# RECORD OF DECISION for OPERABLE UNIT 2 FORT WAINWRIGHT FAIRBANKS, ALASKA

January 1997

## DECLARATION STATEMENT

for RECORD OF DECISION FORT WAINWRIGHT FAIRBANKS, ALASKA OPERABLE UNIT 2 JANUARY 1997

#### SOURCE AREA NAME AND LOCATION

Operable Unit 2 Fort Wainwright Fairbanks, Alaska

#### STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial actions for Operable Unit 2 (OU-2) at Fort Wainwright in Fairbanks, Alaska. OU-2 originally consisted of eight source areas: the Defense Reutilization and Marketing Office (DRMO) Yard, the Building 1168 Leach Well, the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, and the Tar Sites. This ROD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 and 42 United States Code 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan and 40 Code of Federal Regulations 300 et seq. This decision is based on the Administrative Record for this OU.

The United States Army, the United States Environmental Protection Agency, and the State of Alaska, through the Alaska Department of Environmental Conservation, have agreed to the selected remedies.

#### ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the DRMO Yard and Building 1168 Leach Well source areas, if not addressed by implementing the response actions selected in this ROD, may present a substantial endangerment to public health, welfare, or the environment. Specific hazardous substances in the soil and groundwater at the DRMO Yard and Building 1168 Leach Well include benzene, tetrachloroethene, trichloroethene, and petroleum by-products.

#### DESCRIPTION OF THE SELECTED REMEDIES

This is the third OU to reach a final-action ROD at this National Priorities List site. This ROD addresses soil and groundwater contamination at OU-2.

The 801 Drum Burial Site, Engineers Park Drum Site, and Drum Site South of the Landfill were assigned to the Fort Wainwright OU-1 investigation and will be addressed through the

OU-1 decision process. No further action is selected for Building 3477 and the Tar Sites. The contaminated soils at the North Post Site were addressed adequately through an Army removal action; it is anticipated that this will constitute final action for the North Post Site. Therefore, no analysis of remedial alternatives was conducted for these source areas. The documents recommending these actions are included in Appendix A.

The remedial action objectives for the DRMO Yard and Building 1168 Leach Well are designed to:

- Restore groundwater to drinking water quality;
- Prevent further leaching of contaminants into groundwater;
- Reduce or prevent further off-site migration of contaminated groundwater; and
- Prevent use of groundwater above federal Safe Drinking Water
   Act and State of Alaska Drinking Water Standards (18 Alaska
   Administrative Code 80) maximum contaminant levels
   (MCLs).

The major components of the remedies at both source areas are:

- In situ soil vapor extraction and air sparging of the groundwater to reduce volatile organic compounds to a level that meets state and federal MCLs;
- Institutional controls that would include restrictions on groundwater well installations, site access restrictions, and maintenance of fencing at the DRMO Yard until state and federal MCLs are met:
- Additional institutional controls, including a limitation on refilling the DRMO Yard fire suppression water tank from the existing potable water supply well, until state and federal MCLs are met (except in emergency situations); and
- Natural attenuation to attain Alaska Water Quality Standards after reaching state and federal MCLs.

#### STATUTORY DETERMINATION

The selected remedial actions are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial actions, and are cost-effective.

The remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfy the statutory preference for remedies that employ

treatment that reduces toxicity, mobility, or volume (of contaminated media) as a principal element.

Because these remedies will result in hazardous substances at concentrations remaining above regulatory levels at these source areas, a policy review will be conducted within five years after commencement of the remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

# **SIGNATURES**

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

WILLIAM M. STEELE Lieutenant General, USA

Commanding

27 March 1994

## **SIGNATURES**

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

Chuck Clarke

3-31-97

Date

Regional Administrator, Region 10

United States Environmental Protection Agency

#### **SIGNATURES**

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

Kurt Fredriksson

Director, Spill Prevention and Response Alaska Department of Environmental Conservation Date

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# **DECISION SUMMARY**

RECORD OF DECISION
for
OPERABLE UNIT 2
FORT WAINWRIGHT
FAIRBANKS, ALASKA
JANUARY 1997

This decision summary provides an overview of the problems posed by the contaminants at Fort Wainwright, Operable Unit 2 (OU-2), source areas. This summary describes the physical features of the site, the contaminants present, and the associated risks to human health and the environment. The summary also describes the remedial alternatives considered; provides the rationale for the remedial actions selected; and states how the remedial actions satisfy the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) statutory requirements.

The United States Army (Army) completed a Remedial Investigation (RI) to provide information regarding the nature and extent of contamination in the soils and groundwater. A Baseline Human Health and Ecological Risk Assessment was developed and used in conjunction with the RI to determine the need for remedial action and to aid in the selection of remedies. A Feasibility Study (FS) was completed to evaluate remedial options.

#### 1.0 SITE DESCRIPTION

## 1.1 SITE LOCATION AND DESCRIPTION

Fort Wainwright, also referred to as the site, occupies 915,000 acres on the east side of Fairbanks, Alaska. Fort Wainwright originally was established in 1938 as a cold weather testing station. During World War II, it served as a crew transfer point in the United States-Soviet Union Lend-Lease Program. After the war, it became a resupply and maintenance base for remote experimental stations in the Arctic Ocean and remote Distant Early Warning sites throughout Alaska. In 1961, Fort Wainwright was transferred to the Army.

Current primary missions at Fort Wainwright include training of infantry soldiers in the arctic environment, testing of equipment in arctic conditions, preparation of troops for defense of the Pacific Rim, and rapid deployment of troops worldwide. On-site industrial activities include use and maintenance of fixed-wing aircraft, helicopters, vehicles, and support activities. Fort Wainwright includes the main post area, two range complexes, and two maneuver areas.

OU-2 originally consisted of the following eight source areas: the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, four Tar Sites, the Defense Reutilization and Marketing Office (DRMO) Yard, and the Building 1168 Leach Well. All OU-2 source areas have undergone Preliminary Source Evaluations, which include historical record reviews and, if necessary, limited field investigations. These investigations determined whether a source area should be referred to another federal or state program or another OU, recommended for no further action (NFA), or included in the CERCLA remedial investigation. Petroleum contamination can be addressed in the Two-Party Agreement between the State of Alaska and the Army.

The Chena River flows through Fort Wainwright and the City of Fairbanks, into the Tanana River. Figure 1-1 illustrates the entire installation and each source area's location. All source areas are in a 500-year floodplain, except for the North Post and Engineers Park Drum Sites, which are in the 100-year floodplain. No threatened or endangered species reside in the area. Small ponds and wetlands are adjacent to the DRMO Yard. No known historic sites are associated with the source areas.

#### 1.1.1 801 Drum Burial Site

The 801 Drum Burial Site is in an undeveloped depression between River Road and the Chena River, approximately 0.13 mile east of the 801 military housing area. This source area is shown in Figure 1-1.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the 801 Drum Burial Site source area will not be discussed further in this Record of Decision (ROD).

# 1.1.2 Engineers Park Drum Site

The source area location is shown in Figure 1-1. The Engineers Park Drum Site is located on the northeast side of Engineers Park, on the south bank of the Chena River. Drum disposal reportedly began at this source area after the 1967 Chena River flood.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the Engineers Park Drum Site source area will not be discussed further in this ROD.

#### 1.1.3 Drum Site South of the Landfill

The Drum Site South of the Landfill is located 2,000 feet south of the Fort Wainwright Landfill, as shown in Figure 1-1. Historical information and records regarding drum disposal at this source area are not available. This site was identified as a potential source in the Resource Conservation and Recovery Act (RCRA) Facility Assessment conducted in 1988.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the Drum Site South of the Landfill will not be discussed further in this ROD.

# 1.1.4 Building 3477

Building 3477 is located on Chippewa Avenue, approximately 0.25 mile northeast of the South Gate Road Gate House (see Figure 1-1). Building 3477 was constructed as a vehicle maintenance facility in 1955 and is being used for vehicle and equipment maintenance. Batteries were serviced and stored at the site for an unknown period of time. In 1990, the Army discontinued this practice and contracted for cleaning the battery service area. Storage of old batteries continued along the east side of the building until they were disposed of.

Site investigations that included sampling and analysis of soil and groundwater in 1992 indicated that the source area was no longer being used for battery storage. Concentrations of suspected contaminants were below the United States Environmental Protection Agency's (EPA's) Region 3 risk-based screening levels based on residential land use. EPA, Region 10, Supplemental Risk Assessment Guidance recommends use of EPA, Region 3, risk-based screening criteria.

NFA is recommended for Building 3477 under CERCLA. This recommendation is recorded in the decision document included in Appendix A. The Building 3477 source area will not be discussed further in this ROD.

## 1.1.5 Tar Sites

The Tar Sites are in four locations: west of the South Post soccer field, on Southgate Road on the former South Post parade field; at Glass Park next to Building 4040; northwest of the Post Golf Course on the north bank of the Chena River; and west of the Post Power Plant

cooling pond next to the railroad (see Figure 1-1). These locations generally are covered by soil and vegetation.

The Tar Sites reportedly were used as tar disposal areas. An investigation conducted in June and July 1992 indicated that the analyzed tar samples have no potential to leach to groundwater. These results indicate that the Tar Sites should be addressed as a solid waste or through recycling/reuse. NFA is recommended for the Tar Sites under CERCLA. This recommendation is recorded in the decision document included in Appendix A. The Tar Sites source area will not be discussed further in this ROD.

# 1.1.6 Defense Reutilization and Marketing Office Yard

A detailed map of the DRMO Yard source area is depicted in Figure 1-2. The DRMO Yard is located along Badger Road, northwest of Badger Road and the Richardson Highway. The DRMO Yard source area is a fenced compound covering approximately 25 acres and containing seven buildings. The DRMO Yard contains numerous aisles of surplus appliances, tires, transformers, and wire. In addition, it serves as the hazardous material transfer point for Fort Wainwright, Fort Greely, and Eielson Air Force Base. The yard's function is to store obsolete, surplus, unserviceable equipment and supplies for transfer to another authorized user, for public auctions, or for destruction and disposal. Historical records of DRMO Yard activities were not maintained routinely. The DRMO Yard operates as a storage facility in accordance with the Fort Wainwright RCRA Part B Permit.

Approximately 200 feet east of the DRMO Yard source area is the Arctic Surplus site, a privately owned facility and a CERCLA National Priorities List (NPL) site. Many items formerly stored at the DRMO Yard were sold to Arctic Surplus.

# 1.1.7 Building 1168 Leach Well

A detailed map of the Building 1168 Leach Well source area is depicted in Figure 1-3. Building 1168 is located on the north side of Trainor Gate Road, adjacent to the Trainor Gate entrance and within approximately 200 feet of the Post boundary to Fort Wainwright. The Building 1168 Leach Well source area is surrounded by fenced storage yards on the north and east and by unrestricted parking lots on the south and west. Building 1168 is a single-story, 65-foot by 95-foot, lube oil and vehicle storage facility, equipped with a 2,000-gallon heating oil tank and a septic system for sanitary waste. A 10,000-gallon aboveground storage tank (AST) was located inside the southeast corner of the building. In 1958, the tank was removed and the area was converted to a petroleum, oil, and lubricant (POL) laboratory. Five floor drains were located in the west half of the building and were used to drain into an oil/water separator that emptied into a 250-gallon underground storage tank (UST) and a leach well. During summer 1995, the floor drains were filled and the UST and leach well were removed completely from service.

## 1.1.8 North Post Site

A detailed map of the North Post Site is depicted in Figure 1-4. The North Post Site covers approximately 45 acres and is located northwest of and adjacent to two military housing areas, on an oxbow of the Chena River.

In 1947, the Arctic Aeromedical Laboratory (AAL) began operating on the northwest portion of the source area. The laboratory conducted cold adaptation and acclimatization experiments for 20 years. In 1967, the facility was closed. In addition to AAL, several temporary buildings and a radio transmitter were located in the vicinity. The transmitter was most likely a base radio station. Historical photographs show that a slough of the Chena River separated the North Post Site source area from the main Post. This slough apparently was filled with construction debris during the 1940s and early 1950s.

The North Post Site was discovered during a 1985 geotechnical investigation for construction of a proposed housing development. The drilling crew noticed strong odors in soil borings on the west side of the oxbow area. Additional soil borings and wells were drilled, and petroleum and solvents were identified in the west portion of the oxbow. Additional sampling and evaluation occurred in 1986 and 1987 to investigate and delineate areas of potential contamination. An endangerment assessment was conducted to evaluate whether hazardous wastes were present and whether they presented a threat to human health.

While most of the site was found to be free of contamination, fuels, solvents, pesticides, and metals were identified in discrete locations within this source area. Additional samples were collected at these sites to further characterize contamination and to evaluate levels for the Baseline Risk Assessment.

Petroleum-contaminated soil was removed and treated by the Army in 1993. In situ groundwater treatment continues at one of the source areas under the jurisdiction of the Two-Party Agreement between the State of Alaska and the Army. During summer 1996, the Army conducted an additional removal action that included excavation, treatment, and proper disposal of soils containing fuel-related products. This is anticipated to be the final action for this source area. The final report on this removal action may be found in Appendix A. Therefore, the North Post Site will not be discussed further in this ROD.

## 1.2 SOILS AND GEOLOGY

Fort Wainwright is underlain by soil and unconsolidated sediment that consist of silt, sand, and gravel and range in thickness from 10 feet to more than 400 feet before encountering bedrock. A 5-foot-thick surficial soil layer of fine-grained soil overlies the deeper alluvial deposits. The surficial soil consists of varying proportions of sand and gravel, which generally are layered. At the base of Birch Hill and in areas adjacent to the Chena River, soil types are coarse-grained and have high percentages of sand and gravel. Within the shallow alluvial aquifer, predominant groundwater flow beneath Fort Wainwright is toward the Chena River.

# 1.3 HYDROGEOLOGY AND GROUNDWATER USE

The main aquifer in the Fort Wainwright area is the Tanana Basin alluvial aquifer in a buried river valley. This aquifer ranges from a few feet thick at the base of Birch Hill to at least 300 feet thick under the fort's main cantonment area. The aquifer may reach a thickness of 700 feet in the Tanana River valley. Groundwater in the Tanana-Chena floodplain generally is considered to be unconfined in permafrost-free areas. A confined aquifer may develop seasonally where the depth to the water table is less than the depth of the seasonal frost

penetration. The depth to groundwater varies and may range from 2 feet to 18 feet below ground surface (BGS) at OU-2 source areas.

Groundwater movement between the Tanana and Chena Rivers generally follows a northwest regional direction, similar to the flow direction of the rivers. The Chena River flows through Fort Wainwright and the City of Fairbanks, into the Tanana River. The Tanana River borders the south portion of Fort Wainwright. Flow probes near OU-2 source areas indicate seasonal changes in flow direction of up to 180 degrees. This is because of the effects of changing river stages in the Tanana River and, to a lesser extent, in the Chena River. Groundwater levels near the Chena River fluctuate greatly because of river stage and interactions with the Tanana River. Typically, groundwater levels rise when the river stage increases, particularly during spring breakup and the late summer runoff. Groundwater levels usually drop during fall and winter, when precipitation becomes snow. During winter, groundwater seeps into surface water bodies, such as the Chena River, and produces overflow ice. In addition to shifts in the groundwater flow direction due to the surface water hydrology, the groundwater flow direction may be impacted by high-volume pumping at off-post gravel pits for dewatering activities.

Where present, permafrost forms discontinuous confining layers that influence groundwater movement and distribution. The depth to permafrost, when present, ranges from 2 feet to 40 feet BGS. The greater depths are found on cleared and developed land surfaces, where thermal degradation of underlying permafrost occurs.

Groundwater is the only source of potable water used at Fort Wainwright and the Fairbanks area. Approximately 95% of Fort Wainwright's potable water is supplied through a single distribution system which is normally fed by two large-capacity wells located in Building 3559, near the Post Power Plant (see Figure 1-5). These wells were completed at a depth of approximately 80 feet and provide between 1.5 million and 2.5 million gallons of water to the Post Water Treatment Plant for processing and distribution.

In addition to the main drinking water supply wells, there are five emergency standby supply wells located around the cantonment area. These wells have been completed between 80 feet and 120 feet and are capable of pumping approximately 250,000 gallons per day per well. These wells, if used in an emergency, will supply minimally treated water to Fort Wainwright's main drinking water supply system.

During summer 1996, a potable water supply/fire suppression well was installed in the DRMO Yard, 50 feet upgradient of the defined solvent plume and 100 feet downgradient of a defined petroleum plume. Associated with the fire suppression system is a 400,000-gallon tank. To prevent hydraulic movement of the adjacent plumes, the State of Alaska Plan Approval to Construct stipulated a pumping rate limitation of 60 gallons per minute. Additionally, contract restrictions required that initial filling of the storage tank be done with tank trucks rather than from the DRMO Yard aquifer. A granulated activated carbon treatment system was installed for the drinking water supply to remove taste, odor, and potential contaminants of concern.

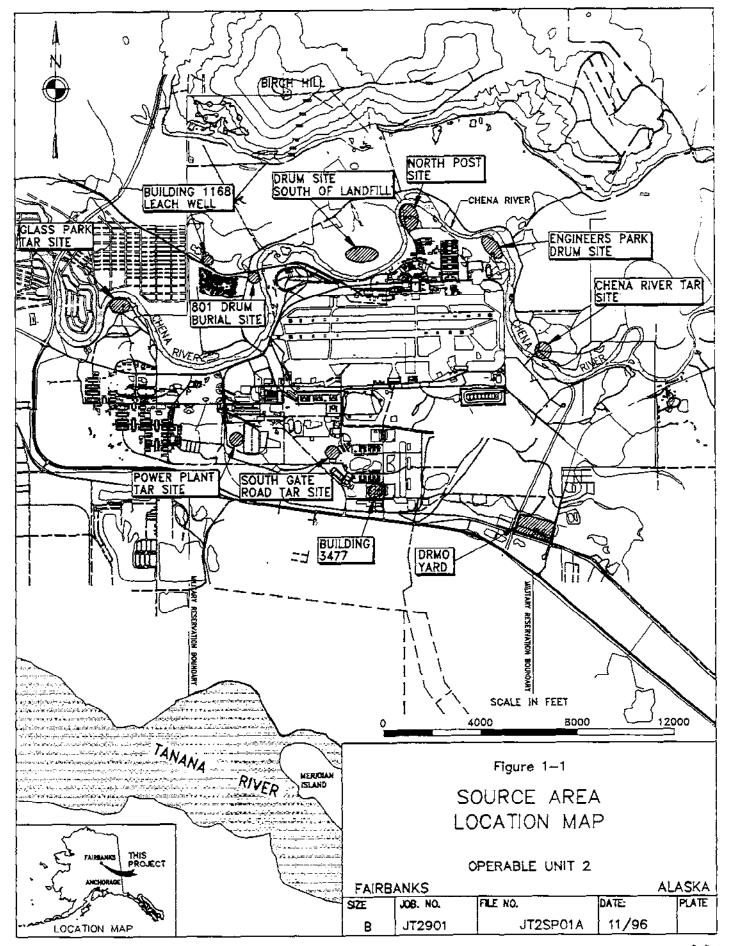
Residential developments that utilize private wells for domestic water supply are close to the DRMO Yard and Building 1168 Leach Well source areas. Some of these private wells near

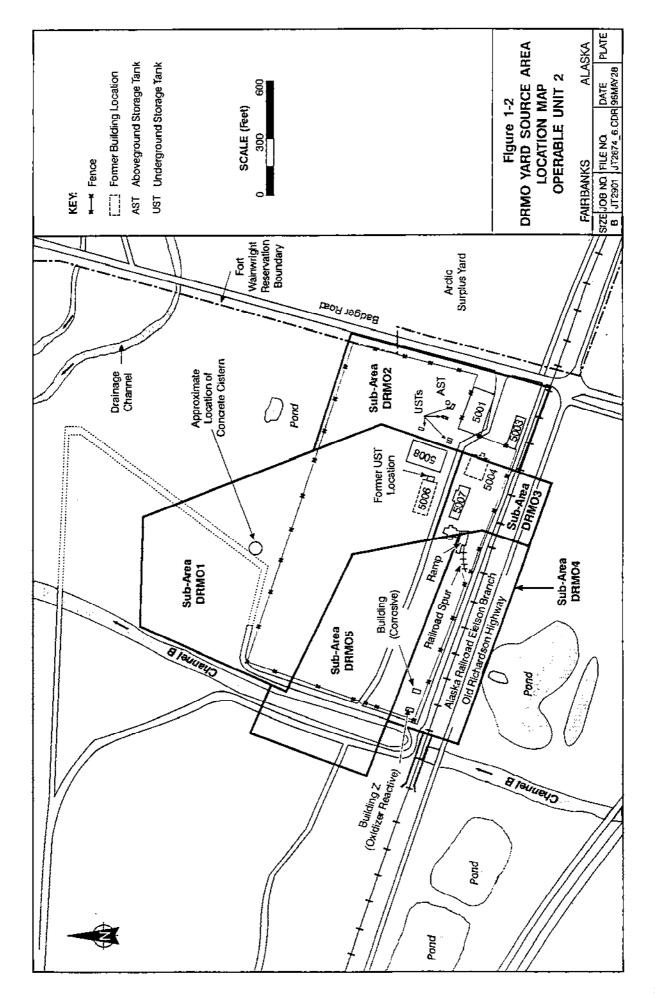
the DRMO Yard are contaminated with solvents and petroleum products. The DRMO Yard is not considered the source of these contaminants. Federal and state regulatory agencies are investigating several locations, not associated with Fort Wainwright, that were identified as potential sources of this contamination.

The City of Fairbanks uses the same aquifer and has four developed Municipal Utility System wells located 1 mile downgradient of the Post's boundaries, on the banks of the Chena River. These wells serve as the main drinking water supply for most of the City of Fairbanks.

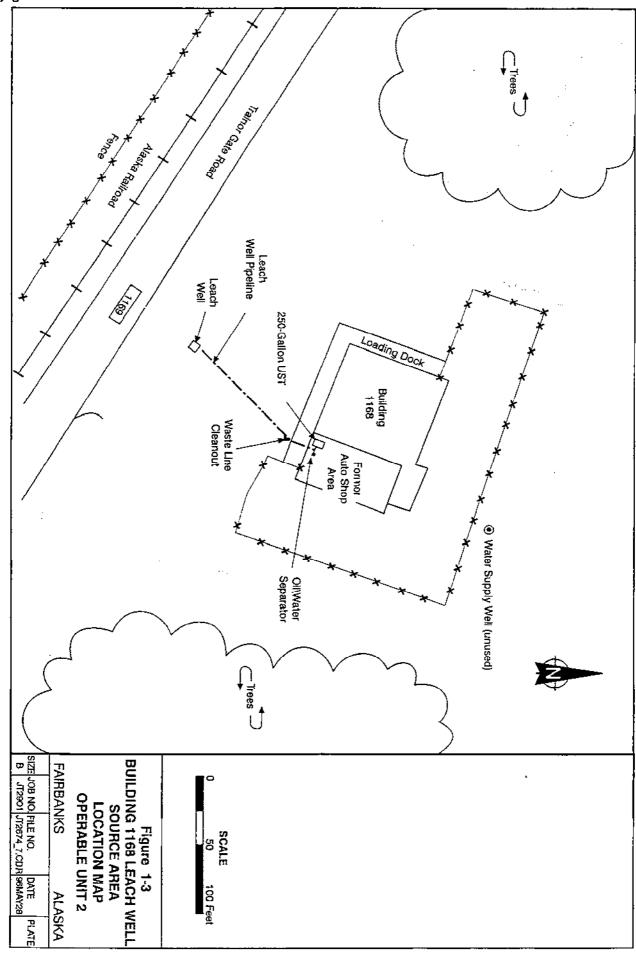
#### 1.4 LAND USE

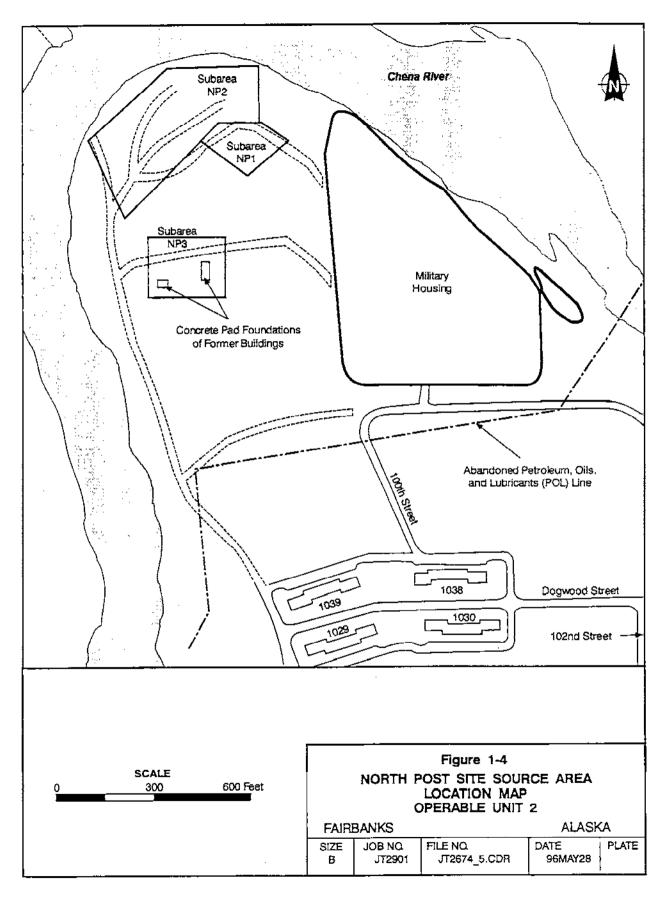
Current land use for the OU-2 source areas is light industrial. Although no residences are located on any source area, residential developments are close to the DRMO Yard and Building 1168 Leach Well source areas. Domestic water use occurs at one OU-2 source area: the DRMO Yard. Groundwater in the aquifer under these source areas is the sole source of drinking water for Fort Wainwright and the City of Fairbanks. Operations at the DRMO Yard and Building 1168 Leach Well are expected to continue indefinitely. Access is unrestricted to OU-2 source areas, except for the DRMO Yard.

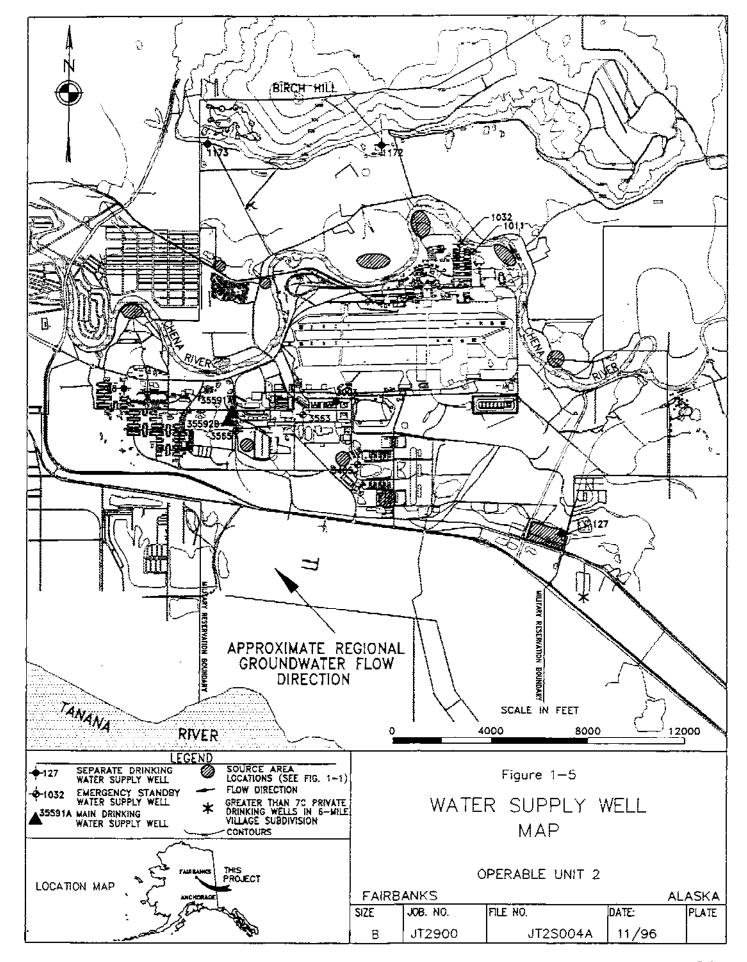












#### 2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

#### 2.1 SITE HISTORY

The DRMO Yard and Building 1168 Leach Well source areas have limited documents available to describe past practices. However, most source areas underwent evaluations, including sampling and analyses, before the RI. The source areas were listed as hazardous waste sites requiring further evaluation in the RCRA Facility Assessment.

## 2.1.1 Defense Reutilization and Marketing Office Yard

From 1945 to 1961, the DRMO Yard was used for vehicle storage and contained a vehicle maintenance shop. In 1961, the source area was converted into a salvage yard and was used to store drums of waste oil; pesticides; solvents; vehicle fluids such as antifreeze and hydraulic fluid; asphalt; and electrical transformers, some of which may have contained polychlorinated biphenyls (PCBs). Many drums reportedly leaked. Items such as mattresses, wood furniture, and possibly plastics were incinerated routinely in a burn pit. It is likely that the drummed fluids also were disposed of by burning. Waste oil, which historically contained heavy metals, solvents, PCBs, and other contaminants, was used to control dust on roads in the DRMO Yard during the 1970s and early 1980s. During the early 1980s, an estimated 3,000 gallons to 8,000 gallons of No. 1 diesel fuel were spilled near the former location of Building 5001. Cleanup included spreading the contaminated soil throughout the yard. Storage and destruction records were maintained by DRMO Yard personnel for three years and then were destroyed. Consequently, complete records of DRMO Yard activities are unavailable.

From 1988 to 1996, eight leaking underground petroleum storage tanks, ranging in size from 500 gallons to 10,000 gallons, were removed from the DRMO Yard. Cleanup of the associated petroleum-contaminated soil and groundwater is being conducted under the Two-Party Agreement.

From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the DRMO Yard.

The DRMO Yard serves as the permitted hazardous material transfer point for Fort Wainwright, Fort Greely, and Eielson Air Force Base.

#### 2.1.2 Building 1168 Leach Weil

Building 1168 was constructed as a lube oil and vehicle storage facility in 1949 and was converted into a petroleum test laboratory in 1962. The building contained a 10,000-gallon lube oil AST, oil/water separator system, 250-gallon UST that discharged to the leach well, 2,000-gallon heating oil UST, and septic system for sanitary waste. Contaminant and water mixtures apparently entered floor drains, passed through the oil/water separator, and flowed into the leach well that serviced the building. Contaminants suspected to have entered the floor drains include engine and transmission oil, gasoline, diesel, jet fuel, solvents, hydraulic fluid, and engine coolants.

As-built drawings from 1962 indicate that the room housing the 10,000-gallon AST was converted into a POL laboratory. The 10,000-gallon tank was removed, and a new floor and floor drain system were installed.

In 1985, the Post utility maintenance group replaced the waste line from Building 1168 to the leach well. The workers did not report any stained soil or odors; however, they reportedly felt light-headed when working near the connection to the leach well.

Numerous investigations occurred at the Building 1168 Leach Well before the start of the RI. From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the Building 1168 Leach Well.

In 1990, a groundwater survey conducted by the United States Army Environmental Hygiene Agency and a RCRA Facility Assessment conducted by EPA recommended further investigation at the Building 1168 Leach Well. This recommendation was based on the high potential for releases via the leach well and UST.

In 1994, a pilot-scale remediation system was installed around the leach well to determine whether an in situ treatment system was technically feasible in source area soils because the contamination is located mainly in subsurface soils and groundwater. Progress reports have shown that the soil vapor extraction (SVE)/air sparging (AS) system has been very effective as a remediation technology at this source area.

## 2.2 ENFORCEMENT ACTIVITIES

Fort Wainwright was placed on the CERCLA NPL in August 1990. Consequently, a Federal Facilities Agreement (FFA) was signed by EPA, the Alaska Department of Environmental Conservation (ADEC), and the United States Department of Army in spring 1992. The FFA ensures that appropriate actions are taken to protect public health and the environment in accordance with state and federal laws. The FFA divided Fort Wainwright into five OUs, one of which is OU-2, and outlines the general requirements for investigation and/or remediation of suspected historical hazardous waste source areas associated with Fort Wainwright.

An additional goal of the FFA was to integrate the Army's CERCLA response obligations and RCRA corrective action obligations. Remedial actions implemented will be protective of human health and the environment such that remediation of releases shall obviate the need for further corrective actions under RCRA (i.e., no further corrective action shall be required for source areas).

## 2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The public was encouraged to participate in the selection of the remedies for OU-2 during a public comment period from May 1 to May 31, 1996. The Fort Wainwright Proposed Plan for Remedial Action, Operable Unit 2 presents more than 11 combinations of options considered by the Army, EPA, and ADEC to address contamination in soil and groundwater at OU-2. The Proposed Plan was released to the public on May 1, 1996, and was sent to 130

known interested parties, including elected officials and concerned citizens. An informational Fact Sheet dated March 1996, providing information about the Army's entire cleanup program at Fort Wainwright, was mailed to the same mailing list.

The Proposed Plan summarizes available information regarding OU-2. Additional materials were placed in two information repositories: one at the Noel Wien Library in Fairbanks and the other at the Fort Wainwright Post Library. An Administrative Record, including all items placed in the information repositories and other documents used in the selection of the remedial actions, was established in Building 3023 on Fort Wainwright. The public is welcome to inspect materials available in the Administrative Record and the information repositories during business hours. The Administrative Record index is provided in Appendix B.

Interested citizens were invited to comment on the Proposed Plan and the remedy selection process by mailing comments to the Fort Wainwright project manager, by calling a toll-free telephone number to record a comment, or by attending and commenting at a public meeting on May 8, 1996, at the Carlson Center Prow Room in Fairbanks. No official comments were received from the public during the comment period. Six people attended the public meeting.

Display advertisements in the Fairbanks Daily News-Miner, published on April 28 and May 1, 5, 6, 7, and 8, 1996, also include information regarding the information repositories, the toll-free telephone line, and an address for submitting written comments.

The Responsiveness Summary in Appendix C summarizes and addresses public comments on the Proposed Plan and the remedy selection process.

# 2.4 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As with many Superfund sites, the problems at Fort Wainwright are complex. OU-2 will be the third OU, following OU-3 and OU-4, at Fort Wainwright to have completed the RI/FS process and to begin remedial action activities. The OU-2 RI and FS were performed in accordance with the RI/FS Management Plan for OU-2. The RI fieldwork was conducted during summer 1993. The final RI, Data Validation Review, Risk Assessment, and FS reports were submitted to EPA and the State of Alaska in January, September, and October 1995 and April 1996, respectively.

This ROD presents the selected remedial action for OU-2 chosen in accordance with CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for OU-2 is based on the Administrative Record.

The remedial actions described in this ROD address threats to human health and the environment posed by the contamination at OU-2. The RI/FS has defined potential risks posed by existing groundwater contamination and the potential for migration if remediation does not occur.

# 3.0 SUMMARY OF SOURCE AREA CHARACTERISTICS

Physical features, hydrogeologic conditions, and the nature and extent of contamination for the DRMO Yard and Building 1168 Leach Well source areas are described briefly in the following sections.

## 3.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD

# 3.1.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

The topography at the DRMO Yard source area grades gently to the north and northwest. However, numerous depressions and the presence of silty soil may promote surface water ponding. Surface water runoff from the northeast portion of the source area drains east to a drainage ditch, adjacent to Badger Road, that eventually drains into the Chena River. Surface water runoff from the west half of the source area may enter Channel B, a man-made, riprapped conveyance that parallels the west boundary of the DRMO Yard and connects the Chena and Tanana Rivers. Flow is predominantly toward the Chena River, approximately 1 mile away.

A shallow stream bed located north of the DRMO Yard source area may serve as a channel for surface water runoff to the Chena River during spring breakup and heavy precipitation. A small pond is located 150 feet north of the DRMO Yard; however, the pond does not discharge into a well-defined surface drainage system and the relationship of the pond to groundwater is unknown.

At the DRMO Yard, surface soil can be characterized as fill material, 3 feet to 6 feet deep, consisting of silt, silty sands, and gravels. Subsurface soil at the DRMO Yard is variable and consists of layers of unconsolidated silty sand, gravel, silt, and alluvial deposits of sand and gravel.

Contaminants were detected in surface soil, subsurface soil, sediment, surface water, and groundwater at the DRMO Yard.

Contaminants in surface soil are available to migrate via surface runoff. Although the DRMO Yard is relatively flat, nearby ponds and drainage ditches may receive contaminated runoff from the site. Contaminated runoff from the DRMO Yard would be deposited in sediments. Dissolved contaminants in runoff may be transported through the system of drainage channels and streams in and around the source area to the Chena River. Contaminants in surface soil also can migrate via infiltration to subsurface soil through the downward percolation of precipitation and snowmelt. The extent of contaminant infiltration into subsurface soil depends on the affinity of specific contaminants to adsorb or complex with soil particles. Surface soil contamination also can migrate from the DRMO Yard via particulate transport and volatilization; however, this migration pathway is considered relatively minor because of the six-month snow cover in the Fairbanks area.

Contaminants in subsurface soil are available to migrate downward through percolation to groundwater, caused by infiltration of precipitation and snowmelt. Volatile subsurface soil contaminants also can migrate upward to the surface through volatilization.

Groundwater is encountered at approximately 7.5 feet BGS in an unconfined drinking water aquifer consisting of poorly graded, coarse-grained deposits of sand and gravel. Groundwater generally flows west to northwest toward Channel B, which was constructed as part of the Chena River flood control project that connects the Chena and Tanana Rivers. Changes in flow direction in Channel B occur frequently and are attributable to water level changes in the Chena and Tanana Rivers. This change may result in Channel B recharging groundwater near the DRMO Yard. However, fluctuations in flow direction occur frequently and are attributable to water level changes in the Chena and Tanana Rivers.

Dissolved contaminants in groundwater will migrate through advective forces, influenced by horizontal and vertical groundwater flow gradients. Contaminated groundwater migrating from the DRMO Yard area eventually may be discharged to Channel B or to the drainage channel located north of the DRMO Yard (see Figure 1-3).

Residents in three nearby subdivisions use groundwater as a drinking water source. These private wells are located upgradient of the DRMO Yard, in the same unconfined aquifer as the identified DRMO Yard groundwater contamination. Groundwater generally flows west to northwest, away from these residential areas; however, fluctuations in flow direction occur. The first residential area is approximately 1,400 feet to the north, the second is approximately 1,000 feet to the northeast, and the third is approximately 400 feet to the southeast. A public drinking water well and fire suppression system were installed in 1996 and are in service within the fenced DRMO Yard. This well was installed directly upgradient of the known groundwater solvent contamination plume, at a depth of 102 feet. The solvent plume extends from approximately 7 feet BGS to between 30 feet and 40 feet BGS. Pumping rates at the public drinking water well will be limited until federal Safe Drinking Water Act and State of Alaska Drinking Water Standard maximum contaminant levels (MCLs) are achieved in the contaminant plume to reduce the chance of changing plume characterization and of causing the plume to be drawn within the cone of influence of the potable water well.

# 3.1.2 Nature and Extent of Contamination

From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the DRMO Yard.

In July 1992, 12 borings and two monitoring wells were installed in an area north of Building 5001 at the DRMO Yard as part of a geotechnical investigation for placing a building foundation. Petroleum hydrocarbons that exceeded ADEC's soil cleanup levels were detected in the soils. Groundwater in one monitoring well contained trichloroethene (TCE) at 8.6 parts per billion (ppb). The state and federal MCL for TCE is 5 ppb. A petroleum UST was associated with the most significant contamination at this source area, which is being remediated under the Two-Party Agreement.

Additional areas of soil and groundwater contamination at the DRMO Yard were investigated through a Preliminary Source Evaluation at the DRMO Yard in September 1992. The evaluation confirmed results from previous investigations conducted in the vicinity of and in the DRMO Yard. Petroleum hydrocarbons and volatile organic compounds (VOCs) associated with fuels and low levels of dioxins/furans, PCBs, and pesticides were detected in

soils and groundwater.

In 1993, the OU-2 RI was conducted. The main objectives at the DRMO Yard were to verify information about the nature and extent of surface and subsurface soil and groundwater contamination and to collect information of sufficient quality to be used in a Baseline Risk Assessment. The field investigation consisted of the following tasks: a geophysical survey, surface and subsurface soil sampling, installation of groundwater probes and monitoring wells, collection of groundwater samples, surface water and sediment sampling, and aquifer testing.

Contaminants detected in soil, groundwater, and sediments included organic compounds; i.e., petroleum hydrocarbons, PCBs, polynuclear aromatic hydrocarbons, chlorinated VOCs, dioxins, and pesticides. Several inorganic elements also were detected; i.e., manganese, lead, and arsenic (see Tables 3-1 through 3-5). These contaminants are believed to have come from several on-site sources, including former petroleum USTs; on-site storage of electrical transformers and drums without secondary containment; and the incineration of mattresses, wood furniture, drummed fluids, and plastics in an on-site fire burn pit. These contaminants were compared to existing background levels determined for inorganics in this mineral-rich area, screened for inclusion in the Human Health and Ecological Risk Assessment, and compared to state and federal drinking water standards. Analytes were retained as contaminants of concern if they exceeded background levels, standard risked-based screening criteria for residential exposure assumptions of  $1 \times 10^7$  for soils and  $1 \times 10^6$  for groundwater and a hazard index of 0.1, or state and federal MCLs. The levels of inorganics are attributable to elevated background concentration. No floating products (lighter-than-water nonaqueous phase liquids [LNAPLs]) or pure product solvents (denser-than-water nonaqueous phase liquids [DNAPLs]) were identified in the groundwater at the DRMO Yard.

