Final

August 8, 1997

RECORD OF DECISION
for
OPERABLE UNITS A AND B
FORT RICHARDSON
ANCHORAGE, ALASKA

August 1997

DECLARATION STATEMENT
for
RECORD OF DECISION
FORT RICHARDSON
ANCHORAGE, ALASKA
OPERABLE UNIT A AND OPERABLE UNIT B
AUGUST 1997

SOURCE AREA NAME AND LOCATION

Operable Unit A and Operable Unit B
Fort Richardson
Anchorage, Alaska

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial actions for Operable Unit B (OU-B) and the rationale for addressing OU-A under a cleanup agreement with the State of Alaska at Fort Richardson. OU-A consists of three source areas: the Roosevelt Road Transmitter Site Leachfield (Transmitter Site); the Ruff Road Fire Training Area (Fire Training Area); and the Petroleum, Oil, and Lubricant Laboratory Dry Well (Dry Well). OU-B consists of one site: the Poleline Road Disposal Area (Poleline Road). This ROD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986; 42 United States Code 9601 et seq.; and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations Part 300 et seq. This decision is based on the Administrative Record for both OUs.

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

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from OU-B source areas, if not addressed by implementing the response actions selected in this ROD, may present an imminent or substantial threat to public health, public welfare, or the environment. OU-A is contaminated with petroleum compounds, and OU-B is contaminated with chlorinated solvents.

The OU-A and OU-B source areas are the first areas of Remedial Investigation to reach a final-action ROD at this National Priorities List site.

DESCRIPTION OF THE SELECTED REMEDY

The Army, ADEC, and EPA have determined that the sources included within OU-A do not represent unacceptable risks to human health or the environment, based on EPA criteria. Thus, no remedial action is necessary to ensure protection of human health and the environment under CERCLA. However, the levels of petroleum contamination in the soil do exceed the ADEC soil cleanup criteria. Accordingly, these sites will be cleaned up under the State-Fort Richardson Environmental Restoration Agreement (Two-Party Agreement) in accordance with applicable State of Alaska regulations. The specific cleanup actions and the time required to remediate the source areas have yet to be determined. The components of the removal actions selected for OU-A will be detailed in separate decision documents prepared in accordance with the Two-Party Agreement.

A remedy was chosen from many alternatives as the best means of addressing contaminated soil and groundwater at OU-B. The selected remedy addresses the risk by reducing contamination to attain cleanup goals. The remedial action objectives for OU-B are designed to:

- Reduce contaminant levels in the groundwater to comply with drinking water standards;
- Prevent contaminated soil from continuing to act as a source of groundwater contamination;
- Prevent the contaminated groundwater from adversely affecting the Eagle River surface water and sediments; and
- Minimize degradation of the State of Alaska's groundwater resources at the site as a result of past disposal practices.

The major components of the preferred remedy for OU-B are:

- High-vacuum extraction (HVE) to remove contaminated vapors and groundwater from the "hot spot." The "hot spot" is defined as the subsurface area containing greater than 1.0 milligrams per liter of 1,1,2,2-tetrachloroethane in groundwater and/or free-phase solvents;
- An air stripping system to treat extracted groundwater to meet State of Alaska and federal maximum contaminant levels (MCLs) before being reinjected into the deep aquifer;
- Institutional controls that will include restrictions on groundwater well installations, site access restrictions, and maintenance of fencing until state and federal MCLs for drinking water are met;
- Natural attenuation of groundwater contamination in areas outside the "hot spot"; and

- Long-term monitoring to assess whether groundwater contamination is approaching the Eagle River and to ensure that contamination levels in the groundwater are decreasing through natural attenuation.

Groundwater at Poleline Road is contaminated with volatile organic compounds, including chlorinated solvents. While there are no current uses of groundwater in the site area or seeps by which wildlife could be exposed to groundwater, modeling indicates that groundwater at the site eventually could reach the Eagle River. Modeling results indicated a time period of more than 100 years for on-site groundwater to reach the Eagle River.

Remediation of the site is necessary because the NCP Groundwater Protection Strategy requires consideration of current and potential future uses of groundwater in remedy selection, and protection and restoration of groundwater resources if necessary and practicable.

The selected remedy will be conducted in a multi-step approach because of the complexity of the contaminant characteristics and the hydrogeology of the site. The HVE system will be installed to reduce the quantity and concentration of contaminants in the "hot spot," and to prevent migration, to the maximum extent practicable, of contaminants above state and federal MCLs. Concurrently, technologies that could enhance the performance of the selected remedy will be evaluated in a Treatability Study, and if these enhancing technologies are deemed effective, they will be implemented to improve performance of the selected remedy. The plume outside the "hot spot" will be monitored to track plume migration and the progress of natural degradation processes. If cleanup of contaminants in the "hot spot" does not appear to be successful, then alternative remedial action goals and/or strategies will be pursued for the site (see Section 7.2).

STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because the remedy will result in hazardous substances remaining above regulatory levels on site, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment, and will continue for five-year increments until the remedy is complete.

SIGNATURES

Signature sheet for the foregoing Operable Units A and B, Fort Richardson, Record of Decision between the United States Army and United States Environmental Protect.on Agency, Region X, with concurrence by the Alaska Department of Environmental Conservation.

William M. Steele
Lieutenant General, USA
Commanding

Date

SIGNATURES

Signature sheet for the foregoing Operable Units A and B, Fort Richardson. Record of Decision between the United States Army and United States Environmental Protection Agency, Region X, with concurrence by the Alaska Department of Environmental Conservation.

Chuck Clarke, Regional Administrator, Region X
United States Environmental Protection Agency

Date

SIGNATURES

This signature sheet documents an agreement between the United States Army and the United States Environmental Protection Agency on the Record of Decision for Operable Units A and B at Fort Richardson. The Alaska Department of Environmental Conservation concurs with the Record of Decision.

Kurt Fredriksson, Director, Spill Prevention and Response
Alaska Department of Environmental Conservation

Date

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LIST OF ILLUSTRATIONS

LIST OF ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AMSL	above mean sea level
AR	Army Regulation
ARARs	applicable or relevant and appropriate requirements
Army	United States Army
AS	air sparging
AWQS	Alaska Water Quality Standards
BGS	below ground surface
BNAs	base/neutral and acid extractable organic compounds
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COCs	contaminants of concern
COECs	contaminants of ecological concern
COPCs	contaminants of potential concern
COPECs	contamintants of potential ecological concern
CSM	conceptual site model
DNAPL	denser-than-water nonaqueous phase liquid
DRO	diesel-range organics
ED	exposure duration
EPA	United States Environmental Protection Agency
EPCs	exposure point concentrations
ERA	Ecological Risk Assessment
FFA	Federal Facility Agreement
FS	Feasibility Study
ft/day	feet per day
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
HVE	high-vacuum extraction
IRIS	Integrated Risk Information System
MCLs	maximum contaminant levels
μg/kg	micrograms per kilogram
μg/L	micrograms per liter (ppb)
mg/kg	milligrams per kilogram (ppm)

mg/kg-day	milligrams per kilogram per day
mg/L	milligrams per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OU	Operable Unit
O&M	operation and maintenance
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
POLs	petroleum, oil, and lubricants
ppm	parts per million
RAOs	remedial action objectives
RBCs	risk-based concentrations
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SFs	slope factors
SVE	soil vapor extraction
TBC	to-be-considered requirement
TCE	trichloroethene
TI	Technical Impracticability
UCLs	upper confidence limits
USC	United States Code
VOCs	volatile organic compounds

DECISION SUMMARY

RECORD OF DECISION
for
OPERABLE UNITS A AND B
FORT RICHARDSON
ANCHORAGE, ALASKA
AUGUST 1997

This Decision Summary provides an overview of the problems posed by the contaminants at Fort Richardson, Operable Unit A (OU-A) and OU-B 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 at OU-B; 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 Remedial Investigations (RIs) for OU-A and OU-B to provide information regarding the nature and extent of contamination in the soils and groundwater. Baseline Human Health Risk Assessments (HHRAs) and Ecological Risk Assessments (ERAs) were developed and used in conjunction with the RIs to determine the need for remedial action and to aid in the selection of remedies. Feasibility Studies (FSs) were completed to evaluate remedial options.

1.0 SITE DESCRIPTIONS

Fort Richardson, established in 1940 as a military staging and supply center during World War II, originally occupied 162,000 acres north of Anchorage. In 1950, the Fort was divided between the Army and the Air Force. The Fort now occupies approximately 56,000 acres bounded to the west by Elmendorf Air Force Base, to the east by Chugach State Park, and to the north and south by the Municipality of Anchorage (see Figure 1-1).

Fort Richardson's land use supports its current mission to provide the services, facilities, and infrastructure necessary to support the rapid deployment of Army forces from Alaska to the Pacific Theater. The area managed by Elmendorf adjacent to Fort Richardson is dedicated to military and recreational use.

The Post contains features that include flat to rolling wooded terrain. The upland areas near the adjacent Chugach Mountain Range rise to approximately 5,000 feet above mean sea level. The Post is located in a climatic transition zone between the maritime climate of the coast and the continental interior climate of Alaska.

The predominant vegetation type at Fort Richardson comprises varying-aged stands of mixed coniferous and deciduous forest. The diverse plant communities provide habitats for a diverse wildlife population including moose, bear, Dall sheep, swans, and waterfowl. There are no known threatened or endangered species residing on the Post.

Five major Pleistocene glaciations have shaped the Cook Inlet basin. These glacial deposits become thicker as they progress from the Chugach Mountain Range to Cook Inlet. Remnants of the glaciation include the massive Elmendorf Moraine, alluvial fans, and a large outwash deposit called the *Naptowne Outwash*. The Elmendorf Moraine comprises poorly sorted, unconsolidated till with boulders, gravel, sand, and silt. The moraine acts as a surface water divide, but not as a groundwater divide.

Two major aquifers exist in the Anchorage area; they dip westward and extend from the Chugach Mountain Range across the Anchorage basin (see Figure 1-2). Most groundwater flows in the Naptowne and Knik glacial outwash sands and gravels. Relatively little groundwater flows in the underlying consolidated bedrock of the Kenai Formation because of the bedrock's low permeability. Well logs from previous investigations indicate that wells installed in bedrock yield small quantities of water.

The Naptowne and Knik outwash aquifers are replenished by surface water runoff from the mountains, direct infiltration of precipitation, and percolation from surface waters. Groundwater flows through these deposits into glacial outwash sediments beneath portions of Fort Richardson south of the Elmendorf Moraine.

Fort Richardson obtains drinking water from the Ship Creek Dam Reservoir and has several emergency supply wells near Ship Creek. Groundwater used for the emergency water supply is obtained from the confined aquifer in the Knik outwash deposit. Water storage for Fort Richardson is provided by a permanent 2.5-million-gallon underground reservoir in the Elmendorf Moraine, and by the Ship Creek Dam Reservoir at the base of the Chugach Mountain Range. A water treatment plant near the dam processes the drinking water.

Fort Richardson has generated and disposed of various hazardous substances since it began operations. The Fort was added to the United States Environmental Protection Agency's (EPA's) National Priorities List (NPL) in June 1994. On December 5, 1994, the Army, Alaska Department of Environmental Conservation (ADEC), and EPA signed a Federal Facility Agreement (FFA) that outlines the procedures and schedules required for a thorough investigation of suspected historical hazardous substance sources at Fort Richardson. The FFA divided Fort Richardson into four OUs: OU-A, OU-B, OU-C, and OU-D. Only OU-A and OU-B are addressed in this Record of Decision (ROD; see Figure 1-1). OU-C and OU-D will be addressed in future RODs. The potential source areas were grouped into OUs based on the amount of existing information and the similarity of potential hazardous substance contamination.

1.1 OPERABLE UNIT A

OU-A comprises three source areas: the Roosevelt Road Transmitter Site Leachfield (Transmitter Site); the Ruff Road Fire Training Area (Fire Training Area); and the Building 986 Petroleum, Oil, and Lubricant (POL) Laboratory Dry Well (Dry Well).

1.1.1 Site Locations and Description

The Transmitter Site is located north of the main Fort area near Otter Lake; the site is illustrated in Figure 1-3. The site includes an underground communications bunker used from World War II through the Korean War. The sanitary facilities within the bunker are connected to a septic leachfield that was the subject of the OU-A RI.

The Fire Training Area is located east of Bryant Airfield near the Glenn Highway (see Figure 1-4). The site consists of an area used for fire-fighting exercises from the 1940s to 1980. The exercises involved applying fuels and other waste combustible liquids to an unlined earthen pit, igniting the fuels, and extinguishing the resulting fires with water.

The Dry Well is located at Building 986 within the main cantonment area of Fort Richardson, near Loop Road and Warehouse Street (see Figure 1-5). The Dry Well opening is approximately 4 feet in diameter, with a concrete collar and a metal and plywood cover. The Dry Well was used for the disposal of drain and sink water from the adjacent POL laboratory. Numerous chemicals were used at the POL laboratory during performance of quality testing of fuels used at Fort Richardson.

1.1.2 Land Use

While land use at the Transmitter Site and Fire Training Area is generally recreational, the Dry Well is a working laboratory. In the future, continued recreational land use (i.e., hiking, hunting, etc.) at the Transmitter Site and Fire Training Area represents the most likely scenario. Continued industrial use of the Dry Well area is expected in the future.

1.2 OPERABLE UNIT B

1.2.1 Site Location and Description

OU-B consists of one site: the Poleline Road Disposal Area (Poleline Road). Poleline Road is located in the north portion of Fort Richardson, approximately 1 mile south of the Eagle River and 0.6 mile north of the Anchorage Regional Landfill (see Figure 1-6). The site is situated in a low-lying wooded area at Poleline Road and Barrs Boulevard. The site was used as a chemical disposal area from 1950 to 1972. During this time, chemical agent identification sets and other military debris were burned and disposed of in trenches. The chemical sets were neutralized with a mixture of bleach or lime and chlorinated solvents before burial.

1.2.2 Hydrogeology and Groundwater Use

Four water-bearing intervals have been identified at Poleline Road: a perched zone, a shallow groundwater zone, an intermediate groundwater zone, and a deep aquifer (see Figure 1-7). The saturated intervals are separated by zones of very dense, low-porosity, compact tills, and the detection of contaminants in all four intervals suggest that they are interconnected to some degree. The top of the perched interval was encountered at 4 feet to 10 feet below ground surface (BGS) and is approximately 5 feet thick. The shallow saturated zone is an average of 10 feet thick; the top was encountered at 20 feet to 25 feet BGS. Groundwater in the shallow zone flows in a northeasterly direction (see Figure 1-6). The intermediate zone was encountered at approximately 65 feet to 95 feet BGS. The deep aquifer is an advance moraine/till complex with a thickness between 3 feet and 40 feet and was encountered at 80 feet to 125 feet BGS. Groundwater elevations indicate that the flow direction in the deep aquifer is locally to the northeast and regionally to the northwest (see Figure 1-6). Hydraulic conductivities were estimated from existing site data and averaged 0.5 feet per day (ft/day) for all saturated zones, except that the intermediate zone averaged 0.05 ft/day. These relatively low hydraulic conductivities suggest that groundwater flow in the site area would not significantly disperse dissolved contaminants.

Available data indicate that the deep aquifer below Poleline Road is not connected with the aquifers used for drinking water in the community of Eagle River (more than 1 mile to the northeast). It is unlikely that groundwater beneath Poleline Road ever would be used for a drinking water supply. Yield from the intermediate, shallow, and perched saturated zones would be too low to supply an average household, and the installation of septic systems would preclude use of the shallow or perched zones for drinking water. The deep aquifer may provide sufficient yield, but the installation of drinking water wells in the deep aquifer is unlikely based on the present growth pattern in the area.

1.2.3 Land Use

The Army uses the land surrounding Poleline Road for military training activities and recreational purposes. OU-B is situated on public domain land that belongs to the United States Department of Interior, Bureau of Land Management. This land is withdrawn from the public domain for military purposes. U.S. Army Alaska holds no deed documents for this land.

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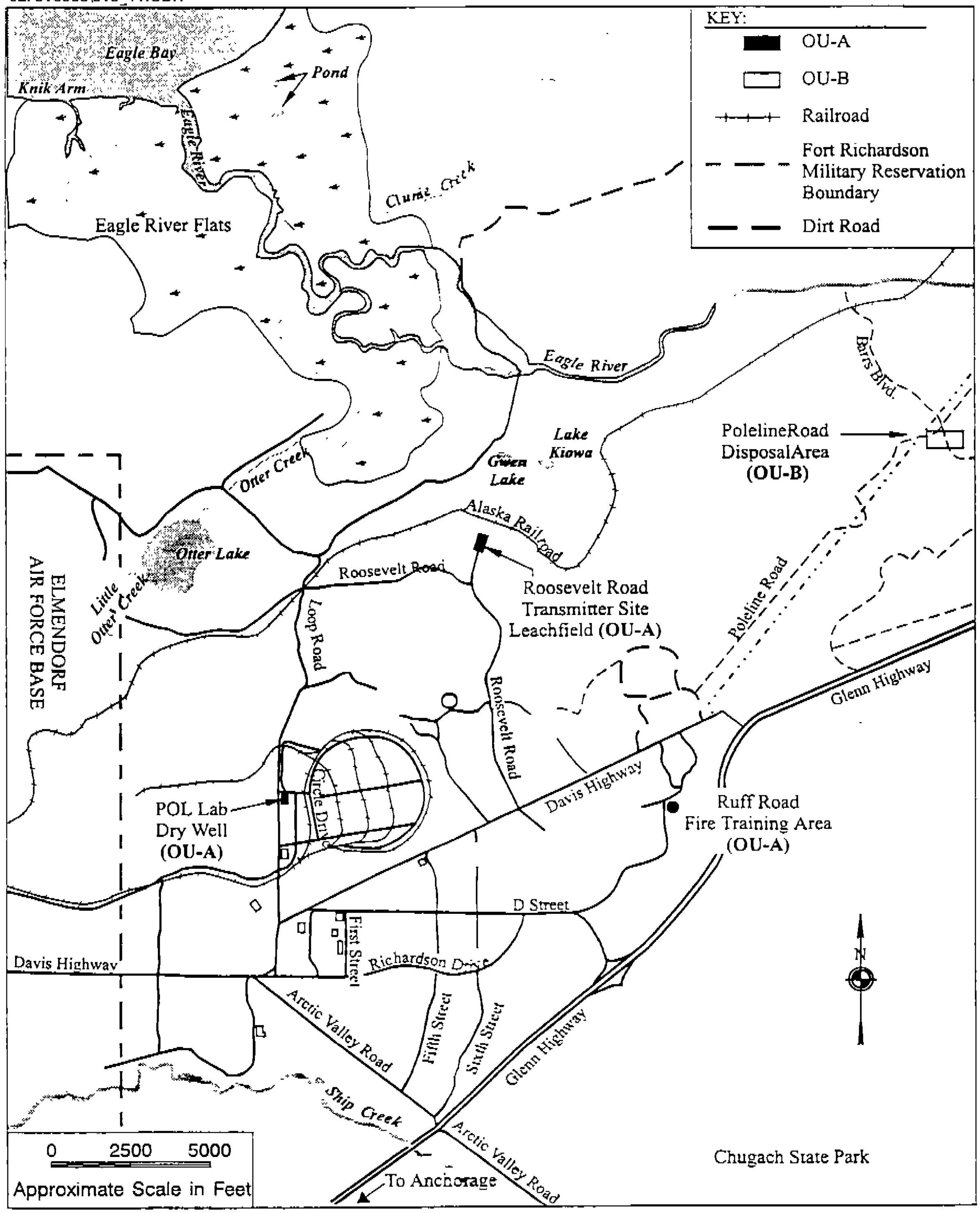
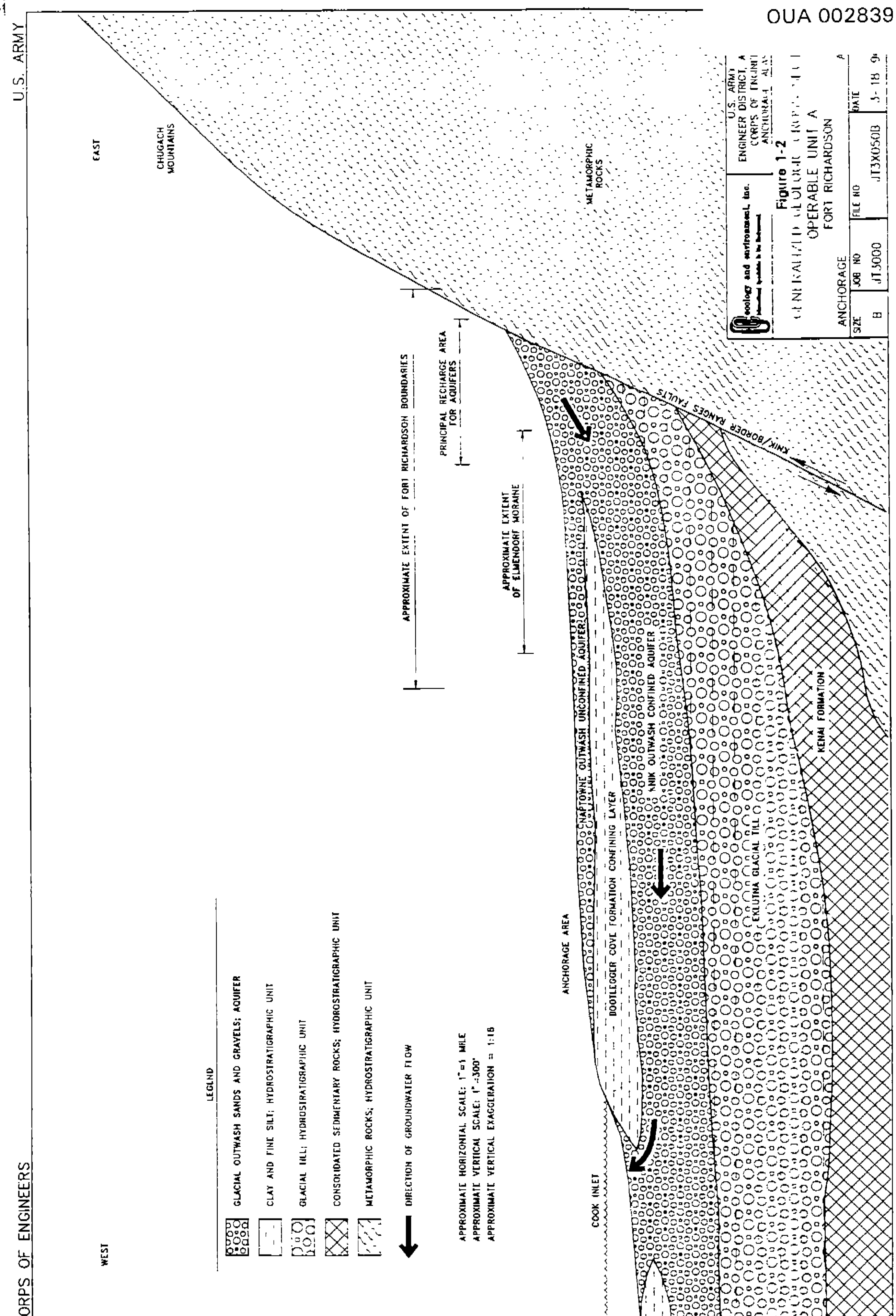


Figure 1-1 OPERABLE UNITS A AND B LOCATION MAP FORT RICHARDSON, ALASKA


U.S. ARMY
CORPS OF ENGINEERS
EAST
WEST
CHUGACH MOUNTAINS
METAMORPHIC ROCKS
APPROXIMATE EXTENT OF FORT RICHARDSON BOUNDARIES
PRINCIPAL RECHARGE AREA FOR AQUIFERS
APPROXIMATE EXTENT OF ELMENDORF MORAINE
KNIK/BORDER RANGES FAULTS
NAPTOWNE OUTWASH UNCONFINED AQUIFER
BOOTLEGGER COVE FORMATION CONFINING LAYER
KNIK OUTWASH CONFINED AQUIFER
EKLUTNA GLACIAL TILL
KENAI FORMATION
ANCHORAGE AREA
COOK INLET
LEGEND
GLACIAL OUTWASH SANDS AND GRAVELS; AQUIFER
CLAY AND FINE SILT; HYDROSTRATIGRAPHIC UNIT
GLACIAL TILL; HYDROSTRATIGRAPHIC UNIT
CONSOLIDATED SEDIMENTARY ROCKS; HYDROSTRATIGRAPHIC UNIT
METAMORPHIC ROCKS; HYDROSTRATIGRAPHIC UNIT
DIRECTION OF GROUNDWATER FLOW
APPROXIMATE HORIZONTAL SCALE: 1"=1 MILE
APPROXIMATE VERTICAL SCALE: 1"=300'
APPROXIMATE VERTICAL EXAGGERATION = 1:18
ecology and environment, inc.
U.S. ARMY ENGINEER DISTRICT, A
CORPS OF ENGINEERS
Figure 1-2
OPERABLE UNIT A
FORT RICHARDSON
ANCHORAGE
SIZE
B
JOB NO
JT3000
FILE NO
JT3X050B
DATE

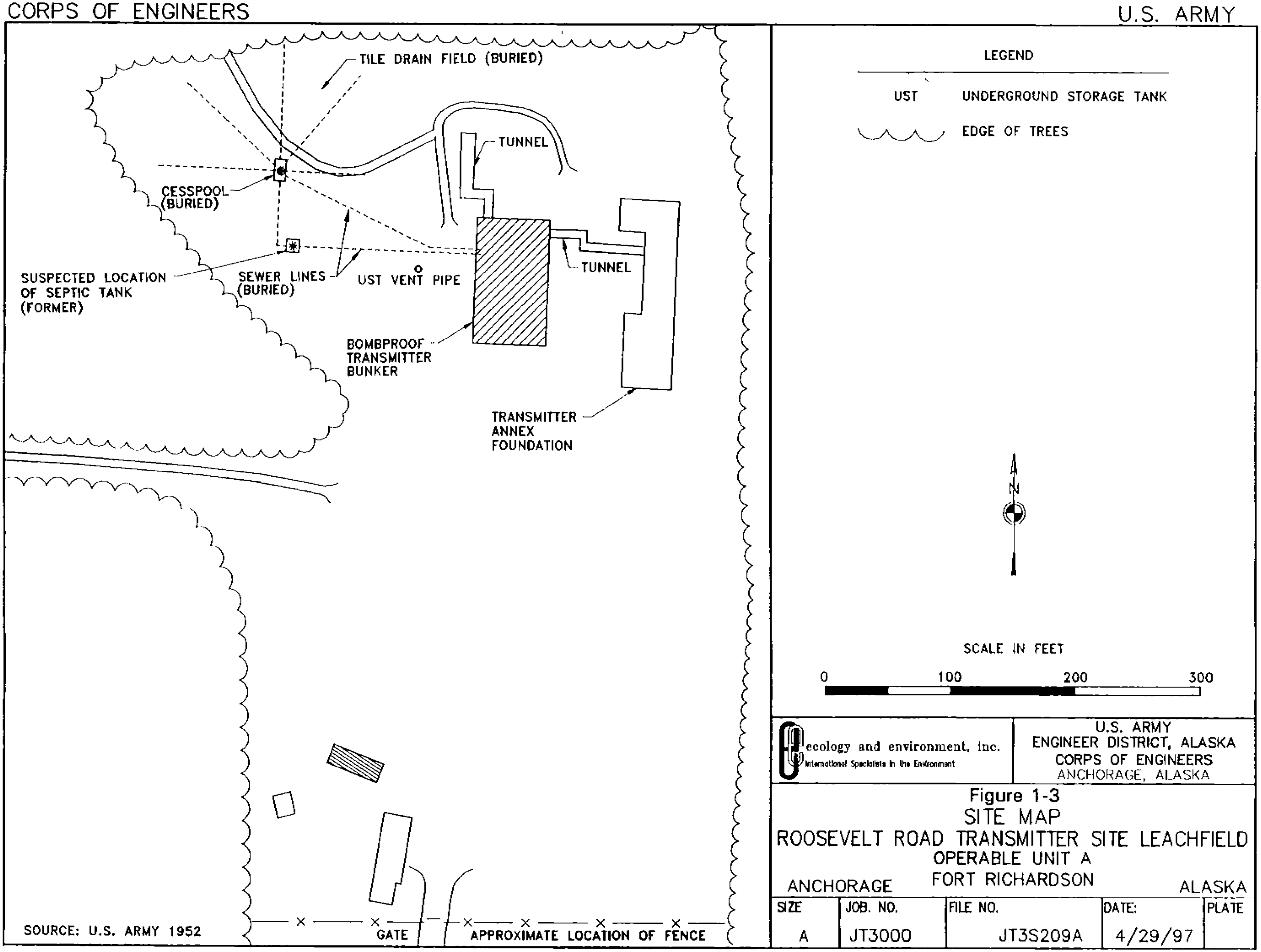
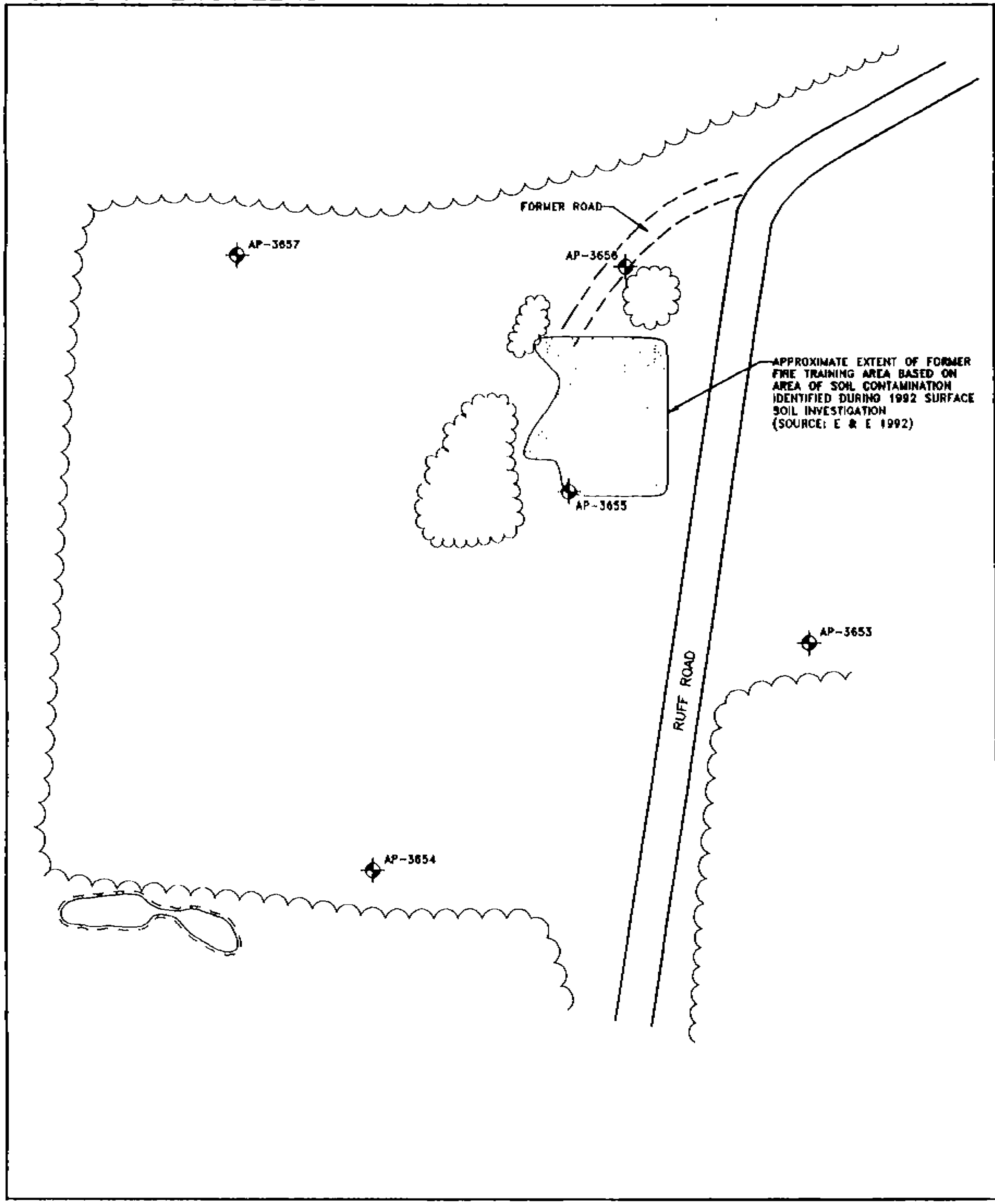
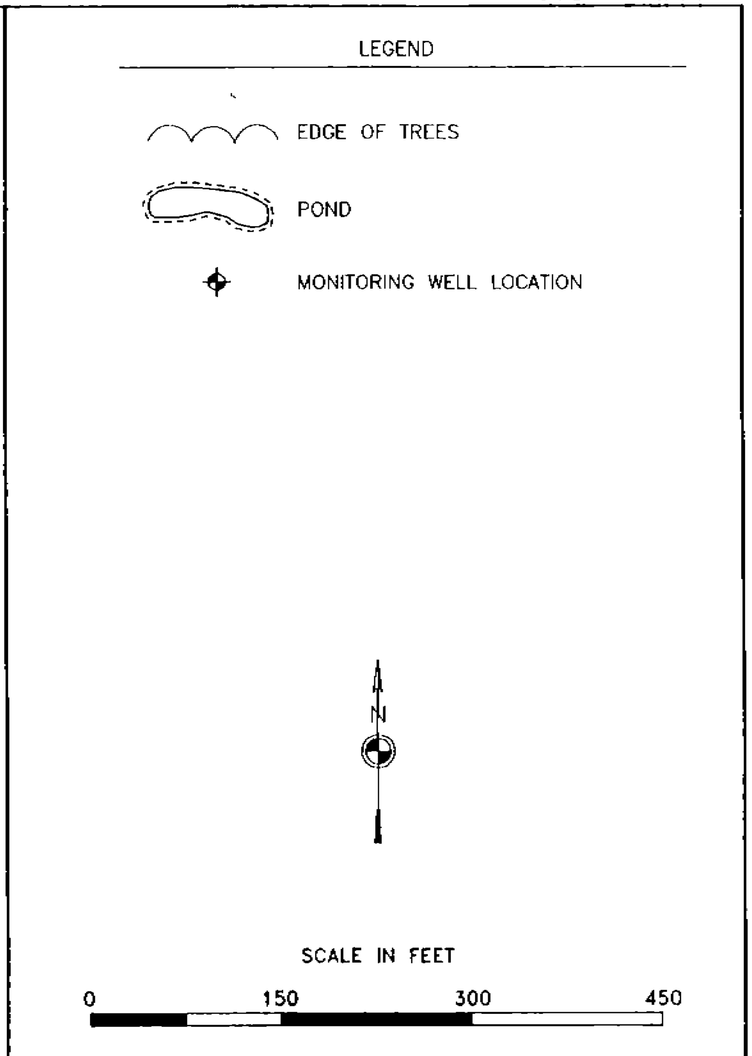


