agement practices at each facility to minimize the potential for polluting stormwater. Stormwater measurements above benchmark levels established in the *LMITCO Storm Water Monitoring Program Plan* (LMITCO 1998) must be investigated and corrected. Based on best management practices, monitoring requirements, and historical measurements of contaminants in INTEC stormwater runoff (Section 4.8), operational impacts to surface water are expected to be minimal under every alternative.

As discussed in Section 4.8***.1.3***, flood studies prepared by the U.S. Geological Survey and Bureau of Reclamation conclude that some inundation at INTEC could occur for a 100-year return period flood. For the two independent 100-year flood studies, the results differ ***by more than*** a factor of two ***in estimated flow rates.*** If, as a result of this EIS, DOE decides to build facilities within the flood plain at INTEC, then some form of mitigation ***could*** be necessary to assure that INTEC facilities would not be impacted by localized flooding. A Mitigation Action Plan would be prepared, if necessary, ***pending results of ongoing flood studies.*** However, before such facilities are constructed, future evaluations and comparative analyses regarding the extent of the 100-year flood at INTEC ***will*** be conducted and used by DOE to determine a more accurate ***evaluation of*** potential inundation.

In a previous study (Koslow and Van Haaften 1986), a probable maximum flood combined with an overtopping failure of Mackay Dam resulted in a larger flood than was presented in the ***U.S. Geological Survey study*** (Berenbrock and Kjelstrom 1998) for a 100-year event. The peak water velocity in the INTEC vicinity was estimated at 2.7 feet per second, which would produce minimal erosion. However, as noted in Appendix C.4, the probable maximum flood could affect bin set 1, causing the bin set to lose its integrity. This is a ***conservative*** design basis bounding event and is discussed in Appendix C.4. ***On January 18, 2001, DOE issued a floodplain determination, an estimate of the 100-year flood elevation, for Resource Conservation and Recovery Act (RCRA) permitting purposes at INTEC (Guymon 2001). The determination is based on Koslow and Van Haaften (1986), as is the probable maximum flood described above. The RCRA determination, however, is based on a 100-year flow scenario which involves the overtopping failure of Mackay Dam resulting in a flood elevation of 4,916 feet, whereas the maximum probable flow estimate results in a flood elevation of 4,917 feet at INTEC. Although this is an extremely conservative assumption, exceeding the requirements for a 10 CFR 1022 floodplain determination, the 4,916 feet elevation is consistent with the safety authorization basis for facilities at INTEC.***

5.2.8 ECOLOGICAL RESOURCES

5.2.8.1 Methodology

This section presents the potential impacts on ecological resources from implementing the proposed waste processing alternatives described in Chapter 3. Potential impacts were qualitatively assessed by reviewing project plans for the ***six*** proposed alternatives to determine if: (1) project activities are likely to produce changes in ecological resources and (2) project plans conform to existing major laws, regulations, and DOE Orders related to protection of ecological resources (e.g., protected species, wetlands). Because the Minimum INEEL Processing ***Alternative*** would involve shipment of mixed HLW to the Hanford Site for treatment, possible impacts to Hanford's ecological resources were also evaluated (see Appendix C.8 for a detailed discussion of at-Hanford impacts). Unless otherwise noted, however, the discussion of impacts in this section applies specifically to the INEEL.

Most of the activities associated with HLW management would take place inside the perimeter fence at INTEC, an area that has been dedicated to industrial use for more than 40 years. Potentially-affected areas (sites and facilities to be used or constructed and surrounding habitat where effluents, emissions, light, or noise may be present) were identified in Chapter 3, Alternatives. Ecological resources of the INEEL are discussed in Section 4.9. The assessment of potential effects is based upon an evaluation of the location, scope, and intensity of construction and waste processing activities in relation to ecological resources. In addition, the potential effects associated with the No Action Alternative serve as a basis of comparison for the other alternatives.

5.2.8.2 Construction Impacts

Construction-related disturbances of various types (such as earthmoving and noise) associated with the development of new INTEC facilities would be a primary source of ecological impacts and could result in displacement of individual animals, habitat loss, and habitat degradation. Table 5.2-1 in Section 5.2.1 lists new facilities and acreage that would be disturbed for the ***six*** proposed waste processing alternatives.