This source was divided into six sub-areas. Sub-areas were used because of the size of the site, and to accurately characterize different types of suspected contaminants based on historical activities or known releases that had occurred. Planned remediation of source areas also is identified by sub-area.

The suspected sources of contaminants in the soil and groundwater at two sub-areas, DRMO2 and DRMO3, are removed USTs. Contaminants include petroleum and fuel products that exceed State of Alaska soil cleanup levels. Groundwater contamination included TCE and tetrachloroethene (PCE) at levels below state and federal MCLs.

Petroleum hydrocarbons in soil and groundwater at sub-area DRMO5 exceeded State of Alaska soil cleanup levels for UST petroleum-contaminated soil. This source area also contained PCBs at concentrations below action levels and one soil boring with dieldrin at a concentration of 1.0 milligrams per liter. A resampling event was conducted at this source area; five samples were collected in the vicinity of the positive dieldrin sample. The results were nondetect or less than screening levels. Because of the type of contaminants and suspected sources of contamination in DRMO2, DRMO3, and DRMO5, these source areas are being remediated under the Two-Party Agreement.

At sub-area DRMO1, two contaminants—PCE and TCE—were detected in the groundwater at levels above their state and federal MCLs of 5 ppb. A well-defined groundwater plume, with

maximum concentrations of 190 ppb and 17 ppb for PCE and TCE, respectively, has been identified. PCE has migrated to the northwest in the direction of the groundwater flow and extends beyond the DRMO Yard boundary, toward Channel B. The extent of the PCE plume is illustrated in Figure 3-1. TCE detected in groundwater and soil is likely a degradation product of PCE. The RI indicates that PCE-saturated soils above the groundwater plume are the source of groundwater contamination; however, soil contaminant levels were not found at concentrations that would result in the identified groundwater contaminant levels. The maximum depth of PCE in groundwater is between 30 feet and 40 feet BGS, with the highest concentration near the soil-water interface (7 feet BGS). This indicates that there is not a pure product DNAPL source in the aquifer. Shallow and fluctuating groundwater conditions contribute to the ongoing release of contaminants to groundwater. This is supported by the highest soil concentration found in the saturated vadose zone, possibly associated with subsurface releases from an abandoned wood stave pipe. Additionally, the groundwater plume isocontours and concentrations are indicative of a discrete defined subsurface source. While soil sampling in an approximate 75-foot grid in this area did not identify the source, the conceptual model supports its presence. The soils will be treated during in situ remediation at this site.

Benzo(a)pyrene was detected in three "hot spots" at sub-areas DRMO1 and DRMO4 (see Figure 3-1). Approximately 1,900 cubic yards of soil has been impacted by this compound. The source of the benzo(a)pyrene has not been identified, but the compound may be a by-product of the burning and drum storage activities within the "hot spot" areas at the source area. The maximum depth of detection was 2 feet BGS, indicating that the contaminant does not migrate readily through the soil column and is not a threat to groundwater.

At sub-area DRMO4, benzene and PCE in the groundwater exceed state and federal MCLs of 5 ppb (at 7.5 ppb and 51 ppb, respectively) and appear to originate from miscellaneous releases associated with operations occurring along a railroad spur. Soils contaminated with solvent and petroleum compounds are considered the source of groundwater contamination. The groundwater contamination is found at the southwest portion of the railroad spur and is isolated and small in size. Although only one groundwater sample exceeded the state and federal MCLs for PCE and two samples exceeded the state and federal MCLs for benzene, a well-defined groundwater plume is present. The contamination begins at the southwest portion of the railroad spur and extends northwest to the road, from the west gate through the DRMO Yard (see Figure 3-2). Several other compounds were detected at concentrations below action screening levels in the soil and groundwater during the RI.

At sub-area DRMO6, sample detections included petroleum hydrocarbons and low levels of PCBs, dioxins, and inorganic elements; however, no contaminants attributable to activities associated with this sub-area exceeded screening levels. Sediment and surface water sample results will be evaluated further for potential contribution to cumulative ecological risk in the postwide Risk Assessment. No action is planned for this sub-area.

## 3.1.3 Defense Reutilization and Marketing Office Yard Summary

The petroleum-related contamination, including diesel-range organics (DRO) and gasoline-range organics (GRO) found in soil and groundwater throughout the source area, will be addressed through the Two-Party Agreement, except in areas where they are comingled with

other contaminants of concern. The PCE and TCE groundwater contaminant plumes underlie a sizable portion of sub-areas DRMO1 and DRMO4. Groundwater monitoring well contaminant levels in these source areas exceed state and federal MCLs for PCE and TCE at DRMO1 and for PCE and benzene at DRMO4. In addition, "hot spots" of benzo(a)pyrene were found in DRMO1 and DRMO4. A summary of analytical results for the DRMO Yard can be found in Tables 3-1 through 3-5.

## 3.2 BUILDING 1168 LEACH WELL

# 3.2.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

The topography at the Building 1168 Leach Well source area is relatively flat. No surface water drainage pathways are evident. During periods of high precipitation and spring snowmelt, surface water may flow overland to low-lying areas north and southeast of the site. The nearest surface water body, the Chena River, is approximately 1,800 feet to the east. The source area is surrounded by a spruce-hardwood forest to the west, north, and east.

Subsurface soil at the Building 1168 Leach Well source area consists of unconsolidated lenses of interlayered silt, silty sand, and poorly graded sand and gravel, underlain by sandy gravel. Fine-grained silt deposits appear as shallow lenses within silty sand and sand, and are overlain mostly by silty gravel. Silty, gravelly surface soil is predominantly fill material, likely laid down when the Building 1168 parking lot was constructed. Near surface sand and silt are underlain mainly by poorly graded, loose- to medium-density, saturated, sandy gravel that is highly permeable.

Contamination originated from a leach well that received liquids collected in floor drains within Building 1168. Floor drains were connected to a buried pipe that discharged to the leach well at approximately 13 feet BGS. Because of the release mechanism, significant surface soil contamination has not been identified at this source area. Floor drains within the building are suspected of receiving spilled oil and lubricants, fuels, solvents, and engine coolants. Contaminants in subsurface soil are available to migrate vertically toward groundwater with infiltration of precipitation and snowmelt. Lateral spreading of contaminants in subsurface soil has occurred from point sources of contamination because of capillary forces and partitioning exceeding gravitational forces on contaminant movement. Volatile contaminants in subsurface soil also can migrate upward through volatilization from groundwater to soil.

Infiltration and percolation through contaminated soil have been contributors to groundwater contamination. Leaching through contaminated soils caused by fluctuating groundwater levels and the affinity of petroleum products to float also have been major factors in continued groundwater contamination.

Groundwater is the main contaminant migration pathway at the Building 1168 Leach Well source area. Groundwater was encountered between 12 feet to 17 feet BGS and flows to the northwest toward the west boundary of Fort Wainwright and off-post residential areas. No confining layers have been encountered in the source area. Dissolved contaminants in groundwater will migrate through advective forces, influenced by horizontal and vertical groundwater flow gradients.

# 3.2.2 Nature and Extent of Contamination

Numerous investigations occurred at the Building 1168 Leach Well before the start of the RI.

In 1990, a groundwater survey conducted by the United States Army Environmental Hygiene Agency and an EPA RCRA Facility Assessment recommended further investigation at the Building 1168 Leach Well. This recommendation was based on the high potential for releases from the leach well and UST.

In 1992 and 1993, a Preliminary Source Evaluation was performed and included analytical measurements of surface and subsurface soil and groundwater samples. Petroleum hydrocarbons were detected in subsurface soil samples exceeding the State of Alaska cleanup levels for non-UST petroleum-contaminated soil. TCE and benzene exceeded the state and federal MCLs of 5 ppb. Ethylbenzene and xylenes also were detected in groundwater. The highest analyte concentrations in soil and groundwater were from samples closest to the leach well.

The OU-2 RI was conducted in 1993. The principal objectives of the RI at the Building 1168 Leach Well were to obtain information about the nature and extent of subsurface soil and groundwater contamination. The field investigation consisted of the following tasks: one surface soil sample, numerous subsurface soil samples, installation of two monitoring wells, collection of groundwater samples, aquifer testing, and a Treatability Study.

The RI results confirmed petroleum hydrocarbon and semivolatile organic compound contamination in groundwater, specifically benzene and TCE above state and federal MCLs of 5 ppb. No floating petroleum product (LNAPL) was found in the groundwater at this site. Manganese also exceeded risk-based concentrations but is attributable to background concentrations in this minerally rich area.

Contaminants detected in subsurface soils at the Building 1168 Leach Well include inorganics and petroleum hydrocarbons. Groundwater at the Building 1168 Leach Well contained petroleum hydrocarbons, aromatic and chlorinated VOCs, and inorganic elements. Tables 3-6, 3-7, and 3-8 list the chemicals detected in soil and groundwater at the Building 1168 Leach Well.

In subsurface soil, petroleum hydrocarbon-contaminated soil extends approximately 50 feet radially from the leach well. Contaminant concentrations decrease with increasing horizontal distance from the leach well. The thickness of subsurface soil contamination ranges from the bottom of the leach well to the seasonal low-water table elevation. A smear zone approximately 4 feet thick exists underneath the leach well and is a result of water table level fluctuations. An estimated 1,300 cubic yards of subsurface soil has been impacted by contaminants discharged from the leach well (see Figure 3-3). Table 3-6 lists the analytes detected in soil.

The contaminated soil around the leach well appears to be the source of petroleum hydrocarbons and VOCs detected in groundwater. Contamination from subsurface soil has created a comingled benzene and TCE plume in groundwater 20 feet to 50 feet BGS. The plume extends horizontally downgradient (northwest) approximately 400 feet from the leach

well (see Figure 3-4). Measurable free-floating product on the groundwater has not been detected at the Building 1168 Leach Well.

An SVE/AS pilot-scale treatability study was initiated in November 1994. Quarterly monitoring results indicate at least a 50% reduction of petroleum-related contaminants in groundwater in the active treatment zone over the last two years. Benzene and TCE were not detected within the active zone. However, exceedances of state and federal MCLs still exist outside the pilot-scale active treatment zone.

		Table 3-1	_			
•	SUMMARY OF	SUMMARY OF SURFACE AND SUBSURFACE SOIL SA DRMO YARD SOURCE AREA OPERABLE UNIT 2		MPLE RESULTS		_ ^-
		(mg/kg)				
	Number of Samples	Range of Detected	Location of Maximum	Risk-Based Screening	Background	Number of Samples
Analyte	Analyzed/Detected	Concentrations	Concentration	Concentration	Concentration	Exceeding RBCs
Petroleum Hydrocarbons						
Diesel-range organics <sup>b</sup>	328/163	0.0038 - 9,600	AP-6738	100	NA	37
Gasoline-range organiese	322/66	0.25 - 690	AP-6773	50	NA	15
Volatile Organic Compounds						
1,2,4-Trimethylbenzene	323/9	0.004 - 2.8	AP-6773	39	NA	0
1,3,5-Trimethylbenzene	323/18	0.006 - 5.6	AP-6773	31	NA	0
Acctone	323/30	0.017 - 0.42	AP-6806	7,800	NA.	0
Benzene	323/4	0.006 - 0.008	AP-6771	22	NA	0
Cumene (isopropylbenzene)	323/2	0.0092 - 0.016	AP-6806	3,100	NA	0
Ethylbenzene	323/5	0.003 - 0.023	AP-6771	7,800	N'A	0
m&p-Xylene	323/7	0.005 - 0.077	AP-6771	160,000	NA	0
Methylene chloride	323/212	0.003 - 0.095	AP-6773	85	NA	5
n-Bulylbenzene	323/6	0.006 - 0.63	AP-6806	NA	NA	NA
n-Propylbenzene	323/2	0,0082 - 0.023	AP-6806	NA	N.	NA
o-Xylene	323/7	0.002 - 0.035	AP-6771	160,000	NA	0
p-Isopropyltoluenc	323/13	0.005 ~ 2.2	AP-6771	NA	NA	NA

<u> </u>	-		Table 3-1				
		SUMMARY OF	SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	FACE SOIL SAM RCE AREA NIT 2 T, ALASKA	PLE RESULTS		
	Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding RBCs
	sec-Butylbenzene	323/2	0.011 - 0.220	AP-6806	780	NA	0
	tert-Butylbenzene	323/1	0,0034	AP-6796	780	٧N	0
	Tetrachloroethene	323/24	0.0025 - 0.15	AP-6803	12	NA	0
24	Toluene	323/11	0.0024 - 0.09	AP-6771	16,000	ΥN	0
	Semivolatile Organic Compounds						
	2-Methylnaphthalene	328/8	0.057 - 13	AP-6773	٧V	NA	ΝΑ
	Acenaphthene	328/2	0.130 - 0.170	AP-6763	4,700	NA	0
	Anthracene	328/4	0.050 - 0.350	AP-6796	23,000	NA	0
	Benzo(a)anthracene	328/7	0.045 - 0.320	AP-6758	0.88	NA	0
	Benzo(a)pyrene	328/7	0.049 - 0.350	AP-6758	0.088	NA	9
	Benzo(b)fluoranthene	328/9	0,048 - 0,350	AP-6758	0.88	NA	0
<del></del>	Benzo(g,h,i)perylene	328/7	0.046 - 0.370	AP-6747	AN	NA	AN
	Benzo(k)fluoranthene	328/7	0.052 - 0.330	AP-6758	8.8	NA	0
	bis(2-ethylhexyl)-pluhalate	328/28	0.029 - 1.600	AP-6745	46	NA	0
	Butyl benzyl phthalate	328/7	0.150 - 0.710	AP-6798	16,000	NA	0
6	Chrysene	328/8	0.046 - 0,390	AP-6758	888	NA	0
49¥2	CS Tekey at end of table.						

	SUMMARY OF	Table 3-1 SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA	RACE SOIL SAM	PLE RESULTS	3	
		OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	INIT 2 IT, ALASKA			
Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding RBCs
di-n-Butyl phthalate	327/133	0.024 - 2.600	004	NA	NA	NA
Dibenzo(a,h)anthracene	328/2	0.052 - 0.084	AP-6758	0.088	AN	0
Fluoranthene	328/11	0999 - 0.058	AP-6758	3,100	NA	0
Fluorene	328/4	0.230 - 1.0	AP-6738	3,100	٧×	0
Indeno(1,2,3-ed)pyrene	328/5	0.052 - 0.2	AP-6758	0.88	NA	0
Naphthalene	651/10	0,004-4.7	AP-6738	3,100	NA	0
Phenauthrene	328/16	0.059 -0.950	AP-6773	A N	NA	NA
Pyrene	328/9	0.091 - 0.640	AP-6758	2,300	NA	0
Other Organic Compounds						
Total organic carbon	331/331	290 - 40,300	AP-6736	NA	NA	۸۸
PCBs and Organochlorine Pesticides	S					
4,4'-Dichlorodiphenyldichloroethane (DDD)	331/31	0.0024 - 0.039	AP-6751	2.7	YZ.	0
4,4'-Dichlorodiphenyldichloroethene (DDE)	331/38	0.0016 - 0.059	AP-6739	1.9	NA .	٥
4,4'-Dichlorodiphenyltrichlorocthane (DDT)	331/119	0.0013 - 1.1	AP-6747	1.9	AN	0

81 and of table.

		Table 3-1			:	
	SUMMARY OF	SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	KFACE SOIL SAM RCE AREA JNIT 2 IT, ALASKA	PLE RESULTS		
Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding RBCs
Aroclor 1254	331/2	0.026 - 0.430	AP-6730	0.083	٧N	2
Aldrin	331/1	0.00065	AP-6806	0.038	ΨN	0
Aroclor 1260	331/55	0,017 - 1,3	500	0.083	NA	25
bcta-BHC	331/4	0.00057 - 0.0016	AP-6797	0.35	NA	0
Dieldrin	331/4	0.012 - 1.0	AP-6794	0.04	٧N	2
Endosulfan I	331/1	910:0	9619-dV	470	NA	0
Endosulfan II	331/5	910'0 - 8/000'0	AP-6758	470	NA	0
Endrin	331/3	0.0097 - 0.014	AP-6794	23	NA	0
Endrin aldehyde	331/1	0.0086	AP-6803	NA	ÑĀ	ΥZ
Endrin ketone	331/5	0.0015 - 0.027	SP-6796	NA	NA	₹ Z
gamma-BHC (Lindane)	331/6	0.0042 - 0.130	SP-6763	0.49	AN	0
Heptachlor epoxide	331/1	0.019	AP-6796	0.07	٧	0
Methoxychlor	331/1	0.0048	AP-6793	390	NA	0

		Table 3-1				
	SUMMARY OF	SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	FACE SOIL SAM RCE AREA NIT 2 IT, ALASKA	PLE RESULTS		
Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding RBCs
Metals						
Arsenic	332/318	0.79 - 72.4	AP-6744	0.37	29	318
Barium	331/331	18 - 381	AP-6750	5,500	234	0
Cadmium	331/84	0.48 - 8.1	AP-6782	39	٧N	0
Chromium	331/330	2.7 - 46.1	AP-6742	78,000	46	0
Lead	336/332	1.7 - 996	AP-6735	400	Ϋ́N	3
Manganese	331/330	29.1 - 2,420	AP-6780	390	318	33
Mercury	331/22	0.07 - 2.3	AP-6732	23	ON	0
Selenium	331/214	0.051 - 4.1	AP-6750	390	0.17	0
Silver	331/12	0.55 - 5.3	AP-6778	390	1.10	0
Thallium	331/6	0.13 - 9.8	AP-6776	NA	QN	ΝΑ
Dioxins/Furans (pg/g)				4.		
2,3,7,8-TCDD TEQ	267/244	0,0008-97,356	AP-6734	4.1	Y Z	6

The RBC used for m&p-xylene is the RBC for xylenes mixed. No RBC for p-xylene in soil exists. The RBC used for chromium is the one for trivalent chromium. The RBC used for arsenic is the one for the carcinogenic form of arsenic. Note:

Key at end of table.

## Table 3-1 (Cont.)

a Risk-based screening concentration values are based on a 1 x 106 residential direct contact risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).

b ADEC soil cleanup matrix score Level A for DRO is 100 mg/kg.

c ADEC soil cleanup matrix score Level A for GRO is 50 mg/kg.

## Key:

ADEC = Alaska Department of Environmental Conservation. BHC = Benzenehexachloride.

DRMO = Defense Reutilization and Marketing Office,

DRO = Diesel-range organics.

GRO = Gasoline-range organics.

µg/kg = Micrograms per kilogram.

mg/kg = Milligrams per kilogram.

NA = Not applicable.

ND = Not detected.

PCBs = Polychlorinated biphenyls.

pg/g = Picograms per gram.

RBCs = Risk-based concentrations.

fCDD = Tetrachlorodibenzo-p-dioxin.

TEQ = Toxicity equivalency.

Key at end of table.

		Table 3-2	3-2			
	SUMI	SUMMARY OF SEDIMENT SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	INT SAMPLE RESCOURCE AREA E UNIT 2 IGHT, ALASKA	SULTS		
Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding RBCs
Petroleum Hydrocarbons						
Diesel-range organics <sup>b</sup>	6/6	000'1 - 69	100	100	NA	5
Volatile Organic Compounds						
Chloroform	1/6	800.0	900	100	NA	0
Other Organic Compounds (%)						
Total organic carbon	רוך	1 - 9.35	100	A'N	NA	NA
PCBs and Organochlorine Pesticides	ડ્યા					
Aroclor 1260	6/6	7 - 60	200	0.083	ΑN	
Metals						
Arsenic	6/6	8 - 38	100	0.37	AN	6
Barium	6/6	139 - 387	10	5,500	NA	0
Cadmium	9/4	2 - 6	200	39	NA	0
Chromium	6/6	18 - 49	700	78,000	NA	0
Lead	6/6	10 - 1,390	000	400	Ϋ́Z	7
Manganese	6/6	251 - 5,140	005	390	NA	7

Key at end of table.

3	۸×	4.10	007	0.0043 - 71.98	9/9	2,3,7,8-TCDD TEQ
						Dioxins/Furans (pg/g)
Number of Samples Exceeding RBCs	Background Concentration	Risk-Based Screening Concentration <sup>a</sup>	Location of Maximum Concentration	Range of Detected Concentrations	Number of Samples Analyzed/Detected	Analyte
		SULTS	ENT SAMPLE RES SOURCE AREA LE UNIT 2 LIGHT, ALASKA /kg)	SUMMARY OF SEDIMENT SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	SUMP	
			e 3-2	Table 3-2		

Note: The RBC used for chromium is the one for trivalent chromium. The RBC used for arsenic is for the carcinogenic form of arsenic

Risk-based screening concentration risk values are based on a 1 × 10<sup>-6</sup> residential direct contact or an HQ = 1 (EPA, Region III, July 11, 1994, Risk-Based Concentration

ADEC soil cleanup matrix score for Level A cleanup of DRO is 100 mg/kg.

## Key:

Alaska Department of Environmental Conscreption.

Diesel-range organics.

DRMO = Defense Reutilization and Marketing Office.

= 3x/3m Micrograms per kilogram.

Milligrams per kilogram.

Not applicable.

PCBs = Polychlorinated biphenyls.

pg/g = RBCs = Picograms per gram.

Risk-based concentrations.

TCDD = Tetrachlorodibenzo-p-dioxin

Toxicity equivalency.

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				C.C alde 1				
<del> </del>		SUMMAR	Y OF GROUNDW, DRM FORT	NDWATER MONITORING WELDRING YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)	E RESULTS		
<u> </u>	Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCL
<u> </u>	Petroleum Hydrocarbons							1
<u> </u>	Diesel-range organics	23/16	130 - 23,000	AP-5825	NA/NA	NA	NA	Ϋ́Ν
<u> </u>	Gasoline-range organics	31/8	50 - 940	AP-5825	NA/NA	NA	Y'A	NA A
<u> </u>	Volatile Organic Compounds	:						
<u> </u>	1,2,4-Trimethylbenzene	31/5	2.9 - 460	AP-5825	100/70	3	NA	
	1,3,5-Trimethylbenzene	31/5	3.7 - 130	AP-5825	100/NA	2.4	NA	¥Z
<u> </u>	Chloroform	31/1	1.9	AP-6802	1,240/100	0.15	AN	0
_	cis-1,2-Dichloroethene	31/1	7.3	AP-5764	11,600/70	19	NA AN	0
<u> </u>	Cumene	31/5	1.6 - 14	AP-5825	NA/NA	1,500	NA	Ϋ́Ν
<u></u>	Ethylbenzene	31/3	2.6 - 3.7	AP-5825	0.2/700	1,300	NA	0
<u> </u>	m&p-Xylene	31/3	3.2 - 92	AP-5825	0.2/10,000	520	NA	0
	Methyl ethyl ketone	31/2	6.4 - 12	AP-5825	NA/NA	22,000	NA	AN
	Methylene chloride	31/12	1 - 1.9	AP-6799	NA/5	4.1	NA	0
<u> </u>	n-Butylbenzene	31/1	3.3	AP-6806	NA/NA	NA	NA	Ϋ́N
64	n-Propylbenzene	3/31	1.7 - 16	AP-5825	NA/NA	NA	NA	NA

## SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA Table 3-3

(Lg/L)

			(MB/ m/)				
Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCL
Naphthalene	54/6	14 - 530	AP-5825	0.1/NA	1,500	NA	NA
o-Xylene	31/1	170	AP-5825	0.2/10,000	1,400	NA	0
p-Isopropyltoluene	31/2	3.5 - 19	AP-5825	NA/NA	NA	NA	NA
sec-Butylbenzenc	31/7	1.6 - 11	AP-5825	NA/NA	61	NA	NA
Tetrachloroethene (PCE)	31/6	1.3 - 190	AP-6803	840/5	1.1	NA	υ.
trans-1,2-Dichloroethene	3/31	1.2 - 1.7	AP-6804	11,600/100	120	NA	0
Trichloroethene (TCE)	5/31	4.8 - 17	AP-6804	5/5	1.6	NA	3
Trichlorofluoromethane	31/1	6.3	AP-5764	NA/NA	1,300	NA	NA
Semivolatile Organic Compounds							
2-Methylnaphthalene	23/5	11 - 200	AP-5825	0.1/NA	N.A	NA	NA
Benzoic acid	23/1	61	AP-6803	NA/NA	150,000	NA	NA
Fluorene	23/1	2	AP-6803	0.1/NA	1,500	NA	NA
Naphthalene	54/6	14 - 530	AP-5825	0.1/NA	1,500	NA	NA
Organophosphorus l'esticides							
Disulfoton	23/3	0.14 - 1.3	AP-5826	NA/NA	1.5	NA	NA

Page 3 of 4

# SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA Table 3-3

Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration <sup>6</sup>	Background Concentration	Number of Samples Exceeding MCL
Metals							
Arsenic (dissolved)	23/13	6 - 24	AP-5825	48/50	0.038	56	0
Arsenic (total)	23/13	6 - 23	AP-5825	48/50	0.038	230	0
Barium (dissolved)	23/20	100 - 310	AP-5825	1,000/2,000	2,600	520	0
Barium (total)	23/20	100 - 320	AP-5825	1,000/2,000	2,600	2,000	0
Lend (dissolved)	23/1	6	AP-6802	NA/15	NA	27	0
Manganese (dissolved)	23/20	250 - 13,000	AP-5825	50 <sup>b</sup>	180	1,900	20
Manganese (total)	23/20	270 - 13,000	AP-5825	50 <sup>b</sup>	180	1,900	20
Dioxins/Furans (pg/L)							
2,3,7,8-TCDD TEQ	20/19	0.33 - 8.4183	AP-5765	10/30	0.43	NA	0

Note: The RBC used for m&p-xylene is the one for p-xylene. This RBC is the more conservative of the two. The RBC used for arsenic is for the carcinogenic form of arsenic.

Table 3-3 (Cont.)

G Key at end of table.

a Risk-based screening concentration values are based on a 1 × 10<sup>-6</sup> residential direct contact risk or HQ = 1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables). b Secondary MCL.

- AAC =
- MCL = Maximum contaminant level.
   μg/L = Micrograms per liter.
   NA = Not applicable.
   pg/L = Picograms per liter.
   TCDD = Tetrachlorodibenzo-p-dioxin.
   TEQ = Toxicity equivalency. Alaska Administrative Code.

  Defense Reutilization and Marketing Office.

  Maximum contaminant level.

  Micrograms per liter.

			Table 3-4		1		
	SUMMARY		GROUNDWATER PROBE SAM DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)	OF GROUNDWATER PROBE SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)		:	-
	Number of Samples	Range of Detected	Location of Maximum	Alaska Water Quality Criteria 18 AAC 70/MCL	Risk-Based Screening	Background	Number of Samples Exceeding
Analyte	Analyzed/Detected	Concentrations	Concentration	(18 AAC 80)	Concentrationa	Concentration	MCLs
Petroleum Hydrocarbons							
Diesel-range organics	94/65	120 - 41,000	P34	NA/NA	V.∀	NA	¥Z
Gasolinc-range organics	61/68	70 - 28,000	P34	NA/NA	NA	AZ	Y Z
Volatile Organic Compounds					:		
1,2,4-Trimethylbenzene	93/11	1.3 - 340	P35	100/NA	E	NA	NA NA
1,2-Dichlorobenzene	161/2	19 - 38	P15	763/600	370	NA	0
1,2-Dichloroethane	93/1	1.5	P13	5/5	0.12	NA	0
1,3,5-Trimethylbenzene	93/10	1.3 - 130	P35	100/NA	2.4	NA	NA
1,3-Dichlorobenzene	1/191	1.5	09d	763/NA	540	NA	NA
1,4-Dichlorobenzene	161/2	6 - 12	P15	763/75	0.44	NA	0
Acutone	7/£6	3.1 - 79	P35	NA/NA	3,700	NA	NA NA
Benzene	93/6	1.4 - 7.5	P05	0.2/5.0	0.36	NA	6
Chlorobenzene	93/1	2.6	P15	NA/100	39	٧V	٥
Chloroform	72126	1.1 .8	MW2	1,240/100	0.15	AN	٥
cis-1,2-Dichloroethene	93/3	1,2 - 2.3	P59	01/000/11	19	NA	٥
Cumene	93/10	1.4 - 14	P34	NA/NA	1,500	NA	NA

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SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS
DRMO YARD SOURCE AREA
OPERABLE UNIT 2
FORT WAINWRIGHT, ALASKA

Table 3-4

		$(\mu g/L)$	
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Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
Dichlorodifluoromethane	93/2	1.7 - 18	P07	11,000/NA	390	NA	NA
Ethylhenzene	93/7	1.3 - 6	P27	0.2/700	1,300	NA	0
m&p-Xylene	93/8	1.6 - 87	P35	0.2/10,000	520	NA	0
Methyl ethyl ketone (MEK)	93/21	2 - 110	Trip Blank	NA/NA	22,000	NA	N.A
Methylene chloride	93/26	1 - 8.8	P35	NA/5	4.1	N.A.	2
n-Butylbenzene	93/1	30	P34	NANA	NA	NA	NA
n-Propyibenzene	93/8	1.6 - 32	P34	NA/NA	NA	NA	NA
x-Xylene	93/7	1.2 - 150	P35	0.2/10,000	N A	AN	0
p-Isopropyltoluene	93/10	1.5 - 200	P34	NA/NA	NA	NA	NA A
sec-Butylbonzene	93/7	1.2 - 25	P34	NA/NA	61	NA	N A
Styrene	93/2	1.7 - 69	P57	NA/100	1,600	NA	0
Tetrachloroethene (PCE)	93/20	1.1 - 65	P35	840/5	1:1	NA	ī.i
Toluenc	93/5	1.5 - 3.7	P61	0.2/1,000	750	NA	0
trans-1,2-Dichloroethene	93/6	1.3 - 4,4	P43	11,600/100	120	NA	0
Trichloroethene (TCE)	93/19	1.4~9.1	P51	5/5	1.6	NA	12
Trichlorofluoromethane	93/2	1.6 - 4.1	P12	NA/NA	1,300	NA	0

			Table 3-4				
	SUMMARY		GROUNDWATER PROBE SAM DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	OF GROUNDWATER PROBE SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (μg/L)	80		
Analyte	Number of Samples Analyzed/Detected	Range of Detected	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
Semivolatile Organic Compounds							
2-Methylnaphthalene	6/89	1 - 240	P35	0.1/NA	NA	NA	Ϋ́ν
Dibenzofuran	68/1	2	P34	NA/NA	150	NA	NA
Diethylphthalate	68/1	10	P34	NA/NA	29,000	NA	YZ.
Fluorene	68/2	4.6	P34	0.1/NA	1,500	NA	NA A
Naphthalene	161/20	1.6 - 410	P35	0.1/620	1,500	NA	0
Phenanthrene	68/1	4	P34	0.1/NA	NA	NA	Ν̈́Α
Organophosphorus Pesticides	:						
Diazinon	1/89	72.0	P37	NA/NA	33	NA	ÑĀ
Disulfoton	68/2	0.11 - 0.53	P46	NA/NA	1.5	NA	A'N
Naled	68/2	0.18 - 0.87	P60	NA/NA	73	NA	NA
Ronnel	68/1	1,100	P27	NA/NA	1,800	AN.	NA
Metais		:					
Arsenic (dissolved)	67/34	5 - 39	P39	48/50	0.038	56	0
Arsenic (total)	68/35	6 - 43	P39	48/50	0,038	230	0
Barium (dissolved)	67/64	30 - 420	P07	1,000/2,000	2,600	520	0
				: :			

C3 Key at end of table.

			Table 3-4				
	SUMMARY		GROUNDWATER PROBE SAM DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)	OF GROUNDWATER PROBE SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)	70	:	
Analyte	Number of Samples Analyzed/Detected	Range of Detected	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
Barium (total)	\$9/89	30 - 1,200	P04	1,000/2,000	2,600	2,000	0
Chromium (total)	64/8	20 - 510	P57	11/100	37,000	390	61
Lead (dissolved)	6/1/3	3-5	P23	NA/15	0.0037	27	0
Lead (total)	68/10	2 - 14	P21	NA/15	0.0037	160	0
Manganese (dissolved)	69/19	20 - 6,100	P35	NA/50b	180	1,900	57
Manganese (total)	\$9/89	20 - 6,400	P35	NA/50 <sup>b</sup>	180	1,900	57
Mercury (dissolved)	67/1	8.0	P Slough 1	0.012/2	#	NA	0
Dioxins (pg/L.)							
2,3,7,8-TCDD TEQ	68/50	0,02 - 8.66	P25	06/01	0.43	٧×	0

The RBC used m&p-xylene as the one for p-xylene. This RBC is the more conservative of the two RBCs. The RBC used for arsenic is for the carcinogenic form of arsenic. Note:

9 **6 K**ey at end of table.

a Risk-based sercening concentration values are based on a 1 × 10<sup>-6</sup> residential direct contact risk or HQ = 1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables). B Secondary MCL.

## Key

AAC = Alaska Administrative Code.

DRMO = Defense Reutilization and Marketing Office.

MCL = Maximum contaminant level.

μg/L = Micrograms per liter.

NA = Not applicable.

pg/L = Picograms per liter.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQ = Toxicity equivalency.

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			Table 3-5				
	NOS	IMARY OF SURF, COLLECTE DRMO Y, OPE FORT WA	Y OF SURFACE WATER SAMPLE COLLECTED FROM CHANNEL B DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	SUMMARY OF SURFACE WATER SAMPLE RESULTS COLLECTED FROM CHANNEL B DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA			
Analyte	Number of Samples Analyzed/Detected	Range of Detected	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
Petroleum Hydrocarbons							
Diesel-range organics	4/1	29	£00	NA/NA	AN	NA	NA
Volatile Organic Compounds			:				
Chloroform	4/3	0.5 - 3.2	000	1,240/100	0.15	NA	0
Methylene chloride	4/3	1 - 1	000	NA/NA	4.1	NA	NA A
Metals							
Barium (dissolved)	4/4	71 - 74	100	1,000/2,000	2,600	520	0
Barium (total)	4/4	70 - 74	003	1,000/2,000	2,600	2,000	0
Manganese (dissolved)	4/4	479 - 536	001	NA/50b	180	1,900	4
Manganese (total)	4/4	478 - 532	100	NA/50b	180	1,900	4

a Risk-bused sercening concentration vulues are based on a 1 × 10<sup>-6</sup> residential risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Bused Concentration Tables).
b Secondary MCL.

**6 4 9** 8 Key at end of table.

Key:

AAC = Alaska Administrative Code,
DRMO = Defense Reutilization and Marketing Office.
MCL = Maximum contaminant level.
μg/L = Micrograms per liter.
NA = Not applicable.

Page 1 of 2

0	NA	160,000	SB-3	4.4 - 62	7/6	m&p-Xylenes
NA	NA	22	NA.	NA	7/0	Benzene
						Volatile Organic Compounds
6	NA	50°	1-82	26 - 4,600	7/7	GRO
7	NA	100 <sup>b</sup>	SB-2	260 - 7,700	7/7	DRO
						Petroleum Hydrocarbons
0	NA.	390	AP-6808	0.98 - 3.7	5/4	Silver
0	NA	390	AP-6808	0.22	5/1	Selenium
0	NA	390	AP-6808	93 - 380	5/5	Manganese
0	25	400	AP-6808	2.4 - 7.9	5/5	Lead
0	35	78,000	AP-6808	6.8 - 22	5/5	Chromium
0	1.7	39	AP-6808	0.73 - 2.2	5/5	Cadmium
0	275	5,500	AP-6808	29 - 120	5/5	Barium
5	17	0.37	AP-6808	1.3 - 5.1	5/5	Arsenic
						Metals
na.	NA	1.9	AP-6808	0.0048	5/1	4,4"-Dichlorodiphenyltrichloroethane
						PCBs and Organochlorine Pesticides
Number of Samples Exceeding RBCs	Background Concentration	Risk-Based Screening Concentration <sup>B</sup>	Location of Maximum Concentration	Range of Detected Concentrations	Number of Samples Analyzed/Detected	Analyte
		(S VREA	WPLE RESULT ILL SOURCE ! NIT 2 T, ALASKA	SUMMARY OF SOIL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	SUMMAR BUILDING 11 FORT	
				Table 3-6		

Key at end of table.

0	NA	58	NA	NA	7/0	Trichloroethene
S	NA	10 <sup>d</sup>	SB-3	7.3 - 103	7/6	втех
0	NA	16,000	SB-3	0.34 - 10	7/4	Toluene
0	NA	160,000	SB-3	2.9 - 31	7/6	o-Xylenes
Number of Samples Exceeding RBCs	Background Concentration	Risk-Based Screening Concentration <sup>a</sup>	Location of Maximum Concentration	Range of Detected Concentrations	Number of Samples Analyzed/Detected	Analyte
		TS AREA	MPLE RESULT FLL SOURCE INIT 2 IT, ALASKA	SUMMARY OF SOIL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (mg/kg)	SUMMAH BUILDING 1 FOR:	
			-1	Table 3-6		

Note: Risk-based screening concentration values are based on a 1 × 10<sup>-6</sup> residential direct contact risk or an HQ=1 (EPA Region III, July 11, 1994, Risk Based The RBC used for m&p-xylenes is the RBC for xylenes mixed. No RBC existes for p-xylenes in soil. The RBC used for arsenic is the one for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium.

- ADEC soil cleanup matrix score for Level A DRO is 100 mg/kg Concentration Tables).
- ADEC soil cleanup matrix score for Level A GRO is 50 mg/kg.
- ADEC soil cleanup matrix score for Level A BTEX is 10 mg/kg

Kcy:

- BTEX Benzene, toluene, ethylbenzene, and total xylenes.
- DRO Diesel-range organics.
- GRO Gasoline-range organics.
- mg/kg NA Not applicable. Milligrams per kilogram.
- PCBs RBCs Polychlorinated biphenyls.
- Risk-based concentrations.

				Table 3-7				
		S	UMMARY OF GI BUILDING 1161 C FORT V	OF GROUNDWATER SAMPLE NG 1168 LEACH WELL SOURCE OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	SUMMARY OF GROUNDWATER SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)		-	
	Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
	Petroleum Hydrocarbons							
	Diesel-range organies	15/9	77 - 34,000	1572-9A	NA/NA	NA.	NA	NA
44	Gasoline-range organics	7/02	11 - 18,000	AP-5747	NA/NA	YX	N	X X
	Volatile Organic Compounds		1					
	1,2,4-Trimethylbenzene	20/4	49 - 350	AP-5751	100/NA	£.	NA	Y.
	1,3,5-Trimethylbenzene	20/4	18 - 150	AP-5751	100/NA	2.4	NA	NA
	Acctone	20/1	41	AP-5751	NA/NA	3,700	NA	NA
	Benzene	20/1	5.1	AP-5752	0.2/5	0.36	NA	1
	Cumene	20/4	18 - 59	AP-5751	NA/NA	1,500	NA	Ϋ́Α
	Ethylbenzene	20/4	26 - 310	AP-5751	0.2/700	1,300	NA	0
	m&p-Xylene	20/4	44 - 620	AP-5751	0.2/10,000	520	NA	0
	n-Butylbenzene	20/3	13 ~ 16	AP-5747	NA/NA	NA	NA	¥Z.
	n-Propylbenzene	20/4	21 - 71	AP-5751	NA/NA	NA	NA	N.
	Naphthalene	35/8	5 - 130	AP-5751	0.1/NA	1,500	NA	NA
(	o-Xylene	20/4	3 - 1,000	AP-5751	0,2/10,000	1,400	NA	0
34962	Key at end of table.							