Figure 1-3
SITE MAP
ROOSEVELT ROAD TRANSMITTER SITE LEACHFIELD
OPERABLE UNIT A
ANCHORAGE FORT RICHARDSON ALASKA

CORPS OF ENGINEERS U.S. ARMY





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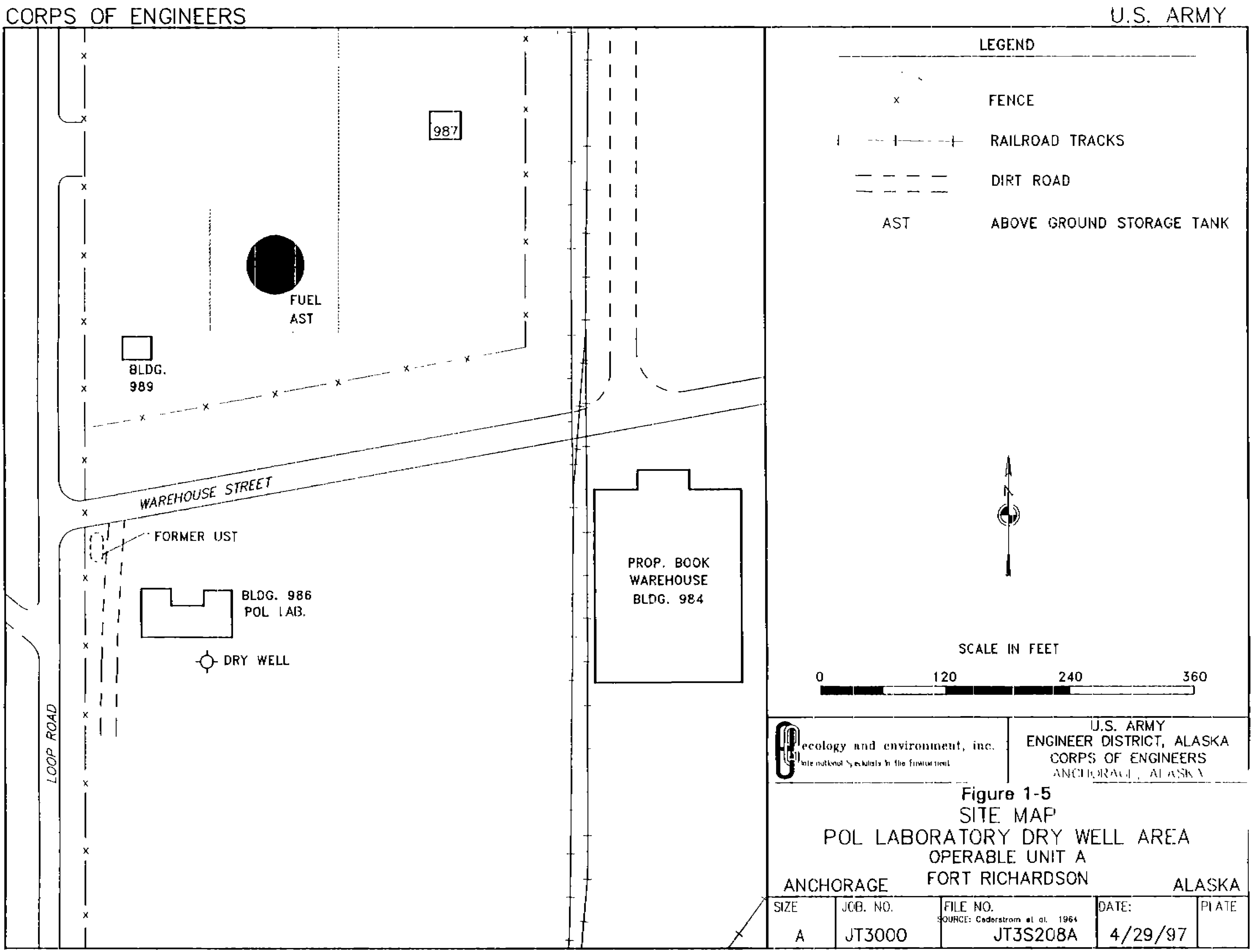
International Specialists in the Environment

U.S. ARMY
ENGINEER DISTRICT, ALASKA
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

Figure 1-4
MONITORING WELL LOCATIONS
RUFF ROAD FIRE TRAINING AREA
OPERABLE UNIT A
FORT RICHARDSON
ANCHORAGE ALASKA

SIZE	JOB. NO.	FILE NO.	DATE:	PLATE
A	JT3000	JT3S207A	4/29/97	


CORPS OF ENGINEERS
U.S. ARMY
LEGEND
FENCE
RAILROAD TRACKS
DIRT ROAD
AST
ABOVE GROUND STORAGE TANK
987
FUEL
AST
BLDG.
989
WAREHOUSE STREET
FORMER UST
BLDG. 986
POL LAB.
DRY WELL
LOOP ROAD
PROP. BOOK
WAREHOUSE
BLDG. 984
SCALE IN FEET
0
120
240
360
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U.S. ARMY
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CORPS OF ENGINEERS
ANCHORAGE, ALASKA
Figure 1-5
SITE MAP
POL LABORATORY DRY WELL AREA
OPERABLE UNIT A
FORT RICHARDSON
ANCHORAGE
ALASKA
SIZE
A
JOB. NO.
JT3000
FILE NO.
SOURCE: Cederstrom et al. 1964
JT3S208A
DATE:
4/29/97
PLATE

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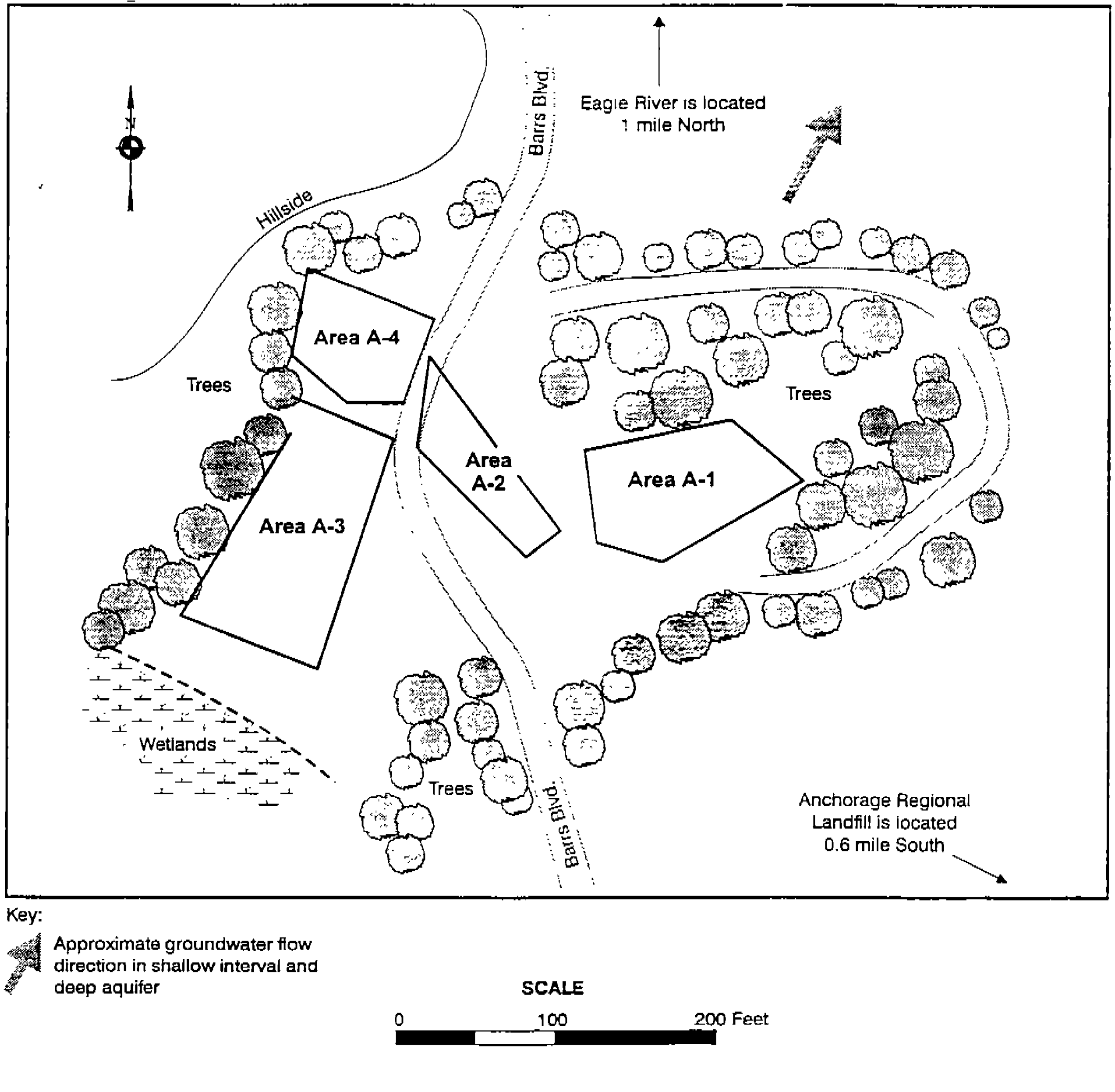

Figure 1-6 POLELINE ROAD DISPOSAL AREA OPERABLE UNIT B FORT RICHARDSON, ALASKA

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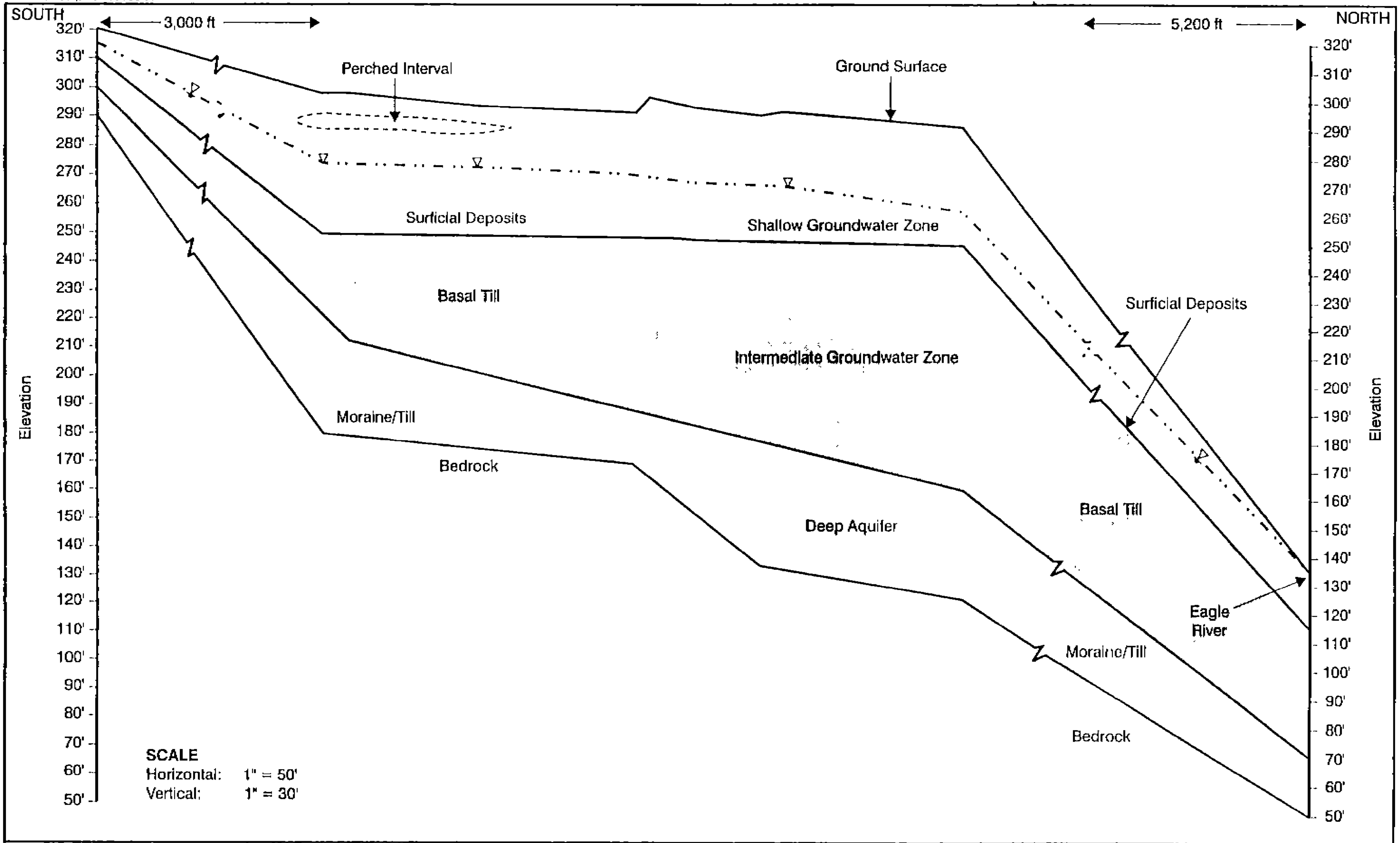


SOURCE: Ecology and Environment, Inc. 1996.

Figure 1-7 GROUNDWATER ZONES AT POLELINE ROAD DISPOSAL AREA OPERABLE UNIT B FORT RICHARDSON, ALASKA

2.0 SITE HISTORIES AND ENFORCEMENT ACTIVITIES

2.1 SITE HISTORIES BEFORE REMEDIAL INVESTIGATIONS

2.1.1 Site History of Operable Unit A

2.1.1.1 Roosevelt Road Transmitter Site Leachfield

The Transmitter Site was utilized from World War II through the end of the Korean War as part of the Alaska Communications System, established to provide command and control communications in the event of enemy attacks on Anchorage or Fort Richardson. The leachfield was associated with the sanitary system facilities at the underground bunker. Two sewer lines originate from the west side of the bunker and extend westward, eventually connecting to a septic tank and a concrete cesspool that is the nucleus of the leachfield. The quantity of sewage disposed of through the septic system is unknown. Additionally, at least two other sewage disposal facilities were present at the Transmitter Site.

During 1978, vandalism of several transformers stored in the former transmitter annex building resulted in a spill of dielectric oils containing polychlorinated biphenyls (PCBs). The spill later was remediated by washing the concrete foundation of the former transmitter annex building with diesel fuel. The date of this action is not documented in existing records; however, anectodal information suggests that the washing action occurred in 1979. In 1988, 150 tons of PCB-contaminated soil surrounding the concrete pad was excavated. Another cleanup effort was conducted in 1992, when at least 600 tons of PCB-contaminated soil was removed.

Three separate investigations were performed at the site between 1988 and 1990 to determine the presence and extent of PCB contamination inside and around the underground bunker. As part of the 1990 investigation, two samples and a duplicate were collected from the leachfield cesspool. The sampling records indicate that the material sampled was sludge and soil. Analytical results of these samples showed the presence of volatile organic compounds (VOCs) and semi-VOCs, PCBs, and heavy metals. Because of the limited amount of sludge-like material observed in the cesspool during the RI, most of this contaminated material may have been removed from the cesspool through sample collection during the 1990 investigation. Alternatively, the cesspool identified during the 1990 investigation may have been the septic tank that could not be located during the RI and that is believed to have been excavated and removed during soil removal operations at the site in 1992.

2.1.1.2 Ruff Road Fire Training Area

The Fire Training Area began operations during the initial establishment of the Post in approximately 1940, and it was used until 1980 to conduct exercises for training fire department and rescue crews. The fire training exercises were conducted by saturating unlined excavations with water, pumping fuel into the excavations, and igniting the fuel. Petroleum fuel products burned during the fire training exercises included jet fuel, waste oil, diesel, brake fluid, and solvents. Based on the assumption that 1,500 gallons to 2,300 gallons of combustible material was burned annually at this site, approximately 85,500 gallons of wastes was burned and disposed of at the Fire Training Area.

The former Fire Training Area has been estimated to be an area of petroleum-stained soils approximately 50 feet in diameter. In 1991, the original road in the area was demolished and the present Ruff Road was constructed. The charred debris associated with the Fire Training Area was removed at that time. In 1994, the Fire Training Area was filled with approximately 18 inches of soil and regraded. During winter 1994, the National Guard parked vehicles at the present site. No visual evidence of the Fire Training Area remains.

Three investigations were conducted at the Fire Training Area—in 1986, 1989, and from 1991 to 1992—to determine the presence and extent of contamination at the site and to estimate potential human health and environmental risks. Analytical results from these investigations documented the presence of petroleum hydrocarbons; benzene, toluene, ethylbenzene, and total xylenes; and dioxins in surface and subsurface soils at the site.

Conclusions from the most recent investigation during 1991 to 1992 suggested that concentrations of petroleum and dioxin were high enough to warrant remediation. The highest levels of contamination were detected in the surface and near-surface soils in the immediate area of the fire training pit. This area later was regraded, and much of the original surface soil was spread and/or buried beneath up to 3 feet of fill.

2.1.1.3 Petroleum, Oil, and Lubricant Laboratory Dry Well

The Dry Well has been used from the 1950s to the present, but the quantity of waste discharged to the Dry Well from the laboratory has not been documented. Operations performed at the POL laboratory include analysis of various fuels such as motor gas, aviation fuel, JP-4, and arctic-grade diesel for United States Government quality assurance purposes.

An 800-gallon underground storage tank was located north of Building 986 until 1992. The tank received the same laboratory waste as the Dry Well. The Army drilled eight soil borings around the tank in 1991 as part of the removal effort. Several soil samples collected from the borings indicated the presence of petroleum hydrocarbons at 10 feet to 20 feet BGS. Following removal of the tank in 1992, the tank excavation was sampled and backfilled with clean fill and closed in accordance with the cleanup standards set forth by the State of Alaska.

The Army conducted an investigation at the Dry Well in November 1992 to determine the presence and extent of contaminants in the well. During the investigation, approximately 18 inches of water and 6 inches to 8 inches of sludge were observed in the well at approximately 15 feet BGS. Analytical results indicated that the sludge and water contained petroleum hydrocarbons and heavy metals, including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

2.1.2 Site History of Operable Unit B

Poleline Road was identified in 1990 through interviews conducted by the Army with two former soldiers who were stationed at Fort Richardson in the 1950s and who recalled the disposal of chemicals, smoke bombs, and Japanese cluster bombs. The disposal location was corroborated by a 1954 United States Army Corps of Engineers map showing a "Chemical Disposal Area" at Poleline

Road and by 1957 aerial photography showing trenches in the area. The disposal area was active from approximately 1950 to 1972.

The site was divided further into four disposal areas: Areas A-1, A-2, A-3, and A-4. Areas A-3 and A-4 showed the greatest evidence of buried waste and trenching. Historical information describes how relatively shallow (8-feet- to 10-feet-deep) trenches were dug and used for the disposal of a wide variety of debris, including chemical agent training kits. During this time, a layer of "bleach/lime" was laid in the bottom of the trench, and then the materials contaminated with chemical weapons were placed on a pallet in the trench. Diesel fuel was poured on the agent and then ignited with thermal grenades. After burning was complete, a mixture of either bleach or lime, combined with chlorinated solvent carrier (trichloroethene [TCE]; tetrachloroethene [PCE]; and 1,1,2,2-tetrachloroethane), was poured over the materials to neutralize the chemical agent.

During the 1993 and 1994 removal action, contaminated debris and soil were removed from Areas A-3 and A-4. Included during this removal action were individual components of gas identification sets that were issued by the Army Chemical Warfare Service during the 1940s and 1950s. These sets were used to train military personnel in the identification of chemical warfare agents. Among the training set components were their drawn steel cylindrical shipping containers, also referred to as *pigs*. Of the approximately 12 pigs recovered at the site, seven were intact and moved to a secure storage location on Fort Richardson. The pigs will be analyzed to verify their contents and will be opened. Their contents will be neutralized by Army chemical destruction personnel. This action is scheduled for late Fiscal Year 1998.

Soils were excavated to a maximum depth of 14 feet, where groundwater was encountered. During the removals, sampling indicated the presence of chlorinated solvents, including TCE; PCE; and 1,1,2,2-tetrachloroethane, in soil and groundwater within 20 feet of the surface. Removal action concentration levels were established for TCE (600 milligrams per kilogram [mg/kg]); PCE (100 mg/kg); and 1,1,2,2-tetrachloroethane (30 mg/kg). Soils that exceeded these action levels were stockpiled in lined, plastic-covered piles surrounded by berms on Barrs Boulevard southeast of the site. The stockpile area is fenced, and remediation of the stockpiled soil from the removal action is scheduled to begin in 1997. A geophysical survey was performed in 1995 to determine whether any suspicious material remained in the recently excavated areas. Results of the survey indicated that the burial material had been removed.

Sampling was not conducted at Areas A-1 and A-2 because of the potential presence of unexploded ordnance. However, geophysical surveys of these areas indicate that they contain lesser quantities of buried waste than Areas A-3 and A-4. In addition, sampling of soil and groundwater surrounding Areas A-1 and A-2 did not detect any compounds or breakdown products associated with ordnance. The sampling did detect relatively lower concentrations of chlorinated solvents than levels detected near Areas A-3 and A-4.

2.2 ENFORCEMENT ACTIVITIES

Fort Richardson was placed on the CERCLA NPL in June 1994. Consequently, an FFA was signed in December 1994 by EPA, ADEC, and the United States Department of Army. The FFA details the responsibilities and authority associated with each party pursuant to the CERCLA process and the environmental investigation and remediation requirements associated with Fort Richardson. The FFA divided Fort Richardson into four OUs, two of which are OU-A and OU-B, and outlines the general requirements for investigation and/or remediation of suspected historical hazardous waste source areas associated with Fort Richardson.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The public was encouraged to participate in the selection of the remedies for OU-A and OU-B during a public comment period from January 20 to February 18, 1997. The *Fort Richardson Proposed Plan for Remedial Action, Operable Units A and B* presents combinations of options considered by the Army, EPA, and ADEC to address contamination in soil and groundwater. The Proposed Plan was released to the public on January 17, 1997, and was sent to 150 known interested parties, including elected officials and concerned citizens.

The Proposed Plan summarizes available information regarding OU-A and OU-B. Additional materials were placed in information repositories established at the Alaska Resources Library, Fort Richardson Post Library, and University of Alaska Anchorage Consortium Library. An Administrative Record, including other documents used in the selection of the remedial actions, was established in the Public Works Environmental Resource Office on Fort Richardson. 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 A.

Interested citizens were invited to comment on the Proposed Plan and the remedy selection process by mailing comments to the Fort Richardson project manager; by calling a toll-free telephone number to record a comment; or by attending and commenting at a public meeting on January 29, 1997, at the Russian Jack Chalet in Anchorage. Fifteen people attended the public meeting. Two comments were received from the public during the comment period.

The Responsiveness Summary in Appendix B provides more details regarding community relations activities and summarizes and addresses public comments on the Proposed Plan and the remedy selection process.

2.4 SCOPE AND ROLE OF OPERABLE UNITS

The OU-A and OU-B RI/FSs were performed in accordance with the RI/FS Management Plans for OU-A and OU-B, respectively. The RI fieldwork for both OUs was conducted during summer 1995.

The principal contamination at source areas within OU-A is petroleum in soil but does not pose unacceptable risks to human health. Because the levels of contamination exceed ADEC soil cleanup criteria, the Agencies (U.S. Army Alaska, EPA, and ADEC) have elected to pursue further cleanup efforts at these sites under the State-Fort Richardson Environmental Restoration Agreement (Two-Party Agreement). Decisions regarding specific cleanup alternatives for OU-A source areas will be documented in separate decision documents, and cleanup will be conducted in accordance with applicable State of Alaska regulations.

The principal contamination at OU-B is chlorinated solvents in soil and groundwater. Based on the origin and nature of disposal, these chlorinated solvents are not listed hazardous wastes under the Resource Conservation and Recovery Act (RCRA). According to results of the RI, potential risks to human health and the environment are posed by on-site contamination. Accordingly, the Agencies have elected to pursue remedial actions under Superfund to address these potential risks.

3.0 SUMMARY OF SITE CHARACTERISTICS

Physical features, hydrogeologic conditions, and the nature and extent of contamination for OU-A and OU-B are described briefly in the following sections.

3.1 OPERABLE UNIT A

3.1.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

The northern and central sections of Fort Richardson, where the OU-A source areas are located, feature flat to gently rolling, wooded terrain, including ponds and numerous streams leading from the mountains and uplands westward to Cook Inlet. Drainages flow mainly west-northwest into the Knik Arm. However, streams in the southernmost portion of the Fort, including Ship Creek, flow through Anchorage before entering the Knik Arm.

3.1.1.1 Roosevelt Road Transmitter Site Leachfield

The Transmitter Site is located near the northern margin of the Elmendorf Moraine on the Naptowne Outwash deposits. Site soil boring logs indicate that the soil consists of dry, massive, very dense, well-graded gravel and sand, with minor silt and clay.

The Transmitter Site is located in an undeveloped portion of Fort Richardson. The site is surrounded by forests. Wetlands are located within 0.5 mile of the site to the southwest, southeast, and northeast.

Groundwater at the Transmitter Site occurs from 88 feet to 99 feet BGS (approximately 176 feet to 178 feet above mean sea level [AMSL]) within a sandy gravel deposit of the Naptowne Outwash Formation. Groundwater generally flows southwest with an estimated gradient of 0.01. This groundwater flow direction is not consistent with the regional west-northwest groundwater flow.

Because the contaminant source is in the subsurface, the most likely contaminant migration pathway at the Transmitter Site is lateral and vertical transport through subsurface soil. Groundwater is not a contaminant migration pathway, as indicated by the absence of contaminants in the samples collected at the site. Figure 3-1 presents a conceptual site model (CSM) based on the results of the RI.

3.1.1.2 Ruff Road Fire Training Area

The Fire Training Area is located near the southern margin of the Elmendorf Moraine on the Naptowne Outwash deposits. Site soil boring logs indicate that the soil consists of dry, massive, well-graded gravel, with minor silt and clay.

The Fire Training Area is located within an area used for gravel excavation and is surrounded by relatively undisturbed forested areas. A wetland is located approximately 600 feet from the southwest corner of the former Fire Training Area. A former gravel pit is located approximately 0.6 mile south and hydraulically upgradient of the site. The pit has filled with water, which is likely an expression of a localized, perched groundwater zone.

Groundwater occurs from 140 feet to 153 feet BGS (approximately 236 feet to 250 feet AMSL) and within the unconfined sandy gravel to gravelly sand aquifer. Groundwater generally flows westward and has an average horizontal hydraulic gradient from 0.018 to 0.023. These conditions are consistent with the regional hydrogeologic characteristics described in Section 1.2.2.

Contaminants were detected in surface and subsurface soil. Off-site contaminant transport through surface runoff and windblown particulates is possible but not expected to contribute significantly to contaminant transport from the site. The absence of site-related contaminants in the surface water and sediment samples collected at the nearby pond substantiates the conclusion that surface water runoff and particulate transport are not migration pathways of concern at the Fire Training Area. The RI conducted transport modeling of petroleum constituents in the subsurface soils. The model predicted that petroleum contaminants will migrate approximately 10 feet vertically from their present location over a 90-year period and that groundwater likely would not be impacted. Based on this result and the absence of contaminants in groundwater samples collected at the site, groundwater is not a contaminant migration pathway. Figure 3-2 presents a CSM based on the results of the RI.