Because INTEC is a heavily-developed industrial area with most natural vegetation removed, its value as wildlife habitat is marginal. No state or Federally-listed species are known to occur in the area. With the exception of the intermittent streams and spreading areas and the engineered percolation ponds and waste treatment lagoons described in Section 4.8 (Water Resources), there are no aquatic habitats on the INEEL or near INTEC. None of the alternatives evaluated in this EIS would affect jurisdictional wetlands.

Because options under the Separations Alternative ***and the Vitrification with Calcine Separations Option*** would have the most construction activity, this alternative ***and option*** would have the greatest potential for construction-related disturbances to plant and animal communities in areas adjacent to INTEC. ***The No Action Alternative would have the least impact.***

Under two of the alternatives, the Separations Alternative and the Minimum INEEL Processing Alternative, DOE could elect to dispose of the grouted low-level waste fraction in a new Low-Activity Waste Disposal Facility ***described in Section 5.2.1.3.*** Although undisturbed, this site is adjacent to INTEC, thus its development would not require the conversion of high-quality wildlife habitat to industrial use. Further, the site's proximity to INTEC would mean that minimal expansion of infrastructure and utilities would be required (Kiser et al. 1998).

Potential construction impacts would be related to activities such as excavating, loading, and hauling soils from the Low-Activity Waste Disposal Facility; grading excavated areas; developing access roads; and building reinforced concrete disposal facilities. The potential effects of clearing approximately 22 acres of shrub-steppe vegetation (see Section 4.9.1) could include a local reduction in plant productivity and invasion by non-native annual plants such as Russian thistle and cheatgrass.

Construction of the Low-Activity Waste Disposal Facility could result in loss of nesting habitat for ground-nesting birds. Small mammals (ground squirrels) and reptiles (snakes and lizards) that live in burrows for much of the year would be subjected to displacement or mortality. Noise, night lights, and increased vehicle activity during the construction phase could disturb wildlife within sight or sound of construction activities and transportation routes. This could result in displacement of some animals and abandonment of nest or burrow sites. Because the area proposed for the Low-Activity Waste Disposal Facility is adjacent to INTEC, it has minimal value as wildlife habitat. This would reduce the extent of animal displacement and mortality.

Once filled to capacity, the Low-Activity Waste Disposal Facility would be equipped with an engineered cap sloping from centerline to ground level with a four percent grade (Kiser et al. 1998). The cap would be revegetated with selected native plants to prevent erosion and improve the appearance of the closed facility.

Under the Minimum INEEL Processing Alternative, two new facilities would be built within the 200-East Area of the Hanford Site. These facilities would be located in a previously-undisturbed area with little value as wildlife habitat due to its proximity to existing waste management facilities. The required acreage would be relatively small (52 acres) and would not result in significant habitat fragmentation. Impacts to biodiversity would be small and local in scope. See Appendix C.8 for a more detailed analysis of impacts at the Hanford site.

5.2.8.3 Operational Impacts

The operation of HLW facilities at INTEC could, depending on the waste processing alternative selected, result in increased levels of human activity (movement of personnel and vehicles, noise, night lighting) and increased emissions of hazardous and radioactive air pollutants over the period of waste processing.

Because operations-phase disturbances to wildlife would be directly related operational employment levels, direct employment levels under the various wastes processing alternatives (see Section 5.2.2) were assumed to reflect the relative amount of disturbance. Direct employment would be highest under the Direct Cement Waste Option. However, as noted in the discussion of socioeconomic impacts, none of the waste processing alternatives is expected to generate significant numbers of new jobs at INTEC, so there would be no marked increase in operational employment levels at INTEC. As a result, operations-related disturbances to wildlife using shrub-steppe habitat adjacent to INTEC would not increase over the period of analysis.

Waste processing and related activities would result in emissions of nonradiological and radiological air pollutants to the atmosphere at INTEC. These emissions are discussed in detail in Section 5.2.6 and discussed here in the context of potential exposures of plants and animals. As noted in Section 5.2.6, minor increases in ambient concentrations of criteria pollutants (e.g., sulfur dioxide and nitrogen dioxide) would be expected, particularly under the Separations Alternative options, but no impacts to local soils or vegetation, including the native sagebrush community, would be expected. The National Park Service has issued interim guidelines for protection of sensitive resources relative to air quality concerns (DOI 1994). For sulfur dioxide, the Park Service recommendation to maximize protection of all plant species is to maintain levels below 40 to 50 parts per billion (ppb) for a 24-hour averaging time, and 8 to 12 ppb for annual average levels. The lower ends of these ranges correspond to about 100 and 20 micrograms per cubic meter, respectively. The guideline for annual average nitrogen dioxide is less than 15 ppb, which corresponds to about 28 micrograms per cubic meter.