Chromium (total)

Chromium (total)

Chromium (total)

Chromium (total)

Number of		
Alaska Water	MPLE RESULTS DURCE AREA ASKA	
	SUMMARY OF GROUNDWATER SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (\(\mu g/\L))	Table 3-7
	30	

		FORT	FORT WAINWRIGHT, ALASKA (\mu g/L)	, ALASKA			
Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
p-Isopropyltoluene	20/4	10 - 30	AP-5751	NA/NA	NA	NA	AN
sec-Butylbenzene	20/4	4.4 - 11	AP-5751	NA/NA	61	NA	NA
Toluenc	20/1	770	AP-5751	0.2/1,000	750	NA	0
Trichloroethene	20/1	23	AP-5751	5/5	1.6	N'A	-
Trichlorofluoromethane	20/3	5.1 - 26	AP-5781	NA/NA	1,300	NA	NA
Semivolatile Organic Compounds							
2-Methylnaphthalene	15/4	5 - 59	AP-5751	0.1/NA	NA	NA	NA
Naphihalene	35/8	5 - 130	AP-5751	0.1/NA	1,500	NA	NA
Metals							
Arsenic (dissolved)	15/7	1/2 - 27	AP-5751	48/50	0.038	20	0
Arsenic (total)	16/6	1.8 - 25	AP-5751	48/50	0.038	72	0
Barium (dissolved)	15/14	62 - 350	AP-5751	1,000/2,000	2,600	988	0
Barium (total)	16/14	48 - 330	AP-5751	1,000/2,000	2,600	341	0
Cadmium (dissolved)	15/1	4.9	AP-6333	9.3/5	-81	4.8	0
Chromium (IoIal)	16/2	8 - 48	AP-6332	11/100	37,000	N <sub>A</sub>	0

			Table 3-7				
	<b>S</b>	SUMMARY OF G BUILDING 116 C	OF GROUNDWATER SAMPLE NG 1168 LEACH WELL SOURCE OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	ARY OF GROUNDWATER SAMPLE RESULTS DING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (\mus_{\mu}/L)	50		
Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration	Background	Number of Samples Exceeding MCLs
Lead (dissolved)	15/2	1.6 - 5.4	AP-5751	NA/15	0.0037	6'6	0
Lead (total)	16/14	1.1 - 21	1575-4A	NA/15	0.0037	99	1
Manganese (dissolved)	15/13	82 - 4,400	AP-5751	NA/50 <sup>b</sup>	180	YN.	11
Manganese (total)	16/14	11 - 4,400	AP-5751	NA/50 <sup>b</sup>	180	NA	11
Selenium (dissolved)	15/2	2.4 - 3.1	AP-5751	05/01	180	NA	0
Selenium (total)	6/91	1.7 - 2.5	AP-5751	10/20	180	NA	0
Silver (total)	1/91	22	AP-5781	NA/100 <sup>h</sup>	180	٧N	0

The RBC used for m&p-xylene is the one for p-xylene. This RBC is the more conservative of the two. The RBC used for arsenic is the one for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium. Nole:

Key:

AAC = Alaska Administrative Code.

MCLs = Maximum contaminant levels.

μg/L = Micrograms per liter.

NA = Not applicable.

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a Risk-based serecning concentration values based on a 1 x 10<sup>-6</sup> residential risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables). b Secondary MCL.

			Table 3-8				
	SC B	SUMMARY OF MICROWELL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)	RY OF MICROWELL SAMPLE ING 1168 LEACH WELL SOURCE OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	MPLE RESULT SOURCE AREA 2 ALASKA	SS		
Analytes	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
Metals							
Aluminum	27/27	135 - 39,300	PS 10	NA/200	37,000	AN	24
Arsenic	27/15	6 - 44	PS12	48/50	0.038	76	0
Barium	27/27	104 - 1,030	PS10	1,000/2,000	2,600	886	0
Chromium	27/16	06 - 9	PS26	11/100	37,000	125	0
Copper	27/17	12 - 22	PS26	12/1,000	1,400	NA	0
Iron	27/27	1,340 - 188,000	PS26	1,000/300	NA	NA	27
Lead	27/17	2 - 49	PS10	3.2/15	0.0037	99	10
Manganese	12112	25 ~ 2,930	PS21	NA/50b	180	¥Z.	26
Vanadium	27/14	911 - 01	PS10	NA/NA	260	NA	NA
Zinc	27/19	16 - 242	PS10	47/5,000	11,000	NA	0
Petroleum Hydrocarbons							!
GRO	27/10	57 - 63,100	PS01	NA/NA	AN	٧N	ΑN
DRO	27/27	55 - 28,400	PS01	NA/NA	AN.	۸N	Ϋ́

Key at end of table.

Key at end of table.

# SUMMARY OF MICROWELL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (ug/L)

	i	(1/B1)				
Analytes A	Number of Range of Samples Detected Concentrations	Location of Maximum	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Background Concentration	·	Number of Samples Exceeding MCLs
olatile Organic Compounds		:				

Volatile Organic Compounds							
1,2,4-Trimethylbenzene	27/6	2 - 800	PS01	100/NA	3	NA	AN
1,3,5-Trimethylbenzene	27/5	3 - 370	PS01	100/NA	2.4	N.A	NA
1,3-Dichlorobenzene	27/1	3	PS21	763/NA	540	NA	N A
2-Butanone (MEK)	27/2	2.3	PS10	NA/NA	22,000	N <sub>A</sub>	NA
4-Chlorotoluene	27/1	5	PS21	NA/NA	NA A	N.	NA
Acetone	27/9	2-9	PS09	NA/NA	3,700	AN	NA
Benzene	27/12	0.6 - 250	PS01	0.2/5.0	0.36	NA	00
Вготовентене	27/1	9	PS21	NA/NA	NA	N'A	AN
Carbon disulfide	27/2	0.5 - 1	PS05	NA/NA	21	NA	NA
Chloroform	27/1	2.4	PS11	1,240/100	0.15	NA	0
Dichlorodifluoromethane	2717	0.7 - 1	P\$15	NA/NA	390	NA	NA
Ethylbenzene	27/8	3.6 - 650	PS01	0.2/700	1,300	NA	0
Cumene (Isopropylbenzene)	27/5	2 - 10	PS01	NA/NA	1,500	NA	N.A

Page 2 of 4

			Table 3-8				
	S B	MMARY OF M UILDING 1168 I OP FORT WA	RY OF MICROWELL SAMPLE ING 1168 LEACH WELL SOURCE OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	SUMMARY OF MICROWELL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)	S	ì	
Analytes	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 79/MCL (18 AAC 80)	Risk-Based Screening Concentration <sup>a</sup>	Background Concentration	Number of Samples Exceeding MCLs
Naphthalene	27/3	6 - 250	10Sd	0.1/NA	1,500	NA	Ϋ́Α
Toluene	27/8	0.6 - 2,700	PS01	0.2/1,000	750	NA	2
Total xylenes	01/12	1,4 - 4,300	PS01	NA/10,000	12,000	٧×	0
Trichloroethene	27/6	1.0 - 47	PS23	5/5	9.1	AN	4
Trichlurofluoromethune	7/17	0.5 - 17	PS11	NA/NA	000,1	NA	NA
cis-1,2-Dichloroethene	27/4	0.7 - 9.5	PS21	11,600/70	19	AN	0
n-Propylbenzene	2112	4-6	PS21	NA/NA	NA	NA	NA
Semivolatile Organic Compounds	ounds		:				
2-Methylnaphthalene	27/3	19 - 29	PS23	0.1/NA	NA	AN	Y.
3- and 4-Methylphenol	27/3	18 - 64	PS01	NA/NA	180	NA	Ϋ́
Naphthalene	27/4	10 - 87	PS23	0.1/NA	1,500	NA	Ϋ́

Key at end of table,

## Table 3-8 (Cont.)

Note: The RBC used for arsenic is for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium. The RBC used for xylenes is the one for xylenes mixed. The RBC used for 3- and 4-methylphenol is the one for 4-methylphenol, the more conservative of the two.

Page 4 of 4

Risk-based screening concentration values based on a 1 x 10<sup>-6</sup> residential risk or HQ=1 (EPA, Region III, July 11, 1994, Risk-Based Concentration Tables). Secondary MCL.

## Kcy:

AAC DRO Alaska Administrative Code.

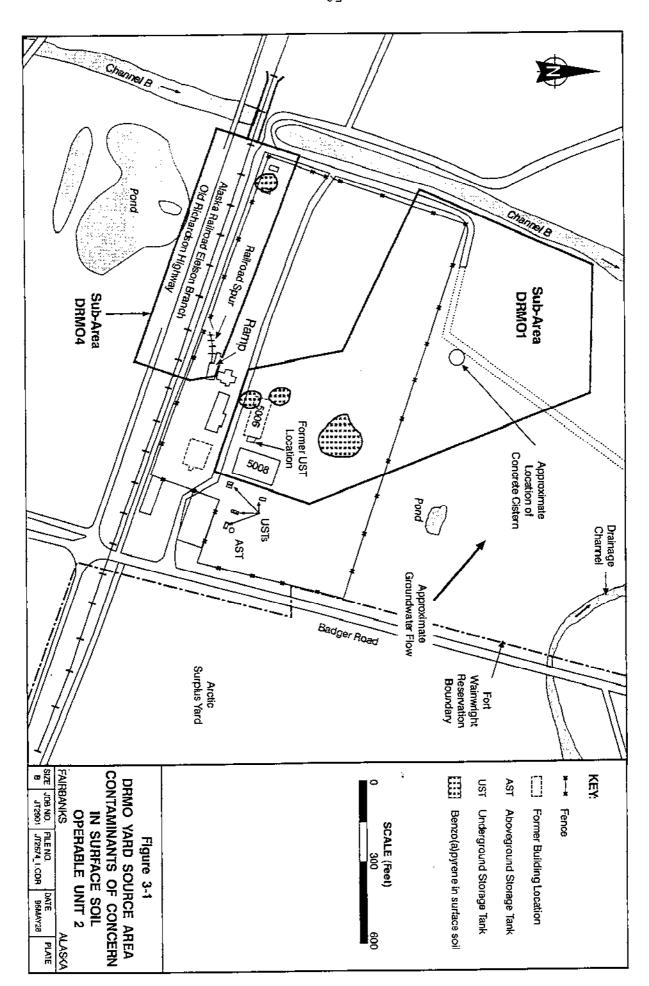
GRO = Diesel-range organics.

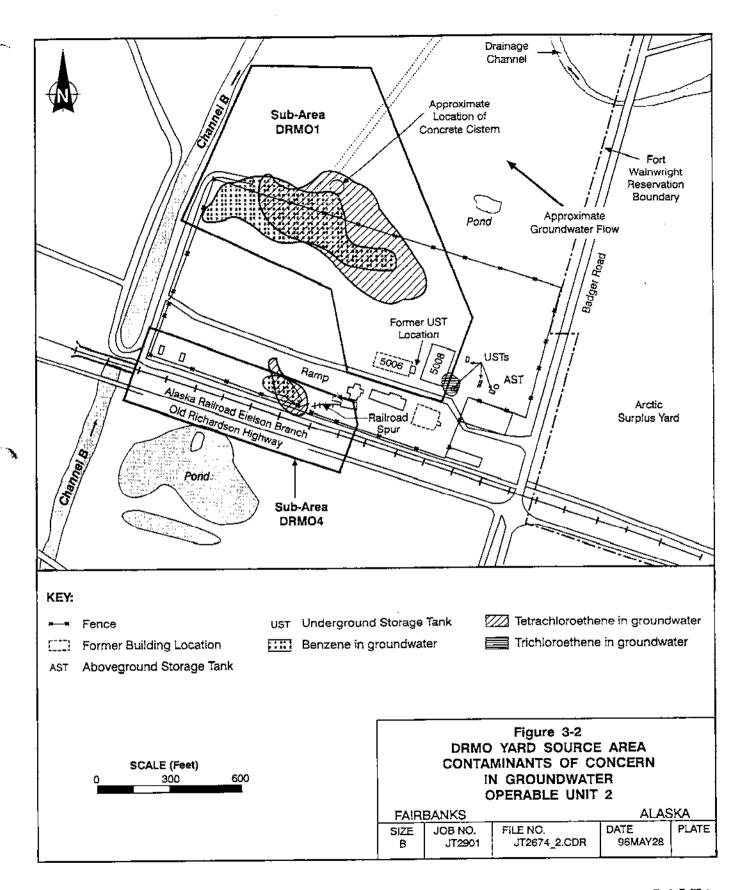
Gasoline-range organics.Maximum contaminant levels.

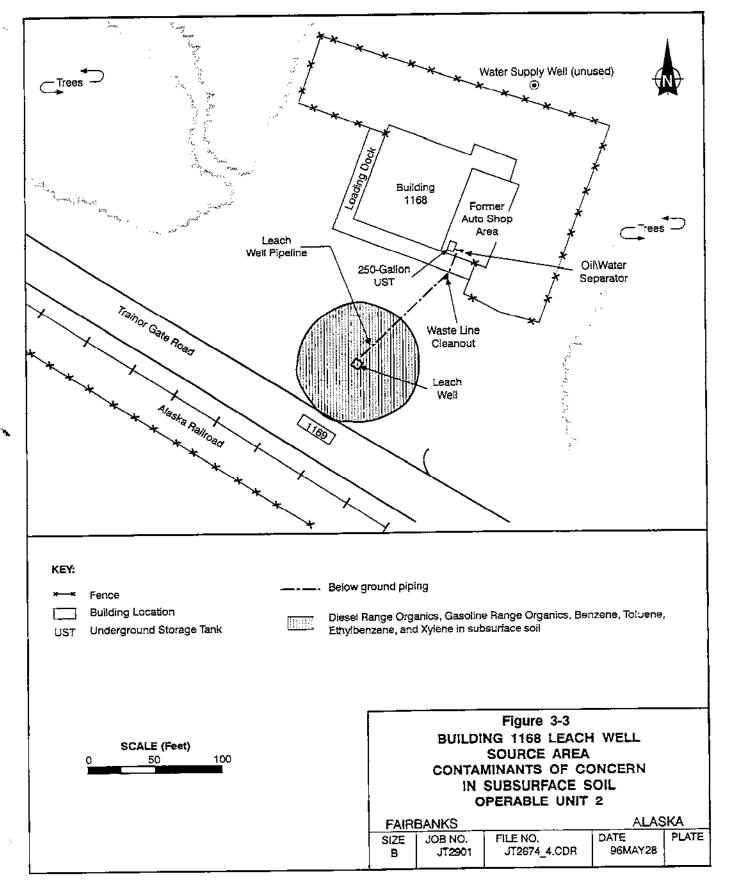
MCLs MEK NA NA = Methyl ethyl ketone.

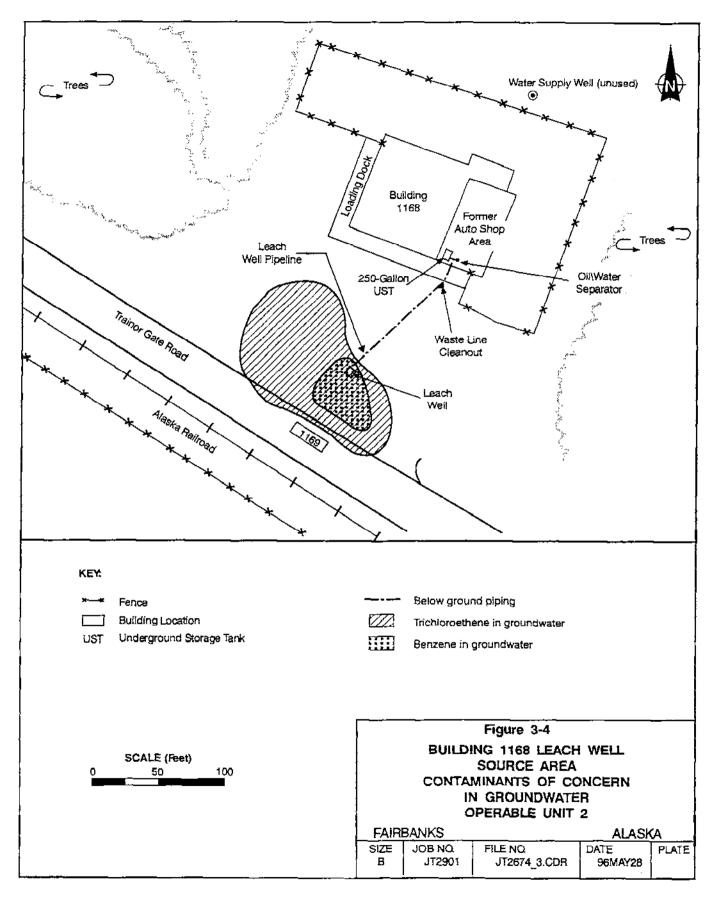
Not applicable. = Micrograms per liter.

Volatile organic compounds.









### 4.0 SUMMARY OF SITE RISKS

The Baseline Human Health and Ecological Risk Assessment is one mechanism for determining the need for taking action at the source areas and indicates exposure pathways that need to be addressed by remedial action. Risk Assessments are performed using information regarding contaminants and assumptions regarding the extent to which people may be exposed to them. This summary of the Baseline Human Health Risk Assessment for the source areas is divided into the five following sections:

- Identification of chemicals of potential concern;
- Exposure assessment;
- Toxicity assessment;
- Risk characterization, which is an integration and summary of the information gathered and analyzed in the preceding sections; and
- Analysis of the uncertainties involved in developing a Risk Assessment.

The summary concludes with the results of the Ecological Risk Assessment conducted for the DRMO Yard and Building 1168 Leach Well.

Human Health and Ecological Risk Assessments were conducted for OU-2 to determine potential risks in the absence of remedial action. CERCLA guidance allows the Baseline Human Health Risk Assessment to reflect the expected future use of a site. Scenarios involving future residential use of the DRMO Yard and Building 1168 Leach Well were completed; however, these scenarios were determined to not be appropriate for soils because industrial use is the reasonably anticipated future use, based on the Post Master Plan and historical use of both areas.

It was determined, because of site hydrological conditions, that future residential risks identified in the Baseline Human Health Risk Assessment apply to groundwater because an exposure pathway for domestic water users exists. The NCP requires that groundwater be returned to its beneficial uses whenever practicable. At these source areas, the beneficial use is domestic water supply.

### 4.1 IDENTIFICATION OF CONTAMINANTS OF CONCERN

Selection of contaminants of concern, which are chemicals that potentially contribute to human health risks at the source areas, was a three-step process. First, the maximum concentrations of contaminants detected in on-site soil and water during the RI field investigation were compared to health-based screening levels for soil and drinking water developed by EPA, Region 3, (April 20, 1994) and Region 10, Supplemental Risk Assessment Guidance. These standards reflect residential exposure assumptions of  $1 \times 10^6$  and  $1 \times 10^7$  risks associated with groundwater and soil, respectively, or a hazard quotient of 0.1 for all media. Secondly, inorganic chemicals were compared to naturally occurring background levels. If concentrations were found below established background levels, they were

eliminated from further consideration. Thirdly, chemicals detected at a frequency of less than 1% were eliminated from consideration unless their concentration was significantly higher than EPA's health-based screening levels. While soil contamination did not pose a direct threat to human health, it does act as an ongoing source of contamination to groundwater.

Table 4-1 presents the contaminants of concern identified in each environmental medium evaluated for each source area.

### 4.2 EXPOSURE ASSESSMENT

The exposure assessment estimates the type and magnitude of exposures to the contaminants of concern at the source areas. The exposure assessment considers the current and potential future uses of the source area, characterizes the potentially exposed populations, identifies the important exposure pathways, and quantifies the intake of each contaminant of concern from each medium for each population at risk. The Human Health Risk Assessment for OU-2 was completed for the DRMO Yard and Building 1168 Leach Well.

### 4.2.1 Identification of Site Uses, Exposed Populations, and Exposure Pathways

### 4.2.1.1 Source Area Land Use Scenarios

The exposure assessment for the DRMO Yard and Building 1168 Leach Well source areas considers land use scenarios to evaluate exposed populations. The Baseline Human Health Risk Assessment evaluated future residential land use of the site, which assumes that individuals would spend 30 years of their time at the source. Even though this scenario is unlikely, it provides a conservative baseline to avoid underestimation of risks. The industrial scenario assumes that the site would continue to be used for industrial purposes and that workers would spend 25 years of continuous employment at the site. Tables 4-2 and 4-3 identify the potential exposure routes evaluated for the Human Health Risk Assessment. It was determined that the industrial scenario would be appropriate for these source areas for the land use purposes. For groundwater, the future residential use scenario is used to represent the impacted drinking water supply aquifer and potential consumption.

### 4.2.1.2 Exposure Pathways and Assumptions

An exposure pathway is the mechanism by which chemicals migrate from their source or point of release to the population at risk. A complete exposure pathway comprises four elements: a source of a chemical release, transport of contaminants through environmental media, a point of potential human contact with a contaminated medium, and entry into the body or exposure route.

The exposure pathways considered in the Baseline Human Health Risk Assessment varied depending on the land use and population potentially exposed. The exposure assessment identified potential pathways for contaminants of concern to reach the exposed population for each source area. A "complete" exposure pathway must exist for a contaminant to pose a potential human health risk (i.e., the potential receptor to be exposed to a contaminant must exist).

### 4.2.1.3 Calculation of Exposure

EPA's Superfund guidance requires that the reasonable maximum exposure be used to calculate potential health impacts at Superfund sites. The reasonable maximum exposure is the highest exposure that is reasonably expected to occur at the source areas and is calculated using conservative assumptions in order to represent exposures that are reasonable and protective. The Baseline Human Health Risk Assessment reasonable maximum and average exposures were estimated for the residential and industrial land use scenarios. Average exposures were calculated to represent exposures of a more typical person.

To estimate exposure, data regarding the concentrations of contaminants of concern in the media of concern at the source area (the exposure point concentrations) are combined with information about the projected behaviors and characteristics of the people who potentially may be exposed to these media (exposure parameters). These elements are described below:

a) Exposure Point Concentrations. Surface soil (0 feet to 2 feet BGS), subsurface soil (2 feet to 12 feet BGS), and groundwater sample results for the DRMO Yard were averaged to calculate exposure point concentrations for the reasonable maximum exposure and average exposure calculations. At the DRMO Yard, two wells were selected from three areas (Area 1, Area 2, and Area 3) within the source area to be evaluated to ensure that the risks associated with "hot spots" were considered. Data from these areas were averaged to provide the reasonable maximum exposure. Because contaminant release occurred through a subsurface leach well at Building 1168, only subsurface soil contamination exists. Therefore, surface soil, sediment, and air exposure pathways risks were not calculated. Groundwater exposure point concentrations were calculated. Tables 4-4 through 4-7 contain exposure point concentrations for carcinogenic and noncarcinogenic contaminants of concern at both source areas. The exposure point concentrations were calculated on the arithmetic mean as the data (average) and as the 95% upper confidence level of the arithmetic mean of the data (reasonable maximum exposure).

Note: A value of one-half the detection limit was used for nondetect concentrations for soil and groundwater to calculate the exposure point concentration. Because of the large number of nondetects (between 75% and 95% of the samples for many chemicals), the calculated 95% upper confidence limits (UCLs) are generally representative of the mean concentration. In addition, the maximum detected concentration for many chemicals was often only one to two orders of magnitude greater than the mean concentration. This finding indicates that, in general, there was not a wide variability in the distribution of chemicals in the different media. Because of these reasons, the 95% UCLs for many of the chemicals detected in soil and groundwater at OU-2 are not substantially different from the mean concentration.

b) Exposure Parameters. The parameters used to calculate the reasonable maximum exposure include body weight, age, contact rate, frequency of exposure, and exposure duration. Exposure parameters were obtained from EPA, Region 10, Risk Assessment guidance (Region 10, Supplemental Risk Assessment Guidance for

Superfund [EPA 1991]). The default exposure factors were modified to reflect site-specific climatological and other factors at Fort Wainwright. Site-specific exposure assumptions were made for soil contact, including ingestion, dermal contact, and inhaling dust, based on snow cover half the year.

For all of the media, exposures were estimated assuming long-term exposures to source area contaminants.

### 4.3 TOXICITY ASSESSMENT

The baseline human health evaluation provides toxicity information for the chemicals of concern. Generally, cancer risks are calculated using toxicity factors known as *slope factors*, while noncancer risks rely on reference doses.

EPA developed slope factors for estimating lifetime cancer risks associated with exposure to potential carcinogens. Slope factors are expressed in units of (milligrams per kilogram [mg/kg]-day<sup>-1</sup>) and are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day<sup>-1</sup>, to provide an upperbound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term *upperbound* reflects the conservative estimate of the risks calculated from the slope factor. Use of this approach makes it highly unlikely that the actual cancer risk would be underestimated. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which mathematical extrapolations from high to low dose and from animal to human dose have been applied.

Reference doses were developed to indicate the potential for adverse health effects from ingestion of potential contaminants of concern that exhibit such noncancer effects as damage to organ systems (e.g., the nervous system and blood forming system). Reference doses also are expressed in units of mg/kg-day and are estimates within an order of magnitude of lifetime daily exposure levels for people, including sensitive individuals, who are likely to be without risk of adverse effect. Estimates of intakes of contaminants of concern from environmental media (e.g., the amount of a contaminant of concern ingested from contaminated drinking water) can be compared to the reference dose. Reference doses are derived from human epidemiological studies and from animal studies to which uncertainty factors have been applied.

The toxicity factors were drawn from the Integrated Risk Information System or, if no Integrated Risk Information System values were available, from the Health Effect Assessment Summary Tables. For chemicals that do not have toxicity values available, other criteria, such as state and federal MCLs, were used to assess potential hazards or to determine action levels.

### 4.4 RISK CHARACTERIZATION

The purpose of the risk characterization is to integrate the results of the exposure and toxicity assessments to estimate risk to humans from exposure to site contaminants. Risks were calculated for carcinogenic (cancer-causing) and noncarcinogenic (toxic) effects based on the reasonable maximum exposure (see Section 4.2). To estimate cancer risk, the slope factor is multiplied by the exposure expected for that chemical to provide an upperbound estimate of

the excess lifetime cancer risk. This estimate is the incremental probability of an individual developing cancer over a lifetime as a result of exposure to cancer-causing chemicals at a source area. EPA considers excess lifetime cancer risks between 1 in 1 million  $(1 \times 10^6)$  and 1 in 10,000  $(1 \times 10^4)$  to be within the generally acceptable range; risks greater than 1 in 10,000 usually suggest the need to take action at a site.

In defining effects from exposure to noncancer-causing contaminants, EPA considers acceptable exposure levels as those that do not adversely affect humans over their expected lifetime, with a built-in margin of safety. Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as a hazard quotient, which is the ratio of the estimated exposure from a site contaminant to that contaminant's reference dose. If the hazard quotient is less than 1, then adverse noncancer health effects are unlikely to occur. Hazard quotients for individual contaminants of concern are summed to yield a hazard index for the sub-area. The potential excess lifetime cancer risks and hazard indices described in this summary were calculated using reasonable maximum exposure assumptions.

Under current land use conditions, the estimates of carcinogenic and noncarcinogenic effects for the DRMO Yard fell within or below the EPA acceptable risk range for CERCLA sites. A current land use scenario was not evaluated for the Building 1168 Leach Well because there were no complete exposure pathways.

The future land use for both source areas is considered to be industrial. However, a residential scenario for groundwater is considered appropriate and representative of risk to current downgradient users, given DRMO Yard and Building 1168 Leach Well site hydrological conditions and the presence of the potable water supply/fire suppression well within the DRMO Yard. When considering groundwater as a source of domestic water, manganese was detected in groundwater at concentrations above EPA's acceptable risk range at the Building 1168 Leach Well. However, the manganese concentrations detected at the Building 1168 Leach Well are considered reflective of background concentrations in this mineral-rich area and are consistent with concentrations found in other source areas throughout Fort Wainwright.

Excess lifetime incremental cancer risks and hazard indices for both source areas are summarized in Tables 4-8 and 4-9. The incremental risks and hazard indices are calculated after subtracting the background concentrations of inorganics.

While soil contaminant concentrations do not pose a hazard for direct human contact, the levels are high enough to pose an ongoing threat to groundwater. Existing groundwater contaminant concentrations exceed state and federal MCLs.

#### 4.4.1 Defense Reutilization and Marketing Office Yard

Excess lifetime incremental cancer risks for soil are below the 1 in 10,000 to 1 in 1 million risk range at the DRMO Yard, with the exception of benzo(a)pyrene, which is within the EPA acceptable risk range. Incremental hazard indices for soil at the DRMO Yard are less than 1. Arsenic was the main contaminant responsible for exceedance of an excess lifetime cancer risk of  $1 \times 10^6$  for site workers and future residents. The average background concentration of arsenic in soil is higher than the estimated surface soil reasonable maximum exposure,

indicating that the arsenic risk for soil is attributable to background concentrations.

Excess incremental lifetime cancer risks for groundwater are below or within EPA's acceptable risk range of 1 in 10,000 to 1 in 1 million at the DRMO Yard. However, groundwater near the DRMO Yard groundwater supply/fire suppression well is contaminated with PCE at concentrations approaching unacceptable excess lifetime cancer risks  $(8.7 \times 10^{-5})$ . VOCs are the contaminants responsible for exceedance of a  $1 \times 10^{-6}$  risk for future residential use of groundwater. The incremental hazard index for groundwater at the DRMO Yard is less than 1.

State and federal MCLs for PCE and TCE are exceeded consistently in sub-area DRMO1 groundwater. State and federal MCLs for benzene and PCE are exceeded in sub-area DRMO4 groundwater.

## 4.4.2 Building 1168 Leach Well

Excess lifetime incremental cancer risks for groundwater are below or within the 1 in 10,000 to 1 in 1 million risk range at the Building 1168 Leach Well. Arsenic was the main contaminant responsible for exceedance of an excess lifetime cancer risk of  $1 \times 10^6$ .

The average incremental hazard index for future groundwater use is less than 1; however, the reasonable maximum exposure hazard index is 7.8. Manganese is the main contaminant contributing to the elevated hazard index. However, manganese was not used and was not a by-product of any process conducted at the Building 1168 Leach Well.

#### 4.5 MAJOR UNCERTAINTIES

Uncertainty is associated with every step of the Risk Assessment process. The main uncertainty associated with the OU-2 Human Health Risk Assessment process that could result in overly conservative risk evaluation is summarized below:

 EPA recommends use of a default value of 30 years for residential exposure; however, most military assignments are for a much shorter period of time, often only one to three years.

Uncertainties that may underestimate site-related risk and exposures include the following:

- As a result of a data review reported by one laboratory, many pesticide and PCB data points were rejected for data quality reasons. However, these rejections do not appear to significantly affect the Risk Assessment; and
- Some of the analyses performed (diesel-range organics, gasoline-range organics, and total petroleum hydrocarbons) do not provide chemicalspecific data; therefore, associated risks could not be quantified.
   However, surrogate chemicals were evaluated.

Uncertainties with unknown effects on the outcome of the Human Health Risk Assessment include the following:

- Multiple laboratories were used to analyze OU-2 samples, which can lead to inconsistencies in approach and can introduce errors or laboratory artifacts not easily identified;
- Surrogate toxicity factors were used to evaluate the potential risk
  associated with structurally similar chemicals that lack EPA-verified
  toxicity factors (e.g., naphthalene was used as a surrogate for
  methylnaphthalene). However, it was impossible to identify
  appropriate surrogates for all chemicals lacking verified toxicity
  factors. Therefore, certain chemicals were not evaluated in the Risk
  Assessment.
- The quality assurance/quality control process identified some concerns with regard to analytical results for organochlorine and organophosphorus pesticide samples. After data concerns were raised for OU-2 pesticide analytical results, separate independent reviews of the data were conducted by the Army; United States Army Engineer District, Alaska; and EPA. While the conclusions of both reviews indicate that the data are usable and consistent with other quality assurance laboratory analyses, uncertainty remains. However, to provide perspective, the action/no action decisions in this Record of Decision would not change even if the results were an order of magnitude different than those reported. The variability of results Is not expected to exceed this estimate, even under worst-case conditions.

Because numerous conservative assumptions were used in the selection of contaminants of concern and the exposure and toxicity assessments, the risk characterization results likely overestimate risks associated with contaminants of concern at OU-2.

#### 4.6 ECOLOGICAL RISKS

An Ecological Risk Assessment addresses the impacts and potential risks posed by contaminants to natural habitats, including plants and animals, in the absence of remedial action. The three main phases of the Ecological Risk Assessment are problem formulation, analysis, and risk characterization.

The following sections present a brief discussion of the Ecological Risk Assessment steps.

#### 4.6.1 Problem Formulation

To narrow the scope and to focus the Ecological Risk Assessment on the most important aspects of OU-2, a number of steps was performed. An ecological survey was conducted at the DRMO Yard and Building 1168 Leach Well. In addition, previous ecological investigations, including wildlife inventories, were reviewed. A description of the regional and local ecology was completed, and threatened, endangered, sensitive, or rare species were

#### identified.

Chemicals of potential ecological concern were identified by a review of the OU-2 analytical database with regard to data quality, spatial representation and adequacy for an Ecological Risk Assessment, comparison to background concentrations, and comparison to ecological risk-based criteria for sediment and surface water. Next, pathways of contaminant migration exposure were identified by an evaluation of sources of contaminants and the mechanisms by which they may be transported to media of ecological concern, plants, and animals.

Potential ecological effects are summarized by a review of the toxicological literature. These summaries present a review of the known toxicological effects of the chemicals of potential ecological concern on wildlife species.

Two types of ecological end points are considered in the Ecological Risk Assessment: assessment and measurement end points:

- Assessment end points are qualitative or quantitative expressions of the environmental values to be protected at OU-2 and are selected by consideration of species that play important roles in community structure or function; species of societal significance or concern; species of concern to federal and state agencies; diet, habitat preference, and behaviors that predispose the species to chemicals of potential ecological concern exposure; amenability of the selected species to measurement or prediction of effects; and species that may be particularly sensitive to the chemicals of potential ecological concern identified at OU-2; and
- Measurement end points include the species and communities used to quantify the potential ecological impacts posed by OU-2 chemicals of potential ecological concern. Representative measurement species are selected based on the relative abundance of each species and establishment of functional groups based on trophic level and preferred habitat. Representative indicator species then are selected based on the potential for exposure and the availability of toxicological data. The following measurement species and communities were selected for evaluation at OU-2: meadow voles, muskrats, and benthic invertebrates.

A conceptual ecological exposure model is formulated and defines the receptors and pathways to be evaluated in the Ecological Risk Assessment. The refined conceptual ecological exposure models for OU-2 are potential ecological risks that may result from exposure of terrestrial wildlife and vegetation to chemicals of potential ecological concern found in the surface soils at the DRMO Yard and from exposure of benthic invertebrates to sediments and surface water associated with the DRMO Yard. No complete ecological exposure pathways associated with the Building 1168 Leach Well were identified; therefore, the source area was not evaluated further.

#### 4.6.2 Analysis

The analysis phase of the Ecological Risk Assessment evaluates receptor exposure to chemicals of potential ecological concern and the potential adverse effects of that exposure. Analysis of exposure and effects is based on the ecological end points and the refined conceptual ecological exposure site model derived during the problem formulation phase. Analysis comprises two main components:

- Exposure assessment, in which exposure point concentrations and chemical of potential ecological concern intakes for the measurement species are estimated; and
- Ecological effects assessment, in which toxicity benchmark values are
  derived from the literature and toxicological databases, and uncertainty
  factors are selected and applied to the toxicity benchmark values to
  yield toxicity reference values. The uncertainty factors are used to
  compensate for applying data derived from laboratory or domestic
  animal studies to free-ranging wildlife (for which little empirical data
  are available).

#### 4.6.3 Risk Characterization

Risk characterization involves two major components: risk estimation and risk description.

#### 4.6.3.1 Risk Estimation

Risk estimation involves calculating hazard quotients to assess potential ecological risks to measurement species and communities. This method involves comparing calculated exposure doses or media concentrations with toxicity reference values and/or experimentally derived risk-based concentrations. Ecological effects are quantified by calculating the ratio between a chemical of potential ecological concern's estimated intake or concentration and its corresponding toxicity reference value (i.e., the intake level or concentration at which no adverse ecological effects are expected to occur). If this ratio (i.e., the hazard quotient) exceeds 1, then adverse ecological effects may be expected for the chemical of potential ecological concern. The hazard quotients described in this summary were calculated using conservative reasonable maximum exposure assumptions.

The hazard quotients for each exposure pathway (e.g., soil ingestion and surface water ingestion) may be summed for each chemical of potential ecological concern to establish chemical-specific hazard indices for each measurement species. The hazard indices provide a species- and chemical-specific characterization of the potential ecological risks across all of the assessed exposure pathways. Finally, the hazard indices can be added across contaminants that have similar effects.

#### 4.6.3.2 Risk Description

Risk description involves summarizing the ecological significance of the potential risks and presenting the uncertainties associated with the Ecological Risk Assessment.

The results of the Ecological Risk Assessment for OU-2 indicate a potential for adverse effects to small terrestrial mammals (e.g., voles) at the DRMO Yard, reflecting ecologically significant concentrations of manganese and lead. These risks are associated with ingestion of soil and vegetation. These contaminants do not appear to be associated with historical source area activities and are consistent with regional background concentrations. Additionally, the DRMO Yard is an industrial area with a significant amount of heavy equipment and human activity. The habitat area in these locations has been altered significantly from the surrounding land. Specific species surveys and traps were not used. The actual number of animals that could be affected by these chemicals could be very low.

At the DRMO Yard drainage ditches, muskrats may be impacted by lead, manganese, arsenic, dioxin, and PCBs present in the sediments; however, the east drainage ditch containing the PCBs and dioxins was excavated in 1995. For the purposes of the Ecological Risk Assessment, it was assumed that the muskrat would remain year-round in the surface water bodies at the DRMO Yard. This is a conservative assumption because muskrats are known to migrate to larger water bodies during winter, when smaller water bodies freeze. Therefore, the risk is overestimated. In addition, impacts to the muskrat population are not expected because the affected areas are limited in size.

Sediment quality criteria are a measure of the potential adverse effects to benthic invertebrates. Organic chemicals of potential ecological concern, lead, and cadmium exceed the sediment quality criteria in the east ditch. However, the east ditch is dry throughout most of the year and therefore does not support aquatic life. In addition, this ditch was excavated in 1995. Although the sediment quality criteria were exceeded for arsenic, manganese, and lead in Channel B and the north channel at the DRMO Yard, the origin of these inorganic chemicals is assumed to be attributable mainly to a combination of naturally occurring concentrations, contributions from other anthropogenic sources, and diffuse nonpoint source input from the DRMO Yard source area.

Overall, there do not appear to be unacceptable potential ecological risks associated with the DRMO Yard source area.

The Ecological Risk Assessment is subject to uncertainties because virtually every step in the Risk Assessment process involves assumptions using professional judgment. Principal uncertainties associated with the OU-2 Ecological Risk Assessment include the following:

- Site and media with incomplete exposure pathways were eliminated from evaluation;
- For terrestrial species, the risks were estimated using average site chemical concentrations in soil between 0 feet and 2 feet BGS and modeled chemical concentrations in plants for the meadow vole;
- For aquatic species, risks were estimated by calculating hazard indices
  for muskrats potentially exposed to chemicals of potential ecological
  concern in sediments and plants, and by evaluating the potential
  adverse effects to benthic invertebrates by comparing sediment
  chemicals of potential ecological concern to sediment quality criteria;

- Sampling was biased toward areas of "expected" soil contamination.
   This is likely to result in an overestimation of potential risks to the OU-2 ecological receptors;
- Conservative assumptions were used in estimating exposures and in developing the contaminant screening criteria (such as using the lowest no observed adverse effect level value from the literature), which tend to overestimate risks;
- Indicator species were selected on the basis of likelihood of exposure to contaminants. Exposure of other terrestrial and aquatic receptors is not expected to exceed these risks. Conservative assumptions were used in the selection of the indicator species to minimize the potential for underestimating the exposure to other unevaluated receptors;
- Exposure parameters for all measurement species were selected based on professional judgment. Assumptions included the following: that chemicals do not degrade, terrestrial receptors are exposed chronically to the mean concentration of all chemicals of potential ecological concern in soil and sediment, receptors spend their lifetime within the contaminated portion of the site, contaminants are absorbed completely via all evaluated exposure routes, chemicals do not combine to form new chemicals, and plant uptake modeling accurately describes chemical uptake in plants. Without extensive site-specific field data, it is unclear whether potential risks are underestimated or overestimated using the selected exposure parameters;
- Assumptions used in the effects assessment include the following: use of animal data can be extrapolated across species, laboratory species have sensitivity to chemicals of potential ecological concern similar to species in the natural environment, data for reproductive and development end points can predict impacts to populations, oral exposure toxicity values can be used to evaluate dermal exposure, indicator species are as sensitive to the toxic effects of chemicals of potential ecological concern as the other species on site, and the toxicity benchmarks adequately address the potential toxicity of chemicals of ecological concern to relevant species. It is unclear whether these assumptions overestimate or underestimate potential risks; and
- Chemicals with different target organs and end points add linearly to
  potential risks. This assumption probably results in an overestimation
  of risk.

The approach described in this Ecological Risk Assessment uses realistic assumptions wherever possible; reasonable and conservative assumptions were used when empirical data were unavailable. Consequently, potential ecological risks to OU-2 species are more likely to be overestimated rather than underestimated.

Table 4-1

# CONTAMINANTS OF CONCERN IN SOIL AND GROUNDWATER FROM THE HUMAN HEALTH RISK ASSESSMENT OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

		<u> </u>	
	DRMO	Yard	Building 1168 Leach Well
Chemical	Groundwater	Soil	Groundwater
Arocior 1260		X	
Arsenic		x	Х
Barium	x		х
Benzene	х		Х
Benzo(a)anthracene		x	
Benzo(a)pyrene		x	
Benzo(b)fluoranthene		X	
n-Butylbenzene	x		Х
sec-Butylbenzene	x		X
Cadmium		X	
Chloroform	x		
Chromium	x	<u></u>	
4,4'-DDT		x	
1,2-Dichlorobenzene	x		
1,1-Dichlorobenzene	х		
1,2-Dichloroethane	x		
1,2(cis)-Dichloroethene	<u>x</u>		
Dieldrin		x	
Diesel-range organics	x	x	X
Disulfoton	х		
Ethylbenzene			x
Gasoline-range organics	х	X	X
Indeno(1,2,3-cd)pyrene		X	
Lindane		x	
Manganese	х	х	x

# CONTAMINANTS OF CONCERN IN SOIL AND GROUNDWATER FROM THE HUMAN HEALTH RISK ASSESSMENT OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

	Source Area					
	DRMO 1	Yard	Building 1168 Leach We			
Chemical	Groundwater	Soil	Groundwater			
Mercury		х				
Methylene chloride	Х					
2-Methylnaphthalene	X					
2,3,7,8-TCDD (as TEQs)	х	X				
Tetrachloroethene	х					
Toluene			x			
Trichloroethene	х		x			
o-Xylene	х		x			

#### Key:

DDT = Dichlorodiphenyldichloroethane.