3.1.1.3 Petroleum, Oil, and Lubricant Laboratory Dry Well

The Dry Well is located near the southern margin of the Elmendorf Moraine on the Naptowne Outwash deposits. Soil boring logs indicate that the soil consists of dry, massive, very dense, well-graded gravel and sand, with minor silt and clay.

The Dry Well is located in a partially developed portion of the Fort Richardson main installation. Patches of developed/disturbed forests surround the site. No known wetlands occur within a 0.5-mile radius of Building 986.

The Dry Well was completed to a depth of 18 feet. Groundwater occurs mainly within a silty sand bed of the Naptowne Outwash Formation from 113 feet to 122 feet BGS (approximately 177 feet to 181 feet AMSL). Groundwater generally flows west with an average gradient from 0.001 to 0.006. These conditions are consistent with the regional hydrogeologic characteristics described in Section 1.2.2.

Contaminants were detected in sludge and subsurface soil. The sludge and the Dry Well will be removed during the upcoming field season. Lateral and vertical migration of contaminants through subsurface soil is the most important pathway at the site. Based on results obtained during the RI, lateral contaminant migration has been restricted to an area within an approximately 40-foot radius of the Dry Well. Contaminant transport modeling suggests that petroleum contaminants would migrate approximately 11 feet vertically from their present location during a 90-year period. Because the distance between the deepest soil contamination at the Dry Well and the groundwater table is approximately 40 feet, the likelihood of groundwater contamination caused by contaminants leached from subsurface soil is low. Based on the results of the RI, neither volatilization of contaminants to air nor particulate transport of contaminants by wind is a release mechanism. Figure 3-3 presents a CSM for the Dry Well.

3.1.2 Nature and Extent of Contamination

3.1.2.1 Roosevelt Road Transmitter Site Leachfield

In 1990, a limited characterization of the septic system was performed. A cesspool sample was obtained from a layer of sludge and detritus on the bottom of the concrete-lined cesspool, while soil samples were obtained from sloughed material in the cesspool. Analytical results indicated the presence of VOCs, base/neutral and acid extractable organic compounds (BNAs), PCBs (up to 5,600 micrograms per kilogram [μg/kg]), and heavy metals including copper (up to 1,100 mg/kg) and lead (up to 1,200 mg/kg). During the 1990 investigation, analysis for fuel was not performed.

The OU-A RI was conducted in 1995. The principal objectives of the RI were to conduct a geophysical survey and to investigate the cesspool, subsurface soil, and groundwater. The results of the RI indicated that soils in isolated locations within the leachfield have been impacted by petroleum contamination. Table 3-1 provides the locations and concentrations of site-related contaminants in subsurface soils. Low levels of heavy metals and PCBs were encountered. The presence of diesel-range organics (DRO) in subsurface soils indicates that these contaminants have dispersed from the leachfield and associated plumbing and have migrated to 15 feet BGS. The lateral extent of DRO contamination appears to be limited to an area extending northwest from the buried sewer line, which connects the transmitter building and the cesspool, to a portion of the leachfield. The presence of PCBs near the bunker at 5 feet BGS suggests that either contaminated soil was reworked during remedial activities or that limited migration through subsurface soils has occurred. These concentrations probably represent residual contamination remaining from remedial activities conducted between 1988 and 1992 at the transmitter annex foundation. Therefore, it is unlikely that this contamination is related to discharges from the leachfield or its associated plumbing.

Sloughed soils within the cesspool contained petroleum hydrocarbons; PCB Aroclor 1260; cyanide; and heavy metals including barium, cadmium, lead, and mercury (see Table 3-2). Petroleum hydrocarbons were detected up to a maximum concentration of 23,000 mg/kg. Cyanide was detected at a concentration of 1.2 mg/kg.

No site-related contaminants were detected at concentrations exceeding state and federal maximum contaminant levels (MCLs) in the Transmitter Site groundwater samples.

3.1.2.2 Ruff Road Fire Training Area

Previous investigations were conducted at the Fire Training Area in 1986, in 1989, and from 1991 to 1992.

In 1986, the Army drilled three soil borings and collected 20 subsurface soil samples at the site. Eight samples were analyzed for VOCs, but VOCs were not detected at concentrations exceeding detection limits.

In 1989, as part of the Installation Restoration Program, 15 soil-gas probes were installed in the area to a depth of 9 feet. Benzene, toluene, and xylene were identified in the soil-gas samples with maximum concentrations of 250 parts per million (ppm), 2,500 ppm, and 1,200 ppm, respectively.

In 1991, the Army collected surface and subsurface soil samples at the site. A composite surface soil sample was collected in triplicate from stained soil near the center of the Fire Training Area. The sample contained lead (80.8 ppm to 543 ppm), diesel and other fuels (10,000 ppm to 20,000 ppm), pyrene (750 μg/kg), PCE (48 μg/kg to 485 μg/kg), toluene (732 μg/kg), xylene (1,116 μg/kg), bis(2-ethylhexyl)phthalate (4,100 μg/kg), and dioxins (0.0022 μg/kg toxicity equivalency factor). Subsurface soil samples also were collected during the 1991 effort. The highest VOC concentrations detected in these samples were acetone (283 μg/kg), TCE (46 μg/kg), toluene (56 μg/kg), and xylene (42 μg/kg). The investigation was continued in 1992. Analytical results obtained in 1992 confirmed the presence of petroleum contamination in surface and subsurface soils. Dioxins also were detected in the surface soils; one sample contained a maximum concentration of 45.4 μg/kg dioxin toxicity equivalency factor.

The RI field investigation was conducted in 1995 to further investigate surface and subsurface soils, groundwater, and surface water/sediment. As mentioned in Section 2.1.1.2 (page 12), the site was covered with approximately 18 inches of soil and regraded in 1994. Accordingly, the RI samples were collected from the current soil surface (fill) and the former soil surface that was characterized in the 1991 to 1992 investigation. The results confirmed the presence of petroleum hydrocarbons and dioxins in the surface and subsurface soil. Maximum contaminant concentrations detected in the RI soil samples include 3,400 mg/kg DRO, 1,300 mg/kg gasoline-range organics, 5,400 mg/kg total recoverable petroleum hydrocarbons, and 0.0239 μg/kg dioxin toxicity equivalency factor (see Figure 3-4). VOCs, semivolatile organic compounds (SVOCs), and lead concentrations detected during the RI were significantly lower than the 1991 to 1992 results. None of the RI soil samples contained dioxin concentrations within three orders of magnitude of the 1992 soil results, which indicates that the maximum 1992 result was associated with a very localized "hot spot" or was related to an analytical error.

The lateral extent of surface soil contamination was estimated based on the findings of the RI and previous site investigations, and by applying ADEC's *Interim Guidance for Non-UST Contaminated Soil Cleanup Levels* for petroleum hydrocarbons. Contamination above the acceptable cleanup level is estimated conservatively to be confined to an area 175 feet by 190 feet. Figure 3-5 depicts the approximate boundaries of lateral contamination. No contamination was detected in any of the subsurface soil samples collected from depths greater than 5 feet BGS. Using these boundaries, the estimated volume of contaminated soil is 6,200 cubic yards. Tables 3-3 and 3-4 summarize the frequency of detection, range, and locations of maximum concentrations of analytes detected in surface and subsurface soil.

No site-related contaminants were detected in groundwater and surface water/sediment samples. Inorganic elements were detected in these samples, but the concentration levels were consistent with naturally occurring background levels.

3.1.2.3 Petroleum, Oil, and Lubricant Laboratory Dry Well

The Army conducted an investigation at the Dry Well in November 1992 to determine the presence and extent of contaminants in the well. During the investigation, approximately 18 inches of water and 6 inches to 8 inches of sludge were observed in the well at approximately 15 feet BGS. The sludge contained VOCs; BNAs; petroleum hydrocarbons; and heavy metals including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Table 3-5 summarizes the analytes detected during the 1992 investigation.

Sludge samples collected from the bottom of the Dry Well during the RI field investigation showed concentrations of petroleum hydrocarbons as kerosene (67,000 mg/kg); cyanide (6.8 mg/kg); and heavy metals including barium, chromium, lead, silver, and mercury (see Table 3-6). The results of the RI indicated that this sludge is contaminated with petroleum products and that approximately 230 cubic yards of petroleum-contaminated subsurface soil is near the bottom of the Dry Well. The heavy metals chromium and mercury also were detected in subsurface soil at the site (see Table 3-7). VOCs were not encountered in soil at levels expected to pose a risk to human health or the environment. The petroleum constituents detected in subsurface soils exceed Alaska cleanup levels for petroleum-contaminated soils; however, the other contaminants of concern (COCs) detected in soil do not exceed EPA's Region 3 risk-based concentrations (RBCs).

Groundwater has not been impacted by petroleum-contaminated sludge and subsurface soil at the site. However, high levels of chloroform, methylene chloride, and manganese were detected. Chloroform and methylene chloride are laboratory contaminants associated with the sample analysis performed for this site; moreover, neither chloroform nor methylene chloride was detected in sludge or subsurface soil samples collected at the Dry Well, which makes it unlikely that chloroform and methylene chloride are contaminating groundwater. Based on results of previous investigations, the presence of manganese in the groundwater samples is likely attributable to naturally occurring minerals in groundwater at the site.

3.2 OPERABLE UNIT B

3.2.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

Poleline Road is a low-lying, relatively flat area bordered by wooded hills to the northwest and southeast. Wetlands are located directly south and southwest of disposal Areas A-1 and A-4 (see Figure 1-6). The remaining area bordering Poleline Road is relatively flat and wooded.

The surficial deposits of the region are fluvially reworked glacial sediments and glacial tills. These deposits appear to be up to 30 feet thick at the site and consist of unstratified to poorly stratified clays, silts, sands, gravels, and boulders. A basal till lies below the surficial deposits and overlies an advance moraine/till complex. Underlying the glacial sediments is bedrock composed of a hard black fissile claystone.

The subsurface soils collected during the 1995 field investigation were glacial tills, generally described as silty sands with some gravel. The soils at Poleline Road were difficult to drill through and sample because of the high density.

The hydrogeologic conditions are discussed in Section 1.2.2. 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

In 1993 and 1994, contaminated debris and soil were removed from two of four burial locations. Soils were excavated to a maximum depth of 14 feet, where groundwater was encountered. During the removals, sampling indicated the presence of chlorinated solvents. Solvents found in soil during this removal included TCE at a maximum concentration of 360 mg/kg; PCE at a maximum concentration of 25 mg/kg; and 1,1,2,2-tetrachloroethane at a maximum concentration of 2,920 mg/kg. During the 1993 removal action, the site was divided into four areas corresponding to the four disposal areas identified previously: Areas A-1, A-2, A-3, and A-4 (see Figure 1-6). Another geophysical survey was performed in 1995 and indicated that the buried material had been removed.

Areas A-1 and A-2 have not been excavated or sampled because of the potential presence of unexploded ordnance. Additionally, there are no breakdown products from the unexploded ordnance, which suggests that Areas A-1 and A-2 do not appear to be an ongoing source of groundwater contamination. Lesser contaminant concentrations were detected in the soils and groundwater surrounding Areas A-1 and A-2. The groundwater flow pattern suggests that the contaminants detected near groundwater zones in Areas A-1 and A-2 migrated there from Areas A-3 and A-4. Contaminants detected during surface sampling near Area A-2 were due to migration from Areas A-3 and A-4.

During the RI, the highest concentrations of contaminants detected in soil and groundwater samples were found in Areas A-3 and A-4 (see Tables 3-8, 3-9, and 3-10). This area of greatest contamination at the site is referred to as the *"hot spot"* and encompasses an area approximately 150 feet by 300 feet that is bounded by a 1 milligram per liter (mg/L; 1,000 micrograms per liter [μg/L]) or greater concentration of 1,1,2,2-tetrachloroethane in groundwater (see Figure 3-6). The highest soil concentrations of these contaminants were encountered more than 15 feet BGS at the "hot spot." The results of the RI indicated the presence of chlorinated solvents in soil up to a maximum concentration of 2,030 mg/kg for 1,1,2,2-tetrachloroethene. PCE; TCE; and 1,1,2,2-tetrachloroethane in contaminated soils are a continuing source of groundwater contamination.

The RI results also indicated the presence of four main water-bearing zones underneath the site (see Table 3-10). Chlorinated solvent contamination, including TCE and 1,1,2,2-tetrachloroethene, was detected in all four groundwater zones. TCE concentrations exceeded the state and federal MCL of 5 μg/L in the perched, shallow, and deep aquifers. 1,1,2,2-Tetrachloroethane was detected up to a maximum concentration of 1,900 mg/L in the perched groundwater zone. While 1,1,2,2-tetrachloroethane does not have a state or federal MCL, its RBC (tap water), based on an excess cancer risk of 1×10^{-4}, is 0.052 mg/L. This concentration was exceeded in the perched, shallow, and deep water-bearing zones. Studies performed at the site indicated that the contaminated groundwater in the deep aquifer is flowing regionally northwest toward the Eagle River, but in the immediate vicinity of Poleline Road it is flowing to the northeast (see Figure 3-6); groundwater flow modeling results suggested that this contaminated groundwater could migrate to the Eagle River within 120 years.

During fall 1996, a Treatability Study was conducted at the site to evaluate the effectiveness of potential remedial technologies addressed in the FS. The Treatability Study involved field tests to evaluate the potential performance of soil vapor extraction (SVE) and air sparging (AS) of groundwater. The studies also involved characterization of hydraulic conductivity of water-bearing zones underlying the site and collection of groundwater samples to assess which types of natural attenuation processes may be degrading contaminants in groundwater. The study concluded that SVE may reduce contamination at the site but AS would not be an effective technology to remediate contaminants in groundwater. The study also concluded that biological components of natural attenuation would not be an important degradation mechanism. However, other attenuation processes, such as adsorption and dispersion, are expected to decrease contaminant concentrations over time.

Groundwater sampling to determine dissolved oxygen levels during the study revealed a two-phase sample of groundwater in the sampling bailer. This was the first time that such a sample was observed at the site, and it was not observed during a single follow-up sampling event to characterize the separate phases at the same location. The two-phase sample was drawn from a newly installed 2-inch-diameter polyvinyl chloride well, screened between 28 feet and 33 feet BGS in the shallow groundwater interval. This well is located several feet from MW-14, which was the location of the highest groundwater contaminant concentrations at OU-B during the RI. MW-14 is screened at approximately 15 feet BGS in the perched groundwater interval.

Table 3-1

SUMMARY OF RI SUBSURFACE SOIL SAMPLES EXCEEDING SCREENING CRITERIA
ROOSEVELT ROAD TRANSMITTER SITE LEACHFIELD
OPERABLE UNIT A
FORT RICHARDSON, ALASKA
(mg/kg, except as noted)

Analyte	Frequency of Detection	Range of Detected Concentrations	Location and Depth (ft. BGS) of Maximum Concentration	Screening Concentration	Number of Samples Exceeding Screening Concentration
DRO	47/89	3 - 470	AP-3598 (15 ft.)	100[a]	4
PCBs					
Aroclor 1260	2/87	0.04 - 0.2	AP-3617	0.083[b]	1
Inorganics					
Aluminum	89/89	9,250 - 24,100	AP-3599 (15 ft.)	22,400[c]	3
Barium	89/89	30 - 211	AP-3602 (40 ft.)	154[c]	1
Calcium	89/89	1,810 - 20,900	AP-3604 (40 ft.)	19,400[c]	1
Chromium	89/89	20 - 76	AP-3604 (20 ft.)	61.9[c]	1
Copper	89/89	18 - 81	AP-3604 (20 ft.)	54[c]	1
Iron	89/89	20,300 - 44,600	AP-3610 (5 ft.)	41,300[c]	1
Lead	89/89	3 - 48	AP-3617 (5 ft.)	29[c]	2
Manganese	89/89	272 - 1,070	AP-3610 (5 ft.)	817[c]	5
Sodium	89/89	72 - 450	AP-3604 (15 ft.)	299[c]	1
Vanadium	89/89	30 - 86	AP-3610 (5 ft.)	77[c]	2
Zinc	89/89	41 - 203	AP-3604 (10 ft.)	108[c]	1

Key at end of table.

Table 3-1 (Cont.)

a Matrix A cleanup levels (ADEC 1991).
b Risk-based concentration equivalent to a cancer risk of 1×10^{-6} or a hazard quotient of 1 for soil ingestion and residential land use (EPA 1995).
c Maximum background concentration detected in RI background samples or as listed in the Fort Richardson Background Study (E & E 1996).

Key:

ADEC = Alaska Department of Environmental Conservation.
DRO = Diesel-range organics.
E & E = Ecology and Environment, Inc.
EPA = United States Environmental Protection Agency.
ft. BGS = Feet below ground surface.
mg/kg = Milligrams per kilogram.
PCBs = Polychlorinated biphenyls.
RI = Remedial Investigation.

Table 3-2

SUMMARY OF RI CESSPOOL SAMPLE RESULTS
ROOSEVELT ROAD TRANSMITTER SITE LEACHFIELD
OPERABLE UNIT A
FORT RICHARDSON, ALASKA

Analyte	Frequency of Detection	Range of Detected Concentrations	Location and Depth (ft. BGS) of Maximum Concentration	Screening Concentration	Number of Samples Exceeding Screening Concentration
Unknown Fuel (mg/kg)	2/2	12,000 - 23,000	23,000	--	NA
PCBs (mg/kg)					
Aroclor 1260	2/2	1.8 - 2.3	CESS	0.0083[a]	2
Inorganics (mg/kg)					
Cyanide	1/2	1.2	CESS	--	NA
TCLP Inorganics (mg/L)					
TCLP Barium	2/2	0.7	CESS	100[b]	NA
TCLP Cadmium	2/2	0.06 - 0.11	CESS	1.0[b]	NA
TCLP Lead	2/2	0.24 - 0.27	CESS	5.0[b]	NA
TCLP Mercury	1/2	0.001	CESS	2.0[b]	NA
Flashpoint (°F)	1/1	200	CESS	< 140[c]	NA

a Risk-based concentration equivalent to a cancer risk of 1×10^{-6} or a hazard quotient of 1 for soil ingestion and residential land use (EPA 1995).
b Toxicity characteristic concentration, Resource Conservation and Recovery Act (40 CFR 261.24).
c Ignitability characteristic threshold, Resource Conservation and Recovery Act (40 CFR 261.21).

Key at end of table.

Table 3-2 (Cont.)

Key:

-- = No screening concentration exists for analyte.
CFR = Code of Federal Regulations.
EPA = United States Environmental Protection Agency.
°F = Degrees Fahrenheit.
ft. BGS = Feet below ground surface.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable.
PCBs = Polychlorinated biphenyls.
RI = Remedial Investigation.
TCLP = Toxicity characteristic leaching procedure.

Table 3-3

SUMMARY OF RI SURFACE SOIL SAMPLES EXCEEDING SCREENING CRITERIA
RUFF ROAD FIRE TRAINING AREA
OPERABLE UNIT A
FORT RICHARDSON, ALASKA
(mg/kg)

Analyte	Frequency of Detection	Range of Concentrations	Location and Depth of Maximum Concentration (ft. BGS)	Screening Concentration	Number of Samples Exceeding Screening Concentration
DRO	11/11	10 - 3,400	N9 (1 ft.)	100[a]	2
GRO	3/5	2.1 - 1,300	N9 (1 ft.)	50[a]	2
TRPH	11/11	20 - 5,400	M11 (1.5 ft.)	2,000[a]	2
BNAs					
Benzo(a)pyrene	3/11	0.21 - 0.94	O9 (1.5 ft.)	0.088[b]	3
Benzo(b)fluoranthene	4/11	0.19 - 1.4	O9 (1.5 ft.)	0.87[b]	2
Dioxins, TEF	11/11	7.25×10^{-9} - 2.39×10^{-5}	M11 (1.5 ft.)	4.3×10^{-6}[b]	1
Inorganics					
Aluminum	11/11	11,000 - 20,000	O9 (1.5 ft.)	19,000[c]	1
Barium	11/11	64 - 360	L10 (0 ft.)	130[c]	1
Calcium	11/11	2,100 - 4,500	O9 (1.5 ft.)	3,600[c]	1
Copper	11/11	18 - 100	L10 (0 ft.)	54[c]	2
Lead	11/11	6.6 - 94	L10 (0 ft.)	27[c]	2
Potassium	11/11	230 - 780	L10 (0 ft.)	420[c]	4

Key at end of table.

Table 3-3

**SUMMARY OF RI SURFACE SOIL SAMPLES EXCEEDING SCREENING CRITERIA
RUFF ROAD FIRE TRAINING AREA
OPERABLE UNIT A
FORT RICHARDSON, ALASKA
(mg/kg)**

Analyte	Frequency of Detection	Range of Concentrations	Location and Depth of Maximum Concentration (ft. BGS)	Screening Concentration	Number of Samples Exceeding Screening Concentration
Sodium	11/11	91 - 450	K9 (0 ft.)	420[c]	3
Zinc	11/11	47 - 210	L10 (0 ft.)	108[c]	2

a Screening criteria based on Alaska non-UST matrix level A concentrations for petroleum-contaminated soil (ADEC 1991).

b Screening criteria based on EPA, Region 3, risk-based concentration corresponding to excess lifetime cancer risk of 1×10^{-6} or a hazard index of 1 for soil ingestion and residential land use (EPA 1995).

c Screening criteria based on the maximum concentrations detected in site-specific background samples or background levels listed in the Background Data Analysis Report, Fort Richardson (E & E 1996).

Key:

- ADEC = Alaska Department of Environmental Conservation.
- BNAs = Base/neutral and acid extractable organic compounds.
- DRO = Diesel-range organics.
- E & E = Ecology and Environment, Inc.
- EPA = United States Environmental Protection Agency.
- ft. BGS = Feet below ground surface.
- GRO = Gasoline-range organics.
- mg/kg = Milligrams per kilogram.
- RI = Remedial Investigation.
- TEF = Toxicity equivalency factor.
- TRPH = Total recoverable petroleum hydrocarbons.
- UST = Underground storage tank.

Table 3-4

SUMMARY OF RI SUBSURFACE SOIL SAMPLES EXCEEDING SCREENING CRITERIA
RUFF ROAD FIRE TRAINING AREA
OPERABLE UNIT A
FORT RICHARDSON, ALASKA
(mg/kg)

Analyte	Frequency of Detection	Range of Concentrations	Location and Depth of Maximum Concentration (ft. BGS)	Screening Concentration	Number of Samples Exceeding Screening Concentration
DRO	73/113	1 - 610	AP-3635 (20 ft.)	100[a]	5
GRO	28/82	0.28 - 420	AP-3635 (20 ft.)	50[a]	4
TRPH	83/111	9.3 - 3,000	AP-3635 (30 ft.)	2,000[a]	1
Dioxins, TEF	58/100	1.54×10^{-9} - 1.91×10^{-5}	AP-3637 (10 ft.)	4.3×10^{-6}[b]	2
Inorganics					
Arsenic	110/110	2.1 - 17	AP-3645 (20 ft.)	14[c]	1
Calcium	111/111	2,700 - 14,100	AP-3657 (110 ft.)	12,000[c]	3
Chromium	111/111	15 - 69	AP-3637 (5 ft.)	58[c]	1
Cobalt	111/111	7.7 - 18	AP-3637 (40 ft.)	16[c]	2
Copper	111/111	17 - 230	N11 (2.5 ft.)	54[c]	4
Iron	111/111	16,000 - 40,000	AP-3637 (40 ft.)	38,000[c]	1
Lead	110/110	4.2 - 59	N11 (2.5 ft.)	29[c]	1
Magnesium	111/111	5,400 - 15,000	AP-3640 (40 ft.)	11,200[c]	5
Nickel	111/111	18 - 79	AP-3640 (40 ft.)	63[c]	2

Key at end of table.

Table 3-4

**SUMMARY OF RI SUBSURFACE SOIL SAMPLES EXCEEDING SCREENING CRITERIA
RUFF ROAD FIRE TRAINING AREA
OPERABLE UNIT A
FORT RICHARDSON, ALASKA
(mg/kg)**

Analyte	Frequency of Detection	Range of Concentrations	Location and Depth of Maximum Concentration (ft. BGS)	Screening Concentration	Number of Samples Exceeding Screening Concentration
Potassium	111/111	340 - 1,700	AP-3643 (20 ft.)	930[c]	5
Vanadium	111/111	25 - 71	AP-3637 (40 ft.)	67[c]	1
Zinc	111/111	41 - 240	N11 (2.5 ft.)	110[c]	2

[a] Screening criteria based on Alaska non-UST matrix level A concentrations for petroleum-contaminated soil (ADEC 1991).
[b] Screening criteria based on EPA, Region 3, risk-based concentration corresponding to excess lifetime cancer risk of 1×10^{-6} or a hazard index of 1 for soil ingestion and residential land use (EPA 1995).
[c] Screening criteria based on the maximum concentrations detected in site-specific background samples or background levels listed in the Background Data Analysis Report, Fort Richardson (E & E 1996).

Key:

ADEC = Alaska Department of Environmental Conservation.
DRO = Diesel-range organics.
E & E = Ecology and Environment, Inc.
EPA = United States Environmental Protection Agency.
ft. BGS = Feet below ground surface.
GRO = Gasoline-range organics.
mg/kg = Milligrams per kilogram.
RI = Remedial Investigation.
TEF = Toxicity equivalency factor.
TRPH = Total recoverable petroleum hydrocarbons.
UST = Underground storage tank.

Table 3-5

BUILDING 986 POL LABORATORY DRY WELL 1992 INVESTIGATION RESULTS OPERABLE UNIT A FORT RICHARDSON, ALASKA

Analyte	Maximum Concentration in Water (μg/L)	Maximum Concentration in Sludge (μg/kg)
VOCs		
1,4-Dichlorobenzene	0.44	ND
1,3,5-Trimethylbenzene	1.8N	42,000
BNAs		
1,2-Dichlorobenzene	270	34,100

Key:

BNAs = Base/neutral and acid extractable organic compounds.
μg/kg = Micrograms per kilogram.
μg/L = Micrograms per liter.
ND = Not detected.
POL = Petroleum, oil, and lubricant.
VOCs = Volatile organic compounds.

Source: United States Army Engineer District, Alaska, 1993.

Table 3-6

SUMMARY OF RI SLUDGE SAMPLE RESULTS
POL LABORATORY DRY WELL
OPERABLE UNIT A
FORT RICHARDSON, ALASKA

Analyte	Frequency of Detection	Concentration	RCRA Hazardous Waste Criteria	Number of Samples Exceeding RCRA Criteria
Inorganics (µg/L)				
TCLP Lead	1/1	4,600	5,000	0
TCLP Mercury	1/1	87 J	200	0
TCLP Silver	1/1	240	5,000	0
Fuel ID (mg/kg)				
Kerosene	1/1	67,000	--	NA

Key:

-- = No screening criterion exists for analyte.
ID = Identification.
J = Estimated.
µg/L = Micrograms per liter.
mg/kg = Milligrams per kilogram.
NA = Not applicable.
POL = Petroleum, oil, and lubricant.
RCRA = Resource Conservation and Recovery Act.
RI = Remedial Investigation.
TCLP = Toxicity characteristic leaching procedure.

Table 3-7

**SUMMARY OF RI SUBSURFACE SOIL SAMPLES EXCEEDING SCREENING CRITERIA
POL LABORATORY DRY WELL
OPERABLE UNIT A
FORT RICHARDSON, ALASKA
(mg/kg)**

Analyte	Frequency of Detection	Range of Concentrations	Location and Depth of Maximum Concentration (ft. BGS)	Screening Concentration	Number of Samples Exceeding Screening Concentration
DRO	55/66	2 - 1,800	AP-3619 (15 ft.)	100[a]	6
GRO	8/56	0.34 - 650	AP-3619 (15 ft.)	50[a]	3
Inorganics					
Antimony	25/66	0.46 - 5.4	AP-3648 (80 ft.)	0.5[b]	22
Calcium	66/66	2,500 - 13,600	AP-3648 (80 ft.)	13,000[b]	2
Chromium	66/66	12 - 120	AP-3619 (15 ft.)	69[b]	1
Cobalt	66/66	6.2 - 36	AP-3620 (50 ft.)	21[b]	1
Lead	66/66	2.7 - 64	AP-3621 (5 ft.)	52[b]	1
Magnesium	66/66	4,400 - 55,000	AP-3620 (50 ft.)	24,000[b]	1
Mercury	37/66	0.066 - 2.2	AP-3618 (5 ft.)	0.6[b]	3
Nickel	66/66	18 - 280	AP-3620 (50 ft.)	170[b]	1
Potassium	66/66	280 - 962	AP-3648 (80 ft.)	950[b]	1
Silver	3/66	2.4 - 12	AP-3620 (50 ft.)	4.2[b]	2
Vanadium	66/66	22 - 78.8	AP-3648 (80 ft.)	77[b]	1

Key at end of table.

Table 3-7 (Cont.)

a Screening criteria based on Alaska non-UST matrix level A concentrations for petroleum-contaminated soil (ADEC 1991).

b Screening criteria based on the maximum concentrations detected in site-specific background samples or background levels listed in the Background Data Analysis Report, Fort Richardson (E & E 1996).

Key:

ADEC = Alaska Department of Environmental Conservation.
DRO = Diesel-range organics.
E & E = Ecology and Environment, Inc.
ft. BGS = Feet below ground surface.
GRO = Gasoline-range organics.
mg/kg = Milligrams per kilogram.
POL = Petroleum, oil, and lubricant.
RI = Remedial Investigation.
UST = Underground storage tank.

Table 3-8

SUMMARY OF SOIL SAMPLE RESULTS
AREAS A-1 AND A-2, AND OTHER AREAS
POLELINE ROAD DISPOSAL AREA
OPERABLE UNIT B
FORT RICHARDSON, ALASKA
(mg/kg)

Analyte	Frequency of Detection	Range of Detected Concentrations	Location of Maximum Concentration	Screening Concentration[a]	Number of Samples Exceeding Screening Concentration
Inorganics					
Arsenic	24/24	4.6-15	SB-011 (6'-9') and SB-015 (12'-15')	0.43(C), 23(N)	23
Beryllium	13/24	0.28-0.45	SB-07 (0'-3')	0.15(C)	13

a EPA, Region 3, October 20, 1995, Risk-Based Concentrations, Residential Soil.

Key:

(C) = Carcinogenic risk-based screening concentration.
EPA = United States Environmental Protection Agency.
mg/kg = Milligrams per kilogram.
(N) = Noncarcinogenic risk-based screening concentration.

Table 3-9

**SUMMARY OF SOIL SAMPLE RESULTS
AREAS A-3 AND A-4
POLELINE ROAD DISPOSAL AREA
OPERABLE UNIT B
FORT RICHARDSON, ALASKA
(mg/kg)**

Analyte	Frequency of Detection	Range of Detected Concentrations	Location of Maximum Concentration	Screening Concentration[a]	Number of Samples Exceeding Screening Concentration
VOCs					
1,1,2,2-Tetrachloroethene	14/14	0.0018-79 J	MW-14 (18'-20')	3.2(C)	5
Inorganics					
Arsenic	14/14	4.0-11	SB-D1 (5'-7')	0.43(C), 23(N)	14
Beryllium	6/14	0.30-0.39	SB-D1 (0'-2')	0.15(C)	6

[a] EPA, Region 3, October 20, 1995, Risk-Based Concentrations, Residential Soil.