The highest projected levels of sulfur dioxide and nitrogen dioxide at ambient air locations from any of the waste processing alternatives would be well below these guidelines under any of the alternatives. When the combined effects of baseline and alternative impacts are considered (see Table C.2-14), the maximum 24-hour sulfur dioxide level would be about 28 micrograms per cubic meter (5 percent of the guideline) along public roads and about half that (less than 3 percent of the guideline) at the INEEL boundary. The maximum annual average sulfur dioxide level would not exceed about 3 percent of the guideline along public roads and would be less than 1 percent at any offsite location. For nitrogen dioxide, the highest public road level would be about 1.8 micrograms per cubic meter, or roughly 2 percent of the guideline. These maximum concentrations would occur under the Planning Basis Option (Separations Alternative), and would be somewhat less for other alternatives. Levels of both pollutants at Craters of the Moon Wilderness Area - the nearest area at which the Park Service guidelines are intended to apply - would be roughly one-seventh to one-tenth of the maximum offsite levels cited above.

A number of toxic air pollutants would be produced by waste processing operations and fossil fuel combustion. These pollutants ***could*** be transported to downwind locations and deposited on surface soils. Plant and animal communities on INEEL could be at risk from the accumulation of these chemical contaminants in surface soils. Animals can be exposed directly to contaminants in surface soils (e.g., incidental ingestion of soils) or indirectly through foodchain exposure (e.g., ingestion of contaminated prey). Plants can be exposed via root contact and subsequent uptake of contaminants in soils or deposition onto the plants themselves. Hence, DOE assessed the impacts of aerial deposition of chemical contaminants from INTEC emissions on ecological receptors in areas surrounding the facility.

DOE assessed the potential impacts to ecological receptors from air emissions associated with waste processing alternatives. A conservative screening approach was used to assess the maximum concentrations of contaminants of potential concern in surface soils that could result from airborne releases and deposition of these substances. Contaminants of potential concern include radionuclides released from waste treatment operations, and toxic air pollutants produced by both fossil fuel combustion and waste treatment operations. The specific contaminants are the same as those assessed for air resources impacts, as described in Section 5.2.6 and Appendix C.2. The assessment involved identifying the area (within the INEEL) of highest predicted impact and estimating the annual deposition rates and total deposition for contaminants of potential concern.

Ibrahim and Morris (1997) found plutonium in detectable concentration to a soil depth of 21 centimeters at the Radioactive Waste Management Complex on the INEEL. However, 50 percent of the plutonium was in the first 3 centimeters, 75 percent was in the first 10 centimeters, and about 88 percent was in the first 15 centimeters. This is a fairly typical pattern for fallout radionuclides, with most radioactivity occurring in the first few centimeters of soil and an exponential decrease below that. For analysis purposes in this EIS, it was assumed that all contaminants would be uniformly distributed through the first 5 centimeters of soil after an operational period ending in 2035. In general, radionuclides adhere or bind to soil particles, and these soil particles are distributed throughout the soil by means of frost heave, penetration of the soil by vertebrate and invertebrate animals, plant roots, and through snow melt and rain. It was also assumed that there would be no loss of contaminants due to radioactive decay, chemical breakdown, weathering, or plant uptake over the period of deposition.

To determine if the predicted concentrations of nonradiological chemical contaminants in surface soils pose a potential risk to plant and animal communities, soil concentrations were compared to ecologically-based screening levels (Table 5.2-***11***). These screening levels represent concentrations of chemicals in surface soils above which adverse effects to plants and animals could occur. These include the lowest ecologically-based screening levels used in the Waste Area Group 3 ecological risk assessment (Rodriquez et al. 1997); screening benchmarks for surface soils developed by Oak Ridge National Laboratory (ORNL) (Efroymson et al. 1997a,b); U.S. Fish and Wildlife Service "A" screening levels (Beyer 1990); and Dutch Ministry of Housing, Spatial Planning and the Environment (MHSP&E 1994) "Target" values. No screening levels were exceeded for any chemical under any waste processing alternative. In general, predicted surface soil concentrations were several orders of magnitude lower than their screening levels, suggesting that plant and animal communities would not be at risk.