DRMO = Defense Reutilization and Marketing Office.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQs = Toxicity equivalencies.

X = Indicates that the chemical was selected as a chemical of concern for the specific site and media shown.

## POTENTIAL EXPOSURE ROUTES DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

	Potentially Exposed Populations				
Exposure Medium and Route	Current Worker	Future Worker	Future Resident	Future Construction Worker	Future Site Visitor
Groundwater					
Ingestion	x	X	х		
Dermal contact	X	х	x	<u> </u>	-
Air					
Inhalation of VOCs			X		_
Inhalation of particulates	x	х	<u> </u>		-
Soil		·			
Ingestion	х	х			_
Dermal contact	х	х		_	

#### Key:

Exposure of this population through this route is not likely to occur.

DRMO = Defense Reutilization and Marketing Office.

VOCs = Volatile organic compounds.

X = Exposure of this population through this route is probable.

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## POTENTIAL EXPOSURE ROUTES BUILDING 1168 LEACH WELL SOURCE AREA **OPERABLE UNIT 2** FORT WAINWRIGHT, ALASKA

		Potentially Exp	osed Populations	
Exposure Medium and Route	Future Worker	Future Resident	Future Construction Worker	Future Site Visitor
Groundwater				
Ingestion		x		
Dermal contact		<u>x</u>		
Air			<u> </u>	
Inhalation of VOCs	_	x		

#### Key:

- = Exposure of this population through this route is not likely to occur.

VOCs = Volatile organic compounds.

X = Exposure of this population through this route is probable.

# EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY CHEMICALS OF POTENTIAL CONCERN SURFACE SOIL AT THE DRMO YARD OPERABLE UNIT 2

# FORT WAINWRIGHT, ALASKA

(mg/kg)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,3,5-Trimethylbenzene	0.004	0.12	0.013	0.006
4,4'-DDT	0.055	1.1	0.0129	. 0.079
Aroclor 1260	0.113	1.1	0.156	0.143
Arsenic	8.37	72.4	7.904	9.85
Benzo(a)anthracene	0.150	0.32	58.557	160.97
Benzo(a)pyrene	0.153	0.35	60.802	164.77
Benzo(b)fluoranthene	0.125	0.35	57.736	136.31
Cadmium	0.68	8.1	1.044	0.88
Dieldrin	0.014	1.0	113.058	35.66
Diesel-range organics	55.682	2,000	251.039	103.402
Gasoline-range organics	4.62	130	15.098	7.49
Indeno(1,2,3-cd)pyrene	0.098	0.2	0.046	0.106
Lead	35.46	996	111.649	56.27
Lindane	0.002	0.004	0.0007	0.002
Manganese	263.56	440	77.887	278.27
Mercury	0.05	0.32	0.040	0.06
p-Isopropyltoluene	0.003	0.051	0.006	0.004
Thallium	0.12	0.13	0.027	0.12
2,3,7,8-TCDD (TEQs)	2.54 pg/g	97.4 pg/g	11.460	4.77 pg/g

Note: The average and RME concentrations represent the arithmetic mean and the 95% UCL calculated on the sitewide surface soil data.

#### Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.

DDT = Dichlorodiphenyldichloroethane.

DRMO = Defense Reutilization and Marketing Office.

mg/kg = Milligrams per kilogram.

pg/g = Picograms per gram.

RME = Reasonable maximum exposure.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQs = Toxicity equivalencies.

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# EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY CHEMICALS OF POTENTIAL CONCERN SUBSURFACE SOIL AT THE DRMO YARD OPERABLE UNIT 2

## FORT WAINWRIGHT, ALASKA

(mg/kg)

Chemical	Sitewide Average Concentration	Maximum  Detected  Concentration	Standard Deviation	RME 95% UCL
1,3,5-Trimethylbenzene	0.0543	5.600	0.457	0.104
4,4'-DDT	0.0120	0.380	0.029	0.015
Aroclor 1260	0.0790	0.590	0.047	0.085
Arsenic	5.38	19.6	3.643	5.78
Benzo(a)anthracene	0.0409	0.045	0.009	0.042
Benzo(a)pyrene	0.0441	0.049	0.011	0.045
Benzo(b)fluoranthene	0.0432	0.048	0.010	0.044
Cadmium	0.42	2	0.311	0.46
Dieldrin	0.0016	0.013	0.001	0.002
Diesel-range organics	114.19	9,600	732.435	194.586
Gasoline-range organics	16.04	690	63.206	22.98
Lead	7.59	130	9.326	8.60
Lindane	0.004	0.130	0.009	0.004
Manganese	235.89	2,420	210.473	258.88
Mercury	0.06	2.3	0.152	0.07
p-Isopropyltoluene	0.025	2.200	0.172	0.044
Thallium	2.24	9.8	1.388	2.39
2,3,7,8-TCDD (TEQs)	0.350 pg/g	1.73 pg/g	1.914	0.584

Note: The average and RME concentrations represent the arithmetic mean and the 95% UCL calculated on the sitewide subsurface soil data.

#### Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.

DDT = Dichlorodiphenyldichloroethane.

DRMO = Defense Reutilization and Marketing Office.

mg/kg = Milligrams per kilogram.

pg/g = Picograms per gram.

RME = Reasonable maximum exposure.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQs = Toxicity equivalencies.

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			Table 4-6				
EXPOSURE	EXPOSURE POINT AND STATISTICAL SUMMARY OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (μg/L)	FATISTICAL S GROUNDV FORT	CAL SUMMARY OF CHEMICAI NUNDWATER AT THE DRMO Y OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	OF POTENTI	AL CONCERN	FOR
Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL	RME Area 1	RME Area 2	RME Area 3
1,2,4-Trimethylbenzene	188.51	460	65.375	27.837	310.000	QN	1.15
1,2-Dichlorobenzene	2,962	38	3.805	3,462	QN	QN	QN
1,2.Dichloroethane	0.524	1.5	0.154	0.552	QN	ND	ON
1,3,5-Trimethylbenzene	6.845	061	22.937	11.04	95.500	ND	1.05
1,4-Dichlorobenzene	2.716	12	2.365	3.027	QN	QN	ND
2-Methylnaphthalene	15,539	240	39,433	23.084	155.000	1	QN
Barium (total)	176	1,200	150	205	255	165	705
Веплепе	0.825	7.5	1,226	1.049	QN	QN	6.7
Butylbenzenc(sec)	1.276	25	3.141	1.850	18.0	3.2	QN.
Chloroform	1.218	\$	1.537	1.449	1.100	ND	QN
Chromium (total)	25	510	69	39	GN.	QN	160
cis-1,2-Dichlorocthene	0.644	E'L	0,802	0.791	CIN	QN	QN
Diesel-range organics	2,613	41,000	7,474	3,856	32,000	2,700	250
Disulfoton	0.122	1.3	0,146	0.150	QN ·	0.315	QN
Gasoline-range organics	531	28,000	3,113	1,104	14,470	250	235

Key at end of table.

			Table 4-6				
EXPOSURE POINT AI	POINT AND S	ND STATISTICAL SUMMARY OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (#g/L)	CAL SUMMARY OF CHEMICAL  OUNDWATER AT THE DRMO Y  OPERABLE UNIT 2  FORT WAINWRIGHT, ALASKA  (#g/L)	GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	OF POTENTI	AL CONCERN	FOR
Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL	RME Area 1	RME Area 2	RME Area 3
Manganese (total)	1,648	13,000	1,822	1,997	8,000	3,150	950
Methylene chloride	0.885	8.8	1.220	1.109	QN	QN	ND
n-Butylbenzene	0,913	30	3,253	1.508	15.250	QN	QN
Naphthalene	16.786	530	64.905	25.306	204.000	QN	UN
o-Xylene	6.477	07.1	26.250	11.277	119.500	QN	QN
p-Isopropyltoluene	4,004	200	22.095	8.045	109.500	QN	QN
Tetrachloroethene	5.995	140	18.375	9,355	QN	102.5	26.8
Trichloroethene	1.857	17	2.884	2.385	QN	3.4	3.7
2,3,7,8-TCDD (TEQs)	9.30E-7	8.65E-6	1.599	1.21E-6	4.30E-7	1.24E-6	9.11E-7

Notes: Area I RME represents the average of monitoring wells P34 and AP-5825, the wells with the highest number of maximum detections.

Arca 2 RME represents the average of monitoring wells MW4 and P46, the area of maximum tetrachloroethene concentrations.

Area 3 RME represents the average of monitoring wells P04 and P05, the area of maximum benzene concentrations.

Key at end of table.

# Key:

- 95% UCL = 95% upper confidence limit on the arithmetic mean.

  COPC = Chemical of potential concern.

  DRMO = Defense Reutilization and Marketing Office.

- μg/L = Micrograms per liter.
   ND = Not detected.
   RME = Reasonable maximum exposure.
   TCDD = Tetrachlorodibenzo-p-dioxin.
   TEQs = Toxicity equivalencies.

Table 4-7

# EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY OF CONTAMINANTS OF POTENTIAL CONCERN FOR GROUNDWATER AT BUILDING 1168 LEACH WELL OPERABLE UNIT 2

# FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$ 

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,2,4-Trimethylbenzene	95.22	350	145.940	234.368
1,3,5-Trimethylbenzene	40.78	150	62.427	100.302
Arsenic	8.63	27	103	185
Barium	238	350	0.100	0.334
Benzene	2.12	5.1	1.733	3.772
Diesel-range organics	7,316	34,000	14,940	21,561
Ethylbenzene	87.32	310	130.681	211.919
Gasoline-range organics	4,365	18,000	7,669	11,677
Manganese (dissolved)	1,682	4,400	1,716.601	3,318.710
n-Butylbenzene	6.77	16	7.557	13.975
o-Xylene	201.62	1,000	446.309	627.158
p-lsopropyltoluene	11.24	30	11.903	22.589
sec-Butylbenzene	4.8	11	4.139	8.747
Toluene	154.8	770	343.907	482.702
Trichloroethene	5.56	23	9.749	14.856

Notes:

Both the average and RME concentrations represent the arithmetic mean and the 95% UCL of the five wells located closest to the leach well: AP-5747, -5751, -5752, -5754, and -6332.

Although cadmium was retained as a COPC based on the screening for all wells at Building 1158, cadmium was not detected in any of the five wells included in the EPC calculations.

#### Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.

COPC = Chemical of potential concern. EPC = Exposure point concentration.

μg/L = Micrograms per liter.

RME = Reasonable maximum exposure.

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### SUMMARY OF INCREMENTAL CARCINOGENIC RISKS AND NONCARCINOGENIC HAZARD INDICES FOR POTENTIALLY EXPOSED POPULATIONS AT THE DRMO YARD OPERABLE UNIT 2

# FORT WAINWRIGHT, ALASKA

	Carcinogenic Risks		Noncarcinogenic Hazard Indices			
Receptor/Pathway	Average	RME	Average	RME		
Surface soil ingestion	1.9E-08	3.4E-07	1.1E-04	6.9E-04		
Surface soil dermal contact	1.0E-08	1.2E-06	3.3E-05	1.9E-03		
Total	3.0E-08	1.5E-06	1.4E-04	2.6E-03		
Future Resident—Sitewide						
Surface soil ingestion	4.6E-07	3.1E-06	8,4E-04	5.3E-03		
Surface soil dermal contact	7.0E-09	2.0E-06	2.5E-05	2.8E-03		
Total	4.7E-07	5.1E-06	8.6E-04	8.1E-03		
Future Resident—Sitewide						
Groundwater ingestion	5.5E-07	1.0E-05	3.4E-02	7.1 <b>E-0</b> 1		

Notes:

Incremental risks are presented for only those receptors exceeding a total risk of 10<sup>6</sup> or a total hazard index of 1.0. Incremental risks are not presented for the three areas with clevated chemical concentrations.

Incremental risks are calculated after subtracting the background concentrations of inorganics.

Arsenic was not a chemical of potential concern in groundwater. Therefore, the groundwater-related incremental risks are identical to the total risks.

The soil and groundwater for OU-2 source areas was reviewed to identify whether hotspots (ares with chemical concentrations significantly elevated above that detected across the rest of the site) were present. There were no clearly discernible hotspots in soil at the DRMO Yard. Three potential groundwater hotspots were identified at the DRMO Yard. Data from two monitoring wells at each hotspot were evaluated independently from the sitewide groundwater database. The Area 1 hotspot included 19 of the maximum detected groundwater concentrations at the DRMO Yard. Areas 2 and 3 represented PCE and benzene hotspots, respectively. Potential human health risks associated with exposure to these hotspots was evaluated separately. Eleven monitoring wells were sampled during the RI at the Building 1168 source area. A subset of the five wells closest to the leachfield source were evaluated in the Risk Assessment. The other six wells were somewhat distant from the Building 1168 source area and did not appear to be impacted significantly by source area chemicals. As a result, the Risk Assessment is based on a grouping of wells that represent the highest concentrations from the Building 1168 source area. Exposure to soil at Building 1168 was not evaluated in the Risk Assessment because of the nature of the release (into deep subsurface soil) and the limited soil data collected during the RI.

### Table 4-8 (Cent.)

### Key:

DRMO = Defense Reutilization and Marketing Office.

OU = Operable Unit.

PCE = Tetrachloroethene.

RI = Remedial Investigation.

RME = Reasonable maximum exposure.

# SUMMARY OF INCREMENTAL CARCINOGENIC RISKS AND NONCARCINOGENIC HAZARD INDICES FOR POTENTIALLY EXPOSED POPULATIONS AT BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2

#### FORT WAINWRIGHT, ALASKA

	Carcinogeni	c Risks	Noncarcinogenic Hazard Indices	
Receptor/Pathway	Average	RME	Average	RME
Future Resident				
Groundwater ingestion	1.1 <b>E-0</b> 7	3.2E-06	2.0E-02	7.5E+00
Groundwater dermal contact	3.2E-11	3.6E-10	2.0E-05	7.6E-05
Groundwater inhalation of VOCs	8.4E-08	2.3E-06	2.7E-02	2.8E-01
Total	1.9E-07	5.5E-06	4.7E-02	7.8E+00

Note: Incremental risks are calculated after subtracting the background concentrations of inorganics.

The soil and groundwater for OU-2 source areas was reviewed to identify whether hotspots (ares with chemical concentrations significantly elevated above that detected across the rest of the site) were present. There were no clearly discernible hotspots in soil at the DRMO Yard. Three potential groundwater hotspots were identified at the DRMO Yard. Data from two monitoring wells at each hotspot were evaluated independently from the sitewide groundwater database. The Area 1 hotspot included 19 of the maximum detected groundwater concentrations at the DRMO Yard. Areas 2 and 3 represented PCE and benzene hotspots, respectively. Potential human health risks associated with exposure to these hotspots was evaluated separately. Eleven monitoring wells were sampled during the RI at the Building I168 source area. A subset of the five wells closest to the leachfield source were evaluated in the Risk Assessment. The other six wells were somewhat distant from the Building 1168 source area and did not appear to be impacted significantly by source area chemicals. As a result, the Risk Assessment is based on a grouping of wells that represent the highest concentrations from the Building 1168 source area. Exposure to soil at Building 1168 was not evaluated in the Risk Assessment because of the nature of the release (into deep subsurface soil) and the limited soil data collected during the RI.

#### Key:

OU = Operable Unit.

PCE = Tetrachloroethene.

RI = Remedial Investigation.

RME = Reasonable maximum exposure.

VOCs = Volatile organic compounds.

#### 5.0 DESCRIPTION OF ALTERNATIVES

#### 5.1 NEED FOR REMEDIAL ACTION

Remedial actions were deemed necessary with respect to groundwater at the DRMO Yard and Building 1168 Leach Well to comply with state and federal MCLs.

Actual or threatened releases of hazardous substances from the DRMO Yard and Building 1168 Leach Well source areas, if not addressed, may present substantial endangerment to public health, welfare, or the environment.

Groundwater is the only source of potable water for Fort Wainwright and surrounding communities. The aquifer is considered unconfined except in areas of permafrost. Additionally, the aquifer is considered highly transmissive, with large hydraulic conductivities. Remedial actions for soils were selected to remove volatile organic and petroleum compounds from the soils as quickly as possible in order to minimize soils acting as an ongoing source of contamination to the groundwater.

#### 5.1.1 Defense Reutilization and Marketing Office Yard

The specific reasons for conducting remedial actions at the DRMO Yard source area are provided below, with the main focus being protection of groundwater:

- VOCs (i.e., benzene, PCE, and TCE) in groundwater at the DRMO
   Yard are present at concentrations above state and federal MCLs; and
- VOC- (e.g., PCE, benzene, and TCE) contaminated soils from unknown sources (within an identified area) are a continuing source of groundwater contamination, as discussed in the nature and extent section.

Petroleum-contaminated subsurface soils act as a continuing source of groundwater contamination because of shallow aquifer conditions and annual groundwater fluctuations. These contaminants are present at concentrations above State of Alaska cleanup levels for UST petroleum-contaminated soil.

Many chemicals were detected at the DRMO Yard; however, the above-listed VOCs and petroleum-related compounds were the only chemicals to exceed regulatory limits or to act as significant sources of risk to human health or the environment. Contamination related to petroleum, including DRO/GRO, has been referred to the Two-Party Agreement, except in instances where it is comingled with other contaminants of concern. Table 5-1 provides the rationale for discarding and retaining chemicals detected at the DRMO Yard source area.

#### 5.1.2 Building 1168 Leach Well

The specific reasons for conducting remedial actions at the Building 1168 Leach Well source area are provided below, with the main focus being protection of groundwater:

- VOCs (benzene and TCE) in groundwater near the Building 1168
   Leach Well are present at concentrations exceeded state and federal MCLs; and
- VOC-contaminated subsurface soils are a continuing source of groundwater contamination.

Petroleum-contaminated subsurface soils, including DRO/GRO, act as a continuing source of groundwater contamination because of shallow aquifer conditions and annual groundwater fluctuations. These contaminants are present at concentrations above State of Alaska cleanup levels for non-UST petroleum-contaminated soil.

Other chemicals were detected at the Building 1168 Leach Well source area; however, the above-listed VOCs and petroleum-related contaminants were the only chemicals to exceed regulatory limits or to act as significant sources of risk to human health or the environment. Table 5-2 provides the rationale for discarding and retaining chemicals detected at the Building 1168 Leach Well.

#### 5.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are based on federal and state applicable or relevant and appropriate requirements (ARARs). All groundwater RAOs are based on state and federal MCLs. Soil RAOs are based on State of Alaska cleanup levels for non-UST petroleum contamination. The RAOs for the DRMO Yard and Building 1168 Leach Well are as follows:

#### Groundwater

- Restore groundwater to its beneficial use of drinking water quality within a reasonable time frame through source control;
- Reduce or prevent further migration of contaminated groundwater from the source areas;
- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act and State of Alaska Drinking Water Standard MCLs and Alaska Water Quality Standards (AWQS), and limit highvolume pumping from the aquifer at the DRMO Yard until state and federal MCLs are achieved; and
- Use natural attenuation to attain AWQS (18 Alaska Administrative Code [AAC] 70) after reaching state and federal MCLs.

#### Soil

 Prevent migration of soil contaminants to groundwater, which could result in groundwater contamination and exceedances of state and federal MCLs and AWQS (18 AAC 70).

# 5.3 SIGNIFICANT APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A full list of ARARs is in Section 8. The following ARARs are the most significant regulations that apply to the remedy selections for the DRMO Yard and Building 1168 Leach Well:

- State and federal MCLs are relevant and appropriate for groundwater.
   These set the active remediation goals for groundwater. AWQS (18 AAC 70) is also applicable; and
- Alaska oil pollution regulations (18 AAC 75) are applicable, and Alaska guidelines for non-UST petroleum-contaminated soil are to be considered. These guidelines require cleanup of petroleumcontaminated soils to protect groundwater quality.

#### 5.4 DESCRIPTION OF ALTERNATIVES

# 5.4.1 Defense Reutilization and Marketing Office Yard

Preliminary remedial alternatives for the DRMO Yard are described below. Numerous assumptions had to be made to determine cleanup time frames. These include consistent contaminant concentrations in soil and groundwater, treatment efficiencies similar to the currently operating SVE/AS system, and consistent groundwater flow direction.

### 5.4.1.1 Alternative 1: No Action

The no-action alternative for the DRMO Yard source area involves no environmental monitoring, institutional controls, or remedial action and would leave the VOC-contaminated groundwater in its present state. The groundwater plume would continue to migrate in the direction of groundwater potentially migrating to the Chena River. Development of the no-action alternative is required by the NCP to provide a basis of comparison for the remaining alternatives, serving as a baseline reflecting current conditions without any cleanup effort. The no-action alternative was evaluated consistent with NCP requirements. No present worth, capital, operation and maintenance (O&M), or groundwater monitoring costs are associated with this no-action alternative.

# 5.4.1.2 Alternative 2: Institutional Controls and Natural Attenuation with Groundwater Monitoring/Evaluation

Institutional controls for the DRMO Yard source area would include land use and site access restrictions, and downgradient groundwater monitoring/evaluation that includes developing and implementing a long-term annual groundwater monitoring program for approximately eight wells (six existing and two new wells) for 30 years. Land use restrictions include limiting future use of the land to operations currently conducted at the DRMO Yard. Access restrictions include maintaining the existing fence around the DRMO Yard. Additional institutional controls would include a prohibition on refilling the DRMO Yard fire suppression tank from the existing potable water supply well until state and federal MCLs are met (except

in emergency situations). This restriction would effectively limit significant groundwater pumping from the aquifer, which could affect the existing groundwater contaminant plume.

The VOC-contaminated groundwater would remain as it exists at this source area, thereby not reducing contaminant concentrations other than through natural attenuation. However, institutional controls would decrease or minimize human exposure to contaminants. Periodic inspections and maintenance of the institutional controls would be conducted. Groundwater use restrictions would be incorporated into the Fort Wainwright Comprehensive Master Plan.

Natural attenuation or breakdown of contaminants occurs over time and is the reduction of contaminant concentrations in the environment through biological processes (aerobic and anaerobic biodegradation, and plant and animal uptake), physical phenomena (advection, dispersion, dilution, diffusion, volatilization, and sorption/desorption), and chemical reactions (ion exchange, complexation, and abiotic transformation). Remediation of VOC-contaminated soil and groundwater at the DRMO Yard source area by natural attenuation is expected to take more than 50 years.

Environmental monitoring and data evaluation would be performed periodically to obtain information regarding the effectiveness of the natural attenuation process in remediating the contamination, as well as to track the extent of contaminant migration from the site. To the extent practicable, this monitoring and evaluation will be conducted using six existing wells that are screened in geological zones hydraulically connected with the contamination source, supplemented by installing two groundwater monitoring wells when required. Upgradient wells would be used to provide information about the background groundwater quality at a source. Downgradient wells are used to monitor the extent of contaminant migration, change in flow direction, or occurrence of degradation products to protect downgradient drinking water wells.

Monitoring requirements would target VOCs, including the contaminants that were found to exceed the state and federal MCLs or their potential degradation products as specified in the RAOs for the DRMO Yard source area. To the extent practicable, monitoring data requirements will be coordinated or combined with those from other state or federal programs, such as RCRA and the Safe Drinking Water Act. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. The frequency of monitoring would be defined specifically during the Remedial Design phase. Changes to this remedy may be required as a result of the Remedial Design or construction phase. These changes will be addressed in the post-ROD documents.

The estimated present worth cost of this alternative is \$180,000, which includes \$34,000 for capital costs and \$146,000 for annual groundwater monitoring, based on an estimated 30-year time frame for groundwater monitoring for cost estimating purposes (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation and flow direction). However, monitoring would occur until state and federal MCLs are achieved, which would be more than 30 years.

# 5.4.1.3 Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, Natural Attenuation, and Groundwater Monitoring/Evaluation

This alternative involves treatment of VOC-contaminated soils in place via SVE, on-site treatment of groundwater via AS with natural attenuation, and groundwater monitoring/evaluation.

The SVE/AS system will inject air below the groundwater table to promote movement of VOCs from subsurface soils and groundwater and to collect the vapors by applying a vacuum through a series of vapor extraction wells. The SVE/AS system would be installed to provide active treatment out to the 20-ppb isocontour of the defined groundwater plume (see Figure 5-1). Treatment beyond this isocontour out to the state and federal MCL of 5 ppb would be through natural attenuation, except for a line of curtain wells near Channel B to prevent contaminants from entering the surface water.

For cost analysis purposes, the major components of the enhanced SVE system are assumed to include approximately 21 driven-point extraction wells; below-ground, horizontal polyvinyl chloride (PVC) piping, valves, sampling ports, and vacuum gauges; 10 extraction blowers; an air/water separator with storage tank; and a heating system for the prefabricated buildings and SVE piping. The blowers would be housed in prefabricated buildings. The SVE system would consist of explosion-proof equipment and automatic safety devices that would deactivate the system if the treatment building interior atmosphere were to exceed 20% of the lower explosive limit. Treatment of exhaust gases will be accomplished by directing these gases through a granulated activated carbon filter unit or air mixing chamber if sampling results exceed regulatory limits. Any water extracted from the air/water separator would be collected in a drum or tank, treated via carbon filtration, and discharged to the sanitary sewer system. The major components of the AS system would include 62 driven-point sparging wells; below-grade, horizontal PVC piping; and 10 centrifugal injection blowers. Changes to this remedy may be required as a result of the Remedial Design phase. These changes will be addressed in post-ROD documents.

Air will be injected below the water table to strip volatiles from groundwater and soil in the saturated and unsaturated zones, respectively. Volatiles are purged to the unsaturated zone, where they will be collected in the vacuum extraction wells. In addition, the vacuum extraction wells create a negative pressure in the unsaturated soil, which enhances contaminant mobility. From the extraction wellhead, the VOCs are routed to the treatment facility. Under current regulations, no off-gas treatment is required. However, off-gas treatment will occur until it is determined that off-gases are safe. The SVE discharge will be monitored during initial operations to determine whether filtration or dispersion of off-gases is necessary.

Regular monitoring of the enhanced SVE system will be conducted to ensure and document its effectiveness and optimize the progress of cleanup. Vapor samples and airflow readings taken from the soil vapor monitoring probes and system exhaust sampling ports will be utilized to monitor the progress of cleanup, to estimate the volume of VOCs removed by the system, and to establish a timetable and cost estimate for completion of the project.

Historically, SVE/AS remediation has been successful at remediating soil and groundwater to the state and federal MCLs within several months to two years, dependent on many conditions

including initial contaminant concentrations. Because of climatic conditions at Fort Wainwright, it is estimated that SVE/AS treatment would operate for three years to meet state and federal MCLs in the active treatment zone and 10 years in the remainder of the groundwater plume, which is located beyond the 20-ppb isocontour.

Remediation of VOC-contaminated soil and groundwater at the DRMO Yard source area by natural attenuation is expected to take more than 50 years.

The estimated present worth cost of this alternative would be approximately \$2,195,000, which comprises \$1,426,000 for capital costs, \$680,000 for annual O&M costs, and \$89,000 for annual groundwater monitoring. For costing purposes, it was assumed that a groundwater monitoring program would be implemented and that there would be one monitoring event per year (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

# 5.4.1.4 Alternative 4: Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

This alternative supplements the remedial measures included under Alternative 3. One thousand nine hundred cubic yards of benzo(a)pyrene-contaminated surface soils would be excavated from the DRMO Yard and transported to the Fort Wainwright Landfill. Clean fill would replace the excavated material. Excavation and disposal of benzo(a)pyrene-contaminated soil would require one month. See DRMO Yard Alternative 3 above for a description of SVE/AS and groundwater monitoring. Soil contaminated with benzo(a)pyrene does not contribute to groundwater contamination and falls within the acceptable risk range for human health.

The estimated present worth cost of this alternative would be approximately \$2,269,000, which comprises \$1,498,000 for capital costs, \$682,000 for annual O&M costs, and \$89,000 for annual groundwater monitoring. For costing purposes, it was assumed that there would be one monitoring event per year (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

# 5.4.1.5 Alternative 5: Alternative 3 Plus Excavation and On-Site Solidification of Benzo(a)pyrene-Contaminated Soils

On-site solidification involves encapsulating benzo(a)pyrene-contaminated soils in concrete. Benzo(a)pyrene-contaminated soil will be excavated, solidified using a Portland cement matrix slurry, and disposed of on site. Excavation and solidification of benzo(a)pyrene-contaminated soils would require three months. See DRMO Yard Alternative 3 above for a description of an SVE/AS system and groundwater monitoring.

The estimated present worth cost of this alternative would be approximately \$2,892,000, which comprises \$2,062,000 for capital costs, \$698,000 for annual O&M costs, and \$132,000 for annual groundwater monitoring. For costing purposes, one monitoring event per year was assumed (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

#### 5.4.2 Building 1168 Leach Well

Preliminary remedial alternatives for the Building 1168 Leach Well source area are described below. Numerous assumptions had to be made to determine cleanup time frames. These include consistent contaminant concentrations in soil and groundwater, treatment efficiencies similar to the currently operating SVE/AS system, and consistent groundwater flow.

#### 5.4.2.1 Alternative 1: No Action

The no-action alternative for the Building 1168 Leach Well source area involves no environmental monitoring, institutional controls, or remedial action and would leave the VOC-contaminated soil and groundwater and petroleum-contaminated soils in their present state. Operation of the existing pilot-scale treatability system would be discontinued. The contaminated soils will continue to be subjected to infiltration and vertical seepage, which would cause further contamination of the groundwater. The groundwater plume will continue to migrate in the direction of groundwater flow. Development of the no-action alternative is required by the NCP to provide a basis of comparison for the remaining alternatives, serving as a baseline reflecting current conditions without any cleanup effort. The no-action alternative was evaluated consistent with NCP requirements. No present worth capital, O&M, or groundwater monitoring costs are associated with this no-action alternative.

#### 5.4.2.2 Alternative 2: Institutional Controls and Natural Attenuation

Institutional controls for the Building 1168 Leach Well source area will include well installation restrictions, land use and site access restrictions, and downgradient groundwater monitoring/evaluation that includes developing and implementing a long-term annual groundwater monitoring program for approximately four wells (two existing and two new wells) for 30 years. Operation of the existing pilot-scale treatability study system would be discontinued. Land use restrictions include limiting future use of the land to operations being conducted at the Building 1168 Leach Well. The VOC-contaminated groundwater would remain as it exists at this source area, thereby not reducing contaminant concentrations other than through natural attenuation. However, institutional controls would decrease or minimize human exposure to contaminants. Periodic inspections and maintenance of the institutional controls would be conducted. Groundwater use restrictions would be incorporated into the Fort Wainwright Comprehensive Master Plan.

Natural attenuation or breakdown of contaminants occurs over time and is the reduction of contaminant concentrations in the environment through biological processes (aerobic and anaerobic biodegradation, and plant and animal uptake), physical phenomena (advection,

dispersion, dilution, diffusion, volatilization, and sorption/desorption), and chemical reactions (ion exchange, complexation, and abiotic transformation). Remediation of VOC-contaminated soil and groundwater at the Building 1168 Leach Well source area by natural attenuation is expected to take more than 50 years.

Environmental monitoring and data evaluation would be performed to obtain information regarding the effectiveness of the natural attenuation process in remediating the contamination, as well as to track the extent of contaminant migration from the site. To the extent practicable, this monitoring and evaluation would be conducted using four wells that are screened in geological zones hydraulically connected with the contamination source, supplemented by installing two additional groundwater monitoring wells if required. Upgradient wells would be used to provide information about the background groundwater quality at a source. Downgradient wells are used to monitor the extent of contaminant migration, change in flow direction, or occurrence of degradation products to protect downgradient drinking water wells.

Monitoring requirements would target VOCs, including contaminants that were found to exceed the state and federal MCLs or their potential degradation products, as specified in the RAOs for the Building 1168 Leach Well source area. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. The frequency of monitoring would be defined during the post-ROD activities.

The estimated present worth cost of this alternative is \$130,000, which comprises \$49,000 for capital costs and \$81,000 for annual groundwater monitoring, based on an estimated 30-year time frame for groundwater monitoring for cost estimating purposes (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation and flow direction). However, monitoring would occur until state and federal MCLs are achieved, which would be more than 30 years.

These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

# 5.4.2.3 Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, and Monitoring

A pilot-scale treatability system is operating at the source area to test the effectiveness of the technologies included in this alternative. This alternative would upgrade the existing system to a full-scale system. The saturated zone active treatment area would be expanded by a factor of six to cover the entire contaminated saturated zone. System modifications would include installation of approximately four additional sparge points and one additional SVE point, increasing the capacity of sparging, extraction, and control equipment. System modification also would require installation of an additional blower to compensate for the increased head losses of the additional wells and piping.

Air will be injected below the water table to strip volatiles from groundwater and soil in the saturated and unsaturated zones, respectively. Volatiles are purged to the unsaturated zone,

where they will be collected in the vacuum extraction wells. In addition, the vacuum extraction wells create a negative pressure in the unsaturated soil, which enhances contaminant mobility. From the extraction wellhead, the VOCs are routed to the treatment facility. Under current regulations, no off-gas treatment is required. However, off-gases were treated initially through a carbon adsorption system. Use of the treatment system was discontinued because air modeling using a worst-case scenario indicated that treatment was unnecessary. This system can be restarted if analytical results indicate that off-gas treatment is necessary.

Regular monitoring of the enhanced SVE system will be conducted to ensure and document its effectiveness and optimize the progress of cleanup. Vapor samples and airflow readings taken from the soil vapor monitoring probes and system exhaust sampling ports will be utilized to monitor the progress of cleanup, to estimate the volume of VOCs removed by the system, and to establish a timetable and cost estimate for completion of the project.

Historically, SVE/AS remediation has been successful at remediating soil and groundwater to state and federal MCLs within several months to two years, depending on many conditions including initial contaminant concentrations. Based on the operational data acquired since the start of the pilot-scale treatment system in 1994, it is estimated that SVE/AS treatment would operate an additional three years to meet state and federal MCLs in the active treatment zone. State and federal MCL exceedances outside the active treatment zone are anticipated to attenuate naturally, partially in response to the increased downgradient dissolved oxygen availability associated with the active treatment system.

Monitoring requirements will target the contaminants that were found to exceed the state and federal MCLs as specified in the RAOs for the Building 1168 Leach Well source area. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. To the extent practicable, monitoring data requirements will be coordinated or combined with those from other state or federal programs, such as RCRA and the Safe Drinking Water Act. The frequency of monitoring would be defined specifically in post-ROD documents.

This alternative would achieve remediation goals in approximately three years. Groundwater monitoring would be conducted 10 years. For costing purposes, one well would be installed for the SVE system and four wells would be installed for the AS system for an operational period of three years. The estimated present worth cost of this alternative would be approximately \$269,000, which comprises \$174,000 for capital, \$66,000 for annual O&M costs, and \$29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

# 5.4.2.4 Alternative 4: Alternative 3 Plus Excavation and Low-Temperature Thermal Desorption of Contaminated Unsaturated Soil

This alternative is similar to Alternative 3, except that approximately 1,400 cubic yards of soil contaminated with DRO; GRO; and benzene, toluene, ethylbenzene, and total xylenes will be excavated and treated using a low-temperature thermal desorption (LTTD) process. This

alternative would be implemented only if SVE/AS could not reduce contaminant concentrations in the unsaturated zone to below RAOs. LTTD involves heating excavated soils in a rotary kiln dryer to release organic contaminants and moisture in the form of gases. The gases go through a series of cooling and condensing stages before they are vented.

Excavation would be conducted to an estimated depth of 19 feet below present grade, which would require shoring. Approximately 4,400 cubic yards of uncontaminated overburden material would need to be removed. Clean soil would replace the 1,300 cubic yards of excavated soil. The treated soil would be disposed of at the Fort Wainwright Landfill.

See Alternative 3 above for descriptions of SVE and groundwater AS and for a description of groundwater monitoring.

Excavation and LTTD treatment would require one month. The estimated present worth cost of this alternative would be approximately \$559,000, which comprises \$452,000 for capital, \$78,000 for annual O&M costs, and \$29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

# 5.4.2.5 Alternative 5: Alternative 3 Plus Excavation and Engineered Pile Treatment (Biopile and Vapor Extraction Pile) of Contaminated Unsaturated Soil

This alternative is similar to Alternative 3, except that excavated soil is treated using engineered pile treatment at a nearby location. There are two options for the engineered pile treatment of the contaminated unsaturated soil: a vapor extraction pile and a biopile. Both options are ex situ remedies and would require excavation, as described in Building 1168 Leach Well Alternative 4. A vapor extraction pile uses the same processes as in situ vapor extraction, but the processes are applied to a pile in a lined cell. Blowers built into a piping system inject and extract air to strip off VOCs and petroleum hydrocarbons from the soil. Biopile or biocell treatment is a process that uses naturally occurring bacteria in soil to break down VOCs and petroleum hydrocarbons. The excavated soil is placed in lined piles and is aerated using an air injection system.

See Alternative 3 above for descriptions of SVE and groundwater AS and for a description of groundwater monitoring and evaluation requirements.

The estimated time frame for cleanup goals to be achieved is three years. The estimated present worth cost of this alternative would be \$498,000, which comprises \$350,000 for capital costs, \$119,000 for annual O&M costs, and \$29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

### Table 5-1

# SELECTION OF CHEMICALS OF CONCERN FOR REMEDIAL EVALUATION IN THE FEASIBILITY STUDY FOR DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

FORT WAIRWRIGHT, ALASKA			
Chemicals of Potential Concern to the FS	Basis for Discarding or Retaining as Chemical of Concern to the FS		
	found in soils and were discarded or carried through the FS as contaminants n. This is based on the following reasons:		
Soil			
Benzo(a)pyrene	Retain: Concentrations are within the 10 <sup>-4</sup> to 10 <sup>-6</sup> risk range.  Benzo(a)pyrene was found in surface soils and is not considered a threat to groundwater.		
PCBs	Discard: The maximum concentration of PCBs detected in soil at the DRMO Yard source area is 1.3 mg/kg, significantly less than the Toxic Substances Control Act (TSCA 1987) most restrictive cleanup level of 10 mg/kg.		
Dioxîn	Discard: Concentrations do not cause exceedance of 10 <sup>-4</sup> cancer risk for site worker, future site worker, future residents, future construction workers, and future recreational users/site visitors. In addition, dioxin is ubiquitous throughout the DRMO Yard source area, at very low concentrations. Analytical results do not indicate that a dioxin "hot spot" exists.		
DRO	Discard: DRO in the DRMO Yard soils is attributed to surface spills and UST releases and will be addressed in a separate Two-Party Agreement between the Army and ADEC.		
GRO	Discard: GRO in the DRMO Yard soils is attributed to surface spills and UST releases and will be addressed in a separate Two-Party Agreement between the Army and ADEC.		
Dieldrin	Discard: The HRA concluded that cancer risk presented by dieldrin exceeded 10 <sup>-6</sup> for two exposure pathways (current/future worker RME dermal contact with surface soil and future resident RME dermal contact with surface soil). However, resampling of surface soil in August 1995 in five locations around the only sampling location where dieldrin was previously detected indicates that dieldrin concentrations are not detectable or are two to three orders of magnitude below 1 mg/kg (1 mg/kg corresponds to a 10 <sup>-4</sup> cancer risk to future residents). Dieldrin was detected in six of 314 samples.		
Arsenic	Discard: Concentrations cause exceedance of 10 <sup>-6</sup> cancer risk for two exposure pathways (current/future worker RME and future resident RME and average exposure ingestion of surface soil) but was not considered a COC because of documented elevated concentrations of arsenic in background surface soil samples. Recalculation of risks after subtracting background concentrations results in a cancer risk of less than 10 <sup>-6</sup> .		

#### Table 5-1

# SELECTION OF CHEMICALS OF CONCERN FOR REMEDIAL EVALUATION IN THE FEASIBILITY STUDY FOR DRMO YARD OPERABLE UNIT 2

# FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern to the FS	Basis for Discarding or Retaining as Chemical of Concern to the FS
The following contaminants we contaminants of concern for re	ere found in groundwater and were discarded or carried through the FS as emedial evaluation. This is based on the following reasons:
Groundwater	
Benzene	Retain: Concentrations cause exceedance of MCL.
Trichlorouthene	Retain: Concentrations measured in excess of MCL.
Tetrachloroethene	Retain: Concentrations cause exceedance of MCL.
Manganese	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME ingestion) but was not considered a COC because of documented elevated concentrations of manganese in background groundwater samples. Recalculation of risks after subtracting background concentrations results in a hazard index of less than 1.0 for the entire DRMO Yard.
Chloroform	Discard: Concentrations cause slight exceedance of 10 <sup>-6</sup> cancer risk for one exposure pathway (future resident RME inhalation) but was not considered a COC because concentrations did not exceed MCL.
Dioxin	Discard: Concentrations cause exceedance of 10 <sup>-6</sup> cancer risk for one exposure pathway (future resident RME ingestion) but was not considered a COC because concentrations did not exceed MCL.
1,4-Dichlorobenzene	Discard: Concentrations cause exceedance of 10 <sup>-6</sup> cancer risk for one exposure pathway (future resident RME ingestion) but was not considered a COC because concentrations did not exceed MCL.

