills, CA
E-4535	Robert Baker	Dalzell, SC
E-4536	Allison Kozdron	New York, NY
E-4537	Joshua Becker	Claymont, DE
E-4538	Sonya M. Garbutt	Davis, CA
E-4539	Ruth Wolfgong	Clarion, PA
E-4540	Rhonda Depue	Portland, OH
E-4541	Dave White	San Marcos, CA
E-4542	Geoffrey Pierce	Fulton, NY
E-4543	Doug Israel	San Francisco, CA
E-4544	Andrew Clarke	Darlington, United Kingdom
E-4545	Colin McClung	Fairbanks, AK
E-4546	Glenn Shuart	Ventura, CA
E-4547	Eric Brecht	Grand Rapids, MI
E-4548	Julia Burlow	Salisbury, United Kingdom
E-4549	Christopher Barnes	Exton, PA
E-4550	Cheryl Van Dyke	Anchorage, AK
E-4551	Daniela Marchini	Mexico City, Mexico
E-4552	Nathan Pierce	Hollister, CA
E-4553	Remy Olson	Cleveland, OH

Log #	Name	Location
E-4554	Amy Lewis	New Dehli, ME
E-4555	Anne Brennan	Saginaw, MI
E-4556	Zachary Hall	Marietta, OH
E-4557	Richard Hunt	Staten Island, NY
E-4558	David Johnson	Orlando, FL
E-4559	Richard Call	Antioch, TN
E-4560	Shannon Reed	Murfreesboro, TN
E-4561	Cyndi Stover	Paradise, CA
E-4562	Margaret Opie (see L-0035)	Barrow, AK
E-4563	Elizabeth Dickinson	Westport, CT
E-4564	Melanie Sherwinski	Indianapolis, IN
E-4565	Starlinne Whatley, RN	Brewton, AL
E-4566	Margaret Opie (see L-0035)	Barrow, AK
E-4567	Laura Price	Denver, CO
E-4568	Maureen Simpson	Lancing, United Kingdom
E-4569	Grace Mueller	Edwardsville, IL
E-4570	Ann Long	Charlotte, NC
E-4571	Melissa Moyer	Gainesville, FL
E-4572	Cindy Gary	Encinitas, CA
E-4573	Josh Spahr	Lewisberry, PA
E-4574	Sheen Perkins	Reno, NV
E-4575	Julianne Berckman	Lexington, NC
E-4576	Concepcion Barquin-Moreno	Bellaire, TX
E-4577	Allan Marshall	HighWycombe,UK
E-4578	Robin Lapierre	Hollywood, FL
E-4579	Terry Szabo	Mentor, OH
E-4580	Brigitta Page	Vineburg, CA
E-4581	Vicki Ganske	Gatesville, TX
E-4582	Carol D. Boozer	Jefferson, GA
E-4583	Elissa Wilson	Xenia, OH
E-4584	Sherri Huggins	Houston, TX
E-4585	Dawn Mitchell	Holly, MI
E-4586	Amber Swortfiguer	Ripon, CA
E-4587	Linda Young	Camp Hill, PA
E-4588	James Marasco-Whitton	Narragansett, RI
E-4589	Cathy Stanley	Ventura, CA
E-4590	Jerri Kuehne	Lenox, MI
E-4591	Linda Hall	Denver, CO
E-4592	Tina Sharp	Cummaquid, MA
E-4593	Robert Couture	Indianapolis, IN
E-4594	Samantha Swisher	Baltimore, MD
E-4595	Diana Corbeil	Toronto, Canada
E-4596	Irene Larsen	Rancho Mirage, CA
E-4597	Jay Shafer	Salt Lake City, UT

Log #	Name	Location
E-4598	Sage Adams	Fairbanks, AK
E-4599	Jennifer Berman	Los Angeles, CA
E-4600	Emma Gib	White Plains, NY
E-4601	Janet Wells	Atlanta, GA
E-4602	Roy DuVerger	Alligator Point, FL