Nonradiological chemical contaminant deposition rates would be low under all waste processing alternatives, limiting direct exposure to above-ground plant structures. Most native plants have deep roots to survive desert conditions, which would reduce root exposure to chemicals in shallow surface soils and limit their uptake. Direct contact with contaminants in surface soils is a possible exposure route for animals but would probably be limited because fur, feathers, and chitinous skeletons provide a barrier against dermal exposure. The scarcity of surface water in the area would reduce exposure from ingestion of contaminants in drinking water, and the low airborne concentrations would result in minimal inhalation exposure. Incidental ingestion of contaminants in surface soils and exposure through the foodchain are likely exposure routes. However, the low concentrations predicted in surface soils would minimize potential risks from these exposure routes. For these reasons, potential risks to plant and animal communities on the INEEL from airborne deposition of INTEC chemical contaminants would be low under any waste processing alternative.

Potential radionuclide exposure of plants and animals in areas surrounding INTEC may increase slightly due to waste processing activities; however, potential radionuclide emissions from INTEC facilities would result in doses to humans that are well below regulatory limits (Section 5.2.6) and are not expected to affect biotic populations and communities in the area. The long-term exposure and intake by plants and animals in areas adjacent to INTEC are surveyed and reported annually in the INEEL Site Environmental Report in accordance with DOE Order 5400.1. Any measurable change in exposure or uptake due to waste processing activities would be identified by the environmental surveillance program and assessed to determine possible long-term impacts.

For potential radiological impacts, DOE estimated the deposition and resulting soil concentration of the principal radionuclides that would be released from the waste processing alternatives. The specific radionuclides considered are those which either (a) are emitted in greatest quantities or (b) have the greatest potential for radiological impacts (see Section 5.2.6).

Table 5.2-11. Maximum concentrations of contaminants in soils outside of INTEC compared to ecologically-based screening levels (in milligrams per kilogram).

Contaminant	Highest predicted concentration	Option or alternative	Minimum WAG 3 EBSL[a]	ORNL soil phytotoxicity benchmark[b]	ORNL micro-organisms benchmark[c]	ORNL earthworm benchmark[c]	USFWS "A" screening value[d]	Dutch Ministry target screening value[e]
Antimony	7.9×10^{-3}	Planning Basis	0.767	5	NA	NA	NA	NA
Arsenic	2.0×10^{-3}	Planning Basis	0.901	10	100	60	20	29
Barium compounds	***4.4×10^{-3}***	***Vitrification with Calcine Separations***	0.108	500	3.0×10^{3}	NA	200	200
Beryllium	4.2×10^{-5}	Planning Basis	0.734	10	NA	NA	NA	NA
Cadmium compounds	6.0×10^{-4}	Planning Basis	2.63×10^{-3}	4	20	20	1	0.8
Chromium (hexavalent)	3.7×10^{-4}	Planning Basis	0.167	1	NA	0.4	NA	NA
Chromium (as Cr)	1.3×10^{-3}	Planning Basis	3.25	NA	NA	NA	100	100
Cobalt	9.0×10^{-3}	Planning Basis	0.467	20	1.0×10^{3}	NA	20	20
Copper	2.6×10^{-3}	Planning Basis/***Vitrification with Calcine Separations***	2.17	100	100	50	50	36
Lead	2.3×10^{-3}	Planning Basis	0.072	50	900	500	50	85
Manganese (as Mn)	4.5×10^{-3}	Planning Basis/***Vitrification with Calcine Separations***	14.4	500	100	NA	NA	NA
Mercury	***2.3×10^{-4}***	***Vitrification with Calcine Separations***	6.3×10^{-3}	0.3	30	0.1	0.5	0.3
Molybdenum	1.2×10^{-3}	Planning Basis	5.57	2	200	NA	10	10
Nickel	0.13	Planning Basis	2.77	30	90	200	50	35
Selenium	1.0×10^{-3}	Planning Basis	0.083	1	100	70	NA	NA
Silver	2.8×10^{-10}	Transuranic Separations	1.39	2	50	NA	NA	NA
Thallium	8.5×10^{-10}	Transuranic Separations/Early Vitrification	0.117	1	NA	NA	NA	NA
Vanadium	0.048	Planning Basis	0.255	2	20	NA	NA	NA
Zinc	0.044	Planning Basis	6.37	50	100	200	200	140

a. From WAG 3 RI/BRA/FS (Rodriguez et al. 1997).

b. From Efroymson et al. (1997a).

c. From Efroymson et al. (1997b).

d. From Beyer (1990).

e. From MHSP&E (1994).