Key:

(C) = Carcinogenic risk-based screening concentration.
EPA = United States Environmental Protection Agency.
J = Estimated.
mg/kg = Milligrams per kilogram.
(N) = Noncarcinogenic risk-based screening concentration.
VOCs = Volatile organic compounds.

Table 3-10

SUMMARY OF GROUNDWATER SAMPLE RESULTS
POLELINE ROAD DISPOSAL AREA
OPERABLE UNIT B
FORT RICHARDSON, ALASKA
(mg/L)

Analyte	Frequency of Detection	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Number of Samples Exceeding Risk-Based Screening Concentration
VOCs					
Benzene	3/14	0.00034 - 2.9 J	MW-14	0.00036(C)	2
Carbon Tetrachloride	2/14	0.0022 - 2.6 J	MW-14	0.00016(C)	2
Chloroform	4/14	0.00053 - 1.4 J	MW-14	0.00015(C)	4
1,1-Dichloroethene	4/14	0.00014 J - 0.0012	MW-9	0.000044(C)	4
cis-1,2-Dichloroethene	9/14	0.0053 - 1.6	MW-4	0.061(N)	3
trans-1,2-Dichloroethene	6/14	0.0038 - 12 J	MW-14	0.12(N)	2
1,1,2,2-Tetrachloroethane	10/14	0.0063-1,900 J	MW-14	0.000052(C)	10
Tetrachloroethene	5/14	0.00035-11 J	MW-14	0.0011(C)	2
1,1,2-Trichloroethane	4/14	0.00078-0.0023	MW-3	0.00019(C)	4
Trichloroethene	12/14	0.00031-220 J	MW-14	0.0016(C)	9
Inorganics					
Arsenic (unfiltered)	1/15	0.012	MW-7	0.000045(C), 0.011(N)	1

Key at end of table.

Table 3-10

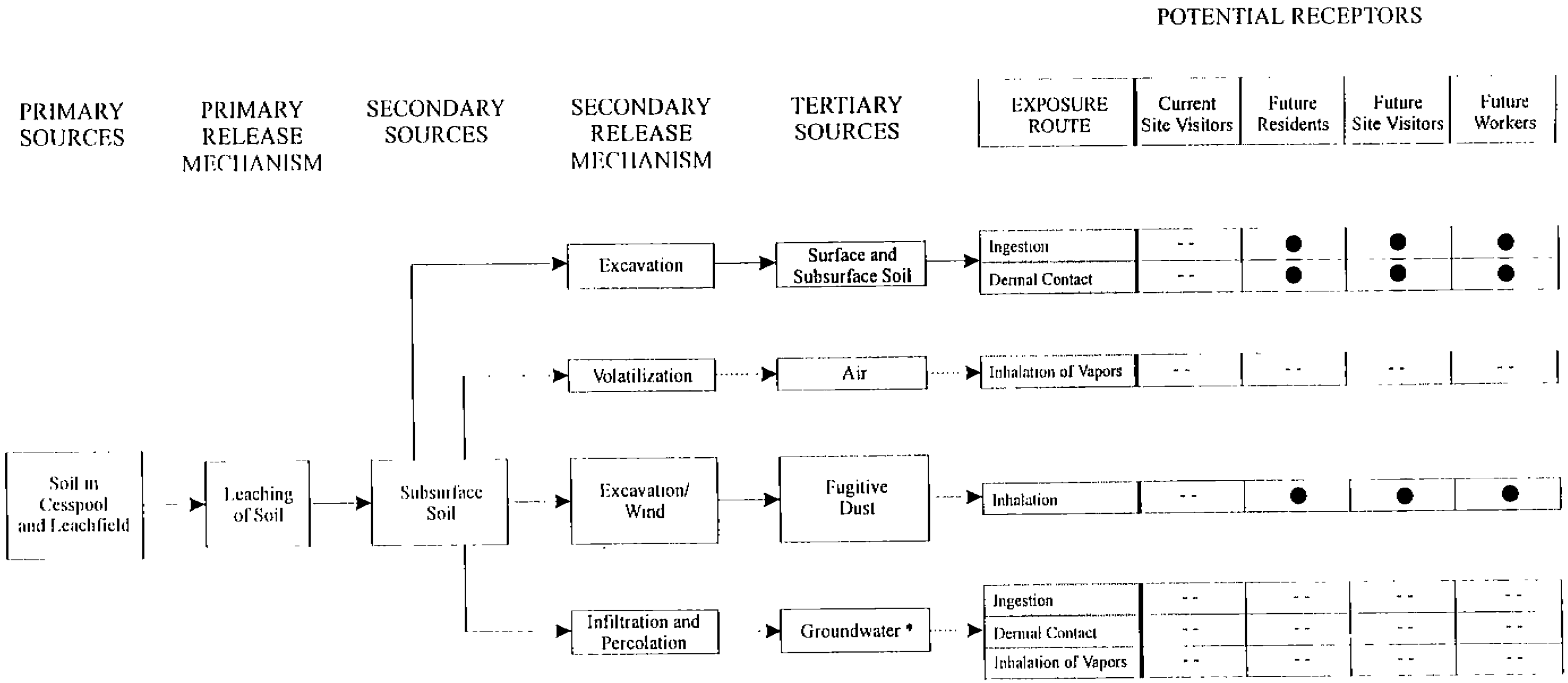
**SUMMARY OF GROUNDWATER SAMPLE RESULTS
POLELINE ROAD DISPOSAL AREA
OPERABLE UNIT B
FORT RICHARDSON, ALASKA
(mg/L)**

Analyte	Frequency of Detection	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration[a]	Number of Samples Exceeding Risk-Based Screening Concentration
Arsenic (filtered)	1/15	0.0071	MW-7	0.00045(C), 0.011(N)	1

a EPA, Region 3, October 20, 1995, Risk-Based Concentrations, Residential Tap Water Ingestion.

Key:

(C) = Carcinogenic risk-based screening concentration.
EPA = United States Environmental Protection Agency.
J = Estimated.
mg/L = Milligrams per liter.
(N) = Noncarcinogenic risk-based screening concentration.
RBC = Risk-based concentration.
VOCs = Volatile organic compounds.



KEY:
● Complete Exposure Pathway
-- Incomplete Exposure Pathway

* No COPCs were identified in groundwater; consequently, this exposure pathway is incomplete

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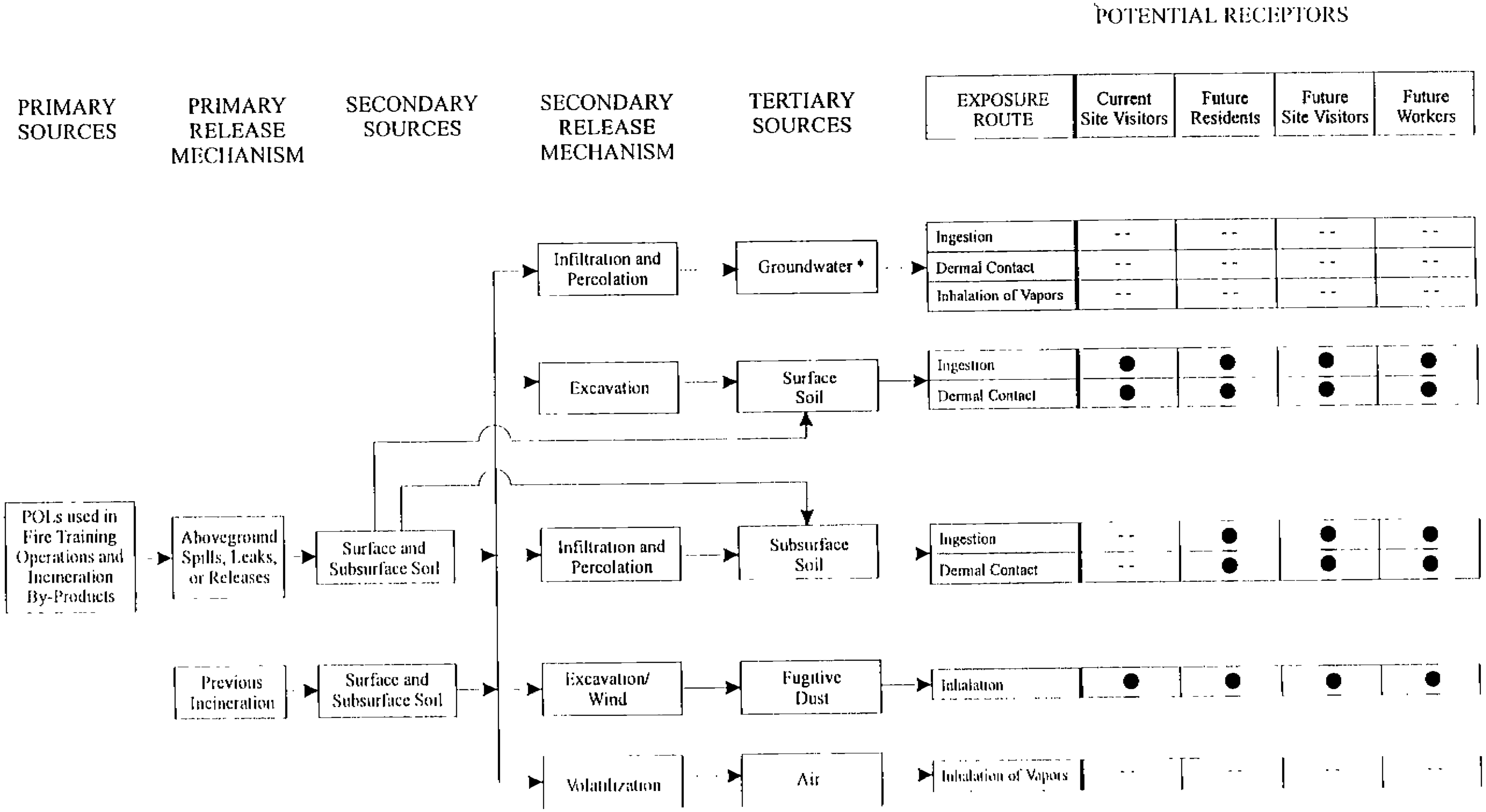
FORT RICHARDSON
Anchorage, Alaska

Figure 3-1
CONCEPTUAL SITE MODEL
ROOSEVELT ROAD
TRANSMITTER SITE LEACHFIELD - OPERABLE UNIT A

Drawn By:	Date	TDD/Job No.	Dwg. No
MRE	4/28/97	JV9905	JV990531



KEY:
● Complete Exposure Pathway
-- Incomplete Exposure Pathway

* No COPCs were identified in groundwater; consequently, this exposure pathway is incomplete.

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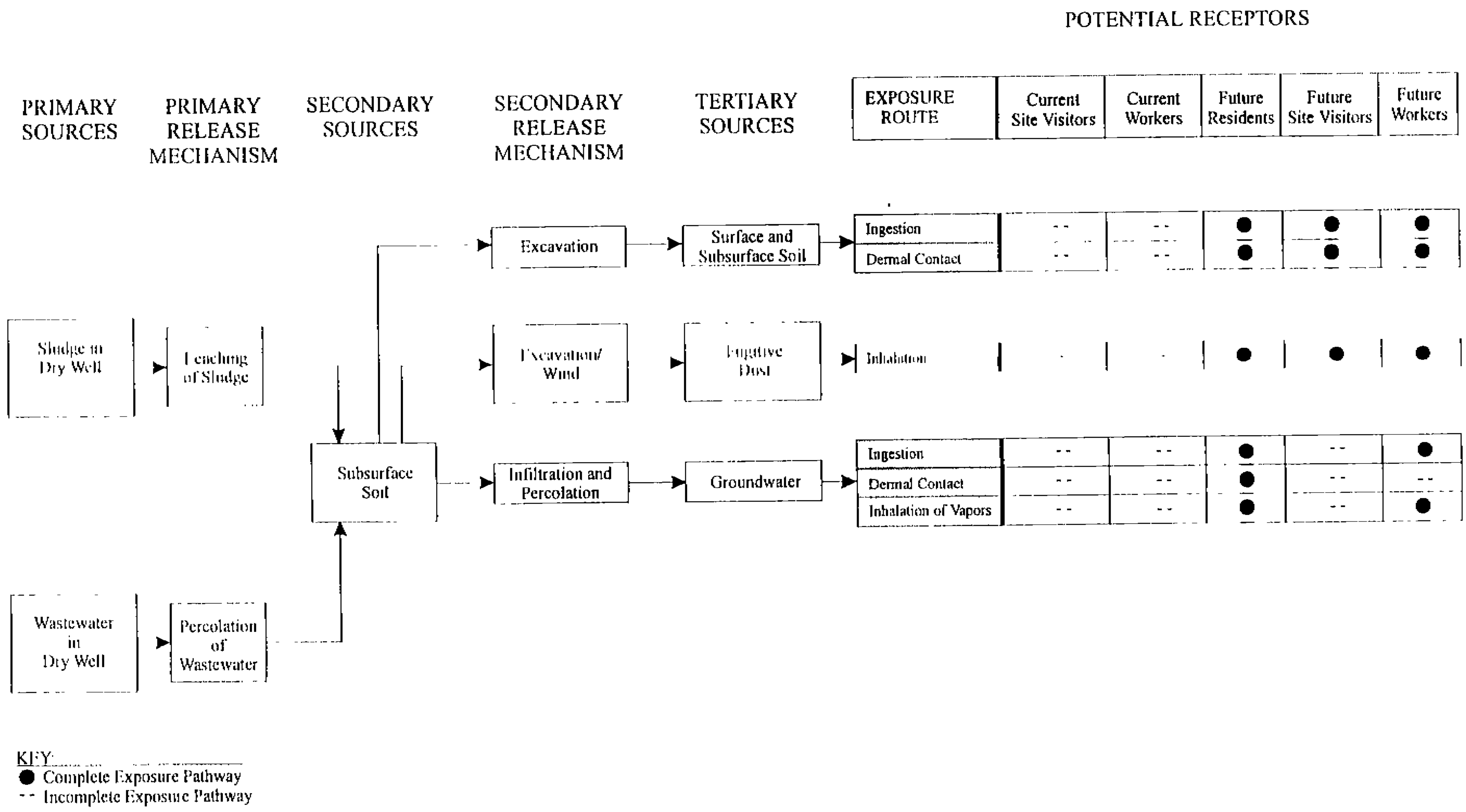
FORT RICHARDSON
Anchorage, Alaska

Figure 3-2

CONCEPTUAL SITE MODEL
RUFF ROAD FIRE TRAINING AREA

Drawn By:	Date	TDD/Job No.	Dwg. No.
MRE	4/29/97	JV9905	JV990532



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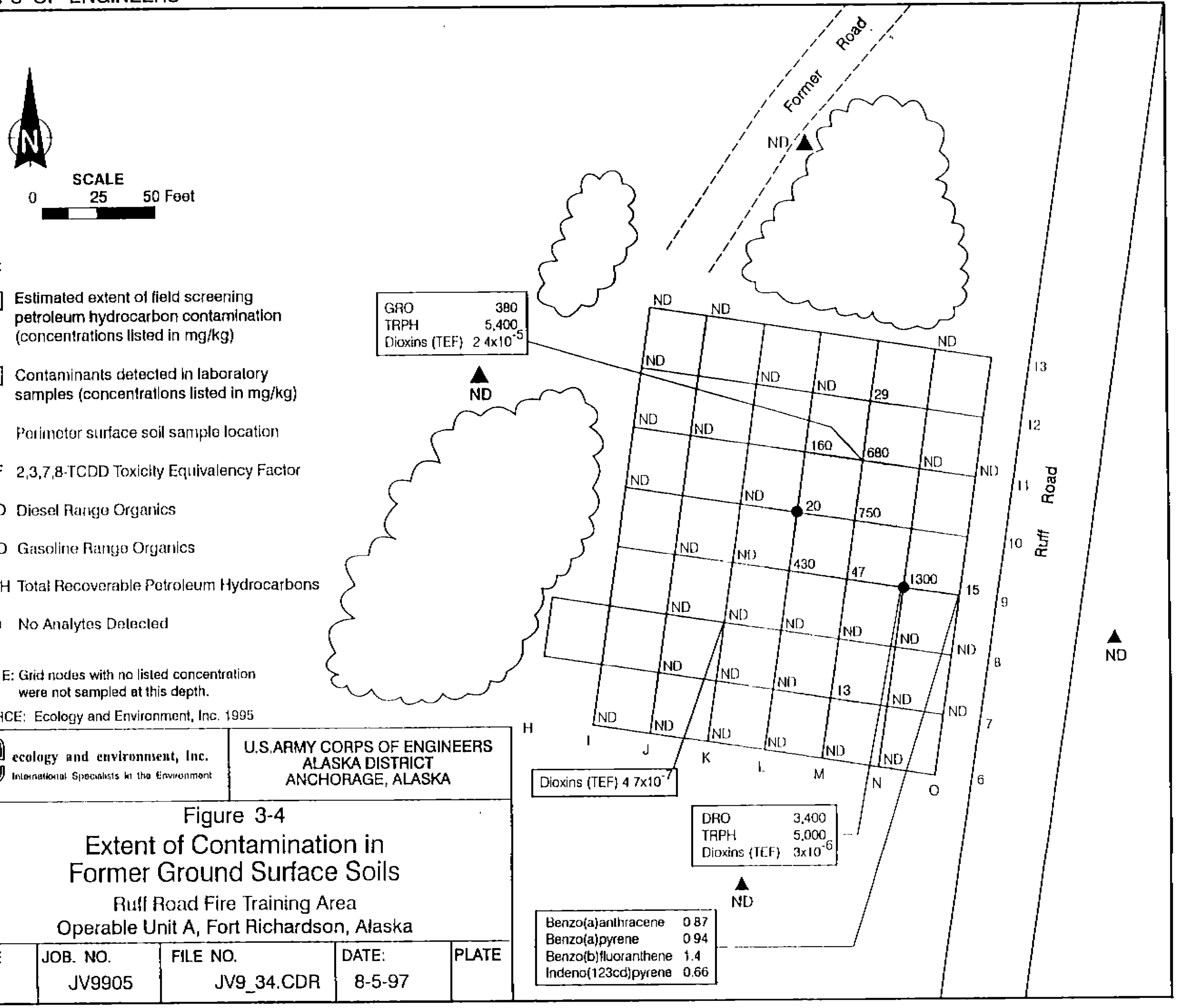
FORT RICHARDSON
Anchorage, Alaska

Figure 3-3

CONCEPTUAL SITE MODEL
POL LABORATORY DRY WELL - OPERABLE UNIT A

Drawn By:	Date	TDD/Job No.	Dwg. No.
MRE	4/28/97	JV9905	JV900533

CORPS OF ENGINEERS U.S. ARMY



KEY:

- Estimated extent of field screening petroleum hydrocarbon contamination (concentrations listed in mg/kg)
- Contaminants detected in laboratory samples (concentrations listed in mg/kg)
- ▲ Perimeter surface soil sample location

TEF 2,3,7,8-TCDD Toxicity Equivalency Factor

DRO Diesel Range Organics

GRO Gasoline Range Organics

TRPH Total Recoverable Petroleum Hydrocarbons

ND No Analytes Detected

NOTE: Grid nodes with no listed concentration were not sampled at this depth.

SOURCE: Ecology and Environment, Inc. 1995

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International Specialists in the Environment

U.S.ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
ANCHORAGE, ALASKA

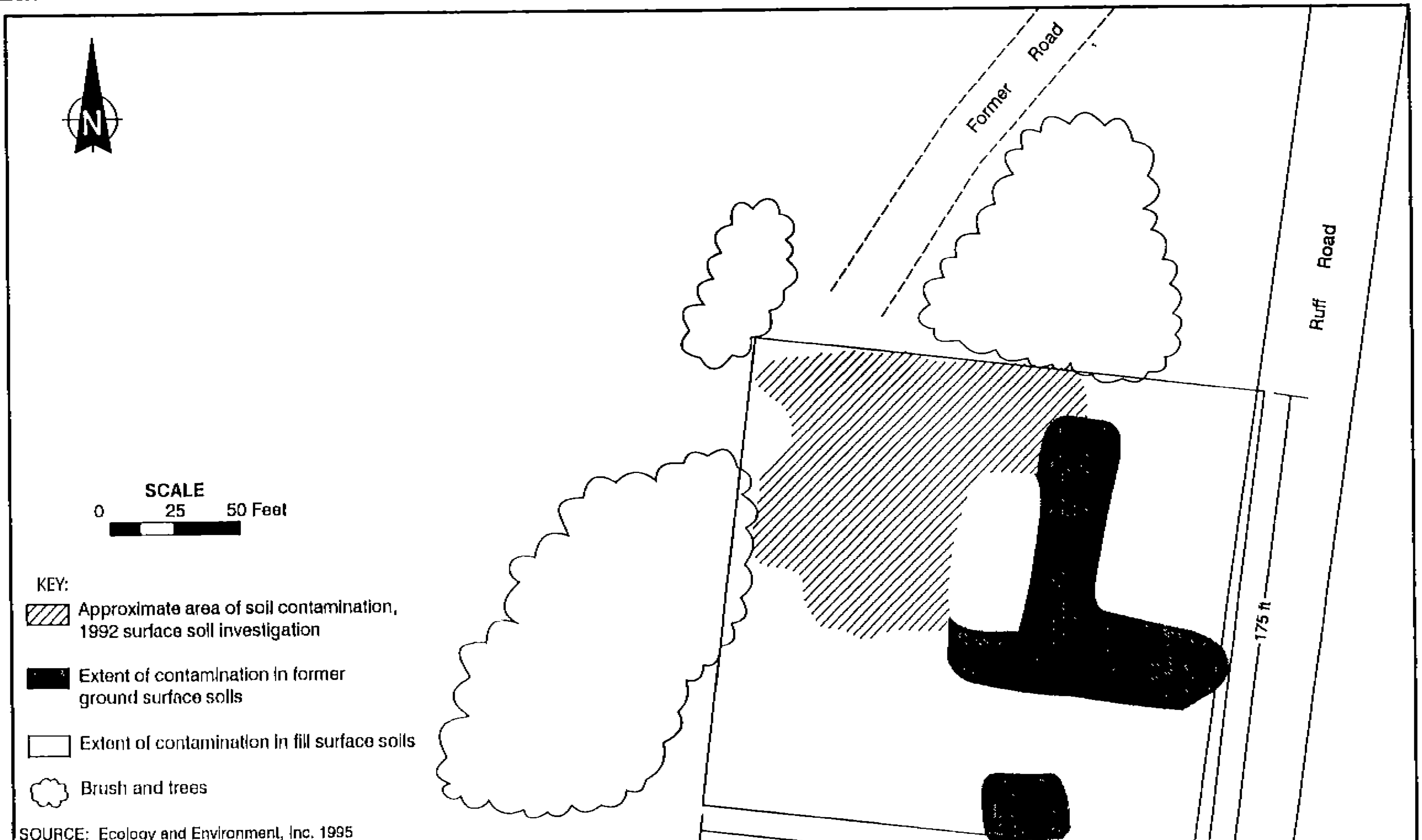
Figure 3-4

Extent of Contamination in Former Ground Surface Soils

Ruff Road Fire Training Area
Operable Unit A, Fort Richardson, Alaska

SIZE	JOB. NO.	FILE NO.	DATE:	PLATE
	JV9905	JV9_34.CDR	8-5-97	

OUA 0028430



ecology and environment, inc.
International Specialists in the Environment

U.S.ARMY
ENGINEER DISTRICT, ALASKA
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

Figure 3-5
Lateral Extent of Area to be Remediated
Ruff Road Fire Training Area
Operable Unit A, Fort Richardson, Alaska

SIZE	JOB. NO.	FILE NO.	DATE:	PLATE
	JV9950	JV9_36.CDR	4-25-97	

02: JV9905\JV9_37.CDR

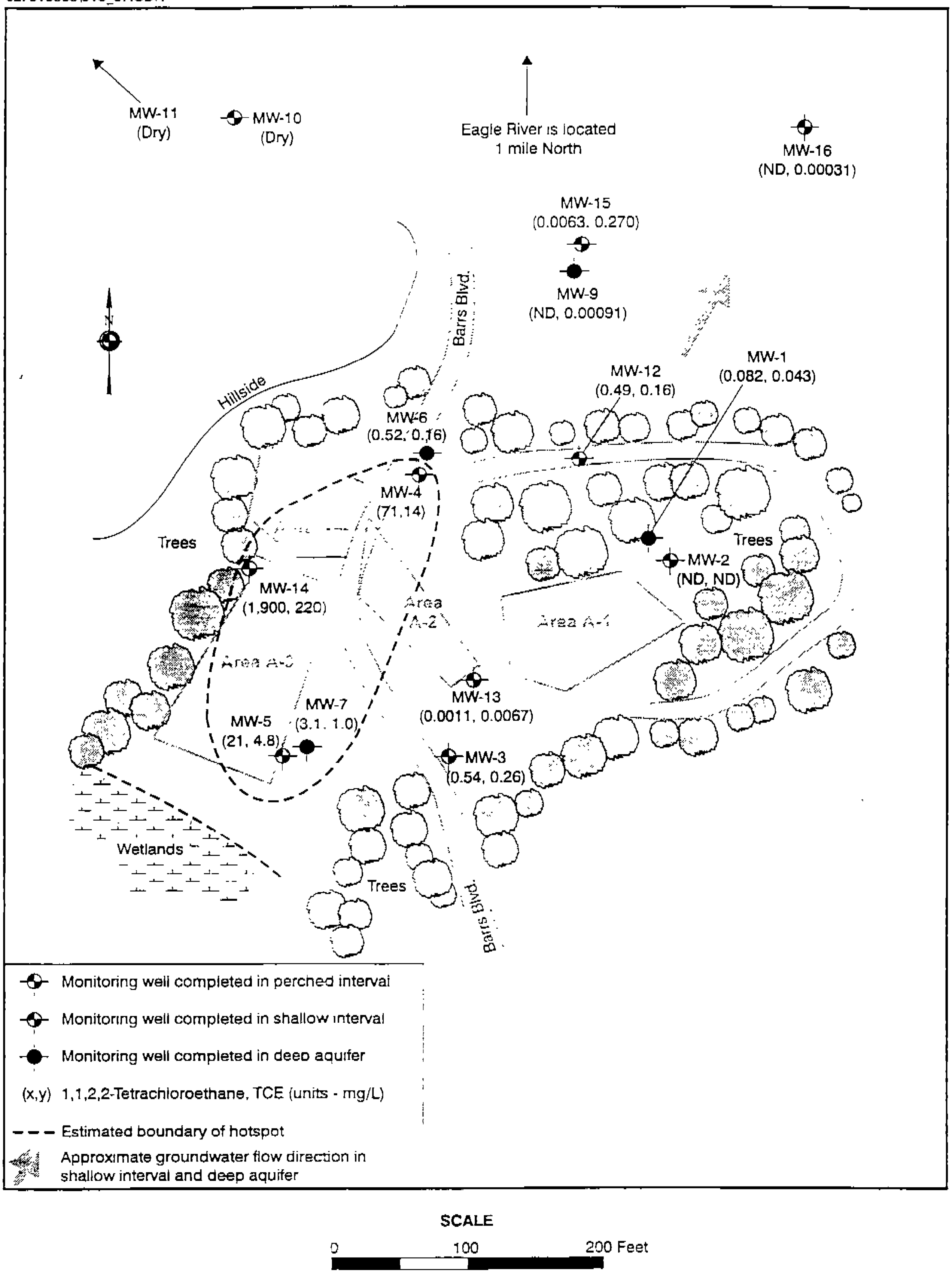


Figure 3-6 VOC RESULTS IN GROUNDWATER FROM MONITORING WELLS POLELINE ROAD DISPOSAL AREA

4.0 SUMMARY OF SITE RISKS

Baseline Risk Assessments were conducted to determine the necessity for and extent of remediation to be protective of human health and the environment. The detailed reports discussing this evaluation are *Risk Assessment Report, Operable Unit A* and *Risk Assessment Report, Operable Unit B* and are available at the information repositories. The risk evaluations were based on the location and amount of contamination, toxicity of each contaminant, current and potential future land use by each site, and pathways by which people could be exposed to contaminants. The Risk Assessment results were used to support decisions concerning the extent of remediation and to aid in the selection of remedial technologies.

The estimated risks from each pathway are added to determine total risk. The potential for adverse effects to human health is evaluated for carcinogens and noncarcinogens. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) defines the acceptable risk range at Superfund sites as excess lifetime cancer risks ranging from 1 in 10,000 (1×10^{-4}) to 1 in 1 million (1×10^{-6}). This means that an individual could face up to a 1 in 10,000 to 1 in 1 million chance of developing cancer because of exposure to chemicals at a site, beyond those cancers expected from other causes. Noncarcinogenic effects are evaluated by calculating the ratio between the estimated intake of a contaminant and its corresponding reference dose (RfD); that is, the intake level at which no adverse health effects are expected to occur. This ratio is a summation of all site contaminants. If this ratio, called a *hazard index (HI)*, is less than 1, then noncarcinogenic health effects are not expected at the site.

4.1 OPERABLE UNIT A

The sites within OU-A are used for industrial or recreational purposes. No residential areas are located within a 1-mile radius of these sites. The Post does not use groundwater as a source for drinking water. All drinking water is supplied by the Ship Creek Dam Reservoir located in the foothills of the Chugach Mountain Range east of the Post.

4.1.1 Human Health Risk Assessment

An assessment of human health involves a four-step process: identification of contaminants of potential concern (COPCs), an exposure assessment for the population at risk, an assessment of contaminant toxicity, and a quantitative characterization of the risk.

4.1.1.1 Contaminants of Potential Concern

A screening analysis was conducted to identify the COPCs. Before screening, detection limits were evaluated. In the first step of the screening, COPCs were selected based on a very conservative estimate of potential health risk. Maximum concentrations of chemicals in media (e.g., soil and groundwater) on the site were compared to conservative RBCs. For this ROD, the RBCs reflect residential exposure assumptions of 1×10^{-6} for soil and groundwater, or a hazard quotient (HQ) of 1.0 for all media. These criteria differ from the criteria used in the 1995 OU-A RI Report, which applies screening criteria of 1×10^{-7} for groundwater and an HQ of 0.1, which were determined to be overly conservative by the Agencies. Inorganic chemical concentrations were compared to naturally occurring background levels in the 1995 OU-A RI Report.

The final list of COPCs for soil and groundwater is shown in Table 4-1. The potential for these COPCs to impact health was evaluated further using site-specific exposure assumptions.

4.1.1.2 Exposure Assessment

The exposure assessment estimates the type and magnitude of exposures to the COCs at the site. The exposure assessment considers the current and potential future uses of the site, characterizes the potentially exposed populations, identifies the important exposure pathways, and quantifies the intake of each COC from each medium for each population at risk.

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.

Under current land use conditions, individuals potentially could be exposed to COPCs in soil by ingesting soil and inhaling vapors and dust. Exposures to groundwater were not evaluated because the groundwater beneath OU-A is between 80 feet to 160 feet BGS and is not used for drinking purposes. Figures 3-1, 3-2, and 3-3 identify the potential complete exposure routes for OU-A.