Note: Breakdown products of the contaminants of concern were not in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

#### Key:

ADEC = Alaska Department of Environmental Conservation.

Army = United States Army. COC = Chemical of concern.

DRMO = Defense Reutilization and Marketing Office.

DRO = Diesel-range organics.

FS = Feasibility Study.

GRO = Gasoline-range organics.

HRA = Human Health Risk Assessment.

MCL = Maximum contaminant level.

mg/kg = Milligrams per kilogram.

PCBs = Polychlorinated biphenyls.

RME = Reasonable maximum exposure.

TSCA = Toxic Substances Control Act.

UST = Underground storage tank.

### Table 5-2

# SELECTION OF CHEMICALS OF CONCERN TO THE FEASIBILITY STUDY FOR BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern	Discard or Retain as Chemical of Concern to the FS and Bases	
Soil		
DRO	Retain: Concentrations exceed ADEC guidelines.	
GRO	Retain: Concentrations exceed ADEC guidelines.	
втех	Retain: Concentrations exceed ADEC guidelines.	
Groundwater		
Benzene	Retain: Concentrations cause exceedance of MCL.	
Trichloroethene	Retain: Concentrations cause exceedance of MCL.	
Manganese	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME and average ingestion) but was not considered a COC because of documented elevated concentrations of manganese in background groundwater samples. Recalculation of risks after subtracting background concentrations of manganese and arsenic results in a hazard index of less than 1.0.	
Arsenie	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME and average ingestion). Arsenic concentrations also cause exceedance of 10 <sup>-6</sup> cancer risk for one exposure pathway (future resident RME and average ingestion). However, arsenic is not considered a COC because of documented elevated concentrations of arsenic in background groundwater samples. Recalculation of risks after subtracting background concentrations of manganese and arsenic results in a hazard index of less than 1.0. Background arsenic concentrations still contribute to cancer risk in excess of 10 <sup>-6</sup> .	

Note:

Breakdown products of the contaminants of concern were not in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

### Key:

ADEC = Alaska Department of Environmental Conservation.

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

COC = Chemical of concern.

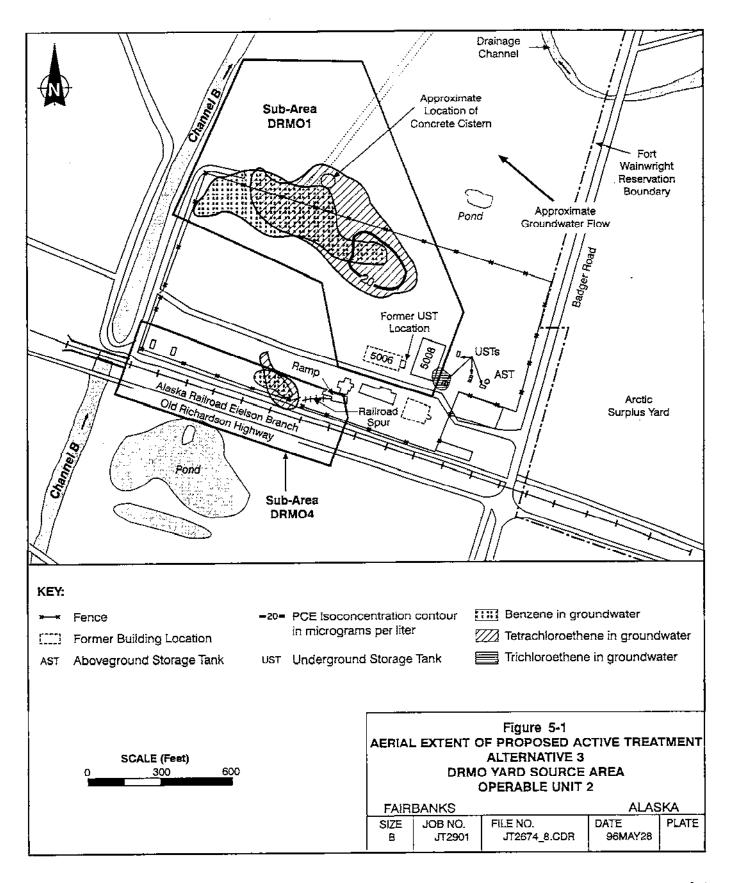
DRO = Diesel-range organics.

FS = Feasibility Study.

GRO = Gasoline-range organics.

MCL = Maximum contaminant level.

RME = Reasonable maximum exposure.



## 6.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with federal regulations, the five alternatives for the DRMO Yard source area and five other alternatives for the Building 1168 Leach Well source area were evaluated based on the nine criteria presented in the NCP.

# 6.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD SOURCE AREA (COMPARATIVE ANALYSIS OF ALTERNATIVES)

#### 6.1.1 Threshold Criteria

## 6.1.1.1 Overall Protection of Human Health and the Environment

Alternatives 3, 4, and 5 would provide the greatest protection to human health and the environment by actively treating contaminated soil and groundwater. Alternatives 1 and 2 would rely on natural processes to slowly decrease contaminant concentrations in the soil and groundwater. Alternatives 1 and 2 would provide no treatment and would not be protective of human health or the environment.

# 6.1.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 are expected to achieve regulatory requirements. Alternatives 3, 4, and 5 include active soil and groundwater treatment to achieve state and federal MCLs and would be expected to achieve these standards more rapidly than Alternative 2. Alternative 2 would rely on natural processes that slowly decrease soil and groundwater contamination. Alternative 1 would not comply with ARARs. AWQS would be achieved through natural attenuation under all of the alternatives.

#### 6.1.2 Main Balancing Criteria

## 6.1.2.1 Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would involve permanent and active reduction of soil and groundwater contamination and would achieve long-term effectiveness. Alternatives 4 and 5 would permanently remove the benzo(a)pyrene-contaminated soil. None of the contaminants would be addressed by Alternatives 1 and 2, except through natural processes. Therefore, Alternatives 1 and 2 would provide the least effective long-term permanence.

## 6.1.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 3, 4, and 5 would involve treatment technologies that reduce the toxicity and mobility of VOC-contaminated soil and groundwater. Alternative 4 would slightly increase the volume of contaminated soil and would not decrease toxicity or mobility of benzo(a)pyrene. Alternative 5 would reduce the mobility and significantly increase the volume of contaminated material. Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of the contaminants through treatment.

#### 6.1.2.3 Short-Term Effectiveness

Alternatives 3, 4, and 5 would pose some short-term potential risks to on-site workers during the estimated three months for groundwater treatment installation and soil excavation (Alternatives 4 and 5). These risks could be minimized by engineering controls. These alternatives may take up to 10 years to achieve state and federal MCLs. The excavation and disposal in Alternative 4 would require one month. Solidification (Alternative 5) would require approximately three months.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil and groundwater contamination, it is expected that contaminant levels would be reduced during the estimated three-year cleanup period. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time except through natural attenuation. Under Alternative 1, no monitoring would be conducted to determine the groundwater remediation time frame. However, it is expected that the time frame to reach remedial goals will be similar to Alternative 2—natural attenuation with groundwater monitoring—which is estimated to exceed 50 years.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil contamination, it is expected that groundwater contaminant levels would be reduced during the estimated three-year cleanup period. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time, except through natural attenuation.

## 6.1.2.4 Implementability

All alternatives would use readily available technologies and would be feasible to construct. Alternatives 1 and 2 would be readily implementable because they would require no additional action other than monitoring or institutional controls. A pilot-scale test study or field test would be conducted before full-scale implementation of the SVE and AS systems proposed in Alternatives 3, 4, and 5. A solidification treatability study would be required before implementing Alternative 5.

#### 6.1.2.5 Cost

The estimated present worth cost for each alternative evaluated for the DRMO Yard source area is shown in Table 6-1. Detailed baseline cost estimates are included in Appendix D.

Based on the information available at the time the alternatives were developed, the estimated costs for each alternative evaluated for the DRMO source area are in Table 6-1. Actual costs are likely to be within +50% to -30% of the values on the table. Present worth is based on a 5% discount rate over 30 years.

#### 6.1.3 Modifying Criteria

#### 6.1.3.1 State Acceptance

ADEC has been involved with the development of remedial alternatives for OU-2 and agrees

with the selected alternative for the DRMO Yard source area.

#### 6.1.3.2 Community Acceptance

Although no official comments were received, community response to the preferred alternatives was generally positive. Community response to the remedial alternatives is presented in the Responsiveness Summary, which addresses comments received during the public comment period.

# 6.2 BUILDING 1168 LEACH WELL (COMPARATIVE ANALYSIS OF ALTERNATIVES)

#### 6.2.1 Threshold Criteria

#### 6.2.1.1 Overall Protection of Human Health and the Environment

Alternatives 3, 4, and 5 would provide the greatest protection to human health and the environment by actively treating contaminated soil and groundwater. Alternatives 1 and 2 would provide no treatment and would not be protective of human health or the environment.

# 6.2.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 are expected to achieve regulatory requirements. Alternatives 3, 4, and 5 include active groundwater treatment to achieve state and federal MCLs and would be expected to achieve these standards more rapidly than Alternative 2. Alternative 2 would rely on natural processes that slowly decrease soil and groundwater contamination. Alternative 1 would not comply with ARARs. AWQS would be achieved through natural attenuation under Alternatives 3, 4, and 5.

#### 6.2.2 Balancing Criteria

#### 6.2.2.1 Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would involve permanent and active reduction of soil and groundwater contamination and would achieve long-term effectiveness. Alternatives 4 and 5 would permanently remove the VOC-contaminated soil by excavation and treatment. None of the contaminants would be addressed by Alternatives 1 and 2, except through natural processes. Therefore, Alternatives 1 and 2 would provide the least effective long-term permanence.

#### 6.2.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 3, 4, and 5 would involve treatment technologies that would reduce the toxicity and mobility of contaminants in soil and groundwater. Alternatives 4 and 5 would reduce the volume of the contaminated soil by excavation and treatment. Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of the contaminants through treatment.

#### 6.2.2.3 Short-Term Effectiveness

Alternatives 3, 4, and 5 would pose some short-term potential risks to on-site workers during the estimated three months for groundwater treatment installation and soil excavation (Alternatives 4 and 5). These risks could be minimized by engineering controls. These alternatives may take up to three years to achieve groundwater cleanup to state and federal MCLs. The excavation and LTTD portion of Alternative 4 would be expected to require one field season. The engineered pile treatment portion of Alternative 5 would require five years.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil and groundwater contamination, it is expected that contaminant levels would be reduced during the estimated three-year cleanup period. Under Alternative 1, no monitoring would be conducted to determine the groundwater remediation time frame. However, it is expected that the time frame for remediation will be similar to Alternative 2—natural attenuation with groundwater monitoring—which is estimated to exceed 50 years. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time except through natural attenuation.

#### 6.2.2.4 Implementability

All alternatives would use readily available technologies and would be feasible to construct. The SVE and AS system pilot study is being conducted at the Building 1168 Leach Well, and results to date indicate that the system is effectively remediating the groundwater contamination. Alternatives 3, 4, and 5 propose expansion of this system for full-scale treatment. LTTD and engineered pile treatability studies would be required before implementing Alternatives 4 and 5, respectively.

#### 6.2.2.5 Cost

The estimated present worth cost for each alternative evaluated for the Building 1168 Leach Well source area is shown in Table 6-2. Detailed cost tables are in Appendix D.

#### 6.2.3 Modifying Criteria

#### 6.2.3.1 State Acceptance

ADEC has been involved with the development of remedial alternatives for OU-2 and agrees with the selected alternative for the Building 1168 Leach Well source area.

#### 6.2.3.2 Community Acceptance

Although no official comments were received, the community response to the preferred alternatives was generally positive. Community response to the remedial alternatives is presented in the Responsiveness Summary, which addresses comments received during the public comment period.

PRESENT WORT	Ta H COSTS F RMO YARI OPERA	Table 6-1 PRESENT WORTH COSTS FOR REMEDIAL ALTERNATIVES DRMO YARD SOURCE AREA OPERABLE UNIT 2	LTERNATIVES		
FC	DRT WAINY	FORT WAINWRIGHT, ALASKA			
Description	Capital Cost	Annual Operation and Maintenance Cost	Annual Groundwater Monitoring Cost	Total Present Worth Cost	Present Worth of Annual Cost
Alternative 1: No Action	20	os	os	0\$	0\$
Akernative 2: Institutional Controls, Natural Attenuation, and Groundwater Monitoring/Evaluation	\$34,000	0\$	\$146,000	\$180,000	\$146,000
Alternative 3: Soil Vupor Extraction, Groundwater Air Sparging, Natural Attenuation, and Groundwater Monitoring/Evaluation	\$1,426,000	000'089\$	000'68\$	\$2,195,000	\$769,000
Alternative 4: Alternative 3 Plus Excavation and Disposal of Surface Soils Containing Benzo(a)pyrene	\$1,498,000	\$682,000	\$89,000	\$2,269,000	\$771,000
Alternative 5: Alternative 3 Plus Excavation and On-Site Solidification of Soils Containing Benzo(a)pyrene	\$2,062,000	\$698,000	\$132,000	\$2,892,000	\$830,000

Key:

DRMO = Defense Reutilization and Marketing Office.

	17	Table 6-2		;	
PRESENT WO	RTH COSTS I ING 1168 LEA OPERA FORT WAIN	PRESENT WORTH COSTS FOR REMEDIAL ALTERNATIVES BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	ALTERNATIVES CE AREA		
Description	Capital Cost	Annual Operation and Maintenance Cost	Annual Groundwater Monitoring Cost	Total Present Worth Cost	Present Worth of Annual Cost
Alternative 1: No Action	\$0	\$0	\$0	\$0	\$0
Allemative 2: Institutional Controls and Natural Attenuation with Groundwater Monitoring/Evaluation	\$49,000 on	\$0	\$81,000	\$130,000	\$81,000
Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging with Natural Attenuation, and Groundwater Monitoring/Evaluation	\$174,000	\$66,000	\$29,000	\$269,000	\$95,000
Alternative 4: Alternative 3 Plus Excavation and Low-Temperature Thermal Desorption of Unsaturated Soil	\$452,000	\$78,000	\$29,000	\$559,000	\$107,000
Alternative 5: Alternative 3 Plus Engineered Pile Treatment of Unsaturated Soil	\$350,000	\$119,000	\$29,000	\$498,000	\$148,000

#### 7.0 SELECTED REMEDIES

#### 7.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD

Because it best meets the nine CERCLA criteria, Alternative 3 is the selected remedy for groundwater contamination for the DRMO Yard source area. This alternative involves inplace treatment of soils via vacuum extraction; in-place, on-site treatment of groundwater via air sparging; groundwater monitoring/evaluation; and institutional controls. Alternative 3 is expected to achieve overall protection of human health and the environment and to meet ARARs through active treatment of soil and groundwater (see Table 7-1). This alternative protects the on-site potable drinking water well as well as the downgradient drinking water aquifer by treating and controlling the source of contamination and is viewed as being an effective and permanent solution to contamination at the DRMO Yard.

After a thorough assessment of the applicable alternatives for the DRMO Yard source area, taking groundwater risks, cleanup times, and cost into consideration, it was determined that protection of human health and the environment is best attained through active in-place treatment of soils and groundwater. After evaluation of the potential risks and appropriate cleanup standards and comparison with the nine CERCLA criteria, it was determined that action is not required for benzo(a)pyrene in soils. This alternative is believed to provide the best balance of criteria among the alternatives evaluated.

#### 7.1.1 Major Components of the Selected Remedy

- In situ treatment of groundwater and soil via air sparging to attain state and federal drinking water standards. Air sparging wells will be placed in the areas of highest contamination;
- In situ treatment of soils via soil vapor extraction to prevent contaminated unsaturated soils from acting as an ongoing source of contamination to groundwater. Soil vapor extraction wells will be placed in areas of highest soil contamination;
- Air emissions from the soil vapor extraction/air sparging treatment system will be monitored and evaluated periodically to meet emission requirements;
- The treatment system will be evaluated and modified as necessary to optimize effectiveness;
- Duration of treatment system operation is estimated to be three years in the active treatment zone and nine years at the Channel B wells to meet soil cleanup goals and state and federal maximum contaminant levels.
   A combination of groundwater monitoring and off-gas measurements will be used to determine attainment of remedial action objectives;

- After active treatment achieves state and federal maximum contaminant levels, natural attenuation will be relied on to achieve Alaska Water Quality Standards;
- Maintaining institutional controls, including restricted access and well
  development restrictions, and a groundwater monitoring and evaluation
  program for the potable drinking water supply wells. These controls
  will remain in place as long as hazardous substances remain on site at
  levels that preclude unrestricted use; and
- Additional institutional controls to prohibit refilling the DRMO Yard fire suppression water tank from the existing DRMO Yard potable water supply well until state and federal maximum contaminant levels are met (except in emergency situations).

#### 7.1.2 Goals of Remedial Action

7-5-

The overall goal of a remedial action is to provide the most effective mechanism to meet state and federal regulations for drinking water. To facilitate selection of the most appropriate remedial action, source area-specific cleanup objectives that specify the contaminants of concern in each medium of interest, exposure pathways and receptors, and an acceptable regulatory level were developed. The following remediation goals were established for the specific contaminants of concern determined to require remedial action at both source areas. These goals are intended for the areas where active remediation will occur.

#### 7.1.2.1 Defense Reutilization and Marketing Office Yard Groundwater and Soil

CHEMICALS OF CONCERN IN GROUNDWATER	REMEDIATION GOAL (μg/L)*
Benzene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Vinyl chloride	2.0
1,1-Dichloroethene	7.0
1,2-Dichloroethene	70.0

Groundwater remediation goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 Code of Federal Regulations [CFR] 141.147 and 18 AAC 80).

At the DRMO Yard, after state and federal MCLs are achieved through active remediation, passive treatment of groundwater through natural attenuation will be relied on to attain AWQS (18 AAC 70).

Because soils contaminated with VOCs and petroleum-related compounds are acting as a continuing source of contamination to groundwater, the remedial action goal for in situ soils is active remediation until contaminant levels in groundwater are consistently below state and federal MCLs. The State of Alaska cleanup levels for UST petroleum-contaminated soil will be considered as a guideline for the treatment of in situ soils (see Table 7-2).

The cost for Alternative 3 is \$1,498,000 for present worth capital costs, which include direct and indirect cost; annual monitoring for 15 years (monitoring frequency may vary) at \$89,000; and present worth of annual operating cost \$680,000, for a total cost of \$2,195,000.

The remedial action goal for in situ soils contaminated with comingled VOC- and petroleum related-compounds is protection of the groundwater. Because the soils are acting as a continuing source of contamination to the groundwater, active remediation of the soils will continue until state and federal MCLs are met consistently. Natural attenuation will continue until AWQS are met. Some changes or modifications could be made to the remedy as a result of Remedial Design and construction processes. These changes will be addressed in post-ROD documents.

The goal of this remedial action is to restore groundwater to its beneficial use, which is a drinking water aquifer. Based on information obtained during the RI and on careful analysis of all remedial alternatives, the Army, EPA, and ADEC believe that the selected remedy would achieve this goal.

#### 7.2 BUILDING 1168 LEACH WELL

Alternative 3 is the preferred alternative for the Building 1168 Leach Well source area because it best meets the nine CERCLA criteria summarized in Table 7-3. This alternative involves in place treatment of soils and groundwater via soil vapor extraction/air sparging, groundwater monitoring, and institutional controls. Alternative 3 is expected to achieve overall protection of human health and the environment and to meet ARARs (see Table 7-4). In addition, this alternative is viewed as being an effective and permanent solution to contamination at the Building 1168 Leach Well.

After a thorough assessment of the applicable alternatives for the Building 1168 Leach Well source area, taking groundwater risks, cleanup times, and cost into consideration, it was determined that protection of human health and the environment is best attained through active in-place treatment of soils and groundwater. This alternative is believed to provide the best balance of criteria among the alternatives evaluated.

#### 7.2.1 Major Components of the Selected Remedy

- In situ treatment of groundwater via air sparging to remove volatile organic compounds, thereby attaining state and federal drinking water standards. Additional air sparging wells will be placed to optimize the existing treatment system;
- In situ treatment of soils via soil vapor extraction to prevent contaminated soils from acting as an ongoing source of contamination to

groundwater. Additional soil vapor extraction wells will be placed to optimize the existing treatment system;

- The treatment system will be evaluated and modified as necessary to optimize effectiveness;
- Air emissions from the soil vapor extraction/air sparging treatment system will be monitored and evaluated periodically to meet emission requirements;
- The duration of treatment system operation is estimated to be three
  years to meet State of Alaska cleanup levels for non-underground
  storage tank petroleum-contaminated soil and state and federal MCLs.
  A combination of groundwater monitoring and off-gas measurements
  will be used to determine attainment of remedial action objectives;
- After active treatment achieves state and federal maximum contaminant levels, natural attenuation will be relied on to achieve Alaska Water Quality Standards; and
- Maintaining institutional controls, including restricted access and well
  development restrictions, as long as hazardous substances remain on
  site at levels that preclude unrestricted use.

#### 7.2.2 Goals of Remedial Action

The overall goal of a remedial action is to provide the most effective mechanism to meet state and federal MCLs for drinking water. To facilitate selection of the most appropriate remedial action, source area-specific cleanup objectives that specify the contaminants of concern in each medium of interest, exposure pathways and receptors, and an acceptable regulatory level were developed. The following remediation goals were established for the specific contaminants of concern determined to require remedial action at both source areas. These goals are intended for the areas where active remediation will occur.

#### 7.2.3 Building 1168 Leach Well Groundwater and Soil

CHEMICALS OF CONCERN IN GROUNDWATER	REMEDIATION GOAL (μg/L) <sup>a</sup>
Benzene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Vinyl chloride	2.0
1,1-Dichloroethene	7.0
1,2-Dichloroethene	70.0

Groundwater remediation goals are based on state and federal MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).

At the Building 1168 Leach Well, after state and federal MCLs are achieved through active remediation, passive treatment of groundwater through natural attenuation will be relied on to attain cleanup levels mandated by the AWQS (18 AAC 70).

Because soils contaminated with VOCs and petroleum-related compounds are acting as a continuing source of contamination to groundwater, the remedial action goal for in situ soils is active remediation until contaminant levels in groundwater are consistently below state and federal MCLs. The State of Alaska cleanup levels for non-UST petroleum-contaminated soil will be considered as a guideline for the treatment of in situ soils.

The cost for Alternative 3 is \$174,000 for present worth capital costs, which include direct and indirect costs; annual monitoring for 15 years at \$29,000 (monitoring frequency may vary); and a present worth of annual operating cost of \$66,000, for a total cost of \$269,000.

The remedial action goal for in situ soils contaminated with VOC and POL compounds is protection of the groundwater. Because the soils are acting as a continuing source of contamination to the groundwater, active remediation of the soils will continue until state and federal MCLs are met consistently. Natural attenuation will continue until AWQS are met. Some changes or modifications could be made to the remedy as a result of Remedial Design and construction processes. These changes will be addressed in post-ROD documents.

The goal of this remedial action is to restore groundwater to its beneficial use, which is, at this site, a potential drinking water aquifer, and to remediate soil to State of Alaska cleanup levels for non-UST petroleum-contaminated soil. Based on information obtained during the RI and on careful analysis of all remedial alternatives, the Army, EPA, and ADEC believe that the selected remedy would achieve this goal.

Because the remedies will result in contaminants remaining on site above health-based or regulatory levels, a review will be conducted within five years after commencement of remedial action. This review will ensure that the remedies continue to provide adequate protection of human health and the environment.

Table 7-1  DRMO YARD REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS  OPERABLE UNIT 2  FORT WAINWRIGHT, ALASKA	Table 7-1 AL ACTION OBJECTIVES AND 1 OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	SS AND REMEDIATION ALASKA	ON GOALS	
Remedial Action Objectives	Chemicals of	Preliminary Remediation Goal	Basis	Maximum Measured Concentration
Environmental Protection	DRO	ADEC Cleanup Matrix®	ADEC 18 AAC 78	2,500 mg/kg
Prevent mieration of chemicals of concern that could result in	Benzene	5 µg/L	MCL	7.50 g/L
groundwater contamination exceeding chemical specific ARARS.	Tetrachloroethene	5 µg/L	MCL	190 µg/L
water to below circumea	Trichloroethene	5 µg/L	MCL	17 µg/L
Human Reath	Vinyt chloride	2 µg/L	Potential degradation	QN
Reduce cancer risk (via ingestion and inhalation by future residents) to within or below the $1 \times 10^{-4}$ to $1 \times 10^{-6}$ risk	1,1-DCE <sup>b</sup>	7 µg/L	Potential degradation	ΩN
range.	1,2-DCE <sup>b</sup>	70 µg/L	Potential degradation	QN

ADEC soil matrix concentrations will be considered as a guidance for in situ treatment of soils.

Breakdown products of trichloroethene were not detected at concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

# Key:

Alaska Administrative Code. 

Alaska Department of Environmental Conservation.

Applicable or relevant and appropriate requirements. Dichlorochene,

Defense Reutilization and Marketing Office.

Diesel-range organies. Grams per liter. Maximum contaminant level.

Milligrams per kilogram.

Micrograms per liter. Not detected.

	Table 7-2	7.7		
СНЕЛ	CHEMICAL-SPECIFIC CLEANUP GOALS FOR SOIL DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	NUP GOALS FOR S JRCE AREA UNIT 2 HT, ALASKA	OIL	
	CLEANUP GOALS FOR SOIL	S FOR SOIL		
DRMO YARD SCORE		ADEC Cleanup Level (mg/kg)	Level (mg/kg)	
	Diesel		Gasoline/Unknown	
Matrix Score = 44  BTEX = 15 mg/kg  Benzene = 0.5 mg/kg  VPH = 100 mg/kg  EPH = 200 mg/kg	Diesel-Range Petroleum Hydrocarbons (EPH)	Gasoline-Rauge Petroleum Hydrocarbous (VPII)	Benzene	BTEX
	190	ŝ	0.1	01
Level B 27 - 40 Level C 21 - 26	7,000	808	0.5	. S
	2,000	1,000	0.5	001

B Site-specific background groundwater concentration.

Key:

Benzene, toluene, ethylbenzene, xylene.

b Background concentrations from USAED Ataska-recommended background value for Fort Wainwright.

C Groundwater remedial goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).

B. Level A cleanup goal is applied to the total matrix score of 44 because of the soil acting as an ongoing source of contamination to groundwater. d 18 AAC 70, Water Quality Standards. The regulatory level for BTEX is 10 µg/L.

Alaska Department of Environmental Conservation. Alaska Administrative Code. AAC ADEC BTEX CFR CFR DRMO

Code of Federal Regulations. Defense Reutilization and Marketing Office. Diesel-range petroleum hydrocarbons. Maximum contaminant level. Micrograms per liter. 11 11 MCL\*

Miligram per kilogram. United States Army Engineer District, Alsska. Gasoline-range petroleum hydrocarbons. Hg/L mg/kg = USAED Alaska VPH =

		Table 7-3			
BUILDING	BUILDING 1168 LEACH WELL SOURCE AR	AREA REMEDIAL ACTION OB OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	ELL SOURCE AREA REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	AND REMEDIATIC	ON GOALS
Media	Remedial Action Objectives	Chemicals of Concern	Preliminary Remediation Goal	Basis	Maximum Measured Concentration
Subsurface soil	Environmental Protection	DRO	ADEC soil cleanup matrixa	ADEC 18 AAC 78	435 mg/kg
	CONCEIN.	GRO	ADEC soil cleanup matrix	ADEC 18 AAC 78	2,000 mg/kg
	Reduce chemical concentrations to below ADEC cleanup fevels.	втех	ADEC soil cleanup matrix*	ADEC 18 AAC 78	Not available
Groundwater	Environmental Protection	Benzene	5 µg/L	MCL	250 µg/L <sup>b</sup>
-	Restore groundwater to below chemical- specific ARARs.	Trichloroethene	5 μg/L	MCL	23.0 g/L
	Human Health Reduce cancer risk (via ingestion and	Vinyl chloride	2 µg/L	Potential degradation product	QN
	inhalation by future residents) to within or below the EPA accepted risk range of $1 \times 10^{-4}$ to $1 \times 10^{-6}$	1,1.DCE	7/8H L	Potential degradation product	ND
		1,2-DCE	70 µg/L	Potential degradation product	QN

Note: Breakdown products of trichloroethene were not detected in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

Key at end of table.

ADEC soil concentrations will be considered as a guidance for treatment of in situ soils.
 Maximum concentration of henzene was measured in a proundwater sample collected from

Maximum concentration of benzene was measured in a groundwater sample collected from Microwell installed by Pine and Swallow under direction from the United States Army's Cold Regions Research and Engineering Laboratory. The sample was collected and analyzed in September 1993 (HLA 1994).

Table 7-3 (Cont.)

Key:

AAC = Alaska Administrative Code.

ADEC = Alaska Department of Environmental Conservation.

ARARs = Applicable or relevant and appropriate requirements.

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

DCE = Dichloroethene.

DRO = Diesel-range organics.

EPA = United States Environmental Protection Agency,

GRO = Gasoline-range organics.

g/L = Grams per liter.

HLA = Harding Lawson Associates.

Maximum contaminant level.

μg/L = Micrograms per liter.
mg/kg = Milligrams per kilogram.
ND = Not detected.

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	Table 7.4		!	
CHEMICAL-SPECIFIC CLEANUP GOALS FOR SOIL BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 1 FORT WAINWRIGHT, ALASKA	IEMICAL-SPECIFIC CLEANUP GOALS FOR SO BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA	S FOR SOIL ICE AREA KA		
CLEANU	CLEANUP GOALS FOR SOIL	ı		
BUILDING 1168 LEACH WELL SOURCE AREA SCORE		ADEC Cleanup Level (mg/kg)	Level (mg/kg)	
	Diesel	)	Gasotine/Unknown	İ
Matrix Score = 46  BTEX = 15 mg/kg  Benzene = 0.5 mg/kg  VPH = 100 mg/kg  EPH = 200 mg/kg	Diesel-Range Petroleum Hydrocarbons (EPII)	Gasoline-Range Petroleum Hydrocarbons (VPH)	Benzeng	BTEX
	905	0.5	0.1	01
Level B 27 :: 40 Level C 21 : 26	200	200	0.3	50 S0
Level D <20	2,000	1,000	0.5	<b>60</b>

Site-specific background groundwater concentration.

Background concentrations from USAED Alaska recommended background value for Fort Wainwright.

Groundwater remedial gouls are based on federal and state MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80). O

18 AAC 70, Water Quality Standards. The regulatory level for BTEX is 10 µg/L. J

Level A cleanup goal is applied to the total matrix score of 46 because of soil acting as an ongoing source of contamination to groundwater.

Alaska Administrative Code. Alaska Department of Environmental Conservation.

**1**1 11

Key:

Benzene, toluene, ethylbenzene, total xylene. Diesel-range petroleum hydrocarbons. Code of Federal Regulations. Maximum contaminant level. Micrograms per liter. AAC = ADEC = BTEX = CFR \* CFR \* EPH = MCLs r wg/L r wg/L r vg/kg : USAED Alsska : VPH

Milligrams per kilogram, United Stated Army Engineer District, Alaska. Gasoline-range petroleum hydrocarbons.

#### 8.0 STATUTORY DETERMINATIONS

The main responsibility of the Army, EPA, and ADEC under their legal CERCLA authority is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA, as amended by SARA, provides several statutory requirements and preferences. The selected remedy must be cost-effective and utilize permanent treatment technologies or resource recovery technologies to the extent practicable. The statute also contains a preference for remedies that permanently or significantly reduce the volume, toxicity, or mobility of hazardous substances through treatment. CERCLA finally requires that the selected remedial action for each source area must comply with ARARs established under federal and state environmental laws, unless a waiver is granted.

#### 8.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected alternatives for the DRMO Yard and Building 1168 Leach Well source areas will provide long-term protection of human health and the environment and satisfy the requirements of Section 121 of CERCLA.

#### 8.1.1 Defense Reutilization and Marketing Office Yard

The selected remedy will provide long-term protection of human health and the environment by removing the contamination from soils and groundwater through installation of an SVE/AS system. The remedy will eliminate the potential exposure routes and minimize the possibility of contamination migrating to drinking water sources. Groundwater monitoring/evaluation will be completed to assess contaminant plume movement and concentrations.

#### 8.1.2 Building 1168 Leach Well

The selected remedy will provide long-term protection of human health and the environment by removing the contamination from soils and groundwater through installation of an SVE/AS system. The remedy will eliminate the potential exposure routes and minimize the possibility of contamination migrating to drinking water sources. Groundwater monitoring/evaluation will be completed to assess contaminant plume movement and concentrations.

# 8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO-BE-CONSIDERED GUIDANCE

The selected remedy for each source area will comply with all applicable, relevant, and appropriate requirements of federal and state environmental and public health laws. These requirements include compliance with all the location-, chemical-, and action-specific ARARs listed below. No other waiver of any ARAR is being sought or invoked for any component of the selected remedies.

### 8.2.1 Applicable or Relevant and Appropriate Description

An ARAR may be either "applicable" or "relevant and appropriate." Applicable requirements are those substantive environmental protection standards, criteria, or limitations promulgated under federal or state law that specifically addresses a hazardous substance, remedial action,

location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those substantive environmental protection requirements promulgated under federal and state law that, while not legally applicable to the circumstances at a CERCLA site, addresses situations sufficiently similar to those encountered at the CERCLA site so that the requirements' use is well-suited to the particular site. The three types of ARARs are described below:

- Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies that establish an acceptable amount or concentration of a chemical in the ambient environment;
- Action-specific ARARs are usually technology- or activity-based requirements for remedial actions; and
- Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activity solely because the ARARs occur in special locations.

To-be-considered requirements (TBCs) are nonpromulgated federal or state standards or guidance documents that are to be used as appropriate in developing cleanup standards. Because they are not promulgated or enforceable, TBCs do not have the same status as ARARs and are not considered required cleanup standards. They generally fall into three categories:

- Health effects information with a high degree of credibility;
- Technical information regarding how to perform or evaluate site investigations or response actions; and
- State or federal agency policy documents.

# 8.2.2 Chemical-Specific Applicable or Relevant and Appropriate Requirements

- Federal Safe Drinking Water Act (40 CFR 141) and Alaska Drinking Water Regulations (18 AAC 80): The MCL and non-zero MCL goals were established under the Safe Drinking Water Act and are relevant and appropriate for groundwater that is a potential drinking water source;
- AWQS (18 AAC 70): Alaska Water Quality Standards for Protection of Class (1)(A) Water Supply, Class (1)(B) Water Recreation, and Class (1) Aquatic Life and Wildlife (18 AAC 70) are applicable to both source areas. Many of the constituents of groundwater regulated by AWQS are identical to MCLs in Drinking Water Standards;
- Alaska Oil Pollution Regulations (18 AAC 75): Alaska Oil Pollution Control Regulations, are applicable. Under these regulations, responsible parties are required to clean up oil or hazardous material

- releases. The Army anticipates achieving a cleanup level consistent with this regulation; and
- Alaska Regulations for Leaking Underground Storage Tanks (18 AAC 78): The State of Alaska has established cleanup requirements for petroleum-contaminated soils from leaking USTs to protect groundwater and are relevant and appropriate for the DRMO Yard.

# 8.2.3 Location-Specific Applicable or Relevant and Appropriate Requirements

No location-specific ARARs have been identified for the DRMO Yard and Building 1168 Leach Well source areas.

## 8.2.4 Action-Specific Applicable or Relevant and Appropriate Requirements

- RCRA Subtitle C Hazardous Waste Management Standards must be
  considered in the evaluation of whether any of the excavated soils from
  the OU-2 source areas exhibit the characteristics of a RCRA hazardous
  waste; however, no soils have been identified to date. RCRA
  regulations will be applicable to the storage and disposal of any RCRA
  hazardous waste;
- Federal Clean Air Act (42 United States Code 7401), as amended, is applicable for venting contaminated vapors;
- Alaska Air Quality Control Regulations (18 AAC 50). Although onsite remedial actions do not require permitting, the substance portion of these regulations must be met for the venting of contaminated vapors associated with operation of the air sparging, SVE, or LTTD; and
- Alaska Solid Waste Management Regulations (18 AAC 60) must be met for proper management and transport of wastes that meet the definition of a RCRA hazardous waste but contain contaminants that exceed cleanup levels.

#### 8.2.5 Information To-Be-Considered

The following information TBC will be used as a guideline when implementing the selected remedy:

- State of Alaska Interim Guidance for Non-UST Contaminated Soil Cleanup Levels (July 17, 1991) for the Building 1168 Leach Well;
- State of Alaska Guidance for Storage, Remediation, and Disposal of Non-UST Petroleum-Contaminated Soils (July 29, 1991) for the Building 1168 Leach Well; and
- State of Alaska Interim Guidance for Surface and Groundwater Clean-

up Levels (September 26, 1990) for both source areas.

#### 8.3 COST EFFECTIVENESS

The selected remedies provide an overall effectiveness proportionate to their costs, such that they represent a reasonable value for the money spent.

#### 8.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREAT-MENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The Army, State of Alaska, and EPA have determined that the selected remedies represent the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner at the OU-2 source areas. Of those alternatives that protect human health and the environment and comply with ARARs, the Army, State of Alaska, and EPA have determined that the selected remedies provide the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; and the statutory preference for treatment as a principal element in considering state and community acceptance.

#### 8.5 PREFERENCE FOR TREATMENT AS A MAIN ELEMENT

The selected remedy for each source area satisfies the statutory preference for treatment for soil and groundwater.

#### 9.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy for the DRMO Yard and Building 1168 Leach Well source areas is the same preferred alternative for each area presented in the Proposed Plan. No changes in the components of the preferred alternative have been made.

#### APPENDIX A

# FORT WAINWRIGHT COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT FEDERAL FACILITY AGREEMENT RECOMMENDED ACTION DOCUMENTS

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Source Area	<u>Pa</u>	age
801 DRUM BURIAL SITE		ii
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BUILDING 3477	•	
TAR SITES		
DEFENSE REUTILIZATION AND MARKETING OFFICE YARD		
BUILDING 1168 LEACH WELL		٠.
NORTH POST SITE		<i>.</i> .

#### FORT WAINWRIGHT

# CERCLA FEDERAL FACILITY AGREEMENT

#### RECOMMENDED ACTION

Source Area:

801 Drum Burial Site

Engineer Park Drum Site Drum Site South of Landfill

Recommended Action: Referral from Operable Unit 2 to Operable Unit 1.

<u>Background</u>: A removal action was completed on these source areas in 1992. The information needed to adequately assess further actions was not received in time to meet the schedule of Operable Unit 2. It was agreed by the Project Managers to move these source areas to Operable Unit 1.

#### Comments:

Directorate of Public Works Remedial Project Manager

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Ricle Marken		2-4-94
Rielle Markey  Alaska Department of Environmental Cor Remedial Project Manager	Date iservation	
Danne Sodelund		2/4/94
Dianne Soderlund US Environmental Protection Agency Remedial Project Manager	Date	·
Crestal Forbrook		4 Feb 94
Cristal Fosbrook 6th Division (Light), US Army Garrison	Date	

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#### FORT WAINWRIGHT

#### CERCLA FEDERAL FACILITY AGREEMENT

#### RECOMMENDED ACTION

Source Area: Tar Sites

Recommended Action: No Further Action

Background: After evaluation of all available historical information and interviews with individuals having an institutional knowledge of Fort Wainwright (FWA), site visit and review of analytical data, no further action (NFA) is planned for this source based on one or more of the following reason:

#### 1. 1992 analytical results.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source, the ultimate risk to human health or the environment that it represents, and analytical results. If, at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 2, as designated by the Federal Facility Agreement (FFA), which was signed by US Environmental Protection Agency (EPA) the Alaska Department of Environmental Conservation (ADEC) and the US Army.

Location: West of the FWA South Post Soccer Field; at Glass park next to Building 4040; northwest of the FWA Golf Course; and west of the power plant cooling pond next to the railroad.

History: Reportedly the sites were used as tar disposal areas. Based on a concern of possible leachate release from these sites, they were included in the FFA as sources that needed further investigation. A sampling effort was conducted in June and July of 1992. The results we summarized in U.S. Army Corps of Engineers memorandum dated October 7th and 15th 1992.

Summary: The criteria used in the decision process for this site is as follows:

 During a 1992 sampling effort the source areas were located and tar samples were collected for Toxicity Characteristic Leaching Procedure (TCLP) analysis; The analytical results indicate that there is no potential for groundwater contamination.

Based on the above information, there is no evidence that a potential source of contamination exists at these sites.

Reference: October 7th and 15th chemical analysis results of the samples collected in June and July of 1992.

#### Comments:

Future actions with these sites should be coordinated with the Solid waste/Pollution Prevention program of AK. Dept. of Environmental Conservation.

7-25-94

# TAR SITES NO FURTHER ACTION

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Alaska Department of Environmental Conservation

Remedial Project Manager

Dianne Soderlund

US Environmental Protection Agency

Remedial Project Manager

6th Division Light/US Army Garrison .

Directorate of Public Works

Remedial Project Manager

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#### FORT WAINWRIGHT

# CERCLA FEDERAL FACILITY AGREEMENT RECOMMENDED ACTION

Source Area: Engineer Park Drum Site

Recommended Action: No Further Action (NFA).