E-4603	Jessica Pappano	Mattawamkeag, ME
E-4604	Ann Ayers	Chuckey, TN
E-4605	Julie Pittman	Brevard, NC
E-4606	Tiana Trutna	Marina, CA
E-4607	Dawson McKinney	Ellensburg, WA
E-4608	Katherine Kline	Decatur, IL
E-4609	Diane Fanelli	Laguna Beach, CA
E-4610	Gidget Rupert	Fort Stewart, GA
E-4611	Jamie Vanucchi	Ithaca, NY
E-4612	J. Y.	New York, NY
E-4613	Lloyd Knight	Victoria, Canada
E-4614	Jane Tibbetts	Anchorage, AK
E-4615	Gregory Muller	unknown
E-4616	Jamie Hardy	Grand Haven, MI
E-4617	Michael Hetz Advertisi	San Diego, CA
E-4618	Tricia Armstrong	Brea, CA
E-4619	Shay Vetterman	Madison, WI
E-4620	Paula Till	Santa Cruz, CA
E-4621	Debbie Hillerich	Beaver Dam, KY
E-4622	Judy Desreuisseau	Gill, MA
E-4623	Jeanetta Davis	Lakewood, CO
E-4624	Jo Anne Smith	Christiansburg, VA
E-4625	Joel Hofstra	Rochester Hills, MI
E-4626	David Perle	Norfolk, VA
E-4627	Kiah Marks	Loxahatchee, FL
E-4628	Phyllis Price	Indianapolis, IN
E-4629	Heather Scott	Clearwater, FL
E-4630	Monica McCroskey	Monroe, IA
E-4631	Harold Johnson	Hammond, IN
E-4632	Meghann Decker	Winter Park, FL
E-4633	James W. Griffiths	Louisville, KY
E-4634	Sumathi Raguraman	Tamilnadu, India
E-4635	Alexandra Cohen	Bennington, VT
E-3636	Kristina Aston	Miami, FL
E-4637	Dea Butcher	Corvallis, OR
E-4638	Preybian Poon	Singapore
E-3639	Bette Zwayer	Cincinnati, OH
E-3640	Ethel Leider	West Palm Beach, FL
E-3641	Julianna Orgel	Riverdale, NY

Log #	Name	Location
E-4642	Sarah Florez	Golden, CO
E-4643	Elizabeth Motter	Cincinnati, OH
E-4644	Martina McGlynn	Huntington Beach, CA
E-4645	Rose Roever	Oconomowoc, WI
E-4646	Lindsey Davis	New York, NY
E-4647	Quinn Labadie	San Clemente, CA
E-4648	Megan Allsup	Longmont, CO
E-4649	Dr. Kenneth R. Sinibaldi	Seattle, WA
E-4650	Laura Dobb	San Francisco, CA
E-4651	Michael Hodgson	Topeka, KS
E-4652	Rickie-Ann Legleitner	Fenton, MI
E-4653	Elke Aston	Marathon, FL
E-4654	Kristen Kirkby	Mercer Island, WA
E-4655	Carla Lyles	Aumsville, OR
E-4656	Arthur Adams	San Francisco, CA
E-4657	Debra Raymond	Kannapolis, NC
E-4658	Kenneth Fong	Elmhurst, NY
E-4659	Vanessa Lauzon	Los Angeles, CA
E-4660	Jesse Lamb	Cryltal Springs, MS
E-4661	Carol Skowronnek	Streamwood, IL
E-4662	Sarah Harris	Innisfail, Australia
E-4663	Kevin Trout	Mission Viejo, CA
E-4664	Michelle Gonzale	West Islip, NY
E-4665	Deena McDougal	Ketchikan, AK
E-4666	Delisa Renideo	Wasilla, AK
E-4667	Nickolas Gordon	San Francisco, CA
E-4668	Adrienne Levine	Anchorage, AK
E-4669	Diona Patterson	Estes Park, CO
E-4670	Gudrun Dreher	Queen Charlotte City, Canada