EPA's Superfund guidance recommends that the reasonable maximum exposure (RME) be used to calculate potential health impacts at Superfund sites. The RME is the highest exposure that is reasonably expected to occur at the source areas and is calculated using conservative assumptions to represent exposures that are reasonable and protective. The estimated risks associated with the contaminants at OU-A are presented in Table 4-2. The risks presented are overly conservative (i.e., health-protective) because they are based on future residential land use, which is not likely at this site, thereby overestimating risk for site-specific exposure scenarios.

To estimate exposures, data regarding the concentration of COCs in the media of concern at the site (the exposure point concentrations [EPCs]) are combined with information about the projected behaviors and characteristics of the people who potentially may be exposed to these media (exposure parameters).

To estimate EPCs in soil, the 95% upper confidence level (UCL) on the mean was calculated. If the 95% UCL was greater than the maximum detected concentration, then the maximum detected concentration was used as the EPC; otherwise, the 95% UCL was used. If data sets contained fewer than 10 samples, then the maximum detected concentration was used as the EPC. EPCs were calculated for the RME and average exposure.

Exposure parameters used to calculate the RME include body weight, age contact rate, frequency of exposure, and exposure duration. Exposure parameters were obtained from EPA, Region X, Risk Assessment guidance (*EPA, Region X Supplemental Risk Assessment Guidance for Superfund*; EPA

1991). The default exposure factors were modified to reflect site-specific climatological and other factors at Fort Richardson. Site-specific exposure assumptions were made for soil contact, including ingestion, dermal contact, and inhaling vapors and dust, based on snow cover for four months of the year. Exposures were estimated assuming long-term exposures to site contaminants.

4.1.1.3 Toxicity Assessment

Toxicity information was provided in the Risk Assessment for the COPCs. Generally, cancer risks are calculated using toxicity factors known as *slope factors (SFs)*, while noncancer risks are assessed using RfDs.

EPA developed SFs for estimating excess lifetime cancer risk associated with exposure to potential carcinogens. SFs are expressed in units of milligrams per kilogram per day $(mg/kg\text{-}day)^{-1}$ and are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term *upper-bound* reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimates of the actual cancer risk highly unlikely. SFs are derived from the results of human epidemiological studies, or chronic animal bioassay data, to which mathematical interpolation from high to low doses, and from animal to human studies, has been applied.

EPA developed RfDs to indicate the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure for humans, including sensitive subpopulations likely to be without risk of adverse effect. Estimated intakes of COCs from environmental media (e.g., the amount of a COC ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied.

The Risk Assessment relied on oral and inhalation SFs and RfDs. Toxicity factors were obtained from the Integrated Risk Information System (IRIS) or, if no IRIS values were available, from the Health Effects Assessment Summary Table (HEAST). For the few chemicals that did not have toxicity values available, sources other than IRIS and HEAST were used.

4.1.1.4 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 and noncarcinogenic effects based on the RME. Excess lifetime cancer risk is calculated by multiplying the SF by the quantitative estimate of exposure: the chronic daily intake. These risks are probabilities generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual has a 1 in 1 million chance of developing cancer as a result of a site-related exposure to a carcinogen under the specific exposure conditions assumed. EPA considers that an excess lifetime cancer risk between 1 in 1 million (1×10^{-6}) and 1 in 10,000 (1×10^{-4}) is within the generally acceptable range; risks greater than 1 in 10,000 usually suggest the need to take action at a site.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (lifetime) to an RfD derived for a similar exposure period. The ratio of exposure to toxicity is called an *HQ*. HQs are calculated by dividing the exposure by the specific RfD. If the HQ is less than 1, then adverse health effects are not likely to occur. By adding the HQs for all COCs that affect the same target organ (liver, nervous system, etc.), the HI can be calculated. 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.

Soil

Under current land use conditions, the estimates of carcinogenic and noncarcinogenic effects for OU-A fell within or below the acceptable risk range for CERCLA sites. The only complete exposure pathway under current land use conditions was recreational exposure to surface soil at the Fire Training Area (see Table 4-3). The other OU-A sites do not have complete exposure pathways under current land use conditions.

At the Fire Training Area, excess lifetime cancer risks greater than or equal to 1×10^{-6} were determined only for potential future RME exposures to soil (3×10^{-6}).

At the cesspool area of the Transmitter Site, potential excess lifetime cancer risks greater than 1×10^{-6} were calculated for potential future RME industrial and residential exposures to soil (1×10^{-5} and 5×10^{-5}, respectively).

While sludge contained in the Dry Well was not evaluated directly in the Risk Assessment because of the lack of exposure pathways, this material is contaminated and could present a health risk if contacted by humans. Sludge in the Dry Well will be removed and disposed of during summer 1997 to eliminate this potential threat.

Under future exposure conditions, no noncancer HIs exceeded EPA's regulatory benchmark of 1 for any exposure scenario at any OU-A site.

The results of the baseline HHRA indicated that for soil exposure pathways, the estimated cumulative potential cancer risks for all current and future exposure scenarios at all OU-A source areas do not represent unacceptable risks to human health, based on EPA criteria.

Groundwater

No COPCs were identified in groundwater at the Fire Training Area or the Transmitter Site. Furthermore, exposures to groundwater at these source areas were considered to be incomplete exposure pathways. Two COPCs, chloroform and manganese, were identified at the Dry Well. Groundwater at the Dry Well is not used as a source of potable water. Therefore, exposure to groundwater under current land use conditions at the Dry Well represents an incomplete exposure pathway. The HHRA concluded that the estimated cumulative potential cancer risks at the Dry Well for hypothetical future groundwater exposure pathways would fall within or below the range of acceptable risks as established by the EPA Superfund program. For noncarcinogenic effects, the regulatory benchmark of a total HI of 1 was not exceeded at any wells at the Dry Well. Removal of contaminated sludge and soil will occur in 1997, further reducing potential threats to future groundwater users.

Uncertainties associated with the baseline HHRA also affect the degree of confidence that can be placed in risk characterization results. The principal uncertainties associated with the OU-A HHRA process, which could result in overly conservative risk evaluations, are summarized below:

- Chloroform was detected in groundwater samples from two wells at the Dry Well. This analyte is a common laboratory contaminant. Because no evidence exists to suggest that chloroform is a site-related contaminant, the risks presented in this section should be regarded with caution;

- Based on results of previous investigations, the presence of manganese in the groundwater samples is likely attributable to naturally occurring minerals in groundwater at the site;

- Future surface soil concentrations were derived from subsurface soil data up to 15 feet BGS. The assumption that subsurface soil would be disturbed and mixed with the present surface soil layer represents a conservative approach; and

- The most conservative exposure scenarios evaluated in the baseline HHRA involved residential exposure assumptions. If future residential development of OU-A source areas does not occur, then the risk estimates for this exposure scenario greatly overestimate actual future site risks. Note that future residential development is not anticipated; rather, land use is expected to remain the same in the future.

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

4.1.2 Ecological Risk Assessment

The ERA performed for OU-A addressed the impacts and potential risks posed by source-related contaminants to natural habitats, including plants and animals, in the absence of remedial action. Unlike the HHRA, the ERA focused on the contaminants' effects on populations or communities, rather than individuals. If identified during the ERA, potential risks to individuals of a species are evaluated within a larger context to determine ecological significance.

The masked shrew, red fox, robin, and kestrel were selected as representative terrestrial site receptors for OU-A based on site-specific exposure pathways and ecological considerations. The potential for adverse effects from contaminants of ecological concern (COECs) on plant communities and aquatic invertebrates also was evaluated.

Risk estimation involves calculating HQs to assess potential ecological risks to measurement species and communities. Ecological effects are quantified by calculating the ratio between a chemical of potential ecological concern's (COPEC'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 HQ) is less than 1, then adverse ecological effects are not expected for the COPEC. This ratio is a summation of all site contaminants. The HQs described in this summary were calculated using conservative RME assumptions.

Based on the risk analysis, COEC concentrations at OU-A result in negligible risk to small-mammal populations, aquatic invertebrates, emergent wetland vegetation, and upland plant vegetation. The overall potential for valued environmental resources at this site to be adversely affected is considered negligible.

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

- Avian and mammalian bioaccumulation factors were unavailable for many COPECs, which resulted in an underestimation of potential risks to measurement species; and
- Most of the available toxicity values were determined using laboratory animals under laboratory conditions. These values, as well as toxicity values determined based on indirect effect measures (such as increased body weight), may not be representative of other significant indirect effects (such as behavioral changes) realized in free-ranging wildlife.

Reasonable and conservative assumptions were used in the ERA when empirical data were unavailable. Consequently, potential ecological risks to OU-A species are more likely to be overestimated rather than underestimated.

4.1.3 Summary of Risks

The conclusion of the baseline Risk Assessment for OU-A is that contaminant levels in soil and groundwater at the OU-A sites do not represent unacceptable risks to human health or the environment, based on EPA criteria. However, the levels of petroleum contamination in the soil do exceed the ADEC soil cleanup criteria. While sludge within the Dry Well may pose a threat to human health, this material will be removed and disposed of in 1997. The Army, ADEC, and EPA have elected to pursue further cleanup efforts at these sites under the Two-Party Agreement. Under the Two-Party Agreement, the Army and ADEC will clean up contaminated materials at each site in accordance with applicable State of Alaska regulations. While the specific cleanup actions and the time required to remediate the sites have yet to be determined, the Army and State of Alaska will jointly consider all available information before selecting appropriate OU-A site cleanup activities. Decisions regarding OU-A site cleanup will be documented in accordance with stipulations of the Two-Party Agreement. Because the OU-A source areas will be addressed through the Two-Party Agreement, they are not discussed further in this ROD.

4.2 OPERABLE UNIT B

4.2.1 Human Health Risk Assessment

The OU-B Risk Assessment identified ways that people working or living on or near the source areas could be exposed to contaminated media: touching and ingesting soil, inhaling vapors and dust released from soil, and using groundwater for drinking and showering. On-site workers and visitors are the individuals most likely to be exposed under current exposure conditions. Current use of Poleline Road is limited to periodic visits by authorized personnel, and by trespassers or open space recreational users. Under potential future land use conditions, exposures to on-site workers, visitors, residents, or downgradient groundwater users are possible. Table 4-4 lists the exposure pathways evaluated at OU-B.

Based on analytical results from surface and subsurface soil surrounding Areas A-1 and A-2, the risk of cancer and noncancer health effects from exposure to low concentrations of solvents in soil was negligible. The excess lifetime cancer risk was 1 in 100,000 (1×10^{-5}), and the noncarcinogenic HI was less than 1 for residential exposure to soils at 0 feet to 15 feet BGS in Areas A-3 and A-4. Generally, remediation is not warranted for protection of public health if the total lifetime excess cancer risk does not exceed 1 in 10,000 and if noncarcinogenic effects have an HI of less than 1. However, although these contaminants in soil do not pose a threat to human health, they may serve as a continuing source of contamination to groundwater.

Excess lifetime cancer risks for soil in the "hot spot" area beneath Area A-3 (see Figure 3-6) and the hillside were not within the acceptable risk range for the current-worker exposure scenario. However, these soils are 14 feet BGS; therefore, the likelihood of direct exposure to humans is unlikely.

The NCP and state regulations require protection and restoration of water resources. Contamination of OU-B groundwater, if used as a drinking water source, presents an unacceptable risk to human health. The "hot spot" area beneath Area A-3 and the hillside presents a continuing source of contamination to the groundwater at the site. Table 4-5 summarizes the maximum possible human risks associated with the various locations at the site and the risks to humans if groundwater from different depths at the site is ingested.

Groundwater at OU-B is not used, and there are no residents or wells downgradient of the site. There are no current plans for commercial or residential development in the site area. Additionally, groundwater transport modeling was used to estimate time of travel for detectable concentrations of TCE and 1,1,2,2-tetrachloroethane (0.005 mg/L) with no depletion or remediation of the contaminant source and no biodegradation over time. The modeled transport time for 0.005 mg/L of TCE to reach the Eagle River is approximately 120 years, and for 1,1,2,2-tetrachloroethane, 170 years. Concentrations of 0.005 mg/L of TCE and 1,1,2,2-tetrachloroethane do not exceed conservative exposure assumptions, nor do they exceed Alaska Water Quality Standards for ingestion of freshwater organisms. Therefore, concentrations in the leading edge of the plume, if it were to reach the Eagle River, would not pose a threat to human health.

The principal uncertainties associated with the OU-B HHRA process, which could result in overly conservative risk evaluations, are summarized below:

- Detection limits for the field screening analytical method for VOCs in soil were higher than those for the laboratory analytical method (about 0.005 mg/kg) and were higher than many detected values from laboratory sampling results. The higher detection limits in field screening samples add uncertainty to the estimates of VOC EPCs;

- Hazard/risk results were assessed based on on-site residential exposure scenarios that assumed an exposure frequency of 350 days per year; an exposure duration (ED) of 30 years; and daily intake rates for soil, air, and water based on an exposure time of 24 hours per day. The potential for future residential development is remote. Exposure of current and possible future receptors at Poleline Road would be much less than that for the residential scenario. Therefore, hazard/risk results reported in the HHRA will overestimate risk to current and possible future receptors; and

- For the purpose of evaluating risk from exposure to groundwater at Poleline Road, it was assumed that groundwater was used for household purposes, including drinking water. However, the potential for residential or commercial development and groundwater use is remote. Therefore, the calculated risk levels do not represent actual risks under current or probable future exposure conditions. In addition, an alternative water supply (pipeline from Eklutna Lake) could meet future water demands near the site, if developed.

4.2.2 Ecological Risk Assessment

The ERA performed for OU-B addressed the impacts and potential risks posed by contaminants to natural habitats, including plants and animals, in the absence of remedial action. Unlike the HHRA, the ERA focuses on the effects to populations or communities of plants and animals, not individuals. If identified during the ERA, potential risks to individuals of a species are evaluated within a larger context to determine ecological significance.

The northern red-backed vole and muskrat were selected as representative terrestrial site receptors for

OU-B based on site-specific exposure pathways and ecological considerations. The potential for adverse effects from COECs on plant communities and aquatic invertebrates also was evaluated.

Based on the risk analysis, COEC concentrations at OU-B result in a negligible risk to small-mammal populations, aquatic invertebrates, emergent wetland vegetation, and upland plant vegetation. The overall potential for valued environmental resources at this site to be adversely affected is considered negligible.

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

- ED and area use by potential receptors assumed a worst-case scenario. Area usage by receptors was assumed conservatively to be 100%. It is also assumed that exposure to contaminated soils and vegetation is continuous. Because mobile receptors are likely to feed at or visit several locations, or avoid VOC-contaminated areas, their daily dose, if averaged over time, could be less than that used in this ERA for evaluating risk. Adverse effects in small, localized areas on a few small-mammal individuals are negligible considerations in terms of risk to the biological population;

- No standardized system is available for identifying toxicity-based "safe" benchmark values for terrestrial wildlife. The potential exists for wildlife species to be more or less sensitive than test species (some biota adapt) and the toxicological benchmarks used. Toxic dose values for laboratory organisms also may be substantially lower than those for wildlife because of the sensitive strain of laboratory animals used and the direct means by which they are dosed. LD_{50} studies usually are designed to promote maximum exposure (absorption) and to lessen any chemical complexing with dietary material. The LD_{50} dietary studies probably provide a better indication of the toxicity of the chemical tested, while no observed adverse effect levels from longer studies are the best laboratory studies to use as predictors of field effects; and

- Groundwater at the site is contaminated with VOCs. However, there are no known on-site or off-site seeps by which wildlife can be exposed. It was assumed that groundwater at the site and the contamination within the groundwater eventually could reach the Eagle River. There is a lack of information regarding migration of the groundwater beneath the site. However, an evaluation of the modeled groundwater data indicates that because of time of travel and concentrations required for toxic effects, the additional risk estimate is negligible.

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

4.2.3 Summary of Risks

Exposure scenarios associated with OU-B soil do not exceed EPA's acceptable excess cancer risk/HIs for human health and ecological receptors. Although excess lifetime cancer risks and HIs for soil at the "hot spot" area beneath Area A-3 exceed EPA's acceptable risk ranges, the contaminants are foúnd at 14 feet BGS and therefore do not pose a hazard for direct human contact.

While soil contamination does not pose a threat to human health or the environment, the contamination level is high enough to pose an ongoing threat to groundwater. Groundwater contamination in the shallow and deep zones exceeds EPA's acceptable risk range and state and federal drinking water MCLs for human consumption. The NCP and state regulations require protection and restoration of water resources. Contamination of OU-B groundwater, if used as a drinking water source, presents an unacceptable risk to human health. Therefore, groundwater and the "hot spot" source at Poleline Road require remedial action. The Army, ADEC, and EPA have selected a preferred remedial alternative for OU-B based on criteria found in the NCP.

Table 4-1

**CONTAMINANTS OF POTENTIAL CONCERN
HUMAN HEALTH RISK ASSESSMENT
OPERABLE UNIT A
FORT RICHARDSON, ALASKA**

Site	Matrix	Chemicals of Potential Concern
RRTSL	Subsurface Soil	Aroclor 1260
		DRO
		Aluminum
		Manganese
		Vanadium
	Cesspool Soil	Aroclor 1260
RRFTA	Surface Soil	Benzo(a)anthracene
		Benzo(a)pyrene
		Benzo(b)fluoranthene
		Indeno(1,2,3-cd)pyrene
		DRO
		GRO
		2,3,7,8-TCDD
		Aluminum
	Subsurface Soil	DRO
		GRO
		2,3,7,8-TCDD
		Beryllium
		Chromium
POLLDW	Subsurface Soil	DRO
		GRO
		Chromium
	Groundwater	Manganese
		Chloroform

Key:

DRO = Diesel-range organics.
GRO = Gasoline-range organics.
POLLDW = Petroleum, Oil, and Lubricant Laboratory Dry Well.
RRFTA = Ruff Road Fire Training Area.
RRTSL = Roosevelt Road Transmitter Site Leachfield.
TCDD = Tetrachlorodibenzo-p-dioxin.

Table 4-2

ESTIMATED HUMAN HEALTH RISKS FUTURE RESIDENTIAL LAND USE OPERABLE UNIT A FORT RICHARDSON, ALASKA

Site	Contaminants of Concern	Maximum Total Excess Cancer Risk to Future Residents
Roosevelt Road Transmitter Site Leachfield	Petroleum Hydrocarbons; PCBs; Petroleum, Oil, and Lubricant	$2E^{-7}$
POL Laboratory Dry Well	Petroleum Hydrocarbons	$1E^{-7}$
Ruff Road Fire Training Area	Petroleum Hydrocarbons	$3E^{-6}$

Key:

PCBs = Polychlorinated biphenyls.
POL = Petroleum, oil, and lubricant.

Table 4-3

**CURRENT EXPOSURE SCENARIOS
REASONABLE MAXIMUM EXPOSURE EXCESS LIFETIME CANCER RISKS
AND HAZARD INDICES
HUMAN HEALTH RISK ASSESSMENT
OPERABLE UNIT A
FORT RICHARDSON, ALASKA**

Exposure Scenario	Exposure Pathway	Fire Training Area	
		Excess Lifetime Cancer Risk	Hazard Index
Recreational	Ingestion	1.3E-07	2.1E-02
	Dermal Contact	9.1E-08	–
	Inhalation of Fugitive Dust	1.1E-11	–
	TOTAL	2E-07	0.02

Note: Recreational exposure at the Ruff Road Fire Training Area is the only complete exposure pathway under current land use conditions at Operable Unit A.

Table 4-4

OPERABLE UNIT B
EXPOSURE PATHWAYS EVALUATED
IN HUMAN HEALTH RISK ASSESSMENT
FORT RICHARDSON, ALASKA

Receptor	Exposure Pathway
Hypothetical On-Site Resident	Ingestion and inhalation of contaminants of concern in groundwater from shallow and deep zones
	Incidental ingestion of soil in exposure Areas A-1, A-2, O and A-3, A-4, and T
	Inhalation of airborne constituents from soil in exposure Areas A-1, A-2, O and A-3, A-4, and T
	Ingestion and inhalation of contaminants of concern in wetland surface water
	Ingestion of wetland sediment
	Inhalation of indoor vapors from soil and groundwater
Hypothetical On-Site Industrial Worker	Incidental ingestion of soil in exposure areas A-1, A-2, O and A-3, A-4, and T
	Inhalation of indoor vapors from soil and groundwater
Off-Site Recreational User	Ingestion of fish from the Eagle River

Table 4-5

SUMMARY OF SITE RISKS
OPERABLE UNIT B
FORT RICHARDSON, ALASKA

Media	Maximum Cancer Risk	Maximum Hazard Index[a]
"Hot spot" soils	$8E^{-3}$	0.8
"Hot spot" groundwater: shallow zone	1	2,800
"Hot spot" groundwater: deep aquifer	$9E^{-2}$	47
Downgradient soils	$8E^{-6}$	0.005
Downgradient groundwater: shallow zone	$2E^{-2}$	18
Downgradient groundwater: deep aquifer	$2E^{-3}$	0.9

[a] Hazard index values greater than 1.0 are considered by the United States Environmental Protection Agency to represent conditions potentially requiring remedial action.

5.0 DESCRIPTION OF ALTERNATIVES

5.1 NEED FOR REMEDIAL ACTION

Actual or threatened releases of hazardous substances (chlorinated solvents) from Poleline Road, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, public welfare, or the environment.

The specific reasons for conducting remedial actions at Poleline Road are provided below, with the main focus being protection of groundwater in accordance with the NCP Groundwater Protection Strategy:

- VOCs (i.e., PCE; TCE; and 1,1,2,2-tetrachloroethane) in groundwater at Poleline Road are present at concentrations above state and federal MCLs and risk-based criteria; and

- VOCs, including PCE; TCE; and 1,1,2,2-tetrachloroethane, in contaminated soils are a continuing source of groundwater contamination.

5.2 REMEDIAL ACTION OBJECTIVES

As a part of the RI/FS process, remedial action objective (RAOs) were developed in accordance with the NCP and EPA guidance for conducting RI/FS investigations. The purpose of the objectives is to reduce the contamination in the groundwater at OU-B to levels that do not pose a threat to human health and the environment. If the OU-B area were converted to public domain at any time in the future, the residents would not be at risk from use of the groundwater.

The objectives of remedial action at OU-B are as follows:

- Reduce contaminant levels in the groundwater to comply with drinking water standards;

- Prevent contaminated soil from continuing to act as a source of groundwater contamination;

- Prevent the contaminated groundwater from adversely affecting the Eagle River surface water and sediments; and

- Minimize degradation of the State of Alaska's groundwater resources at the site as a result of past disposal practices.

Tables 5-1 and 5-2 summarize the chemical-specific cleanup goals for groundwater and soil at Poleline Road.

RAOs are based on either human health risk estimates that exceed or fall within the 1×10^{-6} to 1×10^{-4} risk range or on federal and state applicable or relevant and appropriate requirements (ARARs). All groundwater RAOs are based on state and federal MCLs, with the exception of 1,1,2,2-tetrachloroethane. The RAO for 1,1,2,2-tetrachloroethane is based on the RBC for this chemical in residential drinking water. RAOs for soil are based on protection of the groundwater from leaching of the contaminants (EPA, Region 3, RBCs): 1,1,2,2-tetrachloroethane—0.1 mg/kg and PCE—4.0 mg/kg.

Monitoring at Poleline Road will be conducted to ensure that RAOs are achieved. The goal of this monitoring will be:

- To ensure that no off-source migration of contaminants is occurring;
- To indicate contaminant concentrations and compliance with state and federal MCLs; and
- To indicate whether remedial action is effective or needs modification.

5.3 SIGNIFICANT APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A full list of ARARs is in Section 8. The following ARAR is the most significant regulation that applies to the remedy selections for Poleline Road:

- State and federal MCLs are relevant and appropriate for groundwater. These MCLs set the active remediation goals for groundwater contaminants regulated by state and federal drinking water regulations.

5.4 DESCRIPTION OF ALTERNATIVES

Many technologies were considered to clean up the contaminated soil and groundwater at OU-B. Appropriate technologies were identified and screened for applicability to site conditions. The potential technologies then were combined into media-specific sitewide alternatives. Potential remedial alternatives for OU-B were identified, screened, and evaluated in the FS.

During the development of the FS, a Treatability Study was performed to evaluate the effectiveness of several remedial technologies included in the FS. The results of the Treatability Study indicated that AS of chlorinated solvents in groundwater would not effectively treat contaminants to levels below state and federal MCLs. In addition, the Treatability Study indicated that biological components of natural attenuation would not be an important degradation mechanism of chlorinated solvents in the groundwater system at Poleline Road.

The following are alternatives evaluated in the Proposed Plan.

Alternative 1: No Action

CERCLA requires evaluation of a no-action alternative as a baseline reflecting current conditions without any cleanup effort. This alternative is used for comparison to each of the other alternatives and does not include monitoring or institutional controls. No costs would be associated with this alternative.

Alternative 2: Monitored Natural Attenuation

Natural attenuation, or breakdown of contaminants without artificial stimuli, includes institutional controls and groundwater monitoring to determine whether the contaminants in the groundwater are degrading naturally. Natural attenuation can occur because of degradation processes such as biological breakdown, chemical and physical processes, and volatilization. Even under ideal conditions, entire breakdown of contaminants is rarely complete.

Institutional controls for Poleline Road could include access restrictions (i.e., posted signs; fencing around the area; 6-foot, industrial-grade security fencing with appropriate entry gates; restrictions on future land use; restrictions on groundwater well installation; restrictions on the use of wells; and well use advisories). Such institutional controls would not reduce the source of contamination. While the VOC-contaminated source area would remain as it exists, the concentrations in the groundwater would be reduced by natural processes. However, institutional controls would decrease or minimize human or wildlife exposure to contaminants. Periodic inspections and maintenance of the institutional controls would be conducted.

Environmental monitoring would be performed to obtain information regarding the effectiveness of the attenuation process in remediating the contamination as well as to track the extent of contaminant migration from the site. Approximately two additional wells would be added to the 15 existing wells. These wells would be screened in geological zones hydraulically connected with the contamination source, supplemented by installing groundwater monitoring wells when required. Upgradient wells would be used to provide information regarding the background groundwater quality at a source. All monitoring of downgradient wells necessary to determine the effectiveness of natural attenuation would be performed.

Monitoring would include analysis for the contaminants that exceed the RAOs and associated breakdown products for Poleline Road. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration and attenuation rates are gathered. Evaluation would include potential seasonal fluctuations in groundwater contaminant concentrations. The frequency of monitoring would be defined during the post-ROD activities.

The total estimated present worth cost of this alternative is $1,300,000, which includes $80,000 for capital costs, $29,070 per year for annual operation and maintenance (O&M), and $29,070 per year for annual groundwater monitoring. For costing purposes, it was assumed that the fencing would be installed around the area of contamination. The estimated time frame for cleanup goals to be achieved and for monitoring to be performed was 500 years, although the cost estimate includes 30 years of annual operation costs.

Alternative 3: Containment

The objective of containment is to minimize water flow into or out of contaminated areas, thus minimizing migration of contamination into lower aquifers. This alternative consists of a cap and vertical barrier to reduce the mobility of the contaminants, monitoring, and institutional controls. See Alternative 2 for a description of monitoring and institutional controls. Site soils would be covered with a layer of sand overlying an impermeable synthetic membrane to minimize the amount of surface water and rainwater infiltrating through the contaminated soils. Covering the soils would protect humans and animals from contacting contaminated soils. Bentonite slurry walls would be installed to inhibit the flow of water from the wetlands into the site. Without this flow, the mobility of the contaminants in the soil would be reduced.

Existing groundwater contamination outside the source area would be expected to meet RAOs through natural attenuation. Because the soils would be capped and surface water flow controlled, production of leachate is expected to significantly decrease; therefore, groundwater would be expected to naturally attenuate faster than if no cap were placed on the soils.

Groundwater monitoring/evaluation would be performed to assess when the groundwater naturally attenuates and to evaluate any impact to potential downgradient receptors.

The estimated total present worth for this alternative is $2,500,000, which includes $993,325 for capital costs, $9,600 per year for annual O&M, and $20,620 per year for annual groundwater monitoring. For costing purposes, it was assumed that the fencing would be installed around the area of contamination. The estimated time frame for cleanup goals to be achieved and for monitoring to be performed was 500 years, although the cost estimate includes 30 years of annual operation costs.

Alternative 4: Interception Trench, Air Stripping, and Soil Vapor Extraction

The objective of this alternative is to remove contamination from the soil and groundwater within Areas A-1 through A-4. Trenches would be dug for collection of groundwater, which would be pumped to an air stripper for treatment. Air stripping is a process that removes VOCs by transferring them from contaminated water to air. Vapors from the air stripper would be treated as required by state and federal regulations before being discharged to the atmosphere. SVE is an in-place process for removal of VOCs from unsaturated soils. The system consists of a series of vapor extraction wells, commonly called *vapor extraction points*, and air blowers to draw air through the soil and in the VEPs. SVE includes piping to collect the extracted air and systems to remove contaminants from the extracted air as required by state and federal regulations before being discharged. Long-term monitoring of groundwater to evaluate system performance is also a component of this alternative.

The estimated total present worth for this alternative is $7,500,000, which includes $2,042,000 for capital costs, $142,880 per year for annual O&M, and $20,620 per year for annual groundwater monitoring. For costing purposes, it was assumed that the fencing would be installed around the area of contamination. The estimated time frame for cleanup goals to be achieved through active treatment is five years, and 135 years is estimated for the remainder of the plume to achieve cleanup goals. The cost estimate includes 30 years of annual operation costs.

Alternative 5: Air Sparging and Soil Vapor Extraction of the "Hot Spot" and Monitored Natural Attenuation

The objective of this alternative is to remove contamination from the "hot spot" and to rely on natural attenuation to restore the remainder of the contaminated groundwater plume. AS is the injection of pressurized air into the shallow aquifer, which results in volatilization of VOCs and enhanced biodegradation of contaminants susceptible to aerobic microbial degradation. SVE is used commonly in combination with AS. See Alternative 4 for a description of SVE. See Alternative 2 (Section 7.1) for a description of groundwater monitoring and institutional controls for Poleline Road.

The estimated total present worth for this alternative is $5,500,000, which includes $1,600.000 for capital costs, $72,736 per year for annual O&M, and $29,070 per year for annual groundwater monitoring. For costing purposes, it was assumed that the fencing would be installed around the area of contamination. The estimated time frame for cleanup goals to be achieved and for monitoring to be performed was 150 years, although the cost estimate includes 30 years of annual operation costs.

Alternative 6: High-Vacuum Extraction of the "Hot Spot" and Institutional Controls with Long-Term Groundwater Monitoring

The objective of this alternative is to remove the contamination from the "hot spot" and to monitor the remainder of the contaminated plume in the groundwater to assess the progress of natural attenuation and/or plume migration. This action ensures that removing the source inhibits further migration of the contaminants into the groundwater. The monitoring will be conducted to determine whether the plume is expanding beyond the boundaries of Poleline Road. This alternative also includes enforcement of land use restrictions designed to prohibit extraction and use of the groundwater, periodic groundwater monitoring to track the progress of contaminant breakdown and movement, and an early indication of unforeseen environmental or human health risk. The high-vacuum extraction (HVE) process uses a strong vacuum from the "hot spot" to extract contaminated soil vapors and some contaminated groundwater. As this air and water moisture is drawn to the surface, some of the contaminants in the water will transfer to the air. An air stripping system will be used to treat the extracted groundwater to meet state and federal MCLs before the groundwater is reinjected into the deep aquifer. Soil vapors extracted from the "hot spot" soil will be treated as necessary to meet state and federal air quality standards before being released to the atmosphere.

