

FACT SHEET

Proposed Issuance of Underground Injection Control (UIC) Area Permit AK-11005-A
for the Construction and Operation of a Class I Non-Hazardous Industrial Waste Injection Well
at the Milne Point Oil and Gas Unit on the North Slope of Alaska

U.S. Environmental Protection Agency, Region 10
Office of Compliance and Enforcement, Ground Water Protection Unit, OCE-082
1200 Sixth Avenue
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September 30, 2004

Background

BP Exploration (Alaska), Inc., known as BPXA, submitted an Underground Injection Control (UIC) permit application for the construction and operation of one (1) Class I non-hazardous industrial waste injection well at the Milne Point Unit, located onshore about 10 miles northwest of the main Prudhoe Bay field complex. The initial application was submitted in August 30, 2004. EPA has prepared a draft UIC permit and associated aquifer exemption.

Public Comment

EPA is now requesting public comment on the draft permit. Persons wishing to comment on the proposed permit may do so by November 1, 2004. EPA will issue no separate public notice and may finalize the permit as drafted if no substantive comments are received by the close of the public comment period.

Regulatory Framework

The Underground Injection Control (UIC) program is authorized by Part C of the Safe Drinking Water Act for the principal purpose of protecting Underground Sources of Drinking Water (USDWs) from pollution by injection through wells. The UIC regulations broadly define USDWs (see 40 CFR 144.3) as any aquifer capable of supplying a public water system with water of less than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS). If injection does not occur above, into, or through a USDW, then less stringent injection well permit conditions may be imposed than would otherwise be required (see 40 CFR 144.16).

Primary responsibility for regulation of injection wells through the UIC program is split in Alaska between EPA and the Alaska Oil and Gas Conservation Commission (AOGCC). The AOGCC regulates Class II injection wells, which are defined as those wells used 1) to dispose of waste fluids brought to the surface from oil and gas production operations, 2) for enhanced recovery of oil and gas, or 3) for storage of hydrocarbons which are liquid at standard

temperature and pressure (see 40 CFR 144.6). EPA directly regulates the other four classes of injection wells. The UIC guidelines allow non-hazardous fluids including fluids eligible for disposal in Class II wells to be disposed of into Class I injection wells (40 CFR 144.6). Class I fluids, however, may not be injected into Class II wells.

BPXA expects that almost the entire waste stream at Milne Point would be eligible for injection into Class II disposal wells (approximately 98% of the proposed injection fluids are produced oilfield waters). The remainder would be domestic wastewater and other fluids eligible for disposal into Class I non-hazardous waste industrial injection wells. Therefore, by obtaining a Class I non-hazardous waste injection well permit from EPA, BPXA could dispose of the entire non-hazardous waste stream in addition to the produced reservoir brine at Milne Point into the same injection well.

As noted above and described further below, those aquifers beneath the Milne Point Unit area are too naturally saline to be considered as USDWs. Under these circumstances, the Director may authorize injection with less stringent requirements than would otherwise be required (see 40 CFR 144.16). EPA intends to grant several waivers requested by BPXA, which are described under the Geologic Setting and Injection Issues portion of this Fact Sheet.

EPA Permit and General Project Overview

EPA's 10-year term permit would allow BPXA to inject non-hazardous waste fluids such as, but not limited to, produced oil reservoir brine, production camp waste water, production well workover fluids, storm water and other wastes (that did not come up from down hole) through one injection well. The permit would allow BPXA to inject all of the non-hazardous waste fluids generated at Milne Point.

The proposed permit limits injection to the naturally saline Schrader Bluff (also referred to as the West Sak) and Ugnu (also referred to as the Prince Creek) Formations in the Milne Point Unit location. EPA has determined that the proposed injection intervals and overlying aquifers are too naturally saline to be considered as underground sources of drinking water (USDWs) as defined by the UIC regulations.

The Milne Point Unit includes 13 development well pads connected to a central production facility (CPF). After separation, the oil goes to the Trans-Alaska pipeline and the associated produced water and gas are used in the field for enhanced oil recovery (EOR) and pressure maintenance. The oilfield currently produces 52,000 barrels of oil per day, associated gas, and 65,000 barrels of formation water per day.

BPXA will expand a new oil recovery mechanism at Milne Point L-Pad that involves conversion of the injection wells from higher saline produced water to low-salinity source water, which will increase oil recovery in the low-salinity injection patterns. The Low Salinity Project will require diverting a portion of the produced water and the waste water treatment plant effluent to a disposal well. The proposed Class I well is being drilled principally to enable this conversion, thereby increasing overall reserves delivery and debottle-neck water handling at the Milne Point CPF. BPXA estimates a 5% incremental oil recovery associated with the injection of Low

Salinity water into the Kuparuk Formation and incremental reserves of 4 million barrels of oil at L-Pad.