E-4671	Teri Kitti	Reseda, CA
	9-20-02	
E-4672	Dee Viljoen	Benoni, South Africa
E-4673	Akira Thietje	Honolulu, HI
E-4674	Elizabeth Momin	Mason, MI
E-4675	Kara Kukovich	Arlington, VA
E-4676	Sandra Lockhart	Arlington, VA
E-4677	Autumn Reinhard	Richland, WA
E-4678	Patricia Sousa	Lisboa, Portugal
E-4679	Grace Tolson	Mansfield, Australia
E-4680	Amanda Tep	Atlanta, GA
E-4681	Chung Winnie	Singapore
E-4682	Dan Parsons	Bracklesham, United Kingdom
E-4683	Betty Flinchbaugh	Collegeville, PA
E-4684	Gayle Schuett	Dublin, OH

Log #	Name	Location
E-4685	Gerald Fisher	Bluffton, IN
E-4686	Louis McLove	Toledo, OH
E-4687	Sara Tambrin	Alexandria, VA
E-4688	Mary Sue Rose	Sitka, AK
E-4689	Christine Doulis	Philadelphia, PA
E-4690	Jason J. Green	Stanardsville, VA
E-4691	Michael Kriebel	Quakertown, PA
E-4692	Gene Petsa	Windham, CT
E-4693	Wendi Abbott	Anderson Township, OH
E-4694	Richard Pettus	Haverstraw, NY
E-4695	Justin Bloom	Bronx, NY
E-4696	Jane Benedetto	San Antonio, TX
E-4697	Page Mary	Sete, France
E-4698	Erin Cone	Santa Fe, NM
E-4699	Little Tree	Singapore
E-4700	Jamal El-Turk	Tripoli, Lebanon
E-4701	Jennifer Hodgens	La Verne, CA
E-4702	Catarina Cristao	Lisboa, Portugal
E-4703	Annette Biasetti	Edinburgh, Scotland
E-4704	Don Warsavage	Longmont, CO
E-4705	Sharon McAuliffe	San Leandro, CA
E-4706	Stacey Olszewski	Lansing, MI
E-4707	Jennifer Adams	Atlanta, GA
E-4708	Ronald H. Silver, C.E.P.	Atlantic Beach, FL
E-4709	Galen Bosworth	Sedro Woolley, WA
E-4710	Jamie Caito	Pittsburgh, PA
E-4711	Julie De Silveira	Kitimat, Canada
E-4712	Dana Michaels	Sacramento, CA
E-4713	SarahJane Jackson	Bemidji, MN
E-4714	Silvia Hanna	Buxton, ME
E-4715	Kurt Bretsch	Georgetown, SC
E-4716	Tracy Wasielewski	Milwaukee, WI
E-4717	Margaret Fowler	Lake Worth, FL
E-4718	Mary Connors	Urbana, IL
E-4719	James Lane	Bennington, VT
E-4720	Dorothy Moore Singleton	Los Angeles, CA
E-4721	Ricardo Neves	Mirassol, Brazil
E-4722	Sharon Summers	Toronto, Canada
E-4723	Phyllis Perry	Parker City, IN
E-4724	Kai Chan	Princeton, NJ
E-4725	Jody Turner	Seattle, WA
E-4726	Destiny Zeiders	Williamsport, PA
E-4727	Heather Meyerhofer	NJ
E-4728	Sara Ramirez	Mahwah, NJ

Log #	Name	Location
E-4729	Jeremiah Devlin-Ruelle	Dearborn, MI
E-4730	Yuri Yamane	Los Angeles, CA
E-4731	Stephanie Miller	Santa-Rosa, CA
E-4732	Silvana Garcia	Boston. MA
E-4733	Mandy Osborne	North Wilkesboro, NC
E-4734	Rossana Rodriguez	San Juan, Puerto Rico
E-4735	Marie Calabrese	Highland Heights, OH
E-4736	Juan Irizarry	Vega Baja, Puerto Rico
E-4737	Matt Cox	Anchorage, AK