<u>Background</u>: After evaluation of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright, site visits, and review of analytical data, no further action is planned for this source based on the following reasons:

- 1. In 1992, 680 drums were removed.
- 2. Results of 1992 and 1993 limited field investigations.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 1, as designated by the Federal Facility Agreement (FFA), which was signed by the Alaska Department of Environmental Conservation (ADEC), the US Environmental Protection Agency (USEPA), and the US Army. This source was moved from OU2 to OU1 as part of a Recommended Action dated February 4, 1994.

<u>Location</u>: This source is located on the northeast side of Engineers Park on the south bank of the Chena River. See attached map of source area.

History: Disposal of drums at this location began after the August 1967 flood.

Summary: The criteria used in the decision process for this site is as follows:

- A drum removal was conducted in August and September of 1992. The crum removal activities at this site included removing unburied drums. A total of 680 drums were removed, 613 of the drums found were empty and 67 contained material. The drums contained gasoline, kerosene, degreasing solvents and PCE.
- During a 1992 investigation ten surface soils samples were taken. Low levels of semivolatile organic compounds were detected. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10's Risk-Based-Concentrations, which were used as conservative screening values. The comparison indicates no unacceptable potential risks to human health or the environment.
- During 1993 ground penetrating radar (GPR) was conducted with no additional drums being located. Additionally, eleven surface samples were taken and two soil borings were completed as monitoring wells. The maximum detected size concentration of the suspected contaminates were compared to EPA Regions 10's Risk-Based-Concentrations and the comparison indicates no unacceptable risks to buman health or the environment.
- In both sampling events an observational approach was employed to assure samples represented potential worst case contamination.
- Detected concentrations of soil with Di-n-butylphthalate were determined to be laboratory contaminates.
- All detected concentrations in groundwater data were determined to be laboratory contaminates.

Based on the above information there is no evidence that a contaminant release has occurred at this source area which poses an inacceptable risk to human health or the environment.

#### References:

<u>Preliminary Source Evaluation 2. Blair Lakes and Drum Sites.</u> Fort Wainwright, AK, Harding Lawson and Associaties, March 1994

Final Report for Drummed Waste Removal, Fort Wainwright, Fairbanks, Alaska, Volume I. II. and III, OHM Remediation Services Corporation, February 1993

#### Comments:

# Engineer Park Drum Site-No Further Action

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

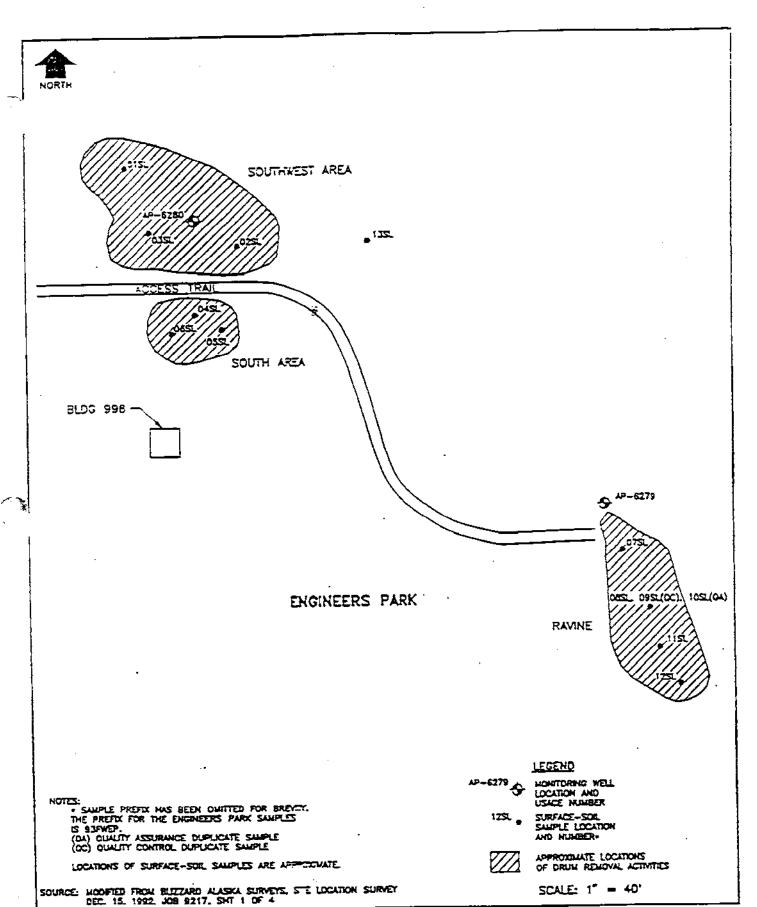
Rielle Marken	_ <u></u>	1-25-99
RIELLE MARKEY	Date	
Alaska Department of Environmental Conse	∍rvation	
Remedial Project Manager		
		1.101
Warner Solement		6/16/94
DIANNE SODERLUND	Date	
US Environmental Protection Agency		

CRISTÁL FOSBROOK

Remedial Project Manager

Date

6th Division (Light), US Army Garrison Directorate of Public Works, Alaska Remedial Project Manager



Har Eng Env	ding Lawson Associates incering and ironmental Services	Site Plan Engineers Operable Unit Fort Wainwrig	1. Preliminary Sour	Ee Evaluation 2	4
DRASK JP	24549	JA-	9/93 64F	235J	
				65	041

#### FORT WAINWRIGHT

# CERCLA FEDERAL FACILITY AGREEMENT

#### RECOMMENDED ACTION

Source Area: Building 3477 - Battery Storage Area

Recommended Action: No Further Action

Background: Based on a review of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright and, if possible, this site, and a limited field investigation. No further action (NFA) is planned for this source based on one or more of the following reasons:

- 1. Interviews with individuals confirming the source existed.
- 2. Results of a 1992 limited field investigation at the source indicates no real potential risks to human health or the environment exists at the battery storage area.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If, at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 2, as designated by the Federal Facility Agreement (FFA), the Alaska Department of Environmental Conservation (ADEC) and the US Army on February 12, 1993.

Location: The battery storage area is located on the east side of Building 3477. Building 3477 is on Chippewa Avenue, approximately 1/4 mile northeast of the South Gate House.

History: Building 3477 was constructed 1955 as a vehicle maintenance facility. The building is currently used for vehicle and equipment maintenance. The site had been used for servicing and storing batteries for an unknown period. These practices were discontinued in 1990, and the U.S. Army contracted for the battery servicing area to be cleaned. The area on the east side of the building

was used for temporary storage of batteries that were to be disposed of. Basec on the potential for contaminant release from this site, it was included in the FF as a source that needed further investigation through the Preliminary Source Evaluation (PSE) 2 process. A draft PSE report was published November 4, 1992.

Summary: The criteria used in the decision process for this site is as follows:

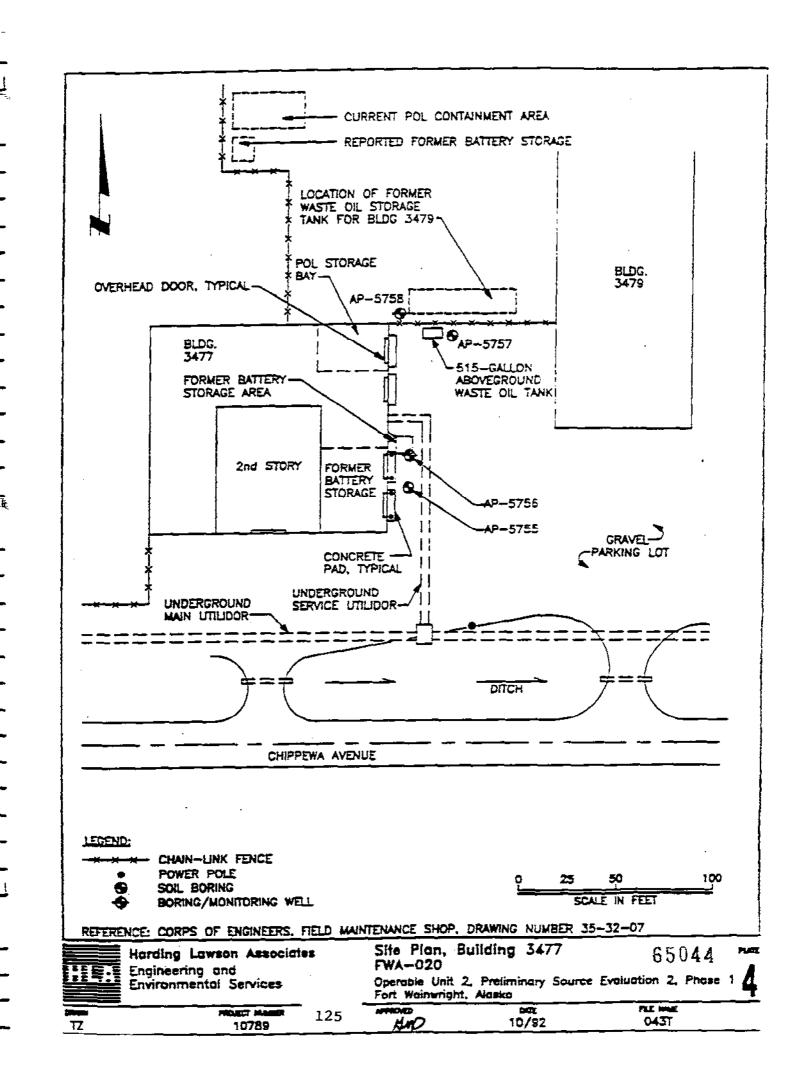
- During interviews with former US Army personnel, one soldier stated the site was no longer used as a storage area for batteries that were to be disposed of.
- During interviews with current and former employees (the site was identified an area of building 3477).
- During a 1192 limited field investigation samples were collected. The maximum detected site concentrations of the suspected contaminates were compared with EPA Region 10's Risk-Based Concentrations and the comparist indicates no real or potential risks to human health or the environment exists at the battery storage area. Attachment 1 includes a plot plan of this source.
- Based on the above information, there is no evidence that a potential source of contamination exists at this site.

Reference: <u>Final Report. Operable Unit 2. Preliminary Source Evaluation 2.</u>

<u>Phase 1. Fort Wainwright. Alaska.</u>; Harding Lawson and Associates,

April 23, 1993.

Comments:



Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey Alaska Department of Environmental Conservation Remedial Project Manager	1/(3/24) Date
Dianne Soderlund US Environmental Protection Agency Remedial Project Manager	1/.2/9-1 Date
Cristal Fosbrook 6th Division Light/US Army Garrison Directorate of Public Works	13 Jan 94 Date

Remedial Project Manager

#### FORT WAINWRIGHT

# CERCLA FEDERAL FACILITY AGREEMENT RECOMMENDED ACTION

Source Area: Drum Site South of Landfill

Recommended Action: No Further Action (NFA).

<u>Background</u>: After evaluation of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright, site visits, and review of analytical data, no further action is planned for this source based on the following reasons:

- 1. In 1992, 573 drums were removed.
- 2. Results of 1992 and 1993 limited field investigations.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 1, as designated by the Federal Facility Agreement (FFA), which was signed by the Alaska Department of Environmental Conservation (ADEC), the US Environmental Protection Agency (USEPA), and the US Army. This source was moved from OU2 to OU1 as part of a Recommended Action dated February 4, 1994.

<u>Location</u>: This source is located on the south of the landfill and includes drum areas, referred to as the east and west drum sites. See attached map of source area.

<u>History</u>: Historical information and records on drum disposal at this location were not available. The site was identified in the RCRA Facility Assessment as a potential source.

Summary: The criteria used in the decision process for this site is as follows:

- A drum removal was conducted in August and September of 1992. The drum removal activities at this site included removing unduried drums. A total of 573 drums were removed, 474 of the drums found were empty and 99 contained material. The drums contained gasoiine, kerosene and degreasing solvents.
- During a 1992 investigation eleven surface soils samples were taken. Low levels semivolatile organic compounds were detected. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10 Risk-Based-Concentrations, which were used as conservative screening values. These levels are within the 10-4 to 10-6 acceptable risk range as specified in 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP).
- During 1993 ground penetrating radar (GPR) was conducted with no additional drums being located. Additionally, eleven surface samples were taken and two aborings were completed as monitoring wells. Low levels of semivolatile organic compounds were detected in groundwater. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10 Risk-Based-Concentrations, which were used as conservative screening values. These levels are within the 10-4 to 10-6 acceptable risk range as specified in 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP). Attachment 2 includes pertinent analytical data.
- In both sampling events an observational approach was applied to assure sample were taken in areas representing potential worst case contamination.
- Detected concentrations of Di-n-butylphthalate and Bis(2 etthylhexyl)pthaltate is soil were-determined to be laboratory contaminates.

Based on the above information, there is no evidence that a contaminant release has occurred which poses an unacceptable risk to human health or the environment.

#### References:

Preliminary Source Evaluation 2, Elair Lakes and Drum Sites, Fort Wainwright, AK, Harding Lawson and Associaties, March 1994

Final Report for Drummed Waste Removal, Fort Wainwright, Fairbanks, Alaska, Volume I. II. and III. OHM Remediation Services Corporation, February 1993

#### **Comments**

Table 4-5. Analytes Detected in Water Samples From the East and West Orum Sites

	gineers foring No Sample No oratory Sample No Duplicate Qual Project Sample No	mber mber ifier	AP-5277 FWEDCIWA 9492-7 N/A N/A	AP-5278 FWD01VA 9492~5 N/A N/A	AP-5278 FWQDC2VA 9492-5 CC FWQD01VA	F
Anai vte	EPA . Metrod	Units				
Diesel Fuel (as #2) Bunker Oil (as #6 Diesel)	2312Hg 2312Hg	mg/L mg/L	0.08 0.34*	 	ND(0.05) 0.48 <sup>™</sup>	
Gasoline Rende Ordanics	8015H <sup>b</sup>	No a	analytes detected	above the ma	ethod reporting	j lim
Diesel Range Organics 080	E100H <sup>b</sup>	mg/L	0.19*	0.28	0.25*	
Volatile Organic Compounds  Number of TICs  Sum of estimated TIC concentration	5250 on 6250	Η/Α μg/L	2 16	2 <del>=</del> 5 <del>=</del>	2 <del>‡</del> . 15 <del>†</del> .	
Semivolatile Organic Compounds Di-n-putyiphthalate bis(Z-Ethylhexyl)phthalate Number of TICs Sum of estimated TIC concentrati	5270 5270 5270 5270 5270	μg/L μg/L Κ/Α μg/L	- 15	32 B ND(10) 3 33	7 B.E 10 E 1 8	
Organocolorine Pesticides and PCEs	S2 <b>S</b> 0	No.	enalytes detected	above the m	ethod reporting	g lin
Organosmosphorus Pesticides	5140	No	analytes detected	above the m	ethod reporting	g lie
Hetals Arsenic Barium Calcium Iron Lead Hagnesium Hanganese	7050 5010 5010 5010 7421 6010 5010	mg/L mg/L mg/L mg/L mg/L mg/L mg/L	0.0035 0.2  0.0014 	0.012 0.18  ND(0.0010)	0.011	
Potassium Sodium	5010	mg/L			•	

<sup>\*</sup> U.S. Army Corps of Engineers Hodified Hethod 8015H.

.65049

Alaska Department of Environmental Conservation Hodified Hethods 8015M and 8100M.

<sup>\*</sup> Not applicable.

EPA • Environmental Protection Agency, mg/L • Hilligrams per liter.

H/A = Not applicable.

Not detected above method reporting limit shown in parentheses.

PCBs = Polychlorinated bipmenyls.

TIEs . Tentatively identified compounds.

μg/L = Micrograms per liter.

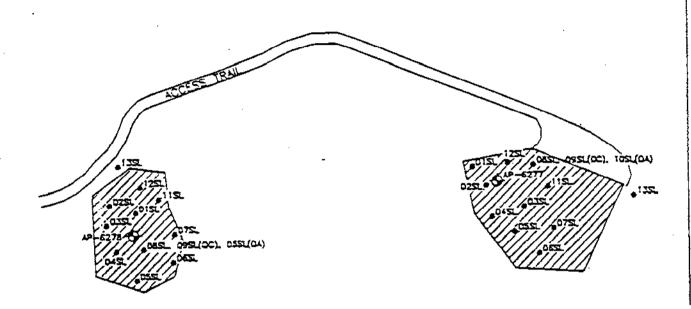
Project Laboratory Qualifiers

8 = indicates the analyte was found in the blank as well as the sample. B = indicates the analyte was found in E = indicates estimated concentration.

Chemical Quality Assurance Report (COAR) Qualifiers

\* Data should be considered with caution (see COAR, Appendix F).

+ The COAR deem the data unacceptable.



\* Sample prefix has been chitted for brevity.
The prefix for the east drum samples is
935450 and for west drum samples 935440.
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(OC) QUALITY CONTROL DUPLICATE SAMPLE LOCATIONS OF SURFACE-STE SAMPLES ARE APPROXIMATE

WEST DRUM AREA

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LECEND

APPROXIMATE LOCATIONS
OF DRUM REMOVAL ACTIVITIES

EAST DRUM AREA

SOURCE: MODERED FROM BUZZARD ALASKA SURVEYS, SITE LOCATION SURVEY DEC. 15, 1892, JOB 9217, SHI 1 OF 4

Harding Lawson Associates

Environmental Services

Engineering and

Site Plans
East and West Drum Areas
Operable Unit 1. Preliminary Sautor E

Fort Weinwright, Alaska TLE MINE 564 -2**35**J 9/93 JP 24549 131

# Drum Site South of Landfill-No Further Action

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

RIELLE MARKEY Date
Alaska Department of Environmental Conservation
Remedial Project Manager

Dianne Soderlund Date
US Environmental Protection Agency
Remedial Project Manager

Cristal Fosbrook Date

6th Division (Light), US Army Garrison Directorate of Public Works, Alaska

Remedial Project Manager

6/16/94

# APPENDIX B

# ADMINISTRATIVE RECORD INDEX

# Fort Wainwright Administrative Record List of Documents Pertaining to OU 2

<u> </u>	Original Doc.	THE	Document	Author Name	Author Organization	Recipient Name	Organization Start Page End Page	Start Page	nd Page
	Date	ey of a Hazardous Waste		Steven A. Arcone	CRREL	Cristal Fosbrook	MdO	02078	02141
!	6/1/86		5 E	None alven	URS Corporation	None given	COE	02142	02210
!	10/1/86	Family Housing Project:-Data Acquisition Frant Confirmation Study: Endangerment Assessment for FTW Family Housing Area; Included			politorocaro O O CI	None given	COE	02211	02822
	4/1/87		Report	None given	Prology &			;	
-		Risk Assessment for Proposed Family Housing Facilities, FTW	<b>Нероп</b>	None given	Environment	CENPA-EN-PM-A	COE	02823	03102
-	8	ena Project, IRP Projects on FTW	Mamorandum	Georgeanne Reynolds	COE	None given	None given	03109	03116
	68/1/12	or Sampling Plan-IRP		Douglas Lowery	ADEC	Eddie Brooks	COE	05118	05120
	7/21/89	North Post Family Housing Memorandum for Record: Tar Seepage in the		Tourne parties			T.	03103	03104
	8/15/89		Memorandum	Bill Quirk	COE	None given	None given	03105	03108
	68/1/6	dwater Contamination at	1000	Loo Sandnikst	Ecology & Environment	Eddle Brooks		05243	05244
	2/9/90	North Post Site on FTW Discussion of Army Request for Interpretation of Groundwater Analytical Data and Their Effect on			Ecology &		u C	06764	05765
	06/6/6	Bemedial Approach for North Post Site	Letter	Jon Sundquist	Environment	Eddle Brooks	- - - - - - - -	3	
	3	EPA Review Comments on Project Report for	letter	Douglas Johnson	EPA	Coi. Edwin Ruff	OEH	03249	03251
	3/1/80	ADEC Review Comments for Draft Project Report			A DEC	Paul Steucke	Env. Res. Div.	03252	03256
	4/3/90	for North Post Site, FTW	Letter	Douglas Dasher	ADEX			_	0
	70,00	Memorandum for Record, Trip Report, Site	Memorandum	David Williams	COE	File	File	- 23117	12121
	25/5/2	TILAGORIA TOTAL TO			Ecology &	Mark Wallace	COE	03122	03241
	2/1/90	Project Report for the North Post Sile, FTW	Report	None given	COE	Public	Public	08303	08303
	5/21/90	Notice of Availability and Comment Period	Notice				700	05240	05242
	6/20/90	Site on Fort Wainwright	Letter	Rielle Markey	ADEC	William Kakel	  -  -  -  -  -	 	
	7/2/00	Remedial Action Required at North Post Site, ETW	Fact Sheet	Catherine Scott	US Army	None given	None given	08304	08304
	116190	Section 1	Article	Kris Capps	Fairbanks Daily News-Miner	Public	Public	05246	06247
	8/2/80	Army Monitors wester site Design Analysis for Soil Remediation Project at	1000	cavio acciv	Ecology & Environment	Mark Wallace	COE	07429	07456
	5/1/91	the North Post Site, FTW Review of Planned Removal Action at North Post	Memorandum	<del></del>	COE	Cristal Fosbrook	DPW	07425	07428
<b>65</b> 0	- Charles								
53		Cumbrand Stadmo reduit		<b>-</b>					6/4/96

# f/lusers/prnyers/coe/do\_3/admn\_rcd/ou\_2

# Fort Wainwright Administrative Record List of Documents Pertaining to OU 2

Original Doc.	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization Start Page End Page	Start Page	End Page
8/1/01	North Post Site Soil		Nane given	COE	Contractors	Contractors	05248	05680
10/17/91	lid Waste Management Units, Issance, FTW Site Safety		Garson Carothers	Harding Lawson	Mark Wallace	COE	03257	03280
11/20/41	nyasiya Sita Inyestigation, SWMU FTW		Garson Carothers	Harding Lawson	CENPA-EN-MB-C	COE	04134	04169
1/9/92	8		James Slattery	Harding Lawson	Mark Wallace	COE	03281	03358
2/14/92	lan PSE,		Garson Carothers	Harding Lawson	Mark Wallace	COE	03359	03488
5/28/92		:	Shaun Sexton	Harding Lawson	CENPA-EN-MB-C	COE	03489	69960
26/23/8	Review Comments for OUZ, PSE2, Phase 2 DRMO		Ronan Short	ADEC	Cristal Fosbrook	DPW	05121	05122
6/23/92		Letter	Dianne Soderlund	EPA	Cristal Fosbrook	DPW	05123	05126
7/28/92	Non-Invasive Site Investigation, DRMO, OU2, PSE2, Phase 2	Report	Sandra Draper	Harding Lawson	CENPA-EN-MB-C	300	04170	04189
		Memorandum	Timothy Seeman	NPDML	Commander	US Allily, An Dist	04190	04223
8/13/92		Letter	Shaun Sexton	Harding Lawson	Mark Wallace	COE	04224	04232
26/8/6	Review Comments for Draft Work Plan for DRMO Storage Yard, PSE2, Phase 2	Letter	Caml Grandinetti	EPA	Cristal Fosbrook	Wda	05127	05129
9/17/92	Work Plan, DRMO, OUZ, PSE2, Phase 2	Report	William Burgess	Harding Lawson	Mark Wallace	COE	036/0	03830
9/18/92	Site Safety and Health Plan, OU2, PSE2, Phase 2	Report	Sandra Draper	Harding Lawson	Mark Wallace	COE	03831	03950
10/5/92	Results of Chemical Analyses	Memorandum	Timothy Seeman	NPDIMIL	Commander	US Army, An Dist	04233	04238
10/7/92	Chemical Analysis Results: Tar Pit	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	US Army	04239	04276
10/16/05	Chambool Analysis Bosuits, Tar Dit 9	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	US Army	04277	04282
10/26/92	Preliminary Summary of Invasive Investigation	Letter	Sandra Draper	Harding Lawson	Mark Wallace	COE	04283	04286
11/1/92	investigations of Burled Drum Sites by Ground Penetrating Radar	Report	Daniel Lawson	CRREL	None given	COE	03242	03248
12/1/92	Błodegredatlon/Volatilizatlon Bench Scale Treatability Study Results for TPH Contaminated Solis Located at the North Post Site	Report	None given	Laidiaw Env. Svcs. None given	None given	COE	08034	08302

# Fort Wainwright Administrative Record List of Documents Pertaining to OU 2

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# Fort Wainwright Administrative Record List of Documents Pertaining to OU 2

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Start Page	26837	26735	37864	24842	24735	27252	48750			37809	39929	   	   			
Recipient Organization Start Page End Page	COE	COE	COE	COE	COE	ajoo	COE	COE	COE		COE	COE	COE	COE	US EPA Reg X; ADEC	COE
Recipient Name	CENPA-EN-EE-AI	CENPA-EN-EE-AL	None given	None given	CENPA-EN-EE-AI	None given	Mark Wallace	None given	None given	None aiven	Mark Wallace	Mark Wallace	Mark Wallace	Mark Wallace	D. Soderlund; R. Markey	Mark Wallace
Author Organization	Harding Lawson		Oil Spill Technology, Inc.	Harding Lawson	Harding Lawson			ENSR Consulting and Engineering		Ī	Harding Lawson Associates	US Army Center for Health Promotion	Harding Lawson Associates	Harding Lawson Associates	US Army Directorate of Public D. Soderlund; R. Works	Harding Lawson Associates
Author Name	Michael J. Schmetzer		 ! 		metzer	Joseph W. McElroy	Tim Gould					Jack M. Heller	Karol Lorraine, J. Robert Allen	Joseph W. McElroy, Timothy F. Gould	Albert J. Kraus	Michael Schrnetzer, George Drewett
Document Type		andum	, -		<u> </u>		Report 1							andum		Report
Title	Qualitative Ecological Risk Assessment Approach, Remedial finvestigation, Operable Unit P. Fort Wainwright, Alaska	MO and Building 1168,	sment, and ding 1168. August 1994	Ī	ī	ty Study,	Building 1169 Treatability Study Offgas Assessment	<del>:</del> : 	Final Work Plan for Release Investigations Building 1002, 1168, and 2250, Fort Wainwright,	al Memorandum, Underground Storage elease Investigations at the North Post	Final Human Health Risk Assessment, OU2, Deliver, Order 002	Review Comments on Final Human Health Risk Assessment, Operable Unit 2, Fort Walnwright,	Release Investigation Report, North Post Site 4, Fort Weinwright Alaska	Technical Memorandum, Monitoring Results, Building 1168 Treatability Study, Fort Wainwright,	Request for Extension of Document Deadline for the Operable Unit 2 Record of Decision	Operable Unit 2 Final Remedial Investigation Report, Fort Wainwright, Alaska, Volumes I, II, III
Original Doc. Date	,			10/14/94	1/10/95	1/31/95	5/15/95	7/1/95	7/1/06	100000	10/13/95	26,000	19/90/95	90/64/1	1/16/96	1/25/96

# Fort Wainwright Administrative Record List of Documents Pertaining to OU 2

		4/1/96			Date	Original poc.	Original Dos	
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Public		Cristal Fosbrook	Public	-		Recipient Name		
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# APPENDIX C

### RESPONSIVENESS SUMMARY

# RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION FOR REMEDIAL ACTION AT OPERABLE UNIT 2, FORT WAINWRIGHT, ALASKA

### OVERVIEW

The United States Army, Alaska (Army); United States Environmental Protection Agency; and Alaska Department of Environmental Conservation, collectively referred to as the Agencies, distributed a Proposed Plan for remedial action at Operable Unit 2 (OU-2), Fort Wainwright, Alaska. OU-2 comprises eight source areas: the Defense Reutilization and Marketing Office (DRMO) Yard, the Building 1168 Leach Well, the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, and the Tar Sites.

The Proposed Plan identified preferred remedial alternatives for two of the eight source areas within OU-2: the DRMO Yard and Building 1168 Leach Well. The other six source areas were not considered for remedial action in the Proposed Plan. The soil contamination at the North Post Site consists of petroleum and petroleum-related products and will be addressed through an Army removal action that includes excavation, treatment, and proper disposal of the remediated soil. The 801 Drum Burial Site, Engineers Park Drum Site, and Drum Site South of the Landfill were assigned to Fort Wainwright OU-1 for a more comprehensive investigation and will addressed through that OU's decision process. Finally, no further action is recommended for Building 3477 and the Tar Sites.

The major components of the remedial alternatives for the DRMO Yard are:

- Soil vapor extraction,
- Groundwater air sparging with natural attenuation, and
- Groundwater monitoring/evaluation.

The major components of the remedial alternatives for the Building 1168 Leach Well are:

- Soil vapor extraction,
- Groundwater air sparging with natural attenuation, and
- Groundwater monitoring/evaluation.

No formal comments regarding the Proposed Plan for the OU-2 remedial action were submitted during the public comment period.

## BACKGROUND OF COMMUNITY INVOLVEMENT

The public was encouraged to participate in the selection of the final remedies for OU-2 during a public comment period from May 1 to May 31, 1996. The Fort Wainwright Proposed Plan for Remedial Action at Operable Unit 2 presents combinations of options considered by the Agencies to address contamination in soil and groundwater at OU-2. The Proposed Plan was released to the public on May 1, 1996, and copies were sent to all known interested parties, including elected officials and concerned citizens. Informational Fact Sheets dated March and September 1995 and March 1996, which provided information

about the Army's entire cleanup program at Fort Wainwright, were mailed to the addresses on the same mailing list.

The Proposed Plan summarized available information regarding the OU. Additional materials were placed into two information repositories: one at the Noel Wien Library in Fairbanks and the other at the Fort Wainwright Post Library. An Administrative Record, including all items placed in the information repositories and other documents used in the selection of the remedial actions, was established in Building 3023 on Fort Wainwright. The public was welcome to inspect materials available in the Administrative Record and the information repositories during business hours.

Interested citizens were invited to comment on the Proposed Plan and the remedy selection process by mailing comments to the Fort Wainwright project manager, by calling a toll-free telephone number to record a comment, or by attending and commenting at a public meeting on May 8, 1996, at the Carlson Center in Fairbanks.

Basewide community relations activities conducted for Fort Wainwright, which includes OU-2, have included:

- July 1992—Community interviews with local officials and interested parties;
- April 1993—Preparation of the Community Relations Plan;
- July 1993—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright;
- July 22, 1993—An informational public meeting covering all OUs;
- April 22, 1994—Establishment of information repositories at the Noel Wien Library and the Fort Wainwright Post Library and at the Administrative Record at Building 3023 on Fort Wainwright;
- March 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright;
- September 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright; and
- March 1996—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright.

Community relations activities conducted specifically for OU-2 included:

- April 28 and May 1, 5, 6, 7, and 8, 1996—Display advertisement announcing the public meeting in the Fairbanks Daily News-Miner;
- May 1, 1996—Distribution of the Proposed Plan for final remedial action at OU-2;

- May 1 to May 31, 1996—Thirty-day public comment period. No extension was requested;
- May 1 to May 31, 1996—Toll-free telephone number for citizens to
  provide comments during the public comment period. The toll-free
  telephone number was advertised in the Proposed Plan and the newspaper
  display advertisement that announced the public meeting; and
- May 8, 1996—Public meeting at the Carlson Center to provide information, a forum for questions and answers, and an opportunity for public comment regarding OU-2.

### SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

No comments were received during the public comment period.

### APPENDIX D

# FORT WAINWRIGHT OPERABLE UNIT 2 SOURCE AREA BASELINE COST ESTIMATES FOR REMEDIAL ALTERNATIVES

# BUILDING 1168 SOURCE AREA BASELINE COST SUMMARY

# Fort Wainwright OU-2 Feasibility Study Building 1168 Baseline Cost Estimate Summary

Component		Ret	medial Action Alterna	tive	
	Alternative 1	Alternative Z	Alternative 3	Alternative 4	Alternative 5
Present Worth of GW Monitoring	\$9	\$81,000	\$29,088	\$29,000	\$29,000
Present Worth of Capital Costs*	\$0	\$49,000	\$174,000	\$452,000	\$350,000
Present Worth of AOC	\$0	\$0	\$66,000	\$78,000	\$119,000
Total Cost to Implement	\$0	\$130,000	\$269,000	\$559,000	\$498,000

<sup>\*</sup> Includes Direct and Indirect Capital Costs.

GW: groundwater

ABC: annual operating cost

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 1 No Action

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# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 1 No Action

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	Design and development			75.00	hr :	\$0	
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	Monitoring and testing (Year D)		3	<b>€</b> 5.00	þт	40	
	Project engineering		0	<i>6</i> 5,00	hr	<b>‡</b> 0	
Subtotal							50
Ingineesing : Decommiss	ioning	NA		A.C. BA		\$0	
	Administration and supervision		)	25.00	Į	) \$0   \$0	
	Design and development		-	75.00 55.00	l	\$0	
	Orafting		3		!	\$5	
	Monitoring and testing		s	55.00 55.00	i i	\$0 \$0	
	Project engineering			53.00	1.0	1 **	s i
Subrotal						<u> </u>	
LicenselPermit/Legal	(10% angineering costs)	NA	=	S.00	ea.	\$0	ţ
Start-up and Shake Dow	m of Treatment System	NA.					
	Materials	i	¢	1,000.00	}	10	
	Labor		) 3	[	1	<b>\$</b> D	
	Equipment	1	] 3	ı	į	\$0	
	Lab Testing	ļ <u> </u>	<u>                                      </u>	500.00	) ea	\$G	
Subtotal							\$6
Contingency	(15% capital costs)	NA	,	2.04	LS	\$0	s.
		NA.					4
Tetal Annual Speratir	g Cast Yea		}	}		1	\$

ea: each

hr: hour

IC: indirect capital cost

NA; not applicable for this alternative

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.1 No Action

### Annual System Operation Cost Detail

	'র্থ	Cuantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Totallyear
Operating Labor Cost		1		T -		NA NA	T
[Post-Construction]	frem 1: Groundwater monitoring	1 0	ļ	N	}		\$0
	Item 2: Training	1 3	ł	LS	1	ĺ	\$0
Subtotal				1	T		\$0
<u> </u>		<u> </u>	<u> </u>	<u> </u>	<u></u>	<u> </u>	<u> </u>
Routine Maintenance Materials and	Labor Eost	1		-		NA NA	
iter	It Groundwater mornoring annual maintenance	1 0	ĺ	[LS	1		\$0
(terr	Z: SVEJair sparge wei annual maintenance	0	Į	12	ĺ		\$0
ten	3: SVEI air sparge system annual maintainence	]a		LS	<u>l</u> i		\$0
Subtotal		]					\$0
Auxbary Materials and Energy		<del></del> -		<del> </del>	<del> </del>	NA NA	<del>!</del>
,	Process Chemicas	l a	1	ŁS	1		\$0
	Electricity	ا آ	ŀ	15	1		\$0
	Water	) ,	ŀ	15	] ]		\$0
	Sewer	ָרֶם <u>"</u>		LS			\$0
	Sewel Fuel	) D:		is	'		30
Subtotal	700	<del>  "</del>		113	<del> </del>	<del></del>	\$0
Seriores		]		,	]		, "
				<del>}</del>			\$0
Dispusat of Residues				ļ.,	1 1	NA	ł .
<del></del>	Wash water, Succe. etc.	0		is_	<u> </u>	<u> </u>	\$8
Subtotal				}	{		50
Purchased Services	<del></del>			1		NA NA	_
	Professional Serves			!	l ì		
	item I: Laboratory Fees	o o		ไเร	l 1		\$0
•	item 2:	٥		LS	} {		\$0
	hem 3:	0		LS			10
Subtoral							\$0
Dither:	=			<del> </del>		NA .	
• • • • • • • • • • • • • • • • • • • •				LZ.	}	1974	4.5
diminustrative cases not studented in either line of	(		n	ls		+	\$0
reactions at the efficiental costs promitted for each		<u>'1</u>				]	\$C
fares, icaxeny, permit removal (1% of cause)				rz.	}		\$0
<del>Kamanusca</del> Reserve Fund 17% of coastal costs: Subtotal	REPUBLISH SIN SINCE ASP. AA. SOMEON!		i	LS	<del>                                     </del>		50
Total Annual Operating Cost			-				\$Ü
							•
	į	{					١
		<del></del>		<u> </u>		<u></u>	

Number of years of implementation:

4

AQC: annual operating cost for hour LS: kimp sum NA: not applicable for this alternative SVE: 203 vapor extraction IC: indirect capital cost