BPXA estimates that approximately 98 percent of the injection waste stream at the MPU Class I well will consist of produced water (oil reservoir brine). The types of wastes and estimated volumes to be injected over a 15 year project life at the Milne Point facility are as follows:

Disposal Volumes (in barrels) by Major Category (15 years)

Produced water (oil reservoir brine)	166,000,000 bbls	97.6 %
Camp waste water effluent	1,900,000 bbls	1.1 %
Well flow-backs and reserve pit dewatering	1,900,000 bbls	1.1 %
Misc. production wastes	270,000 bbls	0.2 %
Industrial non-hazardous waste fluids	10,000 bbls	(0.006) %
Total Estimated Volume	~ 170,000,000 bbls	

BPXA has not applied for a hazardous waste injection well permit. Therefore, any listed hazardous wastes would need to be collected, stored, and transported to a RCRA-approved hazardous waste treatment or disposal facility . Those wastes which are hazardous only because of a characteristic (such as ignitability, corrosivity, toxicity, etc.) may be treated to remove that characteristic and then injected as a Class I non-hazardous waste fluid. The only radioactive substance which may be injected under the proposed permit is naturally occurring radioactive material (NORM) from sludge or pipe scale (a mineral precipitate formed during production), which can be injected into either Class II or Class I non-hazardous waste injection wells.

Geologic Setting and Injection Issues

The geologic setting at the Milne Point Unit is favorable for waste disposal via injection wells. The stratigraphic sequence and lithology are highly correlative with the formations found at Prudhoe Bay, where hundreds of Class II and a few Class I injection wells have operated successfully for almost two decades.

Injection and Confining Zones

The proposed injection and confining zones at Milne Point are within the same formations as those successfully utilized for waste disposal and confinement at the Prudhoe Bay, Northstar and Duck Island Units. In all four areas the lower confining zone is the Colville Mudstone (equivalent to the Seabee Shale and the Canning Formation). The injection zones in all four areas contain the Ugnu (Prince Creek) and Schrader Bluff (West Sak) sands. The upper confining zone is below the Sagavanirktok and Gubik sands and gravels that extend upward into the permafrost.

Structure

Sub-regional dip of the beds is quite consistent, and is down to the northeast. The dips are gentle,

approximately 1 degree.

The Milne Point area has been subjected to several episodes of faulting. The proposed disposal well area is bound to the south and west by faults in the Ugnu and Schrader Bluff intervals. The displacement of these faults is less than the thickness of the injection interval. Drilling and production data from the Milne Point field show that pressures are not transmitted vertically along fault planes to shallower strata. Faults frequently cause hydraulic boundaries in the Schrader Bluff oil development to the southwest in the Milne Point and Kuparuk River fields. No significant faulting has been identified to the north or east in the proposed disposal well area. The injection zone in this fault block is considered to be adequate for the volume of waste proposed.

The permafrost is approximately 2000 feet thick in this area and forms an additional barrier to any upward fluid migration.

Injection Zone Properties

The pressure gradient is estimated to be 0.43 psi/ft of depth from the surface to the Colville mudstones. The temperature gradient below the permafrost is estimated to be 2.5 degrees per 100 feet.

Log data from well MPB-01 indicate that the subsurface waters have a TDS range of 4083-4744 mg/l at a depth of 2864-3304 feet TVD, while laboratory derived results from produced water samples at a similar depth show a TDS range of 3160-3539 mg/l. Salinity at the injection interval of 4270-5050 feet TVD will be greater. There is usually a small amount of gas dissolved in this water.

Areal pressure data measured across the Prudhoe Bay area indicates that originally a flat piezometric surface existed in all zones. Therefore, no natural aquifer movement exists and since reservoir fluids were originally static, the only lateral movement that occurs is caused by injection or production.

The sand intervals have an anticipated fracture gradient of 0.65 psi/foot of depth. The shale gradient has not been defined; however, it will be greater as there is a stress contrast between the two lithologies.

Average Reservoir Properties

Disposal Interval

	<u>Lower</u>	<u>Upper</u>
Gross sand thickness	430'	200'
Net sand thickness	275'	120"
Porosity (%)	30-32	28
Permeability (md)	1000 (10-2000)	100 (10-800)

Subsurface Aquifers/USDWs/Aquifer Exemption

A USDW is defined as an aquifer which is currently serving as a source of potable water or which, by virtue of its potential productivity and natural water quality (i.e., less than 10,000

milligrams per liter of total dissolved solids or TDS), could serve as a public water supply.

The Federal regulations at 40 CFR 144.7 and 146.4 allow an aquifer(s) to be exempted from protection as a USDW provided it meets several criteria. The Milne Point Unit currently has a Class II aquifer exemption approved by the Alaska Oil and Gas Conservation Commission (AOGCC - Aquifer Exemption Order # 2 dated July 8, 1987) and concurred by the EPA (July 2, 1987). BPXA has submitted petrophysical and water sample data to provide support and obtain EPA's concurrence that the aquifers below the B-Pad are also exempted for Class I injection activities.