E-4738	Cristina Case	Ben Lomond, CA
E-4739	Marcus Dilliard	Minneapolis, MN
E-4740	Eva Gasser-Sunz	Naples, FL
E-4741	Mark Mueller	St. Petersburg, FL
E-4742	Dawn Carter	Chesterfield, VA
E-4743	Jonathan Jensen	Greenwood, IN
E-4744	Frank Worshek	Fairfax, VA
E-4745	Kelly Stechenfinger	Cheektowaga, NY
E-4746	Amie Huffman	Portage, MI
E-4747	Sachin Karnik	Lansdale, PA
E-4748	Emily Strasser	Avondale Estates, GA
E-4749	Denise Copeland	Ocala, FL
E-4750	Christina Moseley	Cape Town, South Africa
E-4751	Joanna Cook	Venice, CA
E-4752	Chad White	Thousand Oaks, CA
E-4753	Leslie-Anne Barrington	Hamilton, New Zealand
E-4754	Tammie Priselac	Wilmington, NC
E-4755	Anne Dunlap	Portland, OR
E-4756	Mary Mooney	New York, NY
E-4757	Mariam Shubbak	Las Palmas, Spain
E-4758	Jill Sim	Covesville, VA
E-4759	Lisa Marshall	Houston, TX
E-4760	Fern Dews	North Canton, OH
E-4761	Eleanor Triboletti	Berkley, CA
E-4762	Terri Memeo	San Jose, CA
E-4763	Teresa Judkins (see L-0034)	Barrow, AK
E-4764	Patricia Burke	San Juan, Puerto Rico
E-4765	Ani Sandoval	Williston, VT
E-4766	Deborah Wells	Buena, NJ
E-4767	Jason Scullion	Carnation, WA
E-4768	Alicia Parlette	Lancaster, OH
E-4769	Mary White	Birmingham, MI
E-4770	Jose Ivan Cancel	San German, Puerto Rico
E-4771	Molly Morgan	Milwaukee, WI
E-4772	Lauren Stanulis	Lititz, PA
E-4773	Karyn Kakiba-Russell	West Covina, CA
E-4774	Rominjn Wind	Brooklyn, NY
E-4775	Helen Reinhold	Southampton, NY
E-4776	Ellen Meyers	Newton, MA
E-4777	Claire Conover	Piscataway, NJ
E-4778	Robert Blackiston	Sewell, NJ
E-4779	Harry Quade	Baltimore, MD
E-4780	Albert Torres	Denver, CO
E-4781	David Jr. Barlew	Knozville, TN
E-4782	Melissa Popoluski	LaPorte, IN
E-4783	Sherry Denton	Wilson, NC
E-4784	Robert Taylor	Los Angeles, CA
E-4785	Bryan Wyberg	Coon Rapids, MN
E-4786	Naomi Worcester	Portland, OR
E-4787	Elizabeth Paige	Santa Rosa, CA
E-4788	Jeff Frontz	Columbus, OH
E-4789	Jeff Frontz	Columbus, OH
E-4790	Diana Carey	Santa Monica, CA
E-4791	Russell Fowler	Swansboro, NC
E-4792	Virginia Sui	Honolulu, HI
E-4793	Nova Montgomery	Tarpon Springs, FL
E-4794	Tammy Shortridge	Aberdeen, NC
E-4795	Karen Mangham	Hampton, GA
E-4796	Holly Hilt	Attica, MI
E-4797	Virginia Velasquez	Las Vegas, NV
E-4798	Michelle Meacham	Miami Shores, FL
E-4799	Gwen Baluss	Juneau, AK
E-4800	Laurie McDonough	Cumberland, RI
E-4801	J. Koepp	Milwaukee, WI
E-4802	Anne Oppenheimer	Plantation, FL
E-4803	Eileen Tuthill-Howell	Camden, DE
E-4804	Jemma Sinclaire	Ft. Lauderdale, FL
E-4805	Corey Rennell	Anchorage, AK