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.2 Institutional Controls

### Beart Captal Cost - Donal

		Year of OC Expenditure	O-1007 S	<b>37.1</b>	Seed.	`##
<u> </u>	71-1	Y4	11	1,445 15		10.00
Parkeyale are:	Hall mytelleren (50 hart, 1 74" deserter litter vist, drove wedet	~	i i	170.25	- 1	10.96
	Translang to too books (50°, 2° draw area for each and, and, text (60°).		1 6	\$45.50	₩ .	10.00
			o{	150.15	-	10 00
	Paint at Indiana (50° person for each stall with your emakers and hant from		3	150 00	-	10 00 :
	Valves and Straight for each Clark promp		4	10,600,00	-	10 20 1
<del></del>	Rinterin translative and Nigi actions (20 test, 6" disserts. PSC, data reposition while:	- W		2,200.00		+0.00
Pré, Borani Profis	Francisco to the based GOT, T does not use for sect well, such beautiful.		9	120 25		10.06
	Haring to the case (e.g. of the case)		1	\$45.50		10 00
	Figure to commence fall manage for mach such such part mendature and man war.		1 3	150.15		10.00
	Yakaya man Seringan San sanda din ali Marina		1 4	150.00		10.90 10.00
	Aughalt party a stoke in property district country and planes promi from staffs.		l !!	6 47 10.000 00		10.00
	Communicative least		2			70 00
TVE Sparge Fan Indian	Profit trans	WA.	1 1	5,000.00 9,051,00		17.00
	Name House	}	1 1	1,293.00		10.00
	¥ ric ric-70			1,793.00		10.50
	lån draver		1 3	2.132.45		10 00
	Santa Santanan	•	اة ا	9,051,00		10.80
	Erracius June		0	1,253.90	-	10.00
	Contract (Contract)		1 4	523.67	-	10,90
	Use hear Day hear with hird sortes	Į	[ #	27.84		10.00
	Column Cartries		7	10,344.90		1000
	ing Parinter Land in Commun. Saint	Į .	미	4.344.75		(0.00)
	Sample has	1	1 1	317.90		10.00
	Parties and Section later of	1	1 1	1,990.00		10.00
	Equipment delitate	j		2,176.93		10.00
	Electrical land-on	}	3	1,000.90 200.42		10.00
			<del>   </del>	95 9E		10.00
LTID Trentment	LTTO properties (supposed reasons)	_ ~	l i	2.56		10,00
	faculture (in place related)	I	] "	5.25	1	10.00
	Hading as constant various transmit facility (separated spinite)	1		300,00		19.80
	Conference and particle analysis of particles break, 1 sample 200 CY securitual		0	5,000.00	ĽŠ	10.00
	Translation was		9	Z.57	GT .	10 30
	Seat (1) y special and an expressed of constraint or special or shallow?  Outputs of synthetic and at 19th hapliful (accomment reducers)	ì	1 1	6.00	CT .	19.00
		İ	i al	2.99	ļ.	10,00
	topper & buckfil chose fill if danger of mound sole or FW braffil for parties symbols		1 -1	1 15	9	10.00
	Cay merse		1 1	45,000 00	.5	16.00
Southcreen (pertains contain)	this given restation to the con- fine contains an along systems.			7.55		±0.80
	Higher broad	1	=	193.95		20.61
	Cardynapore and sample ampression or complete traph, it assemble 2000 CT or company		5	600.00		10.00
Language Pilo Sansa	Exception in party recomm		3	2.55		10.00
	Contrato od torno		1 1	37.33 10,000.00	1	10.30
	Tryppaiding surroug		1 1	200.00		10.00
	Confidentially and America and tests assumed from a surround 200 CT of the mail	ļ	<del>]</del>	2,55	1	10.00
Sugarante Prin SVE Prin	Extension in piece attack	*44		32.33		10.00
	Construction and Statement		"	19,344.90	1	10.00
	Office surprise and		"	5,000.00		19 90
	Translation that may	I	5	300 00		10 00
	Cardinactory and sample matrices accesses made, i sample 200 CY approximat	- M	1	2.55		10 00
- MATTER 1	Company and the property of the company of the comp			9.70		19 00
	Sebagain ma galama	İ	1	5,000 00		10 00
		1	1 2	306 00	1=	10.00
	Conferences and become supplied supplied supplied with the part of a conference 200 CT or constant					17, 300,00
H-1- #3	Configuration and second convicted nations or mak, I darkage 200 CT proposition	<del>  - : -</del>	1	2,950 00		
Marstanes Wall Institution	Confirmation's and seconds overviced sections with, 1 contains 200 CT encounted.  One metal-two data development (25 fact, 4" departure. PVC Impering overviews make	***	- 1	27 10	ų£	×9 09
Scarcer Share	Confirmation and sensels secretary extension wash, 1 intelligible 200 CT orderated.  Not install their dark denominates 125 Text, 4" desertion. PVC langua replantations within Stating and Landership and Engineers in motion to device of 15 Next.		1 0	27 10	ı.F	10.00
Facureous Sharing Francing and Sign Pasting	Configurations and Sensels own-food watersteen graph, I contains 200 CT excepted.  And metal-from date de-resources 125 fact, 4° desertor, PSC aspect rep-sets about marks.  Sharing was selected, and inspection in various to device at 15 feet.  6-last chain link earth high residency region.	*4		27 10 14 47 2.55	u u	10.00
Scowner Storing Feeding and Sign Patieng Profesion and Witten Excomplain	Confirmation and sensels secretary extension wash, 1 intelligible 200 CT orderated.  Not install their dark denominates 125 Text, 4" desertion. PVC langua replantations within Stating and Landership and Engineers in motion to device of 15 Next.	ka ka	0	27 10 18 47 2.55 270 00	ul ul Er	10.00 10.00 11.980.00
Economic Stocks reaching and Signification reaching the Window Electronists Estimated and the Windows Estimated and the Wi	Confirmation and borode overvices extension mask, it include 200 CT exception.  Note participate and de-nominate (25 fort, 4" deserter. PVC Index rep-empated number.  Some an action and reserve promise to device of 15 fort.  5-fort Crims had not proposed acting extension and extension of 15 fort.  5-fort Crims had not exception (5-mine) 1150 fort—model in confirmation.  Software mask.	RA RA NA	35	27 10 18 47 2.55 270 60 110 00	LF ET	10.00 10.00 11.980.00 11.254.00
Scowner Storing Feeding and Sign Patieng Profesion and Witten Excomplain	Configuration and Sensels overvices authorises stack, 1 confight 200 CT excerning.  And metallithen she development (25 tests, 4° deserter, PVC department) and configuration.  Solved configurations and resource producting square.  Fromus for written excerning square (5-deserter) against Programs for written excerning (15) tests.  Fromus for written excerning (5-deserter) against (6-deserter) and (6-deserter) against (6-deserter) and (6-deserter	ki ki	35:	27 10 16 47 2.55 220 00 110 00 2.55	1 1 1 1	10.00 10.00 11.980.00 11.854.00
Comment Stuffing rescale and Sign Parting Province to Wince Exemplain Lacomorphism with Prophenical Comment and the Prophenical Comment and th	Configuration and Justicle overvices anti-vision stab. 1 datable 200 CT exception.  And natisfation ship decomposes (25 Sect. 4" decompos. PSC department of the composition of the comp	RA RA NA	35	27 80 16 47 2.55 220 00 110 00 2.55 5.25	2 C C	10.00 10.00 11.980.00 12.854.00 10.90
Comment Stating Funding and Sign Petiting Personals the Warge Economist Septembersoning with Personals shift Septembersoning Stating Septembersoning	Configuration and Sensite secretical estatement mask, I statute 200 CT excented.  With mestal-term data de-secretical LLS Sens, 4: destatement, PSC season reports data sensite.  Similar and selected and resource to review to device at 15 Next.  Simple chain that extl. help estatement require.  Frommen the wester excention (Sunday) 1151 term-model in contact.  Separation that wester excention (Sunday) 1151 term-model in contact.  Separation that wester excention (Sunday) 1151 term-model in contact.  Separation that wester excention is for the second to the second of contact.  Separation that the second terminal terminal instance of the second or contact.  Separation that the second terminal terminal instance of the second or contact.	RA RA NA	35 35 35 0	27 40 16 47 2.55 278 60 110 00 2.55 5.25 0.90	1201125	10.00 10.00 11.980.00 11.854.00
Comment Stating Funding and Sign Petiting Personals the Warge Economist Septembersoning with Personals shift Septembersoning Stating Septembersoning	Configuration and Sensels secretical sections with, 1 contains 200 CT excented.  Note that of the interest of the interest LES Sent, 4 interests, 19 for a sequence of the interest of the int	RA RA NA	35	27 40 18 47 2.55 270 00 110 00 2.55 5.25 0.00 300.00	1 2 2 2 1 1 2 4 4	10.00 10.00 11.960.00 11.254.00 10.00 10.00
Common Storing Francising and Super Portraing Prophosits for Prince Exponential Exponential Commission Exponential	Configuration and Service securities according to part of sentent 200 CT excercises.  Serial metal-time size decomposes (25 Sect. 4" deserver. PSC depart rep-expansive mate.  Serial metal-time size for resource produces to device at 15 Sect.  Serial from last accident particular square.  Serial last accident experience (Serial last according to the serial s	RA RA NA	35 35 35 0	27 40 16 47 2.55 278 60 110 00 2.55 5.25 0.90	3 6 2 2 2 1 1 2 4 4	10.00 10.00 11.980.00 21.850.00 10.90 10.90
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configuration and Sample operated instantion graph, 1 statute 200 CT excents.  With most from the development 125 fact, 4' desarrow, PSC basis representations.  Strong as such extension and represent parameter to device of 13 feet.  5-feet of their limit exist may relate to device of 13 feet.  5-feet of their limit onto high relatest pages.  5-feet of their limit onto high relatest pages.  5-feet man, and with the original facilities of 155 feet most of the contract.  5-feet man, and the contract of the c	RA RA NA	35 35 35 0	27 80 16 47 2.55 228 60 110 90 2.55 5.25 0.90 300.00 2.55	2 2 2 2 2 1 1 2 5 5	10.00 10.00 11.982.00 11.854.00 10.90 10.90 10.90 10.90 10.90
Common Storing Francising and Super Portraing Prophosits for Prince Exponential Exponential Commission Exponential	Configuration and Sensels secretical sections with, 1 contains 200 CT excented.  Note that delivers and development US Sens, 4 december, PSC, leads the exceptional sense.  Solving that land sets in producing a sense, to device at 15 Next.  5-best Chem hall sets high relativity agest.  Fromum for setting excentions (Sensels) 1 (50 tem-model in contains.  Selection and  Selection and  Selection and  Exceptions of place sense.  Exceptions of place sense.  Exceptions of place sense.  Exceptions of place sense.  Configuration of contains according to the contains and sense.  Selections and Selection of Selections according to the contains and selections.  Selections and Selection of Selections according to the contains and selections.  Selections are selections.  Selections and selections of Selections according to the contains and selections.  Selections are selections and selections according to the contains and selections.  Selections are selections and selections according to the contains and selections.	RA RA NA	35 35 35 0 0	27 80 16 47 2.55 278 60 110 90 2.55 5.25 0.90 300.90 2.59	1 2 6 2 2 2 1 1 2 4 4	10.00 10.00 11.00 11.00 10
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configurations and Sensels securities in activation words, I defeated 200 CT excerning.  And metal-from this decomposes LES towards, 4° december, PSC, depart reports about towards.  Solving manufaction and resource to towards or decimal of 15 hord.  Solving Chain the sects help relatively again.  Promount for winter or constant (Summing 1158 town-market in configuration).  Solving manufacture or constant (Summing 1158 town-market in configuration).  Solving manufacture or constant (Summing 1158 town-market in configuration).  Solving recoverant in the National Configuration of Configuration or National Configuration or National Configuration or National Configuration of States and Configuration of Configuration of States and Configuration of Co	RA RA NA	3 35 35 0 0 0	27 80 16 47 2.55 278 60 110 00 2.55 5.25 0.00 309.00 2.55 220 22 119.00	G = 2 = 2 = 2 = 2 = 2	10.00 10.00 11.850.00 12.854.00 10.9
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configuration and Samula superficient materials around 12 Sect. 4: Advance. Pric. Impair representation of the Assessment Lib. Sect. 4: Advance. Pric. Impair representation within Street and the Assessment Lib. Sect. 4: Advance. Pric. Impair representation within Street and	AA AA PA 0 NA	3 35 35 0 0 0	27 30 16 47 2 55 278 60 110 90 2 55 5 25 5 9 50 9 90 300,000 2 25 110,000 2 20 20 2 2 2 2	0 - C	19.00 10.00 11.854.00 10.90 10.00 10
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configuration and Sensels secretical sections work, I defeate 200 CT excerted.  And metal-time due de-summer 125 Sent, 4° deserter, 19°C. department of the control of the summer.  Solving and selected due transmit is sensel to device at 15° Next.  Solving and selected due transmit is sensel.  Frommer bit select excertion (Souther) signs.  Frommer bit select excertion (Souther) signs.  Excertions the select excertion (Souther) 15°C Sens-model is contact.  Excertions the filter visions:  Hading excertains in Next II assempt Loreful Internation systems:  Confirmation your benefit of these Confirmations and the control of the contact of the control of the contro	AA AA PA 0 NA	3 35 35 0 0 0	27 30 16 47 2 55 270 00 1 10 00 2 .55 5 .25 5 .25 5 .25 2 0.00 2 10 00 2 10 00 2 20 2 20 2 20 2 20 2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	19.00 17.00 17.364.00 19.254.00 10.90 10.90 10.90 10.90 10.90 10.90 1344.00 1340.00 1340.00 1490.00 1490.00
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configuration and Sensels secretical sections with, I defeate 200 CT excented.  Note that of the development US Sent, 4 december, PSC, leader report plants within Sharing and Laterable And resources US Sent, 4 december 2015 Next  Solved Charles and Laterable And resources to sensels of 150 Next  Solved Charles and Laterable Sensels Sensels 1150 New-model in configuration  Frameworks of the Configuration (Sensels) 1150 New-model in configuration  Sensels and Sensels of New Managery  Hading accordance for Managery  Hading accordance of the Managery Sensels Sensels Sensels Sensels Sensels  Confirmation and Sensels Andread Andread  Confirmation and Sensels Andread New Managery  Note Confirmation and Sensels Andread New Managery  Note Company and Sensels Andread New Managery  Violatory and place Class CH Andread New Managery  Undergrand passag (values), reach lactified, fruit and detection of SW Sensels  Well Concernment  Undergrand passag (values), reach lactified, fruit and detection of SW Sensels  Well Concernment  Undergrand passag (values), reach lactified, fruit and detection of SW Sensels  Well Concernment  Undergrand passag (values), reach lactified, fruit and detection of SW Sensels	AA AA PA 0 NA	35: 35: 35: 35: 35: 35: 35: 35: 35: 35:	27 30 16 47 2 55 278 60 110 90 2 55 5 25 5 9 50 9 90 300,000 2 25 110,000 2 20 20 2 2 2 2	- 22 - 6 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	19.00 10.00 11.960,00 12.854,00 10.0
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configuration and Sensels secretical sections work, I defeate 200 CT excerted.  And metal-time due de-summer 125 Sent, 4° deserter, 19°C. department of the control of the summer.  Solving and selected due transmit is sensel to device at 15° Next.  Solving and selected due transmit is sensel.  Frommer bit select excertion (Souther) signs.  Frommer bit select excertion (Souther) signs.  Excertions the select excertion (Souther) 15°C Sens-model is contact.  Excertions the filter visions:  Hading excertains in Next II assempt Loreful Internation systems:  Confirmation your benefit of these Confirmations and the control of the contact of the control of the contro	AA AA PA 0 NA	3 3 3 3 3 3 3 3 3 3 4 4 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	27 30 16 47 2 55 270 00 1 10 00 2 .55 5 .25 5 .25 5 .25 2 0.00 2 10 00 2 10 00 2 20 2 20 2 20 2 20 2		19.00 10.00 11.584.00 10
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configuration and Samula superficient matchines work, I statisfied 200 CT excertable  Not in nearly there shall develop make 125 feet, 4° december, 19°C. Impair representation within  Software an acceptable and response to souther to device of 13° feet  Software man despite and statisfied protect  Software man.  Software man.  Exercition to device of complete 10-mining 1 1.50 feet-model in contract  Software man.  Exercition to device of complete 10-mining 1 1.50 feet-model in contract  Software man.  Exercition to deficie removes  Vinding accountain to feet. Minimized Exercited Instantiated systems:  Confirmations and Software Minimized According to the Confirmation and Software many  Software man of Software models.  Software man of the Software man of the Software models.  Software man of the Software man of t	AA AA AA 0 NA	35: 35: 35: 35: 35: 35: 35: 35: 35: 35:	27 30 16 47 2 55 270 00 1 10 00 2 .55 5 .25 5 .25 5 .25 2 0.00 2 10 00 2 10 00 2 20 2 20 2 20 2 20 2	- 22 - 6 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	19.00 10.00 11.854.00 11.554.00 10.0
Community Stating Fracting and Sept Petring Fracting and Sept Petring Framework the streets as community frequence and the sept sept sept sept sept sept sept sep	Configuration and Sensels secretical sections with, 1 contains 200 CT excented.  And most determined for response 125 text, 4 december 200 CT excented.  Solving an interfelor data response to texture to design of 15 text.  Solving an interfelor data response to texture to design of 15 text.  Solving an interfelor data response to texture to design of 15 text.  Solving an interfelor excention (Souther) sign.  Solving to the solving excention to text if intervals [Localida Solving and texture to texture	AA AA AA AA AA AA AA AA AA AA AA AA AA	3 3 3 3 3 3 3 3 3 3 4 4 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	27 30 16 47 2 55 270 00 1 10 00 2 .55 5 .25 5 .25 5 .25 2 0.00 2 10 00 2 10 00 2 20 2 20 2 20 2 20 2		19.00 10.00 11.584.00 10

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# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1158 - Alternative No.2 Institutional Controls

# Indirect Capital Cost Detail

	ltem	Year of iC Expenditure	Guartite	Rate	Units		Cast
ngineering: Design to In	nciementation	J J		!			
	Administration and supervision		80	85.00	ltr.	\$6,800	
	Design and development	j	80	75.00	h	16,000	
	Orafring		48	85.30	hr	\$3,120	
	Monitoring and testing (Year D		ß	0.00	ti	\$0	
	Project engineering		80	65.00	hr	\$5,200	
Subtotal							\$21,120
Engineering : Decommes	signing	30					
	Administration and supervision		8	i		\$68D	
	Besign and development	†	18	į		\$1,200	
	Bratting	1	24	ĺ	1	\$1,560	
	Monitoring and testing		) 9	1	ł	\$0	
	Project engineesing	<u> </u>	80	65.00	thr	\$5,200	
Subtotal							\$8,640
License/Permit/Legal	(18% engineering costs)	0	1	2,976.00	EZ	\$2,976	\$2,878
Start-up and Shake Dov	yn of Treatment System	AK	<del>!</del> -		_		
	Materials		0	1,000.00	62	\$0	
	Labor		0	65.90	hr	<b>\$</b> D	
	Equipment	1	G	1,000.00	22	\$0	
	Lab Testing			500.00	ea_	\$0	
Subtoral							\$1
Contingenty	(15% capital costs)	5	!	7,320.90	ts	\$7,321	\$7,32
		<u> </u>					444.44
Total	Yea	ļ					\$31,41
	Yes	30	<u> </u>		<u></u>	<u></u>	18.54

ea: each

hr: hour

IC: indirect capital cost

LS: kump sum

NA: not applicable for this alternative

# Fort Wainwright 0U-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.2 Institutional Controls

# Annual System Operation Cost Detail

	'tan		Emantity	Rate	Units	Frequency	Yearis) of ADC Expenditure	Totallyear
Operation Labor Cost	<u> </u>					Mear		
	Hern 1: Groundwater month	DT#AG	20	65.00	hr	i		
ft.021 @ fitters hersom		• • • • • • • • • • • • • • • • • • • •	Į f	200.00	LS		1 to 30	
Subtotal								\$1,500
Santine Maintenance N	laterials and Lapor Cost		<del>                                     </del>			1/Year		
		oring annual maintenance	;	500.00	LS		1 to 30	
		-	D	ł	LS			
	trem 3: Sampling field kit		Z	75.00	day	<u> </u>	1 to 30	
Subtotal			Γ			1		\$850
Antakary Materials and	Energy		<del></del> -		<del>-</del>		NA NA	
	Process Chemicals		1 8	[	ĿŠ			1
	Electricity		3			}		1
	Water			1		l		1
	Sewer				1		<b>}</b>	
	Feel		. 0	<u></u>	LS	<b>↓</b>		
Subtotal		<del></del>	1	}		1		***
Disposat of Residues		<del></del>	<del>                                     </del>		<del>i -</del>	1/Year		1
•	Wash water, sludge, ect.		1 1	500.00	LS_		7 to 30	
Subtorai					1	ļ		7500
Purchased Services	<del></del>		<del>-</del>	<del></del>	1	1New		
Demand Labor Cost   Item 1: Groundwater monitoring   20   65.00 hr   200.00 LS	7 20	+2 CD0						
			1	20 65.00 ht 1) rear 1 to 30 \$1,300 \$200 \$200 \$200 \$200 \$200 \$200 \$200 \$				
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Post Construction) Item 1: Groundwater monitoring Item 2: Training  Subtotal  Routine Maintenance Materials and Labor Cost Item 1: Groundwater monitoring aroual Item 2: SVElax sparge well annual man Item 3: Sampling field bit  Subtotal  Availary Materials and Energy Process Chemicals Electricity Water Sewer Fuel  Subtotal  Disposat of Residues Wash water, sludge, ect.  Subtotal  Purchased Services Professional Services Item 2: Item 3: Subtotal  Gither: Automisticatine costs not included in other fine riems Insurance Taxes, licensing, permit renewal		1 -	<del>!</del>	IL3	<del>}</del>	<del>                                     </del>		
Subtotal						<u>i</u>		V2,550
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	ot included in other line stems		•	1	1	F		
				1				
			'	יייי וי	1112			1
			Ι,	07 54			1 to 30	\$94
	orated for each year of empleto	ENTREM!	<del>                                     </del>	23.75	1	+		<del></del>
Subtotal			<u> </u>	<u> </u>	<u>!</u>	<u> </u>		1
Total Annual Operat	ing Cost						1 to 30	15,244

Number of years of implementation:

30

ABC: annual operating cost hr: bour LS: Aump sixth NA: not applicable for this alternative SVE: soil vapor extraction

# Fart Wainweight OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

The company of the co			Year of GC Emergence		Rana :	-	iesi 📄
An experiment (a)   An e		hare				=	(S. 847 BD
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1							10.00
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				1 !			1287.50
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Company   Comp		Dispute of Statistic and a PM health (accounted volume)		į.	. 1		¥0.90
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Comparison of Section (Comparison				0	600,00		18 40
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Experiment   Principal Conference   10,000   2	Columnia Car- Springs						\$0.00
Conference   Fast   Conference   Conferenc		Prophysical Assessment Control of the Control of th		, ,			3D,600 39,60
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Description of the state of the control of the co							10.00
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Confirmation   Conf		1		1 1			10.90
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Company   Comp				<u> </u>			10 00
Present No.   Present				<del>                                     </del>	1		30 00
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			La	+ 7	4 22	_	10 00
Fundamental partial   Partial processor from the processor of the partial pa		Lacqueries (proper printed)	1 -	1 3			10.00
Confirmation and proceedings of companies and proceedings of the control of the	for Samerys Lordfill		1		9 100		P0.00
Temple   T		propose response to the control of t	Ĺ				12.40
Temple   T			<u> </u>		1		15.00
Wed (mean mining) respected   0   110,000 (m   310,000	Commission of English Commission					1	12,200.00
Toronto-coly per color product product product   1,000 cm   1,00			10			1	1980,80 10,80
Underground invest remoral, fromth and dispute on PM bandlet   0   10 00   57   11		Parameter parameter property	l .				23,900.00
Contract of Market Principles Construction and Fractalising Streets Seed   \$ 3.75 Sect.   \$1.700.00 (as.   \$1.700   \$1.700   \$1.700.00 (as.   \$1.700   \$1.		Undergrand have removal, transit bushfill, bush and deposit or PM largelli.	}	, °°			19.86
Radius provide field in placement or or   2   1,700.00 de   31,700 fee   1,700.00 de   31,700 fee   1,700.00 de   31,700 fee   31,700			1	1			10,00
Fig. Name According and reserved   3   1 10,000.000 [LS 110,000   10   10,000   10   10,000   10   1			2	1			11,700.00
Sept. agrammate   Sept. agra			1	ł	12,000.00	13	110,000.0
1 per 7 (52,000		poly regionalis. Conference and county managed pagin () process 200 CT treatest MED	1	1	620.00	-	12,100.00
7 T T T T T T T T T T T T T T T T T T T		116	<del></del> -			Г	158,537.11
	1700	Y-		1	1	[	615,906.0
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es and Par Fact Wannership ir ter Ur Sour fast Lik keep som

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

# Indirect Capital Cost Detail

	item	<u> </u>	Year of IC Expenditure	YntneuO	Rate	Uarts		tza
ngineering: Design to Irr	piementation	-	0			•		
	Administration and supervision	1		80	85.00	àr	\$6,800	
	Design and development			240	75.00	hr	\$18,000	
	Drafting .			144	65.00	hr	\$9,360	
	Monitoring and testing (Year D)			[ 0	9.00	<b>63</b>	\$0	
	Project engineering			240	65.00	jar	\$15,600	
Subtotal							_	\$49,76
ngineering : Decommiss	ioning		3					
	Administration and supervision			15	85.00		\$1,360	
	Gasign and development			20	75.00	Į	\$1,500 \$1,580	
	Drafting			24	65.00	1	,	
	Monitoring and testing			9	65.00	ľ	\$0	
	Project engineering	<b></b> -ŀ		40	55.00	hr	\$2,500	
Subtotal								\$7,02
License/Permit/Legal	(18% engineering costs)	1	0	ī	5,578.00	63	\$5,678	\$5,67
Start-up and Shake Dov	on of Treatment System	-	C					
	Materials			1	100.00	1	\$100	
	Labor			40	65.00	hr	\$2,600	
	Equipment	}		1	198.00	23	\$100	
	Lab Tessing			4	500.00	ea	\$2,000	
Subtotal		•						\$4,80
Contingency	(15% capnal costs)		0	1	23,216.38	LS	\$23,216	\$23,2
		<u> </u>	<del></del>			Ī		48
Total		Year	0					\$83,4
		Y <b>easy</b> }	3	<u> </u>		,		\$7,0

ea: each

hr: hour

(C: indirect capital cost

LS: lump sum

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

# Annual System Operation Cost Detail

lten	Country	Rate	Units .	Frequency	Year(s) of AOC Expenditure	Totallyear
Operating Labor Cos:				Myear		
Post-Construction) Item 1: Groundwater monitoring	12	65.00	hr	ĺ	1 10 10	\$780
nem 2: SVEIAS system monitoring	52	65.00	hr .	Ì	I to 3	\$3,380
hem 3: Transing	1	400.00	LS		7 to 10	\$400
Subtotal					1 to 10	\$1,180
·	<u> </u>		<u> </u>	<u></u>	1103	\$3,380
Routine Maintenance Materials and Labor Cost				1/year		\$500
item 1: Groundwater monitoring annual maintenance	- 1	500,00			1 to 10	3500 3500
item 2: SVEJair starge system annual maintenance	1	500.00		ļ	1 to 3	
Item 3: Sampling field kit	] 1	75.00	ézy		1 to 10	\$75
Subtotal					I to 10	\$575
		<u> </u>	<u> </u>	<u> </u>	1 10 3	\$500
Auxiliary Materials and Energy				1/year		
Process Chemicals	] 0		L\$	1		\$0
Securiting (Phase 1)	1	14,200.00	i.S		1 (n 3	\$14,200
Electricity (Phase 2)	0	0.00	Į,S		[	\$0
Hater	F 0	1	LS	{		\$0
Sews	0		LS	1	1	\$0
Fuel	1	200.00	is	<u>.                                    </u>	1 to 18	\$200
Subtatal					7 to 10	\$200
Jan 18181	- [	ļ	İ	ļ	1 to 3	\$14,200
S	+	<u> </u>	<u>.                                    </u>	13year	<u>.                                    </u>	1
Disposal of Residues  Wash water, studge, act.	1 1	500.00	LS	"	1 to 10	\$500
Subtotal					1 to 10	\$500
		<u> </u>	-	141	1 to 10	<del> </del>
Punchased Services		ŀ	1	1/year	110.0	
Professional Servces	l .	625.00				\$2,500
item 1: Laboratory Fees	1 1	}	month	1		\$130
Item 2: Engineer review/ consultation		1	is is	1	i	\$0
item 3:	_	<del>'</del> }	1.3	<del>                                     </del>	1 to 10	\$2.530
Subtotal		İ	Ì		1 12 73	V2.000
Siher:	1	i		liyear	1 10 10	
Administrative costs not encluded in other line stems		ı	រេទ	!		\$0
lasurance		):	LS	İ		\$0
Taxes, licensing, permit renewal	) (		LS			\$0
Maintenance Reserve rund			l		}	1
(5% of capital costs provated for each year of implementation)	] ;	889.98	ιs			<u> \$890</u>
Subtotal					1 to 10	\$890
		<u> </u>	<u> </u>	<u>! </u>		<del>                                     </del>
Total Annual Operating Cost (includes GW Monitoring)		ļ	ļ	ļ	1 to 3	\$24,055
1919) Vuunei oktaaniid Post fiutingiss mai wolkreinidi	- 1			1	4 to 10	\$5,975
		1			1	40
Groundwater Municoring Portion of Total AUC				1	1 to 10	\$3,780

Number of years of incircumstation:

10

ADC: annual operator; cost AS: aix sparge hr: hour ES: tump sum SVE: soil vapor extraction GW: groundwater

# Fort Wainwright OU 2 Feasibility Study Basefine Cost Estimate - Building 1168 - Alternative No. 4 Alternative 3 Plus Excavation and £TTD at Contaminated Unsaturated Soil

### Deug Caprin Gar: - Decal

	item	"Har in DC Expenditure	Ci	Rang (Ver	Tetal
Ser pri Broserya Walts	Wall antidenses 50 last, 2 1/4" dismeter these etch, annes moles	,	4	1,486.35 m	15.947 (
21 10 10 10 10 10 10 10 10 10 10 10 10 10	Transfers to far huga 50° 2° done seerage for saco and, etc., beckfill	}	4:	120.25	341,6
	Name and one one or will		. 4	248.20 m	12,546.0
	Figure to tentions (AC section for each mall only the statement and last state		4	258 15 au	±3,400.6
	Values and fireign for such on at paper		4	150 🗰 🗪	1500 5
	Sumperge trattalite met	1	ļ (	15,900 BB us	\$10,000
· Li Brownert Walls	Well mountaines (20 hour, 4" downers, Pr.C. hours my my trained wealtr)	3	1	1,790 30 🛪	¥2,200.
	Transform to the bases (SC: 2' door overage for each work, w.c. (ac. 250)	Ī	1	120.25	1179.
	Markets ages (see per and)		1	£45.58]==	1646.
	Paint in female 50' perse in min and and any operation and had were		1	250 15 as	1850.
	Alphae hat garantee the barrier on in second	i i	1	150.00 13	4156.
	And parties only in matter that course are project solely from any		٥	14) 21	10.
	Benefit restains not	İ	ļ 1	10,000 (0) (3	110,000.
	Perint transp	<del>-}</del>		5,000 00 =	10.
Y Li Sparage from Manager		1	1	2.051.00 20	12.057.
	Notes describe	1		1,793 200 00	10.
		1	1 1	1,792,801=	11,213.
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		j		3,651,861 as	15,051.
	faterine in the second	1	1 7.	125120 -	11,293.
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	Der bereit	1	1 .	27.40 44	FD
	Dest better with hard names.	1	l i	10,344 30: ==	110,344
	Friends Commiss	1	1 1	4,844.75 (5	16,848
	Section of the same of the sam	1	1 5	327,00 1.5	1927
	Sampling parts  Charless and destroys based to	i	1	1,000 60 m	11,006.
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	formations		6	1,000,00	10.
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	(spins)		1560	34 M C	1151,233.
TTD Tensione	(1) processes (reprint state)	1 ~	5700	255.07	114,535
			1560	5.25 67	18,190
	Rading accurates series brokenst facility (arpsent reform) Conferencely and complex services, accurates train, 1 annual 200 CT as completely	1	25	700 to -	18,700
				3,000 ac US	15,000.
	Translations installs  Limited translational in product in construct temperature reduces)			2.57 EX	10
			1400		16,754.
	Laife expense due servicie		1560	0 00 07	10.
	Dispute of wasted and at PH bodfd (experient where)		1550	2.99 (3)	14,664
	traper: à partifit chap dit si depart ai travest ants et PH tentifit (expenses overnes				12,004
Canada	Lip accid	<u> </u>			
Solufficación (partient comunit)	West acceptive acceptive for large		6		40.
	License September			2.95 CT	10)
	Mana, promp			783.55 (7	10.
	Confirmation and Automation Annies of Contract of Cont		ļ <u></u>	600.80 m	1 10
Engraver sa Pair-B-syste	License (Pper Terri)	e.V.		2,54 (5:	16
	Common ord trainers			ᅲᆔᅜ	to:
	Transplainty sacrang		0	13,000.00 LS	100
	Confirmations and produce and record and constructive for the construction of the cons			300 80 m	10
represent all Pdo- SVE Pale	Experience recipies with the	- 4	٠	7.55 Ct	FQ.
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aculf arrange	(Lineary or-Party Control)	**	•	7 7 7 7 7	10
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	Treat dishty testing	1	٥	5,800 90: (\$	
	Conference and Security and record according to the A. I a secure 290 CT at corollar				10.
Maratarany Wat Installan	Stall management and severations (25-but, 4" distance, Polic maps representation would)		i	2.950 AV es	\$5,900.
Icanata Suren	Sharing sagistations and remove in some in anything 15 feet		J20	1, 10,11	±3_\$96,
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remain for World' (1) between	France, to revise according (passing 1162 and other according		5700	: 35 CY	214,53S.
Opposite the same of the same	Here was	<del>                                     </del>	1	220.00 ==	\$2,750.
	Personality social proba		35	119 90 00	×3.650.
Guipana Hel-spar Sed at		<del> </del>	0	256) इन	10.
isupan merapa sera Fun Wainungis (selfili	Hading as contains to first Mantacoper, Land Cit Land Antonial Material		1 6	525127	10.
<del></del>	Disputed Security Selection of Control of Co			1 at CY	19
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	imper) and place place fill (a province relation	ı			10.
·		- ;	10	220.00	12,200
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ini si Cump Actor	Will (manufacture) removed	1 "	! :	119 100	170.
	Personally settled public reserved.		Soc	2,00125	s 7,906.
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	(appears) placements and stockling proof self	1	"	525 67	1 10
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	for large decreasing and spinish	1	'	10,000 30 (15	118,000
	So recens	1	1 :	10,000 Sept 10	12,300
	Cofrenity's and sample outprised	3	<u> </u>	92V.#F	13,100.
etila	<u> </u>	••	<b>i</b> 1	į	
elita	·	#			\$262.565.

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LTD: in marries have severe

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File on applicable for the PTC pulywork chlorate SE supero fort ST: square part STE sail super artenion

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 4 Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soils

### Indirect Capital Cost Detail

	Item	Tear of IC Expenditure	Quantity	Rate	Units		ost
Engineerung: Design to im	plementation	0					
•	Administration and supervisor		88	85.00	hr	\$6,800	
	Design and development		240	75.00	pr	\$18,000	
	Bratting		168	65. <b>0</b> 0	M	\$10,920	
	Monitoring and testing (Year Ø		0	0.00	23	\$13	
	Project engineering		240	65.00	jet.	\$15. <b>600</b>	
Subtotal							\$51,320
Engineering : Decommiss	ioning	3			-		
	Administration and Suppressors	}	80:		1	\$5,300	
	Besign and development		100	75.00	1	\$7,500	
	Drafting	·	95	85.00		\$5,240	
	Monitoring and testing	1	0	65.00	hr	\$0	
	Project engineering		150	65.00	'n	<b>\$10,490</b>	
Subtotal					ļ		\$29,240
Licens e:Permn/Legal	(10% anginestring costs)	G	ī	8.056.00	22	\$8,856	\$8,056
Start-up and Shake Bow	en of Treatment System	0					
	Materials	,	1	190,00	22	\$190	
	Labor	1	48	65.00	ľ	\$2,600	
	Equipment		1	100.00	62	\$100	
	Lab Testing		4	500.00	EZ	\$2,000	
Subtotal							\$4,80X
Contingency	(15% capital costs)	0	1	63,824.86	ıs	£63.825	\$63, <b>8</b> 25
	· · · · · · · · · · · · · · · · · · ·						\$1Z\$.00
Total	Year	1	]		•		\$25,24
	YearYear	3	<u>1</u>	l	<u> </u>	<u> </u>	37274

ea: each

hr: hour

IC: indirect capital cost

LS: temp sum

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.4 Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soil

### Annual System Operation Cost Detail

	lten	Quantity	Rate	Uarts	1600GUCA	Yearist of ABC Expendence	Totaliyear
pearing Labor Cos		T			liyear		'
pearmy cases was Para Caretavetical	ten 1: Groundwate monitoring	12	55.00	lhr l		1 to 10	\$780
-021-C005118C1060	hem 2: SVEIAS system monitoring	57	65.00	hr		1 to 3	\$3,380
		1	490.00	ادا		1 to 10	\$400
	Item 3: Training	<del>                                     </del>		1		1 to 10	\$1,180
Subtotal			1			1 to 3	\$3,380
luxbary Materials a	ug Suergy	1			ilkear		
	Item It Groundwater monitoring annual maintenance	1	500.00			T to tO	\$500 \$500
	item 2: SVEIAS system annual maintainence	1 1	508.00	LS		1 to 3	
	hem 3: Sampling field kit	1 1	75.00	day		1 to 10	\$75
	TELL S. OBJECT RES AN					1 to 10	\$575
Subtotal		ļ	<u> </u>	<u>L</u> i		1 ta 3	1500
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	Process Chemicals	1 0	Į.	LS			\$B
	Sectricity (Phase 3)	1	14,200.00	1S		1 to 3	\$14,200
	Remiciny (Phase 2)	1 0		LS		1	
	Water	] o	1	LS :	}		\$0
	Sewer	i	Ì	LS	Ì	1	\$0
		1 7	200.00	LS	}	1 10 20	\$200
	Fuel	_				1 to 10	\$200
Subtotal		ļ				1103	\$14,200
Disposal of Residue		<del>                                     </del>		Ī	1/year		
hizbozai di usamas	s Wash water, sludge, ect.	١ ,	500.00	الحا		1 to 10	\$500
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	tion 1: Laboratory Fees		1	month	ł	1 to 10	\$130
-	ham 2: Engineer review/ consultation	1 1	1	LS	l	1	\$0
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Total Annual Ope	rating Cost (includes GW Monitoring)	-	İ	}		4 to 19	<b>\$7.532</b>
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   Genundwater	Monitoring Portion of Total ADC	ŀ			}	1 20 10	\$3,780

Number of years of implementation:

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ADC: annual operating cost AS: air sparge ea: each hr; hour SVE: sod vapor extraction GW: groundwater 44099

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المحد ثبهمة ثغم المحا

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 5 Alternative 3 Plus Excavation and Engineered Pile Treatment (biopile or vapor extraction pile) of Contaminated Soil

# Indirect Capital Cost Detail

	item	Year of IC Expendit	ure Quantity	Rate	Units		Cost
ng-neering: Design to lit	npiementation	0					
	Administration and supervision		80	85.00	ħr	\$6.800	
	Design and development		240	75.00	hr	\$18,000	
	Drafting		168	65.00	lar .	\$10,920	
	Monitoring and testing (Year D)		0	0.90	83	\$6	
	Project engineering		240	65.00	lv	\$15,600	
Subtotal							\$51,326
Engineering : Decommiss	sioning	3	<del></del>				
	Administration and supervision	. i	80		I	\$5,300	
	Design and development	1	120	75.00	ì <b>r</b>	\$9,000	
	Drafting	}	98	65.00	pa.	16,240	
	Monitorms and lesting	1	0	<b>65.00</b>	hr	50	
	Project engineering	<u> </u>	200	65,08	hr	\$13,000	
Subtotal					1	Year 3	\$33,34
Licensel/Permit(Legal	(10% engineering costs)	G.	1	8,466.60	ea	\$8,466	5 & 4 &
Start-up and Shake Dov	yn af Treatment System	3		<u> </u>	<del>                                     </del>		<del></del>
	Materials		1	290.00	E)	\$200	
	Labor		440	65.00	<b>83</b>	\$2,800	
	Equipment	1	1	200.00	69	\$290	
	Lab Testing		4	500.00	EI .	\$2,000	
Subtotal					Į	ļ 	\$5.00 
Controperty	(15% capital cossis)	0		48,927.09	LS	<b>\$48,927</b>	s 48,52
<u> </u>		Year B	<del>-  </del>	<u></u>		<u> </u>	<b>\$108.71</b>
Total		Year 3					\$38,34

ea: each

hr; hour

IC: indirect capital cost

LS: Lump sum

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 5 Alternative 3 Plus Excavation and Engineered Pile Treatment (biopile or vapor extraction pile) of Contaminated Soil

# Annual System Operation Cost Detail

<u> </u>	item	Quantity	Rate	Units	Frequency	Year(s) of AOC Excenditure	Totaliyear
Operating Labor Cost		<u> </u>			llyear		Ì
Post-Construction!	Itam 1: Groundwater monitoring	12	<b>65.00</b>	hr		I to ID	\$780
LOTI-CRUZUACIONI	ham 2: SVEIAS system monitoring	156	65.00	hr		1 to 3	\$10,140
	Item 3: engreered pile system monitoring	64	65,00	hr	ļ	4 10 5	\$4,160
	hem 4: Training	1	400,00	£S.		1 to 10	\$400
	Rem 4. Transero	<del>                                     </del>				1 to 10	\$1,180
Subtotal				1		4 ta 5	\$4,180
				l _	<u> </u>	1 to 3	\$10,140
Agrikary Materials and	- Parav	1			liyear		
MATERIA MINISTERNA WAY	Item 1: Groundwater monitoring annual maintenance	1	500,00	ÈS	1	1 to 10	1500
	Item 2: SVE/air sparge system annual maintenance	1	1,500.00	عنا	ŀ	1 to 3	\$1,500
	[aut 3] submetted bije skateur ursutanience	16			•	4 10 5	\$1,040
	*	1 7	75.80	day	ì	1 to 10	\$75
	Item 4: Sampling field lift	<del></del>		1	<del></del> -	1 to 10	\$575
Subtotal			1	ļ	i	4 to 5	\$1,040
				1		1 to 3	\$1,500
		<del></del> -	<u> </u>	<del>! -</del>	Nyear		
Auziliary Materials ani		В		LS	(IVEA)		#0
	Process Chemicals	1	14,200.00	1	1	1 to 3	\$14,200
	Bectucity (SVE/AS)	1 '			1	419.5	\$2,000
	Electricity (Engineered pile)	1 1	2,000.00			7.55	#0
	Water	0		េន		!	\$0
	Sewer	0		LS	1	1 15 10	\$200
	Fuel	ļ. <u></u>	200.90	172	<del> </del>	1 to 10	#200
Subtotal	<del></del>	j	i	ı	ŀ	4105	\$2,000
		1		i		1 to 3	\$14,200
				<del>!</del> _	1	7.83	374,250
Desposal of Residues				İ.,	Jiyear	1 to 10	\$500
	Wash water, skedge, atc.	ļ 1	500.00	11.5	<b>.</b>	1 to 10	3500
Subtotal		1					
Fuernased Services		<del></del>	<del></del>	<del>†                                    </del>	1 lyear		1
CARTINIPEN DEL AICAS	Item 1: Laboratory Fees (G.W. montoring)	4	825.00	well	ļ	1 to 10	\$2,500
	Item 2: Engineer review! consultation (G.W. treatment)	2	65.00	month	ŀ	1 to 10	\$130
	Item 3: Engineer review/ consultation lengineered pile)	15	65.00	เร		4 to 5	\$1,040
	Iram 4: Laboratory Fees (engineered pile)	13	500.00	ea	ł	4105	\$6,500
Subtotal	7077	<del>                                     </del>				1 to 10	\$2,530
Sunteral		į	İ	İ	1	4 to 5	\$7,540
			1	1	Nyear	1 to 10	<del>†</del>
Other:	and the same	) D	1	LS	,,,,ea,,		\$0
	not included in other line items	1 6	1	LS			\$0
soneaux		1 2		ES.			\$0
Taxes, licensing, perm		"	1	["	l		"
Maintenance Reserve		1 .	1,875,54	1.	l		\$1,876
	s orgrated for each year of amplementation)		1,5/0.54	<del>' -</del> ''	<del></del>	1 10 10	\$1,875
Subtotal		1	<u> </u>	<u> </u>	!	, 10 70	
						1 to 3	#32,501
Tatal Annual Opera	ting Cost tincludes GW Monitoring)		1	1		4 to 5	\$21,701
		[				5 to 10	16,961
•				1	,	}	
l	anitaring Partian of Total AOC	İ	1	1	1	7 to 10	\$3,780

Number of years of implementation:

10

ADC: annual operating cost AS: air sparge for bour LS: tump sum SVE: soil vapor extraction GW: groundwater

# DRMO YARD SOURCE AREA BASELINE COST SUMMARY

# Fort Wainwright OU-2 Feasibility Study DRMO Yard Baseline Estimate Summary

Component	Remedial Action Alternative								
,	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5				
Present Worth of GW Manitoring	\$0	\$146,000	\$89,000	\$89,000	\$132,000				
Present Worth of Capital Costs*	\$0	\$34,000	\$1,426,000	\$1,498,000	\$2,062,000				
Present Worth of AOC	\$0	\$0	\$680,000	\$682,000	\$698.000				
Total Cost to implement	\$0	\$180,000	\$2,195.000	\$2,269,000	\$2.892.000				

<sup>\*</sup> Includes Direct and Indirect Capital Costs.