BPXA submitted data from borehole geophysical logs from Well MPB-1 that indicated that the TDS range from 4083 to 4744 milligrams/liter (mg/l) for the aquifers between the depths of 2864' to 3304'. Water samples from the same well and a similar interval (2857-3216 feet subsea) confirmed a range of TDS between 3160 and 3539 mg/l. The log and water sample data demonstrate that the TDS concentrations of the ground water in the B Pad area is more than 3,000 mg/l and less than 10,000 mg/l and is not reasonably expected to supply a public water system and meets the criteria for exempted aquifers (40 CFR 146.4 (c)).

In addition to meeting the exemption criteria in 40 CFR 146.4(c), the MPU aquifers in the B pad area also separately meet the aquifer exemption criteria in 40 CFR 146.4 (a) and (b). The aquifer at B pad does not currently serve as a source of drinking water, and cannot now and will not in the future serve as a source of drinking water because it is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical. In 1985, Conoco used saline subsurface water as a source for feeding and operating a reverse osmosis process. Their system was capital intensive, costly, labor intensive and so difficult to operate that it was abandoned. Conoco chose to purchase potable water until a surface system was installed. Most of the camps on the North Slope produce water at a cost of approximately 2 cent/gallon using surface water sources. A system using subsurface water is significantly more expensive to install and operate.

After review of the data submitted by BPXA (including updated 2004 water treatment cost data), EPA has determined that the aquifers (below the 2000-foot-thick permafrost) meet the exemption criteria at the location of the proposed Class I well - MPB-50 at Milne Point. The aquifer exemption covers those portions of the freshwater aquifers (USDWs) present in the interval between the base of the permafrost (at about 2000 feet below the surface and the top of the injection zone (at about 4270 feet below the surface and described by the one-quarter (1/4) mile area beyond and directly below the location of the Class I well - MPB-50 within the Milne Point Unit of the North Slope of the Alaska. The proposed surface location of the Class I well MPB-50 is Latitude 70 deg 28 min 23 sec and Longitude 149 deg 24 min 42 sec.

Due to the absence of USDWs (and aquifer exemption approval) at the proposed location, EPA intends to grant three (3) waivers of UIC regulatory program requirements as listed below:

- (1) Compatibility of Formation and Injectate (40 CFR 146.12 (e) and 146.14 (a):
Based upon the applicability of past injectability studies and injection practices at Prudhoe Bay, EPA intends to waive the requirement to sample and characterize

formation fluids and rock matrix in order to determine whether or not they are compatible with the proposed injectate.

- (2) Injection Zone Fracturing (40 CFR 146.13 (a):
Class I injection wells are prohibited from injecting at pressures that would initiate new fractures or propagate existing fractures within the injection zone. The draft permit would waive this prohibition, and would instead allow hydraulic fracturing provided new fractures are not initiated nor existing ones propagated within the upper confining zone. Injection will be limited to the Schrader Bluff and Ugnu Formations injection zone interval at approximate depths of between 4270 to 5050 feet TVD.
- (3) Ambient Monitoring Above the Confining Zone (40 CFR 146.13 (b):
EPA intends to waive the requirement to monitor the strata overlying the confining zone for fluid movement since the aquifers at the Milne Point Unit are too naturally saline to qualify as USDWs (and meet aquifer exemption criteria).

Summary of Proposed Action and Permit Conditions

EPA has primary enforcement authority in Alaska for the 1422 portion of the UIC program (authorized by Part C of the Safe Drinking Water Act), which includes the regulation of Class I injection wells. Class I wells are used to inject waste fluids for safe disposal beneath any existing USDWs. EPA proposes to grant an area permit to BPXA for one (1) Class I non-hazardous waste injection well at the Milne Point Unit. EPA considered all of the available disposal options, and concludes that underground injection is the best disposal method for the oilfield produced waters and non-hazardous liquid and solid wastes to be disposed at the Milne Point Unit during the Low-Salinity project's anticipated 15-year lifetime.

Based upon all available information, EPA has determined that the fresh water aquifers beneath the Milne Point Unit area meet the criteria of Aquifer Exemption under 40 CFR 144.7 and 146.4, and intends to grant BPXA a waiver of the UIC program regulation which prohibits hydraulic fracturing of the injection zone (40 CFR 146.13). This waiver will enable the injection of fluids composed mostly of produced waters (approximately 98%) and non-hazardous liquid and low solids wastes, and is authorized by the UIC program regulations under 40 CFR 144.16a.

The draft permit contains general legal provisions common to EPA permits, specific technical requirements that apply to all Class I injection wells, and particular technical, monitoring and reporting requirements for the proposed injection operations at Milne Point. Additionally, injection pressure would be limited for the duration of the 10-year term permit.

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