The estimated total present worth for this alternative is $4,000.000, which includes $801,841 for capital costs, $64,878 per year for annual O&M, and $29,070 per year for annual groundwater monitoring. For costing purposes, it was assumed that the fencing would be installed around the area of contamination. The estimated time frame for cleanup goals to be achieved in the "hot spot" is seven to 12 years. The estimate for the remainder of the plume to remediate and for monitoring to be performed was 150 years, although the cost estimate includes 30 years of annual operation costs.

Table 5-1

**REMEDIAL CLEANUP GOALS FOR GROUNDWATER
POLELINE ROAD DISPOSAL AREA
FORT RICHARDSON, ALASKA**

Contaminant of Concern	Maximum Detected Concentration (mg/L)	Remedial Action Objective (mg/L)	Source of RAO[a]
Benzene	2.9	0.005	MCL
Carbon Tetrachloride	2.6	0.005	MCL
cis-1,2-Dichloroethene	37	0.07	MCL
trans-1,2-Dichloroethene	12	0.1	MCL
Tetrachloroethene (PCE)	11	0.005	MCL
Trichloroethene (TCE)	220	0.005	MCL
1,1,2,2-Tetrachloroethane	1,900	0.052	RBC

a State and federal maximum contaminant levels for drinking water.

Key:

MCL = Maximum contaminant level.
mg/L = Milligrams per liter.
RAO = Remedial action objective.
RBC = Risk-based concentration for drinking water, based on an increased cancer risk of 1×10^{-4}.

Table 5-2

**REMEDIAL ACTION OBJECTIVES FOR SOIL
FORT RICHARDSON, ALASKA**

Contaminant of Concern	Maximum Detected Concentration (mg/kg)	Remedial Action Objective (mg/kg)	Source of RAO
Tetrachloroethene	159	4.0	RBC
1,1,2,2-Tetrachloroethane	2,030	0.1	RBC

Note: TCE did not exceed RBCs for soil.

Key:

mg/kg = Milligrams per kilogram.
RAO = Remedial action objective.
RBC = Risk-based concentration for soil contaminants leaching to groundwater, based on an increased cancer risk of 1×10^{-4}.
TCE = Trichloroethene.

6.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The selection of alternatives was based on an evaluation using the nine Superfund criteria specified in Table 6-1. The first two criteria are known as *threshold* criteria that must be met by all selected remedial actions. The following five criteria are known as *balancing* criteria. and the final two criteria as *modifying* criteria.

6.1 THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Alternatives 4 and 6 would provide the greatest protection to human health and the environment by actively treating VOC-contaminated soil and groundwater. Treatability Studies indicated that Alternative 5 would not reduce on-site contamination effectively, thereby not providing protection of human health and the environment. Alternative 3 would protect human health and the environment by reducing the possibility of human contact with contaminants and minimizing future infiltration of contaminants from soil to groundwater. Alternative 2 would rely on natural processes to slowly decrease contaminant concentrations in the soil and groundwater. Alternative 2 does not protect human health and the environment based on Treatability Study results that indicated no evidence of biodegradation. Alternative 2 would provide some protection of human health and the environment through institutional controls, which would reduce contact with contamination. Alternative 1 (no action) would be the least-protective alternative.

Compliance with Applicable or Relevant and Appropriate Requirements

Significant ARARs that apply to the OU-B site include the Federal Safe Drinking Water Act, Alaska Drinking Water Regulations, and the Clean Water Act. Alaska Water Quality Standards (AWQS) are also applicable requirements (see Section 8.2). However, state and federal MCLs have been used to set the remediation goals for OU-B. The AWQS eventually would be achieved through monitored natural attenuation under all of the alternatives, except no action. Alternatives 4, 5, and 6 are expected to meet all state and federal ARARs. These alternatives include active soil and groundwater treatment and would be expected to achieve state and federal standards more rapidly than Alternatives 1, 2, and 3. Alternatives 1, 2, and 3 would rely on natural processes that slowly decrease soil and groundwater to attain cleanup standards. However, under Alternative 1, no monitoring would be conducted to determine compliance with the ARARs.

6.2 BALANCING CRITERIA

Long-Term Effectiveness and Permanence

Alternatives 4 and 6 would involve permanent and active reduction of soil and groundwater contamination and would achieve long-term effectiveness. Alternative 4 would not be effective at reducing contamination, based on Treatability Study results. None of the contaminants would be addressed by Alternatives 1, 2, or 3, except through natural processes. Therefore, Alternatives 1, 2, and 3 would provide the least-effective long-term permanence.

Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 4 and 6 would involve treatment technologies that effectively reduce the toxicity and mobility of VOC-contaminated soil and groundwater. Alternative 5 would not reduce contamination, as shown by Treatability Studies. The other alternatives do not include treatment technologies to reduce site risks. Alternative 3 would reduce contaminant mobility by restricting future infiltration of rainfall and snowmelt through contaminated soils to groundwater. Alternatives 1 and 2 would slowly decrease the toxicity and volume of contaminated media through natural attenuation. Because Alternative 2 includes monitoring, the rate and degree of contaminant reduction would be known.

Short-Term Effectiveness

Alternatives 3, 4, 5, and 6 would pose some short-term potential risks to on-site workers and visitors/members of the community during the time required for construction and installation of containment and treatment systems. These potential risks could be minimized by engineering and institutional controls. These alternatives are expected to achieve state and federal standards more rapidly than Alternatives 1 and 2.

Risks associated with groundwater contamination are equal for Alternatives 4 and 6. Because these alternatives actively treat groundwater contamination, contaminant levels would be expected to decrease during the same period of time of active remediation. While Alternative 4 treats groundwater more aggressively by addressing the entire plume area, the uncertainty associated with this technology's long-term effectiveness suggests that this alternative would not clean the site faster than Alternative 6. Alternatives 1, 2, and 3 do not actively treat soil or groundwater contamination; therefore, risks would not change over time, except through natural processes. Under Alternative 1, no monitoring would be conducted to determine the remediation time frame. However, the time frame for remediation is expected to be similar to Alternative 2.

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 Alternatives 4, 5, and 6.

Cost

The estimated costs for each alternative evaluated for OU-B are in Table 6-2 and are based on the information available at the time the alternatives were developed. Actual costs are likely to be within +50% to -30% of the values on the table. Appendix C includes detailed cost estimates for each of the OU-B remedial alternatives.

6.3 MODIFYING CRITERIA

State Acceptance

The State of Alaska has been involved with the development of remedial alternatives for OU-B and concurs with the Army and EPA in the selection of Alternative 6. This acceptance is contingent on the following items:

- The Remedial Design and Remedial Action will include refining the contaminant fate and transport modeling based on new field data, which will be reviewed and approved by ADEC, EPA, and the Army. This refinement of the modeling is to verify whether the proposed soil RAOs are protective of groundwater, and to better evaluate the anticipated attenuation of groundwater contaminants and the time needed to achieve MCLs;

- If the modeling results indicate that soil meeting the RAOs would continue to act as a secondary source for groundwater contamination, the RAOs will be re-evaluated and modified to be protective;

- If the groundwater monitoring results indicate that contamination is migrating farther from the source area and that the Eagle River could be affected, alternative or additional remedial actions will be evaluated and, if determined appropriate, implemented; and

- Based on current land ownership, ADEC will accept natural attenuation as a treatment of groundwater for 150 years. However, if the land use changes and becomes available for development, then the department will re-evaluate whether the time frame is reasonable for the proposed use.

Community Acceptance

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.

Summary

After evaluation of the potential risks and the appropriate cleanup standards, the preferred alternative for OU-B is Alternative 6: HVE of the "hot spot," sitewide institutional controls, natural attenuation, and long-term monitoring of groundwater.

Alternative 6, the preferred alternative, is expected to achieve overall protection of human health and the environment and to meet ARARs. Additionally, this alternative is a cost-effective and permanent solution to contamination at OU-B.

Table 6-1

CRITERIA FOR EVALUATION OF ALTERNATIVES FORT RICHARDSON, ALASKA

Threshold Criteria: Must be met by all alternatives.	1. Overall protection of human health and the environment. How well does the alternative protect human health and the environment, both during and after construction?
	2. Compliance with requirements. Does the alternative meet all applicable or relevant and appropriate state and federal laws?
Balancing Criteria: Used to compare alternatives.	3. Long-term effectiveness and permanence. How well does the alternative protect human health and the environment after completion of cleanup? What, if any, risks will remain at the site?
	4. Reduction of toxicity, mobility, and volume through treatment. Does the alternative effectively treat the contamination to significantly reduce the toxicity, mobility, and volume of the hazardous substances?
	5. Short-term effectiveness. Are there potential adverse effects to either human health or the environment during construction or implementation of the alternative?
	6. Implementability. Is the alternative both technically and administratively feasible? Has the technology been used successfully at similar areas?
	7. Cost. What are the relative costs of the alternative?
Modifying Criteria: Evaluated as a result of public comments.	8. State acceptance. What are the state's comments or concerns about the alternatives considered and about the preferred alternative? Does the state support or oppose the preferred alternative?
	9. Community acceptance. What are the community's comments or concerns about the alternatives considered and the preferred alternative? Does the community generally support or oppose the preferred alternative?

Table 6-2

COST SUMMARY OF REMEDIAL ALTERNATIVES
POLELINE ROAD DISPOSAL AREA
FORT RICHARDSON, ALASKA

Alternative	Capital Cost	Annual O&M Cost	Annual Monitoring Cost	Total Present-Worth Cost
1- No Action	$0	$0	$0	$0
2- Monitored Natural Attenuation	$80,000	$29,070	$29,070	$1,300,000
3- Containment	$993,325	$9,600	$20,620	$2,500,000
4- Trench, Air Strip, SVE	$2,042,000	$142,880	$20,620	$7,500,000
5- Air Sparging, SVE, Natural Attenuation	$1,600,000	$72,736	$29,070	$5,500,000
6- HVE and Long-Term Groundwater Monitoring	$801,841	$64,878	$29,070	$4,000,000

Notes: Costs may vary and could range from +50% to -30% of the figures presented.

No discount or escalation factors are included in the costs presented. Costs include an operational time frame of 30 years.

Key:

HVE = High-vacuum extraction.
O&M = Operation and maintenance.
SVE = Soil vapor extraction.

7.0 SELECTED REMEDY

Alternative 6 is the selected alternative for treating the soil and groundwater at OU-B. A thorough assessment of alternatives considered groundwater risks. cleanup times, and costs. Alternatives 1 and 2 were eliminated because they did not satisfy the threshold criteria. Alternative 3, containment, does not address the toxicity or volume of the contamination, nor does it actively treat the VOCs; therefore, it was eliminated. While Alternative 4 would remediate a larger portion of the plume, this alternative would not remediate the site noticeably faster than the selected alternative. Therefore, the additional costs are not proportional to the benefits. Preliminary results of on-site testing during fall 1996 indicate that the AS portion of Alternative 5 would not be effective at this site; therefore, this alternative was eliminated.

Protection of human health and the environment and compliance with ARARs will best be attained through cleanup of soil and groundwater in the source area. long-term monitoring of the groundwater plume, and enactment of institutional controls to prevent unrestricted use of the area. The use of HVE, a variation on SVE, is EPA's primary presumptive remedy for VOC-contaminated soils. The multi-step approach adopted in Alternative 6 is part of EPA's presumptive strategy for addressing contaminated groundwater. Figure 7-1 illustrates the key decision points and implementation strategy for the selected remedy.

Initially, the HVE system will be installed within the "hot spot" to decrease contamination and provide hydraulic containment of this area in order to prevent additional contaminant migration downgradient. While HVE directly addresses the source area, it indirectly assists in remediation of the downgradient plume by hydraulic containment of the principal threat. Periodic monitoring of groundwater within and downgradient of the "hot spot" will be performed in conjunction with this effort to determine the effectiveness of the preferred alternative in meeting the long-term groundwater restoration objectives. During this initial step of remedy implementation, Treatability Studies will be conducted to evaluate innovative technologies that may enhance the selected remedy. These technologies include, but are not limited to, soil heating and phytoremediation.

If HVE alone fails to remediate the source area within a reasonable time frame and the Treatability Studies are successful, then one of the successful technologies (i.e., soil heating) for enhanced extraction will be combined with the selected alternative (see Figure 7-1).

The "hot spot" is defined by the area containing greater than 1 mg/L 1,1,2,2-tetrachloroethane in groundwater (see Figure 3-6). This area represents the main threat at this site. Specifically, the "hot spot" is the area that contains the contamination and acts as a reservoir for migration of contamination to groundwater. Actively remediating this "hot spot" addresses the main threat. Concentrations of 1,1,2,2-tetrachloroethane and TCE that exceed the 1% solubility of these chemicals are found within the "hot spot." These high concentrations indicate a need to closely monitor for a denser-than-water nonaqueous phase liquid (DNAPL) during construction and operation of the "hot spot" treatment system.

The flat gradient of the groundwater in this area indicates decreased probability of significant contaminant transport, and the relatively low concentrations of contaminants outside the "hot spot" justify classifying the downgradient plume as a relatively low-level threat. Concurrent with implementation of the selected remedy will be monitoring of the downgradient plume to track and assess the natural attenuation of groundwater contaminants.

7.1 MAJOR COMPONENTS OF THE SELECTED REMEDY

The major components of the selected remedy include the following:

- Treat the "hot spot" through HVE of soil vapor and groundwater in the perched and shallow zones to prevent the main threat from continuing as a source of contamination to groundwater. Soil vapors extracted from the "hot spot" soil will be treated as necessary to meet state and federal air quality standards before release to the atmosphere. Extraction wells will be placed in areas of highest contamination and operated until state and federal MCLs and risk-based criteria are achieved in the "hot spot";

- Treat extracted groundwater through air stripping to achieve state and federal MCLs before discharge;

- Allow natural attenuation of groundwater contamination in areas outside the "hot spot";

- Evaluate and modify the treatment system as necessary to optimize effectiveness in achieving RAOs;

- Monitor groundwater measurements to determine the attainment of RAOs and to detect and thoroughly characterize possible DNAPL. Duration of the HVE system is expected to be from seven years to 12 years for soil and shallow groundwater in the "hot spot" and 150 years for natural attenuation of remaining groundwater to meet state and federal MCLs and risk-based criteria;

- Evaluate the effectiveness of the HVE system to meet long-term restoration goals during initial implementation;

- Conduct Treatability Studies to evaluate innovative technologies with potential to enhance the remedial action, and implement successful innovative technologies if the initial remedy proves ineffective; and

- Maintain institutional controls, including restrictions governing site access, construction, and well development, as long as hazardous substances remain at levels that preclude unrestricted use on site. Implement restrictions on groundwater until contaminant levels are below state and federal MCLs and risk-based criteria.

The Army shall establish and maintain institutional controls, including restrictions governing site access, construction, road and utility maintenance, and well development (except as such wells may be required by this remedial action), as long as hazardous substances remain on site at levels that preclude unrestricted use. The Army shall implement restrictions on groundwater use until contaminant levels are below federal and state MCLs throughout the site. The Army shall ensure compliance with the institutional controls in place at the facility, because noncompliance violates a requirement of this ROD, and therefore violates a requirement of the FFA between the Army, EPA, and ADEC. The institutional controls strategy includes the following:

- To ensure long-term effectiveness of this remedy, permanent implementation processes and policies for implementing institutional controls at the site shall be developed for the period of time that the Army is in control of the real property upon which these institutional controls will be effective and during the time, if any, that the real property may be transferred to another federal agency's responsibility and control. Such processes and policies will be developed through joint EPA, ADEC, and Army negotiations. It is intended that once these implementation processes and policies are in place, this ROD will be revised to incorporate such implementation processes and policies;

- The Army shall conduct an annual review of the institutional controls being implemented by the Army for this site and shall assess, among other things, the effectiveness of the institutional controls based on a visual "walk-through" of the areas of the site where the institutional controls are in effect and a review of the documents that implement the institutional controls; and

- The Army shall notify EPA and ADEC in the event that Fort Richardson property is identified as excess to the Army's needs while hazardous substances remain at or above levels that preclude unrestricted use, and before actual transfer of land management responsibilities to another federal agency or department.

7.2 AGENCY REVIEW OF THE SELECTED REMEDY

Tables 5-1 and 5-2 present the RAOs for groundwater and soil, respectively. The goal of this remedial action is to restore groundwater to its beneficial use. While the long-term goal of the remedial action is to return all the groundwater within and outside of the source area ("hot spot") to state and federal MCLs and risk-based criteria, active remediation will be considered complete when concentrations within the "hot spot" are below remediation goals for three continuous quarters after remedy shutdown and the plume is not expanding. 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 will achieve this goal. Groundwater monitoring data will be reviewed regularly to assess the progress made by the selected remedy toward the cleanup levels, and will continue in the downgradient portion of the plume until state and federal MCLs are achieved over three consecutive quarters and until subsequent soil borings show that RAOs are met after remedy shutdown and the plume is not expanding.

Because the remedy will result in hazardous substances remaining above regulatory levels on site, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment, and will continue for five-year increments until the remedy is complete. After five years of implementation, if monitoring and performance data indicate that the selected remedy and any enhancements to the remedy are not effectively reducing and controlling contamination at the site, then remedial objectives may be re-evaluated. As part of this evaluation, a Technical Impracticability (TI) Waiver may be sought by the Army. The TI Waiver would be granted by EPA if data demonstrate that available remedial technologies cannot attain the RAOs established in this ROD, based on the complexities of the contaminants and hydrogeology at Poleline Road.

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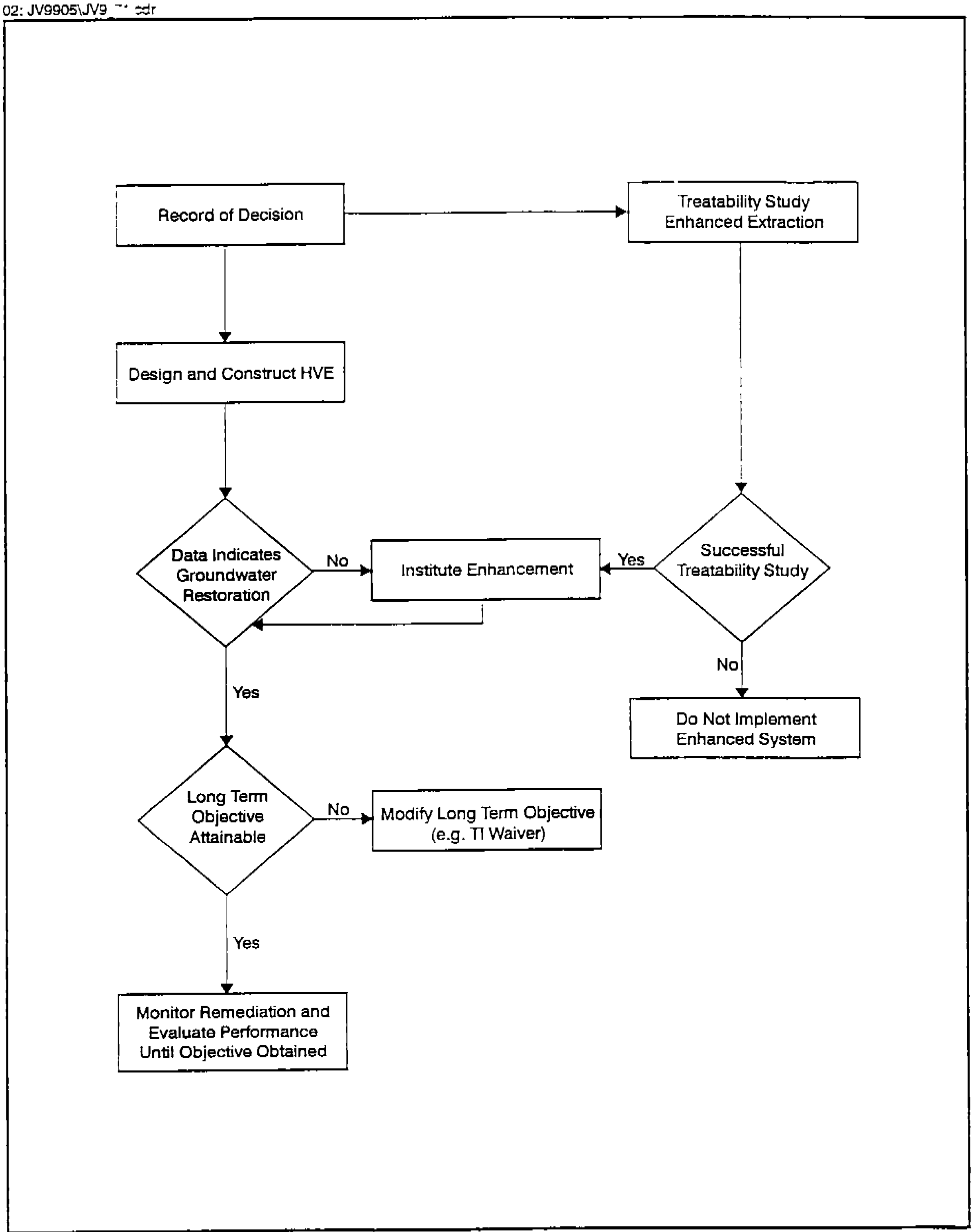

Figure 7-1 **REMEDY IMPLEMENTATION STRATEGY POLELINE ROAD DISPOSAL AREA**

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 the Superfund Amendments and Reauthorization Act of 1986, 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 alternative for OU-B will provide long-term protection of human health and the environment and satisfy the requirements of Section 121 of CERCLA.

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 HVE 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, and to ensure the effectiveness of the remedy.

Institutional controls will be in place to eliminate the threat of exposure to contaminated soils and groundwater until cleanup levels are achieved.

No unacceptable short-term risks will be caused by implementation of the remedy.

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

The selected remedy for OU-B will comply with all ARARs 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 waiver of any ARAR is being sought or invoked for any component of the selected remedy.

8.2.1 Applicable or Relevant and Appropriate Requirements

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, address 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 usually are 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 usually are 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 on an as-appropriate basis 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 Requirements

- Federal Safe Drinking Water Act (40 Code of Federal Regulations [CFR] 141) and Alaska Drinking Water Regulations (18 Alaska Administrative Code [AAC] 80): The state and federal 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. For the constituents of concern at OU-B, state and federal MCLs are equal; and
- AWQS (18 AAC 70): Alaska Water Quality Standards for Protection of Class (1)(A) Water Supply is applicable to the source area, and Class (1)(B) Water Recreation and Class (1) Aquatic Life and Wildlife (18 AAC 70) are applicable to surface water. Many of the constituents of groundwater regulated by AWQS are identical to state and federal MCLs.

8.2.3 Location-Specific Requirements

- Clean Water Act Section 404: Section 404 of the Clean Water Act, which is implemented by EPA and the Army through regulations found in 40 CFR 230 and 33 CFR 320 to 330, prohibits the discharge of dredged or fill materials into waters of the United States without a permit. This statute is relevant and appropriate to the protection of wetlands adjacent to Poleline Road;

- Army Regulation (AR) 200-2 (Environmental Quality), Environmental Effects of Army Actions: This regulation states Department of the Army policy, assigns responsibilities, and establishes procedures for the integration of environmental considerations into Army planning and decision making in accordance with 42 United States Code (USC) 4321 et seq., *National Environmental Policy Act of 1969*; the Council on Environmental Quality regulations of November 29, 1978; and Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*, January 4, 1979; and

- AR 210-20 (Master Planning for Army Installations): This regulation explains the concept of comprehensive planning and establishes policies, procedures, and responsibilities for implementing the Army Installation Master Planning Program. It also establishes the requirements and procedures for developing, submitting for approval, updating, and implementing the Installation Master Plan.

8.2.4 Action-Specific Requirements

- Federal Clean Air Act (42 USC 7401), as amended, is applicable for venting contaminated vapors;

- RCRA (42 USC 6939b[b]) states that contaminated groundwater cannot be injected unless: 1) being done as part of an action under Section 104 or 106 of CERCLA; 2) the contaminated groundwater is treated to "substantially reduce" hazardous constituents before reinjection; and 3) such response action will protect human health and the environment. The selected remedy employs extraction, treatment, and reinjection that substantially improve the condition of the aquifer and meet the substantive intent of this section of RCRA;

- The Safe Drinking Water Act, Underground Injection Control Program, (40 CFR 144) prohibits the movement of contminated fluid into underground sources of drinking water. However, the act makes a provision for reinjection of treated groundwater into the same aquifer from which it was drawn pursuant to an action under CERCLA (40 CFR 144.13[c]);

- RCRA (40 CFR 261, 262, 263, 264, and 268): Applicable for identifying, storing, treating, and disposing of hazardous waste;

- Alaska Wastewater Disposal Regulations (18 AAC 72). Section 72.600 addresses the requirements for engineering plans for treatment of wastewater (extracted groundwater), and Section 72.900 addresses permit requirements for operation of wastewater treatment systems; and

- Alaska Air Quality Control Regulations (18 AAC 50): Although on-site 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 stripping and SVE.

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 Petroleum Cleanup Draft Guidance* will be used as a TBC for cleanup of petroleum contamination in soils.

8.3 COST EFFECTIVENESS

The selected remedy provides an overall effectiveness proportionate to its cost, such that it represents a reasonable value for the money spent.

8.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The Army, State of Alaska, and EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner at OU-B. 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 remedy provides 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.

The selected remedy would use readily available technologies and would be feasible to construct. The installation of HVE systems will be focused on the areas of highest soil contamination.

HVE in conjunction with air stripping provides a permanent solution by eliminating the source of contaminants and treating the off-site migration pathway.

8.5 PREFERENCE FOR TREATMENT AS A MAIN ELEMENT

The selected remedy for OU-B satisfies the statutory preference for treatment of soil and groundwater by utilizing treatment as a main method to permanently reduce the toxicity, mobility, and volume of contaminated soil and groundwater.

9.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy for OU-B is the same as the preferred alternative. No changes in the components of the preferred alternative have been made.

APPENDIX A

ADMINISTRATIVE RECORD INDEX

Fort Richardson, Alaska Administrative Record Index Update, 1997

Page Numbers	OU	Cat No	Date	Title	Abstract	Author	Recipient
00001 00002 OU-A Book I	A	1.1	12/31/89	DERP Program Review, Army Installation Restoration Program, FTW-D-007, Fort Richardson PRE78 PCB Spill	Description, history, list of contaminants, mode of cleanup, status, issues and concerns, milestones, and funding of the Roosevelt Road Transmitter Site	Army	None Given
00003 00004 OU-A Book I	A	1.1	12/31/89	DERP Program Review, Army Installation Restoration Program, WN-D-007, FTW-D-006, and GR-D-001, Fire Burn Pits	Description, history, list of contaminants, mode of cleanup, status, issues and concerns, milestones, and fund status of the two fire burn pits at Fort Richardson.	Army	None Given
00005 00007 OU-A Book I	A	1.1	7/6/90	DERP Program Review, Army Installation Restoration Program, FTW-D-007, Fort Richardson PRE78 PCB Spill	Description, history, list of contaminants, mode of cleanup, status, issues and concerns, milestones, and fund status of the Roosevelt Road Transmitter Site.	Army	None Given
00008 00010 OU-A Book I	A	1.1	7/6/90	DERP Program Review, Army Installation Restoration Program, WN-D-007, FTW-D-006, and GR-D-001, Fire Burn Pits	Description, history, list of contaminants, mode of cleanup, status, issues and concerns, milestones, and fund status of the two fire burn pits at Fort Richardson.	Army	None Given
00011 00049 OU-A Book I	A	1.2.3	6/24/87	Roosevelt Road Transmitter Site Cleanup Plan	Background information for the site cleanup plan for the Roosevelt Road Transmitter Site.	Alexander Johnston USAED Alaska	None Given
00050 00095 OU-A Book I	A	1.2.3	4/15/88	Sampling Plan for the Investigation of PCB-Contaminated Soil at the Roosevelt Road, Fort Richardson Transformer Site	General guidance for safe conduct while sampling hazardous and toxic wastes at the Roosevelt Road Transmitter Site	USAED Alaska	None Given

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Page Numbers	OU	Cat No	Date	Title	Abstract	Author	Recipient
00096 00159 OU-A Book 1	A	1.2.3	8/21/90	Final Roosevelt Road Transmitter Site, A/E QC Plan, Fort Richardson, Anchorage, Alaska	Describes monitoring procedures for sampling, field measurement, and sample analysis activities to be performed during the project to obtain defensible chemical data.	E & E	Eddie Brooks USAED Alaska
00160 00268 OU-A Book 1	A	1.2.3	8/15/92	Fire Training Pits Work Plan, Part I, Ft. Richardson and Ft. Greely	Part I includes the sampling and analysis plan and QA/QC plan for the Fire Training Pits investigation	E & E	David Williams USAED Alaska
00269 00330 OU-A Book 1	A	1.2.3	8/15/92	Fire Training Pits Work Plan, Part II, Subsurface Exploration Plan, Ft Richardson and Ft. Greely	Part II includes the procedures for drilling and collection of subsurface soil samples	E & E	David Williams USAED Alaska
00331 00385 OU-A Book 1	A	1.2.4	9/26/86	Phase I, Hazardous Waste Study No. 37-26-0725-87, Evaluation of Fire Training Pits, Fort Richardson, Alaska	Evaluation of the existence and extent of contamination released to the soil at the Fire Training Pits at Fort Wainwright, Fort Richardson, and Fort Greely	AEHA	Army
00386 00387 OU-A Book 1	A	1.2.4	6/15/88	Report of the Field Investigation Conducted at the Roosevelt Road PCB Area	Includes a description of the Roosevelt Road Transmitter Site sampling investigation undertaken from April 26 through May 4,1988.	Army	None Given
00388 00399 OU-A Book 1	A	1.2.4	10/15/90	Soil Quality Assessment, Building No. 986, Fort Richardson, Alaska	Presents results of soil quality assessment east of Building No. 986.	Shannon & Wilson	USAED Alaska