E-4806	Karen Naifeh	San Mateo, CA
E-4807	Eric & Rebecca Helm	McHenry, IL
E-4808	Johnny Despinis	Peru, IL
E-4809	Stacy Mullins	Brunswick, GA
E-4810	Leon Pereira	Kaneohe, HI
E-4811	Debra Brown	Salemburg, NC
E-4812	M. Chinchilla	Key West, FL
E-4813	Joseph Akpik	Atkasuk, AK
E-4814	Vivian Newman	South Thomaston, ME
E-4815	Lara Hammond	Thousand Oaks, CA
E-4816	Shaindel Beers-Finley	Wauconda, IL

Log #	Name	Location
E-4817	Leslie Paxton	Garden Grove, CA
E-4818	Stephanie Kifowit	Aurora, IL
E-4819	Steve Schwartz	Oakhurst, CA
E-4820	Cecilia Nyholm	Ridgecrest, CA
E-4821	Cathrin Gordon	Tucson, AZ
E-4822	Angie Sheldon	Mequm, WA
	9-23-02	
E-4823	Abigail Shuman	Lititz, PA
E-4824	Nathan Brick	Columbia, SC
E-4825	Connie Mutel	Solon, IA
E-4826	Helen Lembeck	Chula Vista, CA
E-4827	Roger Cole	Forest Ranch, CA
E-4828	Kathy Ruben	Marlton, NJ
E-4829	Danielle Nattress	Orlando, FL
E-4830	Cheryl Chard	Albuquerque, NM
E-4831	Jeff Warren	Portland, OR
E-4832	Sheila Ward	Trujillo Alto, Puerto Rico
E-4833	Susan LoFurno	Webster, NY
E-4834	David Alkalay	Rego Park, NY
E-4835	Rachel Matthews	Oakland, CA
E-4836	Trisha Lyman	Rio Rancho, NM
E-4837	K. Taira	Springfield, IL
E-4838	Elizabeth Jobson	Lake Hill, NY
E-4839	Sherry VonSenden	San Antonio, TX
E-4840	Richard W. Hartmann	Honolulu, HI
E-4841	Kari DeAngelis	Norwalk, CT
E-4842	Jamie Stark	Campbellcroft, Canada
E-4843	Suzanne Rebecchi	Kansas City, MO
E-4844	Lanette Hendren	Mountain View, CA
E-4845	Aminya Hepp	Canberra, Australia
E-4846	Reva Coffey	Pine Knot, KY
E-4847	Robert Ricciotti	Randolph, NJ
E-4848	Maureen Barber	Lake Worth, FL
E-4849	Kevin Haro	Brookfield, WI
E-4850	Lisa Skube	Portland, OR
E-4851	Kim Fortin	Minneapolis, MN
E-4852	Luciane Lindquist	VA
E-4853	Stephanie Schipper	San Francisco, CA
	9-25-02	
E-4854	Maryanne McDonough	Bremerton, WA
E-4855	Claudia Knapp	Roselle Park, NJ
E-4856	Martha Bushnell	Boulder, CA
	9-26-02	
E-4857	Claire Lupton	Charlestown, MA
E-4858	Michelle Pappe	San Francisco, CA
	9-27-02	
E-4859	Gordon Barrett	Saratoga, CA
E-4860	Zelma H. Weisfeld	Ann Arbor, MI
	9-28-02	
E-4861	Ann Gregg	Olympia, WA
E-4862	Catherine Duncan	Richwood, NJ
E-4863	Leesa Youtsey	Albuquerque, NM
	9-29-02	
E-4864	Margaret Adams	Sherman Oaks, CA
E-4865	Travis Lyle	York, PA
E-4866	Tracy Jordan	Galivants Ferry, SC
	9-30-02	
E-4867	Brenda Maurice	Coinjock, NC
E-4868	Christina Strasdas	Salt Lake City, UT
E-4869	Deborah Arnason	Naples, FL
	10-1-02	
E-4870	Mo Adshead	Reading, United Kingdom
E-4871	Maurizio Ferrari	Gloucerstershire, United Kingdom