EBSL = ecologically-based screening level; NA = Not available; ORNL = Oak Ridge National Laboratory; USFWS = U.S. Fish and Wildlife Service; WAG = Waste Area Group.

Predicted soil concentrations, shown in Table 5.2-***12***, are within historical ranges of concentrations in soils around INTEC (Morris 1993; Rodriguez et al. 1997) and below ecologically-based screening levels for radionuclides developed for the Waste Area Group 3 Remedial Investigation/Feasibility Study (Rodriquez et al. 1997).

Because INTEC is a heavily-developed industrial area with most natural vegetation removed, its value as wildlife habitat is marginal. No state or Federally-listed species is known to occur in the area. No currently listed threatened and endangered species or critical habitat would be affected by the alternatives evaluated in this EIS. In November 1997, as part of an informal consultation under Section 7 of the Endangered Species Act, DOE requested assistance from the U.S. Fish and Wildlife Service in identifying any threatened or endangered species or critical habitat that might be affected by the actions analyzed in this EIS. In a letter dated December 16, 1997, the U.S. Fish and Wildlife Service replied that it was their preliminary determination that the proposed action was unlikely to impact any species listed under the Endangered Species Act. In January 1999, DOE sent a second letter to the U.S. Fish and Wildlife Service asking if any conditions had changed with respect to threatened or endangered species or critical habitats that might occur in the general vicinity of INTEC. In a letter dated February 11, 1999, the U.S. Fish and Wildlife Service reiterated that it was their preliminary determination that, given the general nature of the proposal, the project would be unlikely to impact any listed species. Based upon the analyses conducted for this EIS, DOE has determined that the activities analyzed for this EIS are not likely to adversely affect listed species or critical habitat, and, accordingly no further action is necessary.

With the exception of intermittent streams, spreading areas, playas, engineered percolation and evaporation ponds, and waste treatment lagoons there are no aquatic habitats on the INEEL or in the vicinity of INTEC. Before any of these potential wetlands is altered, a wetland determination would be completed to determine if mitigation is required.

5.2.9 TRAFFIC AND TRANSPORTATION

This section presents the estimated impacts of transporting radioactive materials for each of the waste processing alternatives described in Chapter 3. Transportation of hazardous and radioactive materials on highways and railways outside the boundaries of ***the*** INEEL is an integral component of HLW management and affects decisions to be made within the scope of this EIS. The different waste forms that are analyzed include vitrified HLW, vitrified low-level waste, vitrified transuranic waste, grouted low-level waste, grouted transuranic waste, hot isostatic pressed HLW, cementitious HLW, calcine, ***steam reformed SBW***, solidified HLW fraction, and solidified transuranic waste fraction.

Although transportation of road-ready HLW to a geologic repository is beyond the scope of DOE's Proposed Action (see Chapter 1), DOE has, in this EIS, analyzed HLW transportation for two reasons. First, transporting HLW for disposal is an action that logically follows the Proposed Action (40 CFR 1508.25). Second, waste processing alternatives would result in large differences in the number of shipments, resulting in transportation impacts that would have to be considered by the decision-maker.

DOE has assumed that all HLW will ultimately be disposed of in a geologic repository. The Government has not yet ***approved*** a geologic repository for HLW disposal. However, only one site, Yucca Mountain in Nevada, is currently under consideration. Therefore, for purposes of analysis, the transportation impacts for HLW shipment are based on the assumption that Yucca Mountain is the destination. The routes between the INEEL and Yucca Mountain selected in this EIS are ***representative of*** those that DOE may ultimately select. DOE has not yet determined when it would make decisions concerning the transportation of spent nuclear fuel and HLW to the Yucca Mountain site. The Yucca Mountain EIS includes information, such as the comparative impacts of heavy-haul truck and rail transportation, alternative intermodel (rail to truck) transfer station locations associated with heavy-haul truck routes, and alternative rail transport corridors in Nevada. It is uncertain at this time when DOE would make transportation-related