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Page Numbers	OU	Cat No	Date	Title	Abstract	Author	Recipient
00400 00710 OU A Book 2	A	1.2.4	4/1/91	Roosevelt Road Transmitter Site Investigation, Project Report	Presents the results of a site investigation follow up for the Roosevelt Road Transmitter Site and consists of the field investigation and remedial design; construction plans and specifications for remediation of PCB contamination were developed based on this investigation.	E & E	David Williams USAED Alaska
00711 00847 OU A Book 2	A	1.2.4	5/15/91	Environmental Assessment and Finding of No Significant Impact, Army Installation Restoration Program, Roosevelt Road Transmitter Site, Fort Richardson, Alaska	The EA performed in accordance with NEPA determined that no significant impacts would occur from the removal and disposal of contaminated soil from the site	Kenneth Northamer USAED Alaska	None Given
00848 01038 OU-A Book 3	A	1.2.4	2/12/92	Progress Report for the Confirmation of Fire Training Pits at Fort Richardson, Fort Wainwright, and Fort Greely, Alaska	Results of the investigation confirming the presence of Fire Training Pits at Fort Richardson, Fort Wainwright, and Fort Greely.	USAED Alaska	USAED Alaska
01039 01076 OU-A Book 3	A	1.2.4	2/26/93	Summary of Fieldwork and Chemical Data Report from November 1992 Sampling Effort, POL Lab Tank, Fort Richardson, Alaska	Water and sludge samples were collected from the POL Laboratory dry well to determine the concentrations and types of contamination present.	USAED Alaska	USAED Alaska
01077 01114 OU-A Book 3	A	1.2.4	2/26/93	Summary of Fieldwork and Chemical Data Report from November 1992 Sampling Effort, POL Lab Tank, Fort Richardson, Alaska	Summary of fieldwork and chemical data collected from the POL Laboratory tank,	Delwyn Thomas USAED Alaska	None Given
01115 01751 OU A Books 4&5	A	1.2.4	9/15/93	Site Investigation Project Report for Fire Training Pits at Fort Richardson and Fort Greely, Alaska	Methods for and results of investigations of Fire Training Pits; preliminary human health hazards are evaluated and remedial options presented.	E & E	USAED Alaska

Fort Richardson, Alaska Administrative Record Index Update, 1997

Page Numbers	OU	Cat No	Date	Title	Abstract	Author	Recipient
01752 01754 OU-A Book 5	A	1.2.5	7/7/93	Site Investigation Report for Fire Training Pits, Review Comments	ADEC review comments on the draft site investigation report for the Fire Training Pits at Fort Richardson and Fort Greely.	Louis Howard ADEC	Cristal Fosbrook DPW
01755 01759 OU-A Book 5	A	1.3.4	9/12/91	Summary of Soil Chemical Data, POL Lab, Fort Richardson, Alaska	Summary of fieldwork and sampling results for the POL underground storage tank at POL Laboratory Building No. 986.	Delwyn Thomas USAED Alaska	None Given
01760 01767 OU A Book 5	A	1.6	2/24/88	Installation Restoration Program Work Planned for the Roosevelt Road Polychlorinated Biphenyl (PCB) Site on Fort Richardson	Includes remedial alternatives for the Roosevelt Road Transmitter Site.	Alexander Johnston USAED Alaska	EPA
01768 01768 OU-A Book 5	A	1.6	1/19/90	Comments, Roosevelt Road Transmitter Site QC Plan, Sampling and Analysis Plan, and Subsurface Exploration Plan	EPA comments on the work plan.	Douglas Johnson EPA	Kenneth Northamer USAED Alaska
01769 01825 OU-A Book 5	A	2.1.3	2/4/91	Draft Work Plan, Part I, Sampling, Analysis, & QA/QC Plan for Petroleum Laboratory, Building 986, Fort Richardson, Alaska	Sampling, analysis, and QA/QC plans for determining soil contamination by POL products in the vicinity of the UST at the POL Laboratory.	USAED Alaska	None Given
01826 01898 OU-A Book 5	A	2.1.3	10/15/95	Final Approach Document, Remedial Investigation/Feasibility Study, OU-A, Fort Richardson, Alaska	Presents the overall approach for reporting RI and RA results, and establishes a preliminary framework for post-RI activities, including the FS and Record of Decision.	E & E	USAED Alaska

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01899 02024 OU A Book 5	A	2.1.4	2/15/90	Installation Restoration Program, Stage 1, Site No. 2, Roosevelt Road Transmitter Site, Final Report	Remediation process and confirmatory sampling and results for the Roosevelt Road Transmitter Site; Volume 2 of 6; the sampling and analysis plan for confirmatory sampling is included.	WWC	EAFB, DEH
02025 02155 OU A Book 6	A	2.1.4	2/15/90	Installation Restoration Program, Stage 1, Site No. 4, Fire Training Pits, Final Report	Soil gas investigation and qualitative RA of Fire Training Pits at Fort Wainwright, Fort Richardson, and Fort Greely; Volume 4 of 6.	WWC	EAFB, DEH
02156 02187 OU-A Book 6	A	2.1.4	9/12/91	Summary of Soil Chemical Data, POL Lab, Fort Richardson, Alaska	Includes results of chemical analyses for soil samples collected from within the POL Laboratory vicinity.	Delwyn Thomas USAED Alaska	USAED Alaska
02188 02360 OU-A Book 6	A	2.1.4	10/30/92	Laidlaw Environmental Services, Chemical QC Report, Roosevelt Road Transmitter Site, Phase II, PCB Remediation	Summary of soil excavation at the Roosevelt Road Transmitter Site Leachfield.	Sterling & Associates	USAED Alaska
02361 02362 OU-A Book 6	A	2.1.5	4/11/91	Remedial Options of Roosevelt Road Transmitter Site	Documents approval of the recommended remedial alternative of off-site landfilling of contaminated soil from the underground bunker at Roosevelt Road.	Edwin Ruff DEH	David Williams USAED Alaska
02363 02363 OU-A Book 6	A	2.1.5	11/13/95	Comments, October 1995 Approach Document for OU-A	Comments on the approach document for the OU-A RI/FS.	Louis Howard ADEC	Kevin Gardner DPW

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02364 02365 OU-A Book 6	A	2.1.5	11/20/95	Comments, OU-A Approach Document	Comments on the OU-A approach document.	Matthew Wilkening EPA	Kevin Gardner DPW
02366 02370 OU-A Book 6	A	2.1.5	12/7/95	Comments, Fort Richardson Background Study, and OU-A RI/FS Approach Document	Comments on the Fort Richardson background study, and the OU-A approach document.	Matthew Wilkening EPA	Kevin Gardner DPW
02371 02396 OU-A Book 6	A	2.5	3/4/91	Project Review Conference; Project No. FTW-D-007, Roosevelt Road Transmitter Site, Fort Richardson, Alaska, Pre-78 PCB Spill	Includes minutes of the February 8, 1991 subject review conference regarding Roosevelt Road.	Charles Bickley USAED Alaska	Cristal Fosbrook DPW
20282 20283 OU-A Book 9 '97 Update	A	3.1.2	3/7/96	Status report for the OU-A Remedial Investigation	Summarizes activities conducted by E&E during February and March 1996 and projects planned for the remainder of March and April 1996.	William Richards E & E	Ted Bales USAED Alaska
02397 02624 OU-A Books 7&8	A	3.1.3	4/10/90	Roosevelt Road Transmitter Site Work Plan, Fort Richardson, Anchorage, Alaska	Includes the sampling and analysis plan, QA/QC plan, subsurface exploration plan, and site health and safety plan for the field investigation of the Roosevelt Road Transmitter Site to aid in remediation planning.	E & E	USAED Alaska
02625 03029 OU-A Books 7&8	A	3.1.3	2/15/95	Management Plan Documents, Remedial Investigation/Feasibility Study, OU-A, Fort Richardson, Alaska	Management plan, sampling and analysis plan, QA project plan, site specific health and safety plan, and ARARs for the RI and FS of OU-A RI/FS at Fort Richardson.	E & E	USAED Alaska

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03030 03032 OU-A Book 8	A	3.1.3	6/16/95	Remedial Investigation, OU-A (OU-A) Ruff Road Fire Training Area; Proposed Changes to Sampling Strategy	Includes proposed changes to the sampling strategy at the Ruff Road Fire Training Area.	William Richards E & E	Ted Bales USAED Alaska
20284 20286 OU-A Book 9 '97 Update	A	3.1.3	1/8/96	Responses to Comments on the OU-A Approach Document	A response to comments prepared by CHPPM.	William Richards E & E	Ted Bales USAED Alaska
03033 03215 OU-A Book 8	A	3.1.4	8/17/92	Laidlaw Environmental Services, Chemical QC Report, Roosevelt Road Transmitter Site, PCB Remediation	Summary of soil sampling and contamination delineation at the Roosevelt Road Transmitter Site.	Sterling & Associates	USAED Alaska
03216 03241 OU-A Book 8	A	3.1.4	7/22/94	RI/FS Management Plan, OU-A: Review of Background Information	Review of background information for OU-A.	E & E	Ted Bales USAED Alaska
03242 03292 OU-A Book 8	A	3.1.4	8/18/94	RI/FS Management Plan: OU-A: Conceptual Site Models, Data Quality Objectives and Preliminary Applicable or Relevant and Appropriate Requirements, Letter Reports	Preliminary conceptual site models, data quality objectives, and ARARs for OU-A	E & E	Ted Bales USAED Alaska
03293 03306 OU-A Book 8	A	3.1.4	10/4/95	OU-A Soil Stockpile Results/Disposal	Results from soil sampling at the POL Laboratory indicate the drill cuttings are clean.	William Richards E & E	Ted Bales USAED Alaska

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20287 20642 OU-A Book 9 '97 Update	A	3.1.4	8/15/96	Final Baseline Human Health and Ecological Risk Assessment, OU-A, Fort Richardson, Alaska	The RA determines whether site-related contamination present at OU-A is a risk to public health and the environment.	E & E	USAED Alaska
20643 21612 OU-A Books 9-12 '97 Update	A	3.1.4	11/1/96	Final Remedial Investigation Report, OU-A, Fort Richardson, Alaska, Volume I: Report	Presents the results of the RI conducted at OU-A from May 1995 to October 1995 in accordance with the OU-A Management Plan.	E & E	USAED Alaska
03307 03307 OU A Book 8	A	3.1.5	8/1/94	Comments, RI/FS Management Plan, OU-A	Comments on the OU-A RI/FS management plan	Louis Howard ADEC	Kevin Gardner DPW
03308 03308 OU-A Book 8	A	3.1.5	8/9/94	Remedial Investigation/Feasibility Study, OU-A Management Plan, Fort Richardson, Alaska, Comments	Review comments on the OU-A management plan.	Matthew Wilkening EPA	Kevin Gardner DPW
03309 03312 OU-A Book 8	A	3.1.5	9/26/94	Remedial Investigation/Feasibility Study Management Plan, Conceptual Site Model and ARARs, Comments	Review comments on the OU-A management plan conceptual site model and ARARs.	Matthew Wilkening EPA	Kevin Gardner DPW
03313 03314 OU-A Book 8	A	3.1.5	9/26/94	RI/FS Management Plan: OU-A, Fort Richardson, Comments	Review comments on the OU-A management plan.	Louis Howard ADEC	Kevin Gardner DPW

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03315 03323 OU-A Book 8	A	3.1.5	10/3/94	RI/FS Management Plan: OU-A-ARARs, Fort Richardson, Comments	Review comments on the OU-A management plan ARARs	Louis Howard ADEC	Kevin Gardner DPW
03324 03325 OU-A Book 8	A	3.1.5	10/7/94	Response to Comments, RI/FS Management Plan, OU-A	A response to ADEC and EPA comments on the OU-A RI/FS management plan.	William Richards E & E	Ted Bales USAED Alaska
03326 03326 OU-A Book 8	A	3.1.5	11/10/94	Response to Comments, RI/FS Management Plan, OU-A	Response to ADEC's list of ARARs.	Albert Kraus DPW	Louis Howard ADEC
03327 03330 OU-A Book 8	A	3.1.5	11/10/94	RI/FS Management Plan: OU-A-ARARs, Fort Richardson, Comments	Review comments on the OU-A management plan ARARs.	Louis Howard ADEC	Kevin Gardner DPW
03331 03339 OU-A Book 8	A	3.1.5	12/2/94	OU-A, Remedial Investigation/Feasibility Study Management Plan, Comments	Review comments on the OU-A management plan.	Matthew Wilkening EPA	Kevin Gardner DPW
03340 03340 OU-A Book 8	A	3.1.5	2/22/95	Draft Final Management Plan for OU-A, Comments	Review comments on the OU-A draft final management plan.	Matthew Wilkening EPA	Kevin Gardner DPW

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03341 03341 OU-A Book 8	A	3.1.5	3/2/95	Management Plan: OU-A, Fort Richardson, February 1995	Documents the approval of the OU-A management plan.	Louis Howard ADEC	Kevin Gardner DPW
21613 21623 OU-A Book 12 '97 Update	A	3.1.5	2/28/96	OU-A Remedial Investigation/Feasibility Study; Ecological Risk Assessment; Measurement Species and Assessment End Points, Fort Richardson, Alaska	Presents a summary of the ecological end points to be used for the OU-A Ecological RA. The summary was prepared in response to comments on the OU-A Approach Document.	William Richards E & E	Ted Bales USAED Alaska
21624 21625 OU-A Book 12 '97 Update	A	3.1.5	4/19/96	Comments on Draft Remedial Investigation Report Plan, OU-A, March 1996, Fort Richardson, Alaska	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
21626 21628 OU-A Book 12 '97 Update	A	3.1.5	4/24/96	Comments on Draft OU-A Remedial Investigation, Fort Richardson, Alaska	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
21629 21635 OU-A Book 12 '97 Update	A	3.1.5	5/28/96	Draft OU-A RI Report Comments	Review Comments.	Arthur Lee CHPPM	Kevin Gardner DPW
21636 21643 OU-A Book 12 '97 Update	A	3.1.5	5/30/96	Comments on Draft Baseline Risk Assessment, OU-A, Fort Richardson, Alaska	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW

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21644 21644 OU-A Book 12 '97 Update	A	3.1.5	6/3/96	Comments on Draft Human Health and Ecological Risk Assessments, OU-A, April 1996, Fort Richardson, Alaska	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
21645 21647 OU-A Book 12 '97 Update	A	3.1.5	7/2/96	Draft Baseline HHRA and ERA, OU-A, April 1996	Review comments.	Arthur Lee Army	Kevin Gardner DPW
21648 21660 OU-A Book 12 '97 Update	A	3.1.5	10/1/96	Annotated review comments for OU-A, Draft-Final Remedial Investigation and Draft-Final Risk Assessment	Document contains E & E's responses to the Army, EPA, and ADEC's comments on the draft-final versions of the RI and Human Health RA/Ecological RA.	E & E	Ted Bales USAED Alaska
21661 21677 OU-A Book 12 '97 Update	A	4.0	1/3/96	Statement of Work, OU-A Feasibility Study, Fort Richardson, Alaska	Presents site background, contract objectives, description of tasks required from the contractor, completion schedule, discussion of the submittals, presentations required, the relationship of the contractor with the public, and the method of payment.	None Given	None Given
03342 03364 OU-A Book 8	A	4.2	6/15/91	Design Analysis for Remediation Project, Roosevelt Road Transmitter Site, Fort Richardson, Alaska	Summary of the design logic that forms the basis for decisions used in preparing the project plans and specifications for the site; the report contains information about engineering calculations, economic considerations, applicable standards of performance, project SOW, and design constraints	E & E	USAED Alaska
21678 21837 OU-A Book 12 '97 Update	A	4.2	11/1/96	Final Feasibility Study, OU-A, Ruff Road Fire Training Area, Fort Richardson, Alaska	Presents a summary of RI results, establishes remedial action objectives, identifies applicable remedial technologies, and provides a detailed analysis of remedial alternatives	E & E	USAED Alaska

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21854 21870 OU-A Book 13 '97 Update	A	4.3	10/23/96	Work Plan No.1, Proposed Plan for OU-A and OU-B	A draft presentation of cleanup alternatives for OU-A and OU-B.	William Richards E & E	Chris Roe USAED Alaska
21838 21853 OU-A Book 13 '97 Update	A	4.3	1/1/97	Proposed Plan for Remedial Action OU-A and OU-B, Fort Richardson, Alaska	The proposed plan presents cleanup strategies for OU-A and cleanup alternatives for OU-B at Fort Richardson	Army	Public
21871 21885 OU-A Book 13 '97 Update	A	4.4	7/18/96	Technical Memorandum, OU-A Feasibility Study, Task 2	Presents remedial action objectives, preliminary remediation goals, general response actions, technologies and process options, and remedial action alternatives for OU-A based on the RI and RA reports.	William Richards E & E	Ted Bales USAED Alaska
21886 21891 OU A Book 13 '97 Update	A	4.4	7/23/96	Resampling Groundwater Monitoring Wells for Dioxins/Furans at Ruff Road Fire Training Area, Fort Richardson, Alaska	An amendment to the OU-A RI/FS Management Plan addressing the resampling of five monitoring wells for polychlorinated dibenzo-p-dioxins/polychlorinated dibenzo-p-furans analyses at the RRFTA	Paul Cooley E & E	Ted Bales USAED Alaska
21892 21892 OU-A Book 13 '97 Update	A	4.5	7/30/96	Comments to Technical Memorandum Feasibility Study, Task 2, OU-A, Fort Richardson, Alaska	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
21893 21895 OU-A Book 13 '97 Update	A	4.5	8/7/96	Comments on OU-A Feasibility Study Technical Memorandum	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW

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21896 21897 OU-A Book 13 '97 Update	A	4.5	9/16/96	Comments to Draft Feasibility Study, OU-A, Ruff Road Fire Training Area	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
21898 21900 OU-A Book 13 '97 Update	A	4.5	9/30/96	Comments to Draft Feasibility Study, OU-A, Ruff Road Fire Training Area	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
21901 21917 OU-A Book 13 '97 Update	A	4.5	11/25/96	Annotated Comments to the Final Feasibility Study Reports, OU-A; Fort Richardson, Alaska	E & E's responses to comments from the Army, ADEC, and EPA on the draft FS report.	William Richards E & E	Ted Bales USAED Alaska
21918 21919 OU-A Book 13 '97 Update	A	4.5	11/27/96	Comments to Working Draft No. 2 of Proposed Plan for OU-A and OU-B, November 4, 1996	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
21920 21922 OU-A Book 13 '97 Update	A	4.5	12/6/96	Comments on Proposed Plan for OU-A and OU-B	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
21923 21923 OU-A Book 13 '97 Update	A	4.5	12/9/96	Comments on Proposed Plan for OU-A and OU-B	Review comments.	Robert York Army	Kevin Gardner DPW

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21924 21926 OU-A Book 13 '97 Update	A	4.5	12/10/96	Comments on OU-A FS, OU-B FS, OU A/B Proposed Plan	Review comments	Matt McAtee CHPPM	Kevin Gardner DPW
21927 21930 OU-A Book 13 '97 Update	A	4.5	12/17/96	Comments on OU A and OU B Proposed Plan	Review comments.	Michael Harada Army	Kevin Gardner DPW
21931 21934 OU-A Book 13 '97 Update	A	4.5	12/24/96	Comments on OU-A and OU-B Proposed Plan	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
03365 03366 OU-B Book 1	B	1.1	11/5/90	Fact Sheet: Poleline Road Disposal Area (PRDA)	Discusses investigative efforts at Poleline Road Disposal Area and potential further subsurface investigations.	Cristal Fosbrook DPW	None Given
03367 03371 OU-B Book 1	B	1.1	10/20/93	Chemical Event in Alaska	Information concerning the discovery of buried chemical warfare training materials at the Poleline Road Disposal Area.	Matthew Northrop Army	Jimmie Lackey Army
03372 03380 OU-B Book 1	B	1.1	10/27/93	Safety Concerns for PRDA Soil Storage	Presentation of chemical screening conducted to date and guidance regarding the chemical agents suspected at the site (Mustard and Lewisite).	Robert Wrentmore DPW	None Given

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03381 03460 OU-B Book 1	B	1.2.3	8/15/91	Poleline Road Disposal Area, Remedial Investigation Technical Plan	Presents the sampling design plan and the preliminary RA plan for the Poleline Road Disposal Area.	Robert Chesson ESE	None Given
03461 03489 OU-B Book 1	B	1.2.4	5/15/94	Reconnaissance Ground-Penetrating Radar and Electromagnetic Induction Surveys of the Poleline Road Site, Fort Richardson, Alaska	Evaluates subsurface conditions at the Poleline Road Disposal Area at Fort Richardson.	Daniel Lawson CRREL	USAED Alaska
03490 03710 OU-B Book 1	B	1.2.4	12/15/94	Poleline Road Disposal Area, Draft Final Report, Phase I & II	Work performed and findings of investigations at the Poleline Road Disposal Area.	OHM	USAED Alaska
03711 03751 OU-B Book 1	B	1.4	7/15/90	Poleline Road Disposal Area, Expanded Site Investigation, Fort Richardson, Alaska, Draft Accident Prevention Safety Plan	Site-specific safety plans for the expanded site investigation of Fort Richardson.	ESE	ATHAMA
03752 03966 OU-B Book 2	B	1.4	2/15/91	Poleline Road Disposal Area, Expanded Site Investigation, Fort Richardson, Alaska	Provides results of the investigation of source area contaminants and categorizes the nature of any releases and/or potential threats to human health and the environment.	ESE	ATHAMA
03967 04028 OU-B Book 2	B	1.4	9/24/91	Poleline Road Disposal Area, Remedial Investigation, Fort Richardson, Alaska, Technical Plan	Plans for the initial investigation of contamination at the Poleline Road source areas to assess the potential threats to human health and the environment and to make recommendations regarding potential remedial actions.	ESE	ATHAMA

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04029 04055 OU B Book 2	B	1.4.2	8/8/95	Geophysical Investigation of the PRDA	Draft final report summarizing a series of geophysical investigations at the Poleline Road Disposal Area conducted to delineate the locations of suspected buried hazardous materials.	CRREL	DPW
04056 04081 OU-B Book 2	B	1.5	8/24/90	Surface Geophysical Investigation, United States Army Fort Richardson Facility, Anchorage, Alaska	Three surface geophysical investigative methods were used to help detect the possible presence of materials and/or objects buried in the shallow subsurface of the study area.	ESE	None Given
04082 04082 OU-B Book 2	B	1.6	12/14/89	Notification to USEPA of the Poleline Road Disposal Area	Written notification to EPA regarding the discovery of a possible past contamination site near Poleline Road.	Kenneth Northamer USAED Alaska	Douglas Johnson EPA
04083 04083 OU-B Book 2	B	1.6	1/19/90	Review Comments on the Poleline Road Disposal Site, Expanded Site Investigation	Review comments on the Poleline Road Disposal Area expanded site investigation.	Douglas Johnson EPA	Kenneth Northamer USAED Alaska
04084 04085 OU-B Book 2	B	1.6	8/24/90	Interview with Mr. Paul Roseland	Interview with Paul Roseland regarding the types and locations of chemicals disposed of at Poleline Road.	Catherine Scott DPW	None Given
04086 04088 OU-B Book 2	B	2.1.2	10/3/93	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-9/23/93 through 10/3/93.	Larry Hudson OHM	USAED Alaska

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04089 04090 OU B Book 2	B	2.1.2	10/17/93	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-10/10/93 through 10/17/93.	Larry Hudson OHM	USAED Alaska
04091 04093 OU-B Book 2	B	2.1.2	10/24/93	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-8/21/93 through 8/24/93.	Larry Hudson OHM	USAED Alaska
04094 04095 OU B Book 2	B	2.1.2	7/23/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-7/5/94 through 7/23/94.	Larry Hudson OHM	USAED Alaska
04096 04098 OU-B Book 2	B	2.1.2	7/30/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-7/23/94 through 7/30/94.	Larry Hudson OHM	USAED Alaska
04099 04101 OU-B Book 2	B	2.1.2	8/4/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-8/1/94 through 8/4/94.	Larry Hudson OHM	USAED Alaska
04102 04106 OU-B Book 2	B	2.1.2	8/13/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-8/9/94 through 8/13/94.	Larry Hudson OHM	USAED Alaska

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04107 04111 OU-B Book 2	B	2.1.2	8/20/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-8/15/94 through 8/20/94.	Larry Hudson OHM	USAED Alaska
04112 04116 OU-B Book 2	B	2.1.2	8/27/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-8/22/94 through 8/27/94.	Larry Hudson OHM	USAED Alaska
04117 04120 OU-B Book 2	B	2.1.2	9/1/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-8/29/94 through 9/1/94.	Larry Hudson OHM	USAED Alaska
04121 04123 OU-B Book 2	B	2.1.2	9/10/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-9/7/94 through 9/10/94.	Larry Hudson OHM	USAED Alaska
04124 04127 OU-B Book 2	B	2.1.2	9/17/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-9/12/94 through 9/17/94.	Larry Hudson OHM	USAED Alaska
04128 04131 OU-B Book 2	B	2.1.2	9/24/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-9/19/94 through 9/24/94.	Larry Hudson OHM	USAED Alaska

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04132 04133 OU-B Book 2	B	2.1.2	9/29/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-9/26/94 through 9/29/94.	Larry Hudson OHM	USAED Alaska
04134 04138 OU B Book 2	B	2.1.2	10/8/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-10/4/94 through 10/8/94.	Larry Hudson OHM	USAED Alaska
04139 04140 OU-B Book 2	B	2.1.2	10/15/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-10/10/94 through 10/15/94.	Larry Hudson OHM	USAED Alaska
04141 04143 OU-B Book 2	B	2.1.2	10/21/94	Rapid Response Weekly Report	Weekly report for the Poleline Road removal action-10/17/94 through 10/21/94.	Larry Hudson OHM	USAED Alaska
04144 04145 OU-B Book 2	B	2.1.3	10/8/93	Letter with proposed plan for chemical warfare munitions cleanup at Poleline Road	Letter with proposed plan for chemical warfare munitions cleanup at Poleline Road.	Hud Heaton Army	Teresa Cansler USAED Alaska
04146 04823 OU-B Books 3&4	B	2.1.3	5/15/94	Poleline Road Disposal Area, Field Operations Work Plan	Work plan for remedial activities to be performed at the Poleline Road Disposal Area.	Larry Hudson OHM	USAED Alaska

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04824 04825 OU-B Book 4	B	2.1.3	5/16/94	Poleline Road GPR Report	Summary of excavation plans for the Poleline Road Disposal Area.	Kevin Gardner DPW	Matthew Wilkening EPA
04826 05462 OU-B Book 5	B	2.1.3	5/27/94	Poleline Road Disposal Area, Phase 2-Continuation of the Removal Action, Project Work Plan	Field operations work plan; site specific health and safety plan; environmental protection plan; sampling and analysis plan; and packaging, transportation, and storage plan for the removal action at the Poleline Road Disposal Area.	Larry Hudson OHM	USAED Alaska
05463 05467 OU-B Book 5	B	2.1.3	9/29/94	Additional Excavation at Poleline Road Disposal Area	Modifications in the site work and safety plan for additional removal work at the Poleline Road Disposal Area.	Albert Kraus DPW	None Given
05468 05468 OU-B Book 6	B	2.1.5	9/3/93	Project Work Plan for Poleline Road Disposal Area, Comments	Approval of the work plan for the Poleline Road Disposal Area.	Louis Howard ADEC	Douglas Johnson EPA
05469 05470 OU-B Book 6	B	2.1.5	9/7/93	Project Work Plan, Rapid Response Removal Action, Poleline Road Disposal Area, Comments	EPA comments on the project work plan for the Poleline Road Disposal Area.	Matthew Wilkening EPA	Juanita Gwin USAED Alaska
05471 05471 OU-B Book 6	B	2.1.5	2/22/94	Poleline Road Disposal Area Work and Health and Safety Plans, Comments	Review comments on the Poleline Road Disposal Area work and health and safety plans.	Louis Howard ADEC	Douglas Johnson EPA

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05472 05474 OU-B Book 6	B	2.1.5	2/24/94	Poleline Road Disposal Area Work and Health and Safety Plans, Comments	Review comments on the Poleline Road Disposal Area work and health and safety plans.	Matthew Wilkening EPA	Douglas Johnson EPA
05475 05480 OU-B Book 6	B	2.1.5	3/9/94	Poleline Road Disposal Area Work and Health and Safety Plans, Comments	Review comments on the Poleline Road Disposal Area work and health and safety plans.	Louis Jackson ANSCM	Teresa Cansler USAED Alaska
05481 05481 OU-B Book 6	B	2.1.5	5/13/94	Review Comments on McLarn Hart's Low Temperature Thermal Desorption Process for the Excavated Soils at Poleline Road	Review comments on McLarn Hart's LTTD process for the excavated soils at the Poleline Road Disposal Area.	Matthew Wilkening EPA	Kevin Gardner DPW
05482 05485 OU-B Book 6	B	2.1.5	5/13/94	Review Comments on the Draft Final Workplan for the Poleline Road Disposal Area	Review comments on the Poleline Road Disposal Area draft final work plan.	Louis Jackson ANSCM	Teresa Cansler USAED Alaska
05486 05486 OU-B Book 6	B	2.1.5	2/13/95	Comments, PRDA, Phase I & II, Draft Final, January 1995	Comments on the Poleline Road Disposal Area report.	Louis Howard ADEC	Kevin Gardner DPW
05487 05489 OU-B Book 6	B	2.1.5	6/17/95	Rapid Response Weekly Report	Weekly Report for the Poleline Road Disposal Area removal action, June 1 through June 17, 1995.	Larry Hudson OHM	USAED Alaska

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05490 05491 OU-B Book 6	B	2.1.5	7/1/95	Rapid Response Weekly Report	Update of field activities from June 19 to July 1,1995, for the Poleline Road Disposal Area removal action.	Larry Hudson OHM	USAED Alaska
05492 05504 OU B Book 6	B	2.1.5	7/15/95	Response to Comments, Excavation of the Poleline Road Disposal Area	Response to EPA, Army, and ADEC comments on the excavation report.	OHM	USAED Alaska
21935 22162 OU-B Book 9 '97 Update	B	2.2	8/1/96	Draft EE/CA for the Treatment and Disposal of Chemical Agent Identification Sets Recovered from the PRDA, Fort Richardson, Alaska	An EE/CA to identify objectives of a removal action and to analyze various alternatives that maybe used to satisfy these objectives for cost, effectiveness, and implementation.	USAED Alaska	None Given
05505 05506 OU-B Book 6	B	2.3	10/26/93	Poleline Road Disposal Area, Fort Richardson, Alaska	Chemical agent situation at the Poleline Road Disposal Area.	Robert Wrentmore DPW	John Sandor ADEC
05507 05508 OU B Book 6	B	2.5	10/7/93	Suspect Chemical Warfare Material at Fort Richardson, Alaska	Guidance for proceeding with the soil removal at the Poleline Road Disposal Area.	Louis Jackson ANSCM	Douglas Johnson EPA
05509 05509 OU-B Book 6	B	2.5	5/9/94	April 1994 Draft Final Project Workplan Phase 2 - Continuation of the Removal Action Poleline Road Disposal Site, OHM Project No. 14925RI	Documents approval of the April 1994 draft final project workplan phase 2, continuation of the removal action at Poleline Road Disposal Area, OHM Project No. 14925RI.	Louis Howard ADEC	Kevin Gardner DPW