6W: groupowater

ADC: annual operating cost

### Fort Wainwright DU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 1 No Action

### Deuts Change Cart - Detail

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CT: selvic year OC, direct cantal west oct seek Felf: Fart Washington ley home LF: Seven have LS: home year

(TT): No securious terroi describ NA; as applicable for the absorbing

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4/25/96

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 1 No Action

# Indirect Capital Cost Detail

	iten	Year of IC Expenditure	Countity	Rate	Units	Eost	_
nginesing Design to Im	plementation	NA					
•	Administration and supervision	•	G!	85.00	hr	18	
	Design and development		0	75.00	hr :	\$0	
	Braftling		ol	65.00	hr	\$ <b>9</b>	
	Montains and texts of mentand		0	65.00	hr	\$B	
	Project engineering		0	55.00	hr	\$0	
Subsetal							\$0
Engineering : Decorrinissioning		NA					
	Administration and supervision		e e	85.00	1	<b>\$</b> D	
	Design and development		) 0:			\$0	
	Oratting		0		1	\$0	
	Manitoring and restring		0			\$0	
	Project engineering		0	65.00	hr	\$0	
Subtotal			<u> </u>				\$0
License.Permet/Legat	(18% sudinserud costs)	NA.	0	0.00	ы	\$0	\$0
Start-up and Shake Day	on of Treatment System	NA NA	<u> </u>		1		
	Materials		0	1,000.00	Ea .	\$0	
	Labor	<u> </u>	0	1		<b>\$</b> 0	
	Equipment		9	1,000.00	22	\$0	
	Lab Testing		Ð	500.00	1 62	\$0	
Subtotal						ļ	st
Contingency	(15% capital costs)	NA NA	1	9.00	LŞ	\$0	S
<del></del>							\$1
Total Annual Operating Cost Yes							\$
	Yes	NA	<u> </u>	<u> </u>		1	

ea: each

ite; hour

IC: indirect capital cost

NA: not applicable for this alternative

### Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMQ - Alternative No.1 No Action

### Annual System Operation Cost Detail

	liem	Quantity	R2te	Lints.	Frequency	Yearisi of ADC Expenditure	Totaliyear
Operating Labor Cost			}	T -	Ţ	NA.	
(Past-Construction)	item is Groundwater monitorary	} 0	1	he			\$0
	Item 2: Training	1 0	<u> </u>	_ گئ}		<u> </u>	‡0
Subtotal			ĺ		}		\$0
Routine Maintenance Materials and Labor Cost		+	_	<del>  -</del> -	<del></del>	NA NA	
	Hem 1: Groundwater monitoring annual maintenance	] 0	ł.	LS	] :	}	<b>#0</b>
	Hem 2: SVEfair sparge system annual maintenance	1 0	ŧ .	LS	ļ		+0
	Item 3: Samdeng field kit	0	<u> </u>	day	<b> </b>		#0
Subtotal		1	}		}		10
Auxiliary Materials and E		<del></del>		1=		NA	<del></del>
	Process Chemicals	0		LS	<b>]</b>		. 10
	Electricity (Phase 1)	0	ı	ıs			<b>#0</b>
	Electricity (Phase 2)	0		21	}		10
•	Water	0		LS	<u> </u>		\$0:
	Sewer	{ o;		ی	[ :		#G
<u> </u>	Fuel	0	<u> </u>	15	<u> </u>		\$0
Subtotel			}	-{	]		\$0
		İ					50
Disposal of Residues		† <del></del>		1		NA	
<u> </u>	Wash water, sludge, ect.	n		<u>LS</u>			\$0
Subtotal			}				10
Purchased Services		<del>†</del> -		<del>                                     </del>		АK	
Professional Servic				Ţ			1 .
	Item I: Laboratory Fees	0		LS			<b>\$0</b>
	item 2: Engineer review) consultration	0		LS			13
	Iten 3:	0.		LS			¥Q:
Subtotal							40
Othes:		<del>† - </del>		Ť		NA	
Administrative costs not	included in other line items	) 0		2.5	i (	l	\$81
Insurance		1		<u>-{ıs</u>	] ]		18;
Taxes, Icensing, permit re		1		\$\\\\$	l		ļ #0 i
Maintenance Reserve Fun		}			}	i	}
	orated for each year of implementation	44		:1.\$		<del></del> -	*0
Subtutal							\$0
Total Annual Operating	Cost					<del></del>	401
runner	****						
		]		<u> </u>	<u> </u>		

Number of years of implementation:

0

ADC: annual operating cost first hour LS: famp sum NA: not applicable for this afternative SVE; soil vapor extraction

## Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 2 Institutional Controls and Natural Attenuation

#### Syste Capter (art. Detail

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	that deligious (\$0 text, 1 2 4" powers, that yet, drove make	¥4	9	1,496.95		10.00
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	Town to contain the paper to make their wife and specialist has been seen	Į.	. •	RSQ 15.		06 01
	Yarras and descript for season on the season		1 !	\$50,00		30.00
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	Yalanda and determining state over 10 miles.	ł	"!	9.67		17.95
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	Bernatt gegräßen tart	<u> </u>		5,000.60	_	10 00
SV1. Sear per Fren Happur	first the facility	T **		3.057.9C		,,,,,,
	lapaceum, hipsoner	j	[ ]	1,293.00	1	10.50
	Nyter tanaratus	!	1 1	1,293.00		19.90
	Mari director	j	[ة ا	2.577.45		10.00
	Duct in year	1	1 1	\$.051.90		10.90
	(remainded)	Į.	اها	1,293.00		10,00
	Cardinages reporter	ļ		523.47		10.00
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		!	ł	4,848.75		20,00
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	Commercial and and and and and and and and and and	1	l o	2.076.63	ļ=	10.00
	Electrical head-one	1	٥	1,500.00	=	+0.10¢
	Later Control of the	ļ	0	209.42	-	10.00
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	Experience in piece reducer	1	٥	2.55	er .	17.80
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	Impart & hackful class full of decrease at warrant such as PM baselike accounts were success.	1		2.55		1000
5	Compt	×τ	- 0	119		10.00
Special parties county	May design visit marks has been			15,000,00	12.5	\$0,00
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	[ \( \frac{1}{2} \)			19,000,00		
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Engraves Pile SVL Fin		- KA	0	309.00 2.55	es 67	10.00 19.00
Engraves Pile-SVL Pas	Confirmation and squade programs accomplying vision. I suppose 200 CT or completely	- XA	0 0 0	309.00 2.55 32.33	च दर	10.00 10.00 10.00
Engineerus Piles SVI File	Confirmation and specific promptions at Configure visits. I summer 200, CT is compated.  Electropie No. Balan recommon	KA.	0	309.00 7.55 32.33 10,344.00	स स स	10.00 10.00 10.00
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Engradras Pile-SVL Pas	Confirmation of squale provision interrities when I amount 200 CT or comment  Elementary and recomment Office arrangement part		0	307.00 7.55 37.33 10,344.00 5.000.80	द द ध ध	00.00 (00.01 (00.01 (00.01 (00.01 (00.01)
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Lander Finds  Workering West Instill Ridge  Excernible Shorms  Francis Sid Say Parting  Francis Sid Say Parting  Francis Sid Says Parting  Francis Sid Says Parting  Francis Sid Says Says Says  Francis Sid Says Says Says Says  Fact Warneright Landful	Confirmation and squale sourcepts in description white. I assume 200 CT or constant  Electropic to the second of terminal  Office or properly size.  Trystation between  Trystation between  Electropic or of terminal  Electropic or of terminal  Electropic or of terminal  Electropic or of terminal  Electropic or of terminal  Electropic or of terminal  Confirmation or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or one or of terminal  Electropic or of terminal  Electropi	AA	0 0 0 0 0 0 0	304 000 2.53: 22.33: 10.344 00 5.000,80: 300,009 2.55; 9.70: 5.000,00: 1.250 00 1.250 00 1.40: 2.35: 2.20.00 110 00 2.55: 5.75: 0.00 100.00 100.00 2.55: 2.2	□ (1) (2) (3) (4) (5) (5) (5) (6) (6) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7	10.00 10.00
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Lands or hade  Manufarms Seems Seems  Excessions Seems  Faccount for Seets Postory  Faccount for Seets Excessions  Communication for Seets Faccounts  Communication  Commun	Conformation and equals interview interview when, I common 200 CT or consisted  Electropic to the second.  Office appropriate give.  Provided to the second.  Conformation and second.  Conformation and second.  Conformation and second.  Conformation and second.  Conformation and second.  Conformation are second.  Conformation are commonly as 27 Feb. 4" parties. "P.C. Date representation are commonly as 27 Feb. 4" parties." P.C. Date representation are commonly as 27 Feb. 4" parties. "P.C. Date representation are commonly as 27 Feb. 4" parties." P.C. Date representation are commonly as 27 Feb. 4" parties. "P.C. Date representation are commonly as a second as a	AA	0 0 0 0 0 0 0	304 000 2.53: 22.33: 10.344 00. 5.000,80: 70.000 2.55: 5.70: 5.000,00: 123:000 123:000 123:000 123:000 123:000 123:000 123:000 123:000 100:000 200:0000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:0000 200:000 200:000 200:000 200:000 200:000 200:000 200:000 200:00000 200:0000 200:0000 200:0000 200:0000 200:0000 200:0000 200:00000 200:0000 200:0000 200:0000 200:0000 200:0000 200:0000 200:00000 200:0000 200:0000 200:0000 200:0000 200:0000 200:0000 200:00000 200:0000 200:0000 200:0000 200:0000 200:00000 200:0000 200:00000 200:0000 200:0000 200:0000 200:0000 200:0000 200:0000 200:00		16.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 11.540.00
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# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 2 Institutional Controls and Natural Attenuation

### Indirect Capital Cost Detail

	Itam		Year of IC Expenditure	Quantity	Rate	Units		Cost
ngineering: Design to c	ciementation		a					
	Administration and supervision	- [		40	85.00	hr	\$3,400	
	Design and development			80	75.90	hr	\$6.000	
	Orafting			32	65.00	he .	±2,080	•
	Monitoring and testing (Year O)	1		0	<b>65.00</b>	he	\$0	
	Project engines ing			24	<b>65.00</b>	hr	\$1,560	
Subtetel								\$13,040
Епринента : Оесоттах	noting	<del>- i</del>	30					:
	Administration and supervision		,	20!	85.90	1	\$1,790	
	Design and development			40	75.00		\$3,000	
	Stafting	. [		8	}	ĺ	\$520	
	Monitoring and testing	ļ		0	65.00	hr	<b>\$0</b>	
	Project engineering			40	65.00	ħr	\$2, <b>600</b>	
Subtotal							İ	\$7,820
Licensei?emntitegal	.10% engineering costs)		g	1	z,086.00	ea	\$2,085	\$2,086
Start-up and Shake Dow	m of Treatment System	<del>-  </del>	MA	1				
	Hatsials			a	1,000.00	22	<b>\$0</b>	
	Labor	1		0	55.00	hz	10	
	Equipment			0	1,000.00	22	\$0	
	Lab Testing		<u> </u>	0	500.00	ea .	\$0	
Subtoral								\$6
Cantingency	175% capital costs)		0	1	5,349.90	IS	\$5,350	15,350
·				Ţ-				
Total		Year	σ		1	}	1	\$20,47
l	<u> </u>	Year	30	<u> </u>	<u> </u>	<u> </u>	<u> </u>	\$7,820

ea: each

hr: hour

IC: indirect capital cost

t.S: lump sum

NA: not applicable for this atternative

## Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No.2 Institutional Controls and Natural Attenuation

## Annual System Operation Cost Detail

	frem	Quantity	Rate .	Units	Frequency	Yearisi of ACC Expenditure	Totaliyear
Operating Labor Cost					1/Year		
	Item 1: Groundwater monitoring	40	85.00	hr		1 to 38	\$2,600
Post-Constructions		1 1	200.00		ļ	1 to 30	\$200
	Itam 2: Training	<del> </del>		_			\$2,800
Subtotal		<u> </u>		<u> </u>	<u></u>	<u> </u>	<u> </u>
lourine Maintenance N	faterials and Labor Cost	T			1/Year	1 to 38	\$1,000
	Item I: Groundwater monitoring ancies maintenance	1	1,000.00			1 10 30	\$0
	item 2: SVEise sparge well annual macramance	} 0	!	LS	1		\$150
	Item 3: Samoling field kit		75.90	day	<del> </del> -	1 to 30	\$1,150
Subtotal			<u> </u>				71,130
AusBary Materials and	E- 44-	<del></del>		<del>                                     </del>	1	NA	
KATERIA WEIGHT BUD	Process Chemicals	0	ļ	LS	1		-\$0
	Electricity	0		ιs			\$0
	Water	0		LS	ļ		\$0
	Sewer	0	1	is.	ļ	1	\$0
	Sewa Furi	1 0		LS_	<u> </u>	ļ	\$0
Subtotal							\$0
Disposal of Residues		<del>-                                    </del>	<del>                                       </del>	<del>                                     </del>	1,Year		1
Orbhorn or usavers	Wash water, studge, ect.	<u> </u>	580.00	NLS.	<u> </u>	1 to 30	\$500
Subtotal	37431 8410. 37000			Γ	Ì		\$500
Purchased Services		<del>-  </del>	_		1/Year		
LAKERITSED SERANTEZ	Professional Services		Ì	Ţ		Ĭ	1
	hem 1: _icoratory Fees		\$25.00	wel	j	1 to 30	\$5,000
	Item 2:	1 1	ıl	LS	}		\$1
	Iten 3:	1		LS	<u> </u>		\$(
Subtotal							\$5,000
0.5		1	<del>1</del>	T	1/Year	<del></del>	1
Other:	as maked at a short line states		ol .	LS		1	\$(
	or included in other line items	1 1	0.00	I LS	Ī		\$1
Instrance	:	1 7	7	olus	į	}	\$6
Taxes, licensing, perm		- [	}	1	1	1	
Maintenance Reserve	rurated for each year of emplementation!		68.36	รโเร		1 to 30	\$61
Subtotal	De Stan : At Carca 2591 At subhappingssearch						\$ 552
<u> </u>		<u> </u>	+	╁	<del> </del>	<del>                                     </del>	<del> </del>
Tetal Annual Operat	ing Cost		ļ			1 to 30	\$9,511

Number of years of implementation:

30

ADC: annual operating cost hr: hour LS: kemp sum NA: not applicable for this alternative SVE: sol vapo: extraction

# Fort Waimweight OU-2 Fassibility Study Saseline Cost Estimate - DRMD - Alternative No. 3 Soil Yacor Extraction, Groundwater Air Spanging and Monitoring

#### Berect Council Cost - Dated

		Tex of DC Expendence	Carrier 1	- L	<b>-</b>	er al
		<del></del>	Ω	1,486.85	• 1	112,110 1
per for Bases up Wills	Hall medicine (SO-type, ) 1.6" danseler man was, press walls)	•	62	520.25 ·	•	17 455 5
	Tracking is for home 64%? A deep money for each well, with backfully		\$27	\$46,50		144.851
	Market with cours was not well.  Papers to inchance S.O. corrupt for each well, some pape annual teach and functions.		\$7.	\$50.35	- 1	152,70%
	Literal Sec pulment (in which you is proved)		62	150 00 14		19 200 (
	Supply substitutes and			18,000,06		14.200 A
Vi.Samue was	Den menteren fig feit a. Bretein jeit wien inbestriere megt:	. 3	21	120.25		12575.
103mms = 105	Transferry to the forms (50°, 2° does presents my mark seed, seed, backfill)		1 2)	E46.50		113,576.
	Market and the first state and		21	150.15		117,853
	Party in Sections (14" provings had made under made provinces and hand which		71	150.00		F3.150
	( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )		25,600	147		:211,350
	Label aring cost a report man-archite and project pure from marks		1 4	10,000.00	<u>.</u>	10
	Remai periadire tert	0	10	5,000.00	-	152 000
NE:Searge from Person	Profits instances		10	2,051.00	-	190,518
	Inches there		10	7,293.00		112.530
	The second		10	1,233.90		:1 <u>2.930</u>
	Class (mater		177	2.133.65		171,334
	Francisco		10	1,051.00		150.510 412,830
	Continues reports		10	523.67		15,234
	Quer Santer		10	27.80		1278
			ומו		- 1	1183,440
	Exhaust Compells		10	4,649.75		:44
	lay transmission (propriet to Section 1	-	10	387.90	12	13.875
	Sampling parts		to	1,009.00		110,000
	Pauline say shorted 1970-19 Constant controls		10	2,878.53		126.761
	Cherical test on		19	1,000.00		110,000
			10	200.42		12,004
LITO Treatment	VIII Becoming strongers and	W.		96.90 2.55		
CITO HISTORIA	(a-phi vers		1 1	5.25		11
	Named recognition to party description of exceptions of exceptions of the contrast of the cont		1 6	300,801		16
	Conference and remain addresses or continue study. I sample/200 CF as completely		١	5,000.00		10
	Transition was		6	2.52		3.0
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	lapper & backfill class fill if dispuse or remaind suchs at PM (majfile languaged values)	**	0	1.19	¥	10
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	The street	]		193,55		1.0 65
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	Contractor and Processed		1 5			
	Translative two trees		i	1		11
	Conference कर्म प्रकारक सम्पन्नक स्वतंत्रकारक क्ष्मिक, 1 स्थानक200 दिए स्थानकर्मिक	. Ki	0	2 55		
Ergrapes Par-SYL Pie	Carried to State States		1 0	32.33	57	u
	Contractor pel Paris -		) 0	18,344,00	15	ž
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	Translation secure		3			,
	Confession (As Lands provided in contents when I spread 200 CY expended	<del> </del>	<del></del>	2,550.00	_	15 52
Managery wall but also	And mandages and devicement are track of described Principality by special states.		<del></del>			
Excession Storag	Surrey delineates and reviews to owner to mark or 19 feet		<del></del>	15.42		
Fernancy and Supp Persons	Francisco (m. m.) (c.)- (com/)	<del></del>	-			<del>- ,</del>
Programs for Whole Exceptable	Proposes for event as contrast classing 435 ft and proper at waters	<del>- : -</del>	- + ;	220.60	*	11.54
December of particularies	Lange and the second se		] 32	110 00	-	12.52
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Common start speet See #	Haging decades to fact the surrought Caroline (surrought systems)	ł	4			'
for Waterings Landfill	Samuel Statement Statement	1	٠ ا			<u> </u>
	Confession and America provides accompany thats. I a sequence QCC CV or constability	L	! !			
	Impact and player places OF Impactance Princess	<u> </u>				1242
Decision promp at least of Copyright Action	that managery, Strict or strongs resident	15	113			1 124.7
	Parameter included process recovery	Ť	5,000			1150
	Desir proper represent, where security had not deposed at the bandle	1	,			1
	(winners by planta de la companie de	1		•	1	
	Names and a parameter of	1	30	1		117.0
	(a) 100 (a) 10	I	1 7	10,000.00		1180
	Supposes	i	19	520.00	4=	
Totalo	Site operations Conference and passess assuring to state on the (2 passes 200 CT passes) and		15	\$20.00	_	15.30 61.418.41 678.61

CT: sales veri DC; direct coords com or and Pit for this orge to bed Ur have but

ETT: top temperature the sold determine EX; and applicable for the offerential PYC polymout determine ST: expense foot ST: spaces parts

St. in the state

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

### Indirect Capital Cost Detail

	hem	Year of IC Expenditure	Ораниту	Rate	Units		Cast
Engineering: Design to in	inplamentation	0		_			
	Administration and supervision		320	85.00	îv	\$27,200	
	Besign and development		540	75.00	hr .	\$48,DOO	
	Drafting		240.	65.00	hr	\$15,600	
	Monitoring and testing (Year O)		0	65.00	hr	#0	
	Project engineering		280	<b>65.00</b>	ìr	\$18.200	
Suprated							\$109.000
Engineering : Decommiss	Biominis	15			-		<del></del> -
	Administration and supervision		. 80		i i	\$5,100	-
	Design and development		150	75.00	hr	\$12,000	
	Drafting		40			\$2,600	
	Monitoring and testing	'	0	65.00	hr	\$0	
	Project engineering		138	65.00	hr	\$8,970	
Su <del>टाव</del> ाम							\$2 <b>8.</b> 670
Lease Permittegal	(10% engineering costs)	0	1	13,7\$7.00	Eà	113,767	:1 <b>3.767</b>
Start-up and Shake Dow	m of Treatment System	0				-	
l !	Materials		6	1,000,00	Ça	\$6,000	
•	Laber		246	<b>65.00</b>	hr	\$15,800	
	Equipment		6:	1,008.00	E2	\$6.500	
	Lab Testing	<u> </u>	48	500.00	E4	\$24,000	
Sucretar							151 <b>.500</b>
Comprehency	(15% capital costs)	Œ	1	226,142,41	r2	\$226,142	:226.142
Tetsú	Year	t t					:480,503
10.00	rea: Year	15					128.670
	) 584		<u></u>		-		

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hr: soor

IC: indirect capital cost

mus qenut :2.)

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No.3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

## Annual System Operation Cost Detail

	item	Quantity	Rate	Units	Frequency	Yearls) of AOC Expenditure	Totatiyear
	1/811	<del></del>			liyear		]
perating Labor Cost		1 40	€5.00	pt.		1 to 15	\$2,600
Post-Construction)	Item 1: Groundwater mongoring	208	65.00		l	1 to 19	<b>\$13.520</b>
	item 2. SVEAS system monitoring	1 "1	400.00			1 10 15	\$400
	Item 3: Training	<del></del>		-		1 to 15	\$3,000
ubtotal						1 to 10	\$13,520
		╅═╌╡		_	Uyear		
loutine Maintenance Ma	terials and Labor Lost		1,500,00	LS		1 to 15	\$1,900
	item 2: Groundwater monitoring annual maintenance		1,000,00			1 to 10	\$1,000
	item 2: SVEJsir sparge system annual maintenance	1 2	75.00	1		i to 15	\$150
	Item 3: Sampling field kit	<del></del>		1		1 to 15	\$1,150
Subtotal		} !		<u> </u>		1 10 10	\$1,000
		<del>-</del>		1	3/year	1	T
Auguary Materials and E		i 5	•	LS	<b>}</b>	1	<b>\$0</b>
	Process Chemicals	1 1	152,000.00	15	ļ	1 to 3	\$152,000
	Electricity (Phase 1)		14,200.00			4 to 10	\$14,208
	Electricity (Phase 2)	, a		LS			10
	Water	3		LS	İ		\$0
	Se <b>wa</b> r	,	±30.00	5	]	1 to 15	\$400
	Fuel	<del></del>		<del>1</del>	<del>}                                    </del>	1 to 15	3400
Subtorai		1		1	1	4 to 10	\$14,200
			ŀ	1		1 to 3	\$152,000
		<del></del>	<u> </u>		liyear	Ĭ	Ti "
Disposal of Residues		١,	900.01	ปเร	1	1 to 15	\$500
	Wash water, studge, ect.	<del>                                     </del>		1	<del>                                     </del>	1 to 15	1500
Subtotal		<u> </u>	<u>l</u> _	<u> </u>	<u></u> _		1
Purchases Services			Ī	1	) (year	1	1
Professional Servi	cez	١,	525.0	ما ساد		1 10 15	\$5,000
	item 1: Laboratory Fees		}	o month	1	1 to 15	\$1,550
	item 2: Engineer reviews consultation	17	1	LZ olusoure			\$0
<u></u>	ttem 3:	_	<del> </del>	143	<del> </del>	1 to 15	\$6,560
Subtotal	·	ļ	İ				
~		-	1		1/year		
Other:	a maked at a short line income		]	ιs			\$6
	t included in other line items	1 0	ıl .	ιs		,	10
Insurance			ıl	LS	}		\$0
Taxes, scensing, permit			1				
Maintenance Reserve F	prorated for each year of emplementation:	1 1	8 779.1	21   9	ł	1 to 15	\$5,775
	Bidifitab ibt Racu Asst of entirementation.	_		7		1 to 15	\$5.779
Subtotal			<u> </u>		<u> </u>	<u> </u>	<u> </u>
					1		1183.909
Zotel Annual Operatio	ng Cost (includes GW Monitoring)					1 to 3	\$46,109
1		· ·	ì	1		4 to 10	\$17,389
		Ţ	İ	ĺ		11 to 15	\$11,2K
	A CONTRACTOR AND	1		{		1 to 15	\$8,600
Groundwater Moi	nitoring Portion Of Total AOC	ı	i	Į.	1	1	

Number of years of implementation:

15

AGC: annual operating cost AS: air sparge his hour ES: lump sum SVE: soil vapor extraction GW: groundwater

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 4 Alternative 3 Plus Excavaben of Surface Seils Containing Benzolalpyrene and Disposal at the Fort Wainwright Landfill

#### Corpor Capital Cort - Batal

	.185	Tay of QC Expendeurs	Constity		Unit	
	Adjustations to hat 1 1/4" descript the real state and t	1	92	1,441.35		14E,198
rpilatery out	Transfer to the mater (54°, 7° from proving to seath and, and, backfully	1	1 25	120.25		17 €≦.
		ŀ	F2	£4£ 50	- 1	:44,705
	Mandage with closer was per main. Paper to become SC provide for spite and spite and spite amounts. But implicately		62	650.15		152 FBS
	Three and formers to the second of the secon	i	F2	150 00		11.25
			1 0	19,000.00		
	Supplies transferent text  Long agricultura (20 lain, 4° Supplies, P1C again representation texts)		21	2,200.00	,	141.78
(£§erem Relia	Angle option and the Control of Special Control o		21	120.25		12575
		<b>\</b>	71	646.50	•	:11576
	Markets are come less as well.  There is instance GO process for such and well specially and approximate the such such		21	350.15		117,553
		,	21	150 00		12.750
	Values and foreign for made one of plants.  Augheit mattern come to simulate plant-decreases, and promote pushing from Walface.	}	25,000	\$ 47	1	1211,752
	i ·		0	10.000,00		1 4
<u> </u>	Service State Self (Self)		10	5,000.00		19.50
LiSparge dus repus	Profit language	<b>I</b>	161	9,051,00	-	198.5%
	parameter property and the parameter	1	10	1,233.90	i.	102,000
	Water specimen	l.	10	1,233.00		117,000
	Mind of the second seco	l l	10	2,122.45		127,754
	Cutt hopes	1	10			:FL\$16
	Eranden ment		10.	1,213.00	<b>=</b>	112,55
	(		10	523.67	=	15,230
	Unit hamer	1	10	27 89	( <b>-</b>	1271
	Dear invest with her at them		10	10,344.00	-	1102.60
	Erhant Contrals		10	4,348,75	is.	146.00
	(Michaelle Collection of the State of S	1	10	387.96	t.s	:1.07
	Samples parts	1	10			119,000
	Paraless, and processed from 40	1	10			131.70
	familia Galler	1	10	1.000.00		184.00
	Electronia lamate et	i	10	200.4		12,700
	Lepton	NA.	- 3	96.9		1
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	Underground testing reserved, greated lead file, black and dispersion on PM landful.	1	5.00	- 1		1
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# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 4 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

#### Indirect Capital Cost Detail

	lien	Year of IC Expenditure	Quantity	Rate	Units		Cost
Engineering: Design to In	nglementation	0				1	
	Administration and supervision		320	85.00	pr	\$27.200	
	Design and development		720	75.00	he	154.000	•
	Bratting	•	288	65.00	he	±18,720	
	Monitoring and testing (Year D)		D	65.00	ļĸ	<b>\$</b> 0	
	Project engineering	ļ	540	65.00	hr	141,600	
Subtotal							\$141,520
Engineering : Decommiss	sioning	15		. <del>-</del>			······································
	Administration and supervision		80	85.00	ľ	\$5,800	
	Design and development		; so (	75.00	hr	\$12,000	
	Grafting		48	65.00		\$3,120	
	Monitoring and testing		l o	65.00	:	\$6	
	Project engineering		120	65.00	hr	\$7,800	
Subtatal							\$29,720
License/Permit/Legal	(10% engineering costs)	g	1	17,124.00	23	\$17,124	\$17,124
Start-up and Shake Dow	en of Treatment System	0					
	Materials		6	1,000.00	u	\$6,000	
	Labor		Z40	65.00	hr	\$15,600	
	Equipment		8	1,000.00	11	\$6,000	
	Lab Testing		48	500.00	ea .	\$24,000	
Subtotal							151,600
Contingency	(15% capital costs)	ū	;	262,213.35	LS.	\$202,213	\$202,213
							****
Total	Year		}	}	<u> </u>	•	\$412,457
	Year	15		,			<b>\$29.720</b>

ea: each

hr; hour

IC: indirect capital cost

LS: lump som

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No.4 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

### Annual System Operation Cost Detail

<del></del>	ten	2cannity	Rate	Units	Frequency	Yearts) of AOC Expenditure	Totalivear
Operating Labor Cost					Tiyear		
(Post-Construction)	tiem 1: Groundwater monitoring	40	65.00	br		1 to 15	12,800
1. Alt. Condition in the	tem Z: SVE'AS system montains	208	85.00	hr		1 to 10	\$13,520
	Item 3: Training	1.	400.00	LS .		1 to 15	#400
Subtotal	11816-3. 1121143	1 —				1 to 15	\$3,000
SUPTOLES					<u> </u>	1 to 10	\$13,520
Routine Maintenance Ma	ormusis and Labor Cost			<u> </u>	) iyear		i
HODERE MENTANCE III	Item 1: Groundwater monitoring annual maintenance	1	1,000,00	LS		1 to 15	\$1,000
	hem 2: SVE ar sparge system annual maintenance	j 1	1,000,00	LS		1 to 10	\$1,000
	Item 3: Samoling field kit	2	75.00	qsv		1 to 15	\$150
Subtotal	HEIT DE DESTRUCTION CONTRACTOR					1 to 15	\$1,150
20010121				<u> </u>		1 to 10	- 11,000
Ausgusty Materials and E	ne/Gy	<del></del>		_	1/Aset		i
	Process Chemicals	8	,	LS	ŀ		\$6
	Electricity (Phase 1)	1	152,000.00	LS		1 ta 3	\$152,000
	Electricity (Phase 2)	1	14,200.00			4 to 10	\$14,200
	Water Water	5		LS		1	\$0
		0		is		İ	\$0
	Sewa	,	400.00		1	1 to 15	3400
	Fuel	<del>-                                    </del>		-		1 10 15	\$400
Subtotal				l	l	4 to 10	#14,200
				1	ļ	1 to 3	\$152,000
	<del></del>	<del></del>		<del>-</del>	llyear	<del>                                     </del>	1
Disposal of Residues		,	500.00		111/2:00+	1 to 15	1509
	Wash water, shoose, ect.	<del>'</del>	500.00			1 to 15	\$500
Subtotal					<u> </u>		
Purchased Services					liyear	1	i
Protessional Servi	cat	1			1	]	1
	Item 1: Laboratory Fees	8	625.00		•	1 to 15	\$5,000
	item 2: Engager reviewi consultation	12		month	1	1 to 15	\$1,560
	Item 3:	0	<u> </u>	LS			10
Subtotal						1 to 15	\$5,560
		<del></del> _		<del>!</del>	<u> </u>	<u> </u>	+
Other:		٥		LS.	l lyear	1	\$0
	moluded in other line stams	ا ا		LS		)	\$0
Insurance		٥		LS	ļ		\$0
Taxes, Icensing, permit		<b>ا</b> "		-	}		-
Maintenance Reserve Fu		Ι.			Į	1 10 15	15,168
15% of capital costs (	prorated for each year of emplementation)	1	5.167.67	113	<del> </del>	1 to 15	\$5.158
Subtotel		-		1	1	1,10,13	1 12/00
		<del></del>		i T		1	T
Tatal Appual Operation	g Cost ( includes GW Manitoring)	1	i		ļ	1 to 3	1183,298
10th Kunner ofter eru	2	ļ	ł		1	4 to 10	\$45,498
				1	1	11 to 15	\$16,778
			į	1			
Groundwater Monu	itoring Portion Of Total AOC	į.	1		1	1 to 15	\$8,600
	•		<u> </u>	<u></u>	<u></u>	<u> </u>	<u> </u>

Number of years of implementation:

15

ABC: annual operating cost AS; air sparge ea: each hit hour SVE: soil vapor extraction GW: groundwater

# Fort Wainwright QU-2 Feasibility Study Baseline Cost Estimate - DRMO - Afternative No. 5 Alternative 3 Plus Exception of Surface Soils Containing Benzo(a)pyrene and On-site Soildiffication

### Direct Captel Cast - Detail

		THE ST DISCOUNTS	Linkert	7207 (740)	, and
		- 0	621	1, UK 15 en	187, 180 BC
Semina (contractor de degra	Mid partitions 60-box, 5 214" demoir, Markey, markey with	•	1 12	129.25	s? a55 50
	Translation to the larger (50°, 7° does provings for each small, seek bestelle)		177	544 50 au	242 083 BC
	Markets are compressed for well- ligant to horsens 60° storage for many mark year manifester, and have made		6.2	£50 15∫ <b>™</b>	r\$2,799.36
	Lines and litters to keep the last one of lasts.		62	150 00 (44	11 300 PC
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	See merbilde (f.c. just' 4, Abusbal' 5,00° reibe auf enzempt aungt)		77	7.2.0	142.00
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			21	546 50 m	172,574,54
	Paid to provide the same of the same and the same and the same		21	150 15 as	117,855,15
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	The state and a salam transfer and the transfer transfer and the salar		25,900	147 57	2213,750 30
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Tit Safer per Figer Handale	legates Meati		1 3	9.05190	194510 51
			19	1,753,00 🕳	#1 <b>Z.330 P</b>
	المسلم المسلم	i	19	1,793,00	112,530,0
	Dect terms		10	Z12.45	121,3345
	Statement Street		10		1 1 1 5 1 4 1
	Contractive recover		10	1.293.00 m	112,930 #
		ĺ	10	523.67 e	15.236.7
	Outr Inner serie bert stram	l .	15	27 <b>25</b> m	1275.8
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	September (Printer Best	Ì	19		14.475
	Specifical design	1	79	347.90(1.5	12 972.W
	Panking and decrease hands on	]	10	1,004.99	519,000
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	Succession bunk-up	1	15	1.006.00	110 000 B
	Lightens	l	10	770 42 m	17,004.2
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	frankling wrong		"	5.001.00 LS 2.57 CT	18.30
	Build provided a regard communication of the second		"	809 17	10 0
	Contract to principle was to the straight tendencing inchmine		"	2.99 67	100
	lapper & buckfill close fill of distance of market parts on PM bardfill (or popular) velocati	<u> </u>		7.35 GT	1 12 14
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	Exemples (n-place values)		2738	193 95 67	1442,206 8
	State plants		"	300 00 -	13 000 0
	Community of sends material securities trans. Security 200 CY excepted	- FX	<del>                                     </del>	125 61	13
Sapara of No. Boron	(Internal of Persons Security)		اه ا	នុងស	19.0
	Complyments and western	<b>;</b>	t o	19,900,000,05	\$0 D
	Trapphiny series Conference (and America analytical-sychopomo trasts, 4 passeds 200 CV accounted	<b>!</b>	[ oi	200 86	( 40 m
	Digram or Alle Waller	NA .	1	1722 02	150
Tapana and Fast Style (Fast	Contract on the contract of		1 0	17.33	10.0
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	Translative weeks			2.000 0000.2	( ""
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		N.A.		1.25 61	10.0
	Congress of Parish	l	=	170 (27	108
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Property of Indian			77	110 00 ==	123
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Per Nove Establish	Chancer was a second of the Chancer was also for the Chancer was also for the Chancer was a second of the Chancer with the Chancer with the Chancer was a second of the Chancer with the Chancer was a second of the Chancer with the Chancer was a second of the Chancer with the Chancer was a second of the Chancer with the Chancer was a second of the Chancer with the Chancer was a second of the Chancer with the Chancer with the Chancer was a second of the Chancer with the Chancer wit	*4	3	110 00 m 5 25 27 1 00 07 100 00 m 2 30 07	101 101 102
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Transmit for North Exception  Transmitted and or Transmitted  Transmitted for Each and or  Transmitted	Remote was  **Problem of the Control	%å	3 6 2 3 3 5 5,000	110 00 m 111 of 525 DY 100 of 100	104 104 105 107 107 107 107 107 107 107 107 107
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# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 5 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and On-site Solidification

### Indirect Capital Cost Detail

	izem	Year of IC Excenditure	Ossanida	ate	Units		Cost
ngineering: Gesign to Im	olementation	0					
	Administration and supervision	' '	380	85.00	hr	\$30,600	
	Design and Sevelopment	·	800	75.00	l <b>y</b> r	\$50,900	
	Orastring		335	85.00	òr	\$21,840	
	Monitoring and testing (Year Q		<b>6</b>	300.00		\$19, <b>500</b>	
	Project engineering		580	65.90	te	\$35,400	
Subtotal							\$168.340
Enginessing : Decommiss	ioning			· · · · · · · · · · · · · · · · · · ·			
	Administration and supervision	15	80	85. <b>9</b> 0		\$6. <b>800</b>	
	Design and development	15	160	75.30	ļ	\$12,000	
	Drafting	15		65.00		\$3,120	
	Monitoring and testing		이	85.00		\$5	
	Project engineering	15	120	<b>65.00</b>	j	17,800	
	Project engineering	30	80	65.00	hr	\$5,280	
Subtotal						Year 15	\$29.720
			<u> </u>		<u> </u>	Year 30	15.20
LicenselPermit/Legal	(10% engineering costs)	ů	1	20,326.00	ea	\$20,326	\$20.32
Start-up and Shake Dow	m of Treatment System	D					
	Materials		5	1,000.00	ez	\$6,090	
	Labor		24D	65.00	22	\$15,600	
	Equipment		6	1,000.00	<b>1</b>	\$6,000	
	Lab Testing		43	500.00	23	\$24.000	
Subtotal							\$51, <b>60</b>
Contingency	[35% capital costs!	0	;	276.259.47	LS	\$276,259	\$278.25
	Year	0	Ì	<u> </u>	<del>!                                    </del>		±516.52
Total	Year	15		Ī			\$29,72
<del>-</del> -	Year	30			1		15.20

ea: each

hr: hour

IC; indirect capital cost

LS: tump sum

# Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 5 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and On-site Solidification

### Annual System Operation Cost Detail

	Item	Cuantity	Rate	Units	Frequency	Yearis) of AOC Expenditure	Totallyear
Operating Labor Cost		}			1/year		Ì
Post-Construction	item 1: Groundwater monitoring	40	85.00			1 to 30	\$2,600°
	itam 2: SVEJAS system monitoring	208				1 to 10	\$13,520
	ftem 3: Training	1,	400.80	LS		1 to 30	3406
Subtotal						J to 30	\$3,000
	<u></u>			<u> </u>	<u>.</u>	1 to 10	\$13,520
Routine Maintenance Mat	erials and Labor Cost	T :			Hyear		
	Groundwater monitoring annual maintenance	1	1,000.00			1 to 30	\$1,000
	SVElair sparge system annual maintenance	1	1,000,000			1 10 10	\$1,000
	Sampling field kit	2	75.00	đay		1 16 30	\$150
Subtotal				į į	İ	1 to 30	\$1,150
••••		<u> </u>				1 to 10	\$1,000
Auxiliary Materials and En	eco v	7			liyear		
	Process Chemicals	9		LS	[	<b>}</b>	\$0
	Electricity (Phase 1)	1	152,000.00	LS	•	1 to 3	\$152,000
	Electricity (Phase 2)	1	14,200.00	LS		4 to 10	\$14,200
	Water	0		LS		}	10
	Sewer	ļo	i i	ŁS	 	}	\$0
	Fuel	1	480.00	LS		1 to 30	\$400
Subtotal					i -	1 to 30	\$400
John Pro-				ĺ	1	4 to 10	\$14,200
						1 10 3	\$152,000
Disposal of Residues			<u> </u>	Ī	liyear		
Disborat of periodes	Wash water, sludge, ect.	;	500.00	rz	'	1 to 30	\$500
Subtetal						3 to 30	1500
Purchased Services	<u> </u>	<del>_</del>	<u> </u>	<del>                                     </del>	Tiyear	<u>.                                    </u>	1
						İ	1
Professional Service		8	625.00	well		1 to 30	\$5,000
	Item 1: Laboratory Fees	12		menth		1 to 30	\$1,580
	item 2: Engineer review/ consultation	1 6	[	ıs			\$B
	Item 3:	<del></del> -	<del>                                     </del>	-	<del></del> -	1 to 30	\$ 6.5 <b>5</b> 0
Subtotal			i	ļ	1		·
Other:		1		<del>  -</del> -	1/year		1
	included in other line items	1 0		LS	-		1
NOTIFIED OF SUPERIOR	RECEIPED BY OFFICE MILE FEO.		1	LS	Į	1	
Taxes, icensing, permit r	energy!	} 0		LS	ļ	1	
Maintenance Reserve Fur				l		}	
	iniated for each year of anotementation:	1	3,529,98	٤s	İ	1 re 30	\$3,530
Subtotal	Diates in Each Less & August Contains			<del>                                     </del>		1 to 30	\$3,530
Septeta						<u> </u>	<u>,                                     </u>
<del></del> -			[	1			
Total Asnual Operating	Cost (includes GW Monitoring)		1	ļ		1 to 3	\$181.550
}	· · · · · · · · · · · · · · · · · · ·			1	-	4 to 10	\$43,860
		- [				11 to 30	\$15,140
	oring Portion DI Total AOC			1	1	1 to 30	\$8,800

Number of years of implementation:

30

AOC: annual operating cost AS: air sparge hi: how LS: lump sum SVE: spil yapor extraction GW: groundwater