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22163 22183 OU-B Book 9 '97 Update	B	3.1	4/22/96	Technical Memorandum, Remedial Alternatives Development and Screening, OU-B, Feasibility Study, Fort Richardson, Alaska	Presents draft remedial alternatives for the OU-B FS.	WWC	USAED Alaska
22184 22185 OU-B Book 9 '97 Update	B	3.1.1	10/22/96	Scope of Work Mod. #3, OU-B FS	Scope modification to delete production of FS and addition of air sparging as an alternative for the OU-B FS	None Given	None given
05510 05906 OU-B Book 7	B	3.1.3	3/15/95	Remedial Investigation Management Plan, OU-B, Poleline Road Disposal Area, Fort Richardson, Alaska	Plans to conduct the RI to characterize the nature and extent of contamination, obtain data for RA, and evaluate remedial alternatives.	WWC	USAED Alaska
05907 05939 OU-B Book 8	B	3.1.3	8/15/95	Ecological Risk Approach Document, OU-B, PRDA	An approach document for developing the OU-B Poleline Road Disposal Area ecological RA.	WWC	USAED Alaska
05940 05957 OU-B Book 8	B	3.1.4	6/15/94	Finding of No Significant Impact and Environmental Assessment, Poleline Road Removal Action, Fort Richardson, Alaska	FONSI and EA for the soil removal action at the Poleline Road Disposal Area.	USAED Alaska	None Given
05958 05980 OU-B Book 8	B	3.1.4	10/19/94	Existing Data Report: OU-B Remedial Investigation Management Plan	Review of existing data for the Poleline Road Disposal Area.	WWC	Teresa Cansler USAED Alaska

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05981 05990 OU-B Book 8	B	3.1.4	11/2/94	ARARs and TBCs Letter Report: OU-B Remedial Investigation Management Plan	Applicable or relevant, and appropriate requirements and regulations to be considered for the Poleline Road Disposal Area.	WWC	Teresa Cansler USAED Alaska
05991 06021 OU-B Book 8	B	3.1.4	11/2/94	CSM and DQO Letter Report: OU-B Remedial Investigation Management Plan	Conceptual site models and data quality objectives for the Poleline Road Disposal Area.	WWC	Teresa Cansler USAED Alaska
06025 06032 OU-B Book 8	B	3.1.4	12/7/95	Human Health Risk Assessment Approach Document, OU-B	Planned approach for conducting the human health RA for OU-B	WWC	Kevin Gardner DPW
22186 22193 OU-B Book 9 '97 Update	B	3.1.4	1/24/96	Quarter 1 Groundwater Elevation Report, OU-B Remedial Investigation	Presents results of first quarter monthly groundwater level measurements at the Poleline Road Disposal Area	Sally Rothwell WWC	Andrea Elconin USAED Alaska
22195 22202 OU-B Book 9 '97 Update	B	3.1.4	4/23/96	Quarter2 Groundwater Elevation Report, OU-B Remedial Investigation	Presents results of second quarter monthly groundwater level measurements at the Poleline Road Disposal Area.	Sally Rothwell WWC	Andrea Elconin USAED Alaska
22203 22424 OU-B Books 9&10 '97 Update	B	3.1.4	9/1/96	Final Remedial Investigation Report, OU-B, Poleline Road Disposal Area, Fort Richardson, Alaska, Volume I	This document summarizes the RI at the Poleline Road Disposal Area and describes the methodologies and results of field investigations conducted for soil, groundwater.	WWC	USAED Alaska

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22425 23057 OU B Books 10 12 '97 Update	B	3.1.4	9/1/96	Final Remedial Investigation Report, OU B, Poleline Road Disposal Area, Fort Richardson, Alaska, Volume II, Appendices	Volume II contains RI Report that include field logs, boring logs and monitoring well completion logs, survey data, QA reports, analytical data, a Statement of Work on-site mustard gas screening, geophysical surveys and an investigation report, groundwater fate and transport modeling report, and quarterly groundwater elevation reports.	WWC	USAED Alaska
23058 23398 OU-B Book 12 '97 Update	B	3.1.4	9/1/96	Final Risk Assessment Report, OU-B, Poleline Road Disposal Area, Fort Richardson, Alaska	This report contains a Baseline Human Health RA and Ecological RA for the Poleline Road Disposal Area.	WWC	USAED Alaska
06033 06033 OU-B Book 8	B	3.1.5	11/9/94	Existing Documents Letter Report OU-B RI Management Plan-Comments	Review comments on the existing data letter reports for the Poleline Road Disposal Area.	Louis Howard ADEC	Kevin Gardner DPW
06034 06042 OU-B Book 8	B	3.1.5	11/10/94	ARARs and TBCs, CSM and DQO Letter Reports, OU-B RI Management Plan, Comments	Review comments on the applicable or relevant and appropriated requirements and regulations to be considered, conceptual site model and data quality objective letter reports for the Poleline Road Disposal Area	Louis Howard ADEC	Kevin Gardner DPW
06043 06044 OU-B Book 8	B	3.1.5	11/10/94	ARARs and TBCs, CSM and DQO Letter Reports, OU-B RI Management Plan, Comments	Review comments on the conceptual models, applicable or relevant and appropriate requirements, and regulations to be considered for the Poleline Road Disposal Area.	Matthew Wilkening EPA	Kevin Gardner DPW
06045 06047 OU-B Book 8	B	3.1.5	1/6/95	OU-B, Remedial Investigation Draft Management Plan, Comments	Review comments on the management plan for the Poleline Road Disposal Area.	Louis Howard ADEC	Kevin Gardner DPW

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06085 06096 OU-B Book 8	B	3.1.5	1/11/95	Poleline Road, Remedial Investigation, Draft Final Management Plan, Comments	Review comments on the Poleline Road Disposal Area RI draft final management plan.	EPA	Sally Rothwell WWC
06048 06061 OU B Book 8	B	3.1.5	1/12/95	OU-B, Management Plan for the Remedial Investigation, Comments	Review comments on the management plan for Poleline Road Disposal Area.	Matthew Wilkening EPA	Kevin Gardner DPW
06062 06108 OU-B Book 8	B	3.1.5	2/21/95	Response to Comments, RI Management Plan, OU-B	Response to agency comments concerning the OU-B RI management plan.	Sally Rothwell WWC	Teresa Cansler USAED Alaska
06109 06112 OU B Book 8	B	3.1.5	3/27/95	Poleline Road, Remedial Investigation, Draft Final Management Plan, Comments	EPA comments on the Poleline Road Disposal Area draft final management plan.	EPA	Kevin Gardner DPW
06113 06113 OU-B Book 8	B	3.1.5	9/27/95	Comments, Ecological Risk Approach Document, OU-B	United States Army Center for Health Promotion and Preventive Medicine comments on the OU-B ecological risk approach document.	Jack Heller CHPPM	Kevin Gardner DPW
23399 23403 OU-B Book 12 '97 Update	B	3.1.5	1/10/96	Comments on OU-B Approach Document and OU-D Management Plan.	Comments include review comments on the OU-D Management Plan, OU-B Groundwater Modeling Approach Document, and the OU-B Baseline RA Approach Document.	Matthew Wilkening EPA	Kevin Gardner DPW

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23404 23405 OU B Book 12 '97 Update	B	3.1.5	1/16/96	Comments, OU-B Eco-Risk Approach Document	Review comments by EPA on OU-B Ecological Risk Approach Document.	Matthew Wilkening EPA	Kevin Gardner DPW
23406 23409 OU B Book 12 '97 Update	B	3.1.5	4/11/96	Meeting Minutes for OU-B Feasibility Study Scoping Meeting	Minutes for meeting discussing remedial action objectives for OU-B.	Scott Kendall WWC	Andrea Elconin USAED Alaska
23410 23411 OU-B Book 13 '97 Update	B	3.1.5	5/2/96	Comments on Draft Remedial Investigation Report and Risk Assessment, OU-B, March 1996, Fort Richardson, Alaska	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
23412 23422 OU-B Book 13 '97 Update	B	3.1.5	5/3/96	Comments on OU-B Remedial Investigation and Draft Final Management Plan	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
23423 23424 OU-B Book 13 '97 Update	B	3.1.5	5/15/96	Meeting Minutes, Pre review Conference, OU-B RI	Meeting to review comments on draft OU-B RI and RA reports prior to a meeting with ADEC and EPA	WWC	None Given
23425 23431 OU-B Book 13 '97 Update	B	3.1.5	5/21/96	Review Conference Minutes, Draft RI and RA Reports, OU-B, Fort Richardson, Alaska	Review conference concerning the Draft RI and RA Reports for OU-B.	Andrea Elconin USAED Alaska	None Given

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23432 23447 OU-B Book 13 '97 Update	B	3.1.5	5/23/96	Comments on Technical Memo: Remedial Alternatives Development, OU-B, Fort Richardson, Alaska	Comments include revised list of ARARs that should be considered.	Louis Howard ADEC	Kevin Gardner DPW
23448 23459 OU-B Book 13 '97 Update	B	3.1.5	5/31/96	Comments on Draft OU-B Remedial Investigation Report and Risk Assessment Report, Fort Richardson, Alaska, March 1996	Review comments.	Arthur Lee CHPPM	Kevin Gardner DPW
23460 23474 OU-B Book 13 '97 Update	B	3.1.5	6/19/96	Responses to Comments by Army CHPPM, Draft Remedial Investigation and Risk Assessment Reports, OU-B, Fort Richardson, Alaska	Response to comments.	WWC	USAED Alaska
23475 23483 OU-B Book 13 '97 Update	B	3.1.5	7/18/96	Analytical Results, Poleline Road Stockpile, Fort Richardson, Alaska	A memorandum characterizing the sampling effort to determine whether remediation is required of a 403-cubic-yard stockpile at Poleline Road. The chlorinated solvent concentrations were below the site cleanup levels.	Delwyn Thomas Army	Andrea Elconin USAED Alaska
23484 23488 OU-B Book 13 '97 Update	B	3.1.5	10/4/96	Comments on OU-B Draft Final RI, Draft Final RA, Draft Final FS	Review comments.	Arthur Lee CHPPM	Kevin Gardner DPW
23489 23491 OU-B Book 13 '97 Update	B	3.1.5	10/8/96	Response to comment, Draft Treatability Study Work Plan, OU-B	Response to ADEC and USAED Alaska Comments	WWC	None Given

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23492 23506 OU-B Book 13 '97 Update	B	3.1.5	10/9/96	Comments on the OU-B Technical Memo, Treatability Study Workplan	Review comments on the soil vapor extraction and air sparging technical memorandum.	Matthew Wilkening EPA	Kevin Gardner DPW
23507 23519 OU-B Book 13 '97 Update	B	3.2	10/8/96	Final Work Plan Technical Memorandum, Treatability Study, Pump Test and Intrinsic Remediation Parameters, OU-B, Fort Richardson, Alaska	Presents the field procedures for conducting an aquifer pump test and groundwater sampling for intrinsic remediaton parameters.	WWC	USAED Alaska
23520 23532 OU-B Book 13 '97 Update	B	3.2	10/30/96	Final Work Plan Addendum, Treatability Study Work Plan, Soil Vapor Extraction and Air Sparging	The OU-B draft FS identified a number of remedial alternatives. This Technical Memorandum discusses the field procedures for conducting a soil vapor extraction and air sparging pilot test at OU-B	WWC	USAED Alaska
23533 23533 OU B Book 13 '97 Update	B	3.3	10/1/96	Comments on OU B Treatability Study Workplan, Sept. 23, 1996	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
23534 23566 OU-B Book 13 '97 Update	B	4.2	6/17/96	Second Technical Memorandum, Detailed Analysis of Alternatives, OU-B, FS, Fort Richardson, Alaska	This document presents a detailed analysis of alternatives for the OU-B FS. The remedial action objectives are further refined from Technical Memorandum No 1 and are restated in this document.	WWC	USAED Alaska
23567 23791 OU-B Book 13 '97 Update	B	4.2	1/1/97	Final Feasibility Study Report, OU-B, Poleline Road Disposal Area	Presents remedial action objectives and alternatives for cleanup.	WWC	USAED Alaska

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21854 21870 OU-A Book 13 '97 Update	B	4.3	10/23/96	Work Plan No.1, Proposed Plan for OU-A and OU-B	A draft presentation of cleanup alternatives for OU-A and OU-B.	William Richards E & E	Chris Roe USAED Alaska
23792 23798 OU-B Book 14 '97 Update	B	4.5	1/10/96	Comments, OU-D Management Plan, OU-B Approach Document	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
23799 23802 OU-B Book 14 '97 Update	B	4.5	5/23/96	Comments on OU-B Technical Memorandum, Feasibility Study	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
23803 23818 OU-B Book 14 '97 Update	B	4.5	5/23/96	Comments, Technical Memorandum, OU-B Remedial Alternatives Development, OU B, May 1996	Review comments and list of ARARs.	Louis Howard ADEC	Kevin Gardner DPW
23819 23827 OU-B Book 14 '97 Update	B	4.5	6/24/96	Comments on Technical Memorandum No. 1, OU-B Feasibility Study	Review comments submitted by ADEC, EPA, and USAED Alaska.	Andrea Elconin Army	Kevin Gardner DPW
23828 23861 OU-B Book 14 '97 Update	B	4.5	6/24/96	Responses to Comments on Technical Memorandum No. 1, OU-B Feasibility Study, Fort Richardson, Alaska	Resonse to comments submitted by ADEC, EPA, and USAED Alaska.	WWC	Andrea Elconin USAED Alaska

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23862 23862 OU-B Book 14 '97 Update	B	4.5	6/25/96	Comments on Technical Memorandum #2: OU-B Detailed Analysis of Alternatives	Responses to EPA, ADEC, and Army comments on Technical Memorandum, No. 1, OU-B Feasibility Study, Fort Richardson, Alaska	Louis Howard ADEC	Kevin Gardner DPW
23863 23866 OU-B Book 14 '97 Update	B	4.5	7/22/96	Teleconference Minutes, OU-B Feasibility Study, Fort Richardson	A meeting discussing the comments to the Second Technical Memorandum, OU-B FS, Fort Richardson, Alaska.	WWC	Andrea Elconin USAED Alaska
23867 23878 OU B Book 14 '97 Update	B	4.5	8/7/96	Response to Comments on Technical Memorandum No. 2, OU-B FS	A response to comments from the Army, EPA, ADEC, and DPW.	Scott Kendall WWC	Andrea Elconin USAED Alaska
23879 23883 OU-B Book 14 '97 Update	B	4.5	8/26/96	Comments on OU-B FS Report	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
23884 23886 OU-B Book 14 '97 Update	B	4.5	8/29/96	Comments on OU-B Draft Final RI, RA, and FS Reports	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
23887 23890 OU-B Book 14 '97 Update	B	4.5	9/19/96	Review Conference Minutes, Draft Feasibility Study, OU-B, Fort Richardson, Alaska	Comments on the draft FS Report, OU-B, Fort Richardson, Alaska were discussed.	WWC	Andrea Elconin USAED Alaska

Page Numbers	OU	Cat No	Date	Title	Abstract	Author	Recipient
23891 23893 OU-B Book 14 '97 Update	B	4.5	10/1/96	Review Conference Minutes, Draft Feasibility Study, OU-B	Review conference minutes.	Scott Kendall WWC	Andrea Elconin USAED Alaska
23894 23901 OU-B Book 14 '97 Update	B	4.5	10/30/96	Response to Comments, OU-B Draft and Final Treatability Study Work Plan Addendum	Response to comments.	Scott Kendall WWC	Andrea Elconin USAED Alaska
23902 23917 OU-B Book 14 '97 Update	B	4.5	11/25/96	Annotated Comments to the Final Feasibility Study Reports, OU-A; Fort Richardson, Alaska	E & E's responses to comments from the Army, ADEC, and EPA on the draft FS report	William Richards E & E	Ted Bales USAED Alaska
21918 21919 OU-A Book 13 '97 Update	B	4.5	11/27/96	Comments to Working Draft No. 2 of Proposed Plan for OU-A and OU-B, November 4, 1996	Review comments.	Louis Howard ADEC	Kevin Gardner DPW
21920 21922 OU-A Book 13 '97 Update	B	4.5	12/6/96	Comments on Proposed Plan for OU-A and OU-B	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
21923 21923 OU-A Book 13 '97 Update	B	4.5	12/9/96	Comments on Proposed Plan for OU-A and OU-B	Review comments.	Robert York Army	Kevin Gardner DPW

Page Numbers	OU	Cat No	Date	Title	Abstract	Author	Recipient
21924 21926 OU-A Book 13 '97 Update	B	4.5	12/10/96	Comments on OU-A FS, OU-B FS, OU A/B Proposed Plan	Review comments	Matt McAtee CHPPM	Kevin Gardner DPW
21927 21930 OU-A Book 13 '97 Update	B	4.5	12/17/96	Comments on OU-A and OU-B Proposed Plan	Review comments.	Michael Harada Army	Kevin Gardner DPW
23918 23921 OU-B Book 14 '97 Update	B	4.5	12/24/96	Comments on OU-A and OU-B Proposed Plan	Review comments.	Matthew Wilkening EPA	Kevin Gardner DPW
06114 06119 OU-B Book 8	B	10.1	6/15/94	Poleline Road Questions from the Anchorage Daily News	Questions and responses about the Poleline Road Disposal Area.	Steve Rinehart Anchorage Daily News	Chuck Canterbury PAO
06120 06120 OU-B Book 8	B	10.3	6/8/94	Public Notice for an Environmental Assessment for removal of contaminated material from Poleline Road Disposal Area	Public notice for an EA for the removal of contaminated material from the Poleline Road Disposal Area.	Army	None Given
06121 06121 OU-B Book 8	B	10.3	6/18/95	Public Notice, PRDA, EE/CA	USAED Alaska public notice soliciting public comment on the engineering evaluation/cost analysis (EE/CA) for cleaning contaminated soil excavated from the Poleline Road Disposal Area	Chuck Canterbury PAO	None Given

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Page Numbers	OU	Cat No	Date	Title	Abstract	Author	Recipient
06122 06123 OU-B Book 8	B	10.6	11/13/89	Poleline Road Chemical Disposal Area	Background information about the Poleline Road Disposal Area.	Paul Steuke, Jr. Army	None Given
06124 06127 OU-B Book 8	B	10.6	2/6/90	Update on Eagle River Flats/Poleline Road Contaminated Site Studies, Fact Sheet	Includes a description of the initial identification of the Poleline Road Disposal Area.	Edwin Ruff DEH	William Gossweiler DPW
06128 06129 OU-B Book 8	B	10.6	2/8/90	Army Investigating Possible Old Chemical Disposal Site	Background and plans for the Poleline Road Disposal Area.	Army	None Given
06130 06131 OU-B Book 8	B	10.6	6/30/90	Fort Richardson's Poleline Road Disposal Area Expanded Site Investigation	Background and action taken at Poleline Road.	Steven Bird IRD	None Given
06132 06132 OU-B Book 8	B	10.6	10/2/93	Metal Tubes Found at Chemical Disposal Site	Presents information about two metal tubes discovered during removal of decontamination products at the Poleline Road Disposal Area.	PAO	None Given
06133 06134 OU-B Book 8	B	10.6	10/4/93	Metal Tubes from Disposal Site to be Stored on Post	Disposition of two metal cylinders uncovered at the Poleline Road Disposal Area.	PAO	None Given

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06135 06139 OU-B Book 8	B	10.6	10/6/93	Information Paper: Poleline Road Disposal Area	Current information regarding the Poleline Road Disposal Area remediation project.	DPW	Army
06156 06157 OU-B Book 8	B	10.6	5/13/94	Information Paper on the Poleline Road Disposal Area, Fort Richardson, Alaska	Letter to Frank Murkowski with attached Information Paper. Overview of Poleline Road Disposal Area history, recent actions, and future RI efforts	George Vakalis Army	Don Young US House of Representatives
06140 06153 OU-B Book 8	B	10.6	5/13/94	Information Paper on the Poleline Road Disposal Area, Fort Richardson, Alaska	Letter to Ted Stevens with attached Information Paper. Overview of Poleline Road Disposal Area history, recent actions, and future RI efforts.	George Vakalis Army	Ted Stevens US Senate
06154 06155 OU-B Book 8	B	10.6	5/13/94	Information Paper on the Poleline Road Disposal Area, Fort Richardson, Alaska	Letter to Don Young with attached Information Paper. Overview of Poleline Road Disposal Area history, recent actions, and future RI efforts.	George Vakalis Army	Frank Murkowski US Senate
06158 06159 OU-B Book 8	B	10.6	5/26/94	Eagle River Closure Update	Closure of portions of Eagle River because of remediation at the Poleline Road Disposal Area	Army	None Given
06160 06161 OU-B Book 8	B	10.6	6/15/95	Poleline Road Disposal Area, Fort Richardson, Alaska-Fact Sheet	Public comment announcement for the Poleline Road Disposal Area removal plan.	Army	None Given

APPENDIX B

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION FOR REMEDIAL ACTION AT OPERABLE UNIT A AND OPERABLE UNIT B FORT RICHARDSON, ALASKA

OVERVIEW

U.S. Army Alaska (the Army), the United States Environmental Protection Agency (EPA), and the Alaska Department of Environmental Conservation (ADEC), collectively referred to as *the Agencies*, distributed a Proposed Plan for remedial action at Operable Unit A (OU-A) and OU-B, Fort Richardson, Alaska. OU-A comprises three source areas: the Roosevelt Road Transmitter Site Leachfield; Ruff Road Fire Training Area; and Building 986 Petroleum, Oil, and Lubricant Laboratory Dry Well. OU-B consists of one site: the Poleline Road Disposal Area (Poleline Road).

The Proposed Plan identified preferred remedial alternatives for Poleline Road, the only site in OU-B. The three source areas in OU-A were not considered for remedial action in the Proposed Plan. The Army, EPA, and ADEC have determined that the sites included within OU-A will be addressed under the conditions of the State-Fort Richardson Environmental Restoration Agreement (Two-Party Agreement) between the Army and ADEC.

The major components of the remedial alternative for Poleline Road are:

- High-vacuum extraction of the chlorinated-solvent-contaminated "hot spot";
- Sitewide institutional controls;
- Natural attenuation of contaminants; and
- Long-term groundwater monitoring.

Two formal comments regarding the Proposed Plan for the OU-B remedial action were received during the public comment period; these comments are summarized and presented in this Responsiveness Summary.

BACKGROUND OF COMMUNITY INVOLVEMENT

The public was encouraged to participate in the selection of the final remedies for OU-A and OU-B during a public comment period from January 20 to February 18, 1997. The *Fort Richardson Proposed Plan for Remedial Action at Operable Unit A and Operable Unit B* presents six options considered by the Agencies to address contamination in soil and groundwater at OU-B. The Proposed Plan was released to the public on January 18, 1997, and copies were sent to all known interested parties, including elected officials and concerned citizens. Informational Fact Sheets, prepared quarterly since June 1995, provided information about the Army's entire cleanup program at Fort Richardson and were mailed to the addresses on the same mailing list.

The Proposed Plan summarizes available information regarding the OUs. Additional materials were placed into three information repositories: the University of Alaska Anchorage Consortium Library, Alaska Resources Library, and Fort Richardson 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 724 on Fort Richardson. 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 Richardson project manager; by calling a toll-free telephone number to record a comment; or by attending and commenting at a public meeting conducted on January 29, 1997, at the Russian Jack Chalet in Anchorage.

Basewide community relations activities conducted for Fort Richardson, which include OU-A and OU-B, have included:

- December 1994—Community interviews with local officials and interested parties;
- April 1995—Preparation of the Community Relations Plan;
- June 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Richardson;
- June 29, 1995—An informational public meeting covering all OUs;
- October 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Richardson;
- January 1996—Distribution of an informational Fact Sheet covering all OUs at Fort Richardson;
- March 1996—Establishment of information repositories at the University of Alaska Anchorage Consortium Library, Alaska Resources Library, and Fort Richardson Post Library, and the Administrative Record at Building 724 on Fort Richardson;
- March 14, 1996—An informational public meeting covering all OUs;
- April 1996—Distribution of an informational Fact Sheet covering all OUs at Fort Richardson;
- July 1996—Distribution of an informational Fact Sheet covering all OUs at Fort Richardson; and

- October 1996—Distribution of an informational Fact Sheet covering all OUs at Fort Richardson.

Community relations activities specifically conducted for OU-A and OU-B included:

- January 17, 19, 22, 24, and 26, 1997—Display advertisement announcing the public comment period in the *Anchorage Daily News*;

- January 23, 1997—Display advertisement announcing the public comment period and public meeting in the *Alaska Star*;

- January 25, 26, 27, 28, and 29, 1997—Display advertisement announcing the public meeting in the *Anchorage Daily News*;

- January 20, 1997—Distribution of the Proposed Plan for final remedial action at OU-A and OU-B;

- January 20 to February 18, 1997—Thirty-day public comment period. No extension was requested;

- January 20 to February 18, 1997—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 comment period; and

- January 29, 1997—Public meeting at the Russian Jack Chalet to provide information, a forum for questions and answers, and an opportunity for public comment regarding OU-A and OU-B.

SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

The public comment period on the Proposed Plan for remedial action at OU-A and OU-B was from January 20 to February 18, 1997. Two comments were received during the public comment period: one comment was mailed to the Army, and the second comment was recorded on the toll-free telephone line. These comments are summarized below.

1. **Public Comment:** A letter was received from a community member during the public comment period. The author indicates that after careful review of the Proposed Plan, he wants to be on the record as concurring with the Agencies' preferred alternative for OU-B.

   Agency Response: The Agencies appreciate input from community members.

2. **Public Comment:** The comment received on the toll-free telephone line acknowledged that the Proposed Plan was "nicely done" and that the presentation of the alternatives and discussion of the selection of the preferred alternative were "well supported, very well argued." However, the caller believes that although Alternative 6 will cost less than Alternative 4, Alternative 4 will "deal with the kind of contamination to the degree that it needs to be dealt with."

   Agency Response: The Agencies appreciate input from community members. The National Oil and Hazardous Substances Pollution Contingency Plan Groundwater Protection Strategy requires that current and potential future use of groundwater be considered in remedy selection, and that groundwater resources be protected and restored if necessary and practicable. During a rigorous evaluation of remedial alternatives, the Agencies carefully weighed all of the factors that influence the selection of a preferred alternative. Cost effectiveness, risk to human health and the environment, and compliance with state and federal water quality statutes were the key considerations used to evaluate the six alternatives. At the conclusion of the evaluation process, Alternative 6 was determined to provide the most effective balance of the three criteria listed above. The preferred alternative will be implemented in a phased approach because of the complexity of the contaminant characteristics and the hydrogeology at the site. The actual length of time necessary to remediate the "hot spot" and the groundwater plume depends largely on the success of each phase. However, because there is no current or projected use of the groundwater anticipated during the period of remediation required for Alternative 6, the potentially shorter time frame required for remediation under Alternative 4 does not provide additional protection.

APPENDIX C

FORT RICHARDSON
OPERABLE UNIT B SOURCE AREA
BASELINE COST ESTIMATES FOR REMEDIAL ALTERNATIVES

ESTIMATED COSTS - ALTERNATIVE 2
NATURAL ATTENUATION

ITEM	UNIT COST	UNIT	QUANTITY	COST
I. CAPITAL COSTS				
Additional Monitoring Well Installation	$40,000	well	2	$80,000
TOTAL CAPITAL REQUIREMENTS				**$80,000**
II. ANNUAL O&M COSTS				
Groundwater Monitoring				
Sampling Labor	$60	hr	40	$2,400
Sampling Analysis-VOCs (17 wells + 10% dupl)	$180	sample	19	$3,420
Sampling Analysis[1] (9 wells + 10% dupl)	$360	sample	10	$3,600
Sampling Analysis[2] (9 wells + 10% dupl)	$145	sample	10	$1,450
Supervision	$100	hr	40	$4,000
Data Evaluation and Reporting	$85	hr	160	$13,600
Supplies and Materials	$600	ls	1	$600
TOTAL ANNUAL O&M COSTS				**$29,070**
TOTAL O&M COSTS (for 30 years)				**$872,100**
TOTAL CAPITAL AND O&M COSTS				**$952,100**
CONTINGENCY (30% of Total Capital and O&M Costs)				$285,630
SUBTOTAL (Total Capital and O&M Costs and Contingency)				**$1,237,730**
USACE SIOH (8% Total Capital and O&M Costs and Contingency)				$99,018
TOTAL ESTIMATED PROGRAM COSTS[3]				**$1,300,000**

NOTES.

[1] Analysis for parameters which can indicate biodegradation of chlorinated solvents (e.g., NO_3-nitrogen, NH_3-nitrogen, total Kjeldahl nitrogen, total phosphorus, SO_4, soluble iron, methane, ethane, ethene)

[2] Bacteria enumeration

[3] Escalation costs are not included

ESTIMATED COSTS - ALTERNATIVE 3
CONTAINMENT

ITEM	UNIT COST	UNIT	QUANTITY	COST
I. CAPITAL COSTS				
CAPITAL DIRECT COSTS				
A. Preparation Work/Mob & Demob				
Mobilization & Demobilization	$120,000	LS	1	$120,000
Additional Monitoring Well Installation	$40,000	well	2	$80,000
Site Preparation (Clearing & Grubbing)	$1,785	acre	3.0	$5,355
B. Soil/Bentonite Slurry Wall				
Excavate Trench	$2.67	sf	13,000	$34,710
Backfill Trench - Placement of Slurry	$3.20	sf	13,000	$41,600
C. Multi-Layer Cap				
Synthetic Cap Material	$2.70	sy	8,400	$22,680
Cap Placement	$1.35	sy	8,400	$11,340
Sand and Gravel Placement	$16	cy	5,600	$89,600
Grading	$1.00	sy	8,400	$8,400
Drainage	$5,000	LS	1	$5,000
TOTAL DIRECT COSTS (TDC)				$418,685
CAPITAL INDIRECT COSTS				
A. Contractor's Overhead and Profit (50% TDC)				$209,343
B. Engineering Design (25% TDC)				$104,671
C. Design Studies (30% TDC)				$125,606
D. Health and Safety (5% TDC)				$20,934
TOTAL INDIRECT COSTS				$460,554
TOTAL CAPITAL COSTS (Total Direct Costs + Total Indirect Costs)				$879,239
II. ANNUAL O&M COSTS				
A. Cap Maintenance				
Maintenance (8 hr/month @ 12 months)	$100	hr	96	$9,600
B. Groundwater Monitoring				
Sampling Labor	$60	hr	40	$2,400
Sampling Analysis (17 Monitoring wells + 10% dupl)	$180	sample	19	$3,420
Supervision	$100	hr	40	$4,000
Data Evaluation and Reporting	$85	hr	120	$10,200
Supplies and Materials	$600	ls	1	$600
TOTAL ANNUAL O&M COSTS				$30,220
TOTAL O&M COSTS (for 30 years)				$906,600
TOTAL CAPITAL AND O&M COSTS				$1,785,839
CONTINGENCY (30% of Total Capital and O&M Costs)				$535,752
SUBTOTAL (Total Capital and O&M Costs and Contingency)				$2,321,590
USACE SIOH (8% Total Capital and O&M Costs and Contingency)				$185,727
TOTAL ESTIMATED PROGRAM COSTS [1]				$2,500,000

[1] Escalation costs are not included

ESTIMATED COSTS - ALTERNATIVE 4
INTERCEPTION TRENCH, AIR STRIPPING, AND SOIL VAPOR EXTRACTION

ITEM	UNIT COST	UNIT	QUANTITY	COST
I. CAPITAL COSTS				
CAPITAL DIRECT COSTS				
A. Preparation Work/Mob & Demob				
Mobilization & Demobilization	$130,000	LS	1	$130,000
Additional Monitoring Well Installation	$40,000	well	2	$80,000
Barrier Wall Excavation (between wetlands & disposal areas)	$2.67	sf	13,000	$34,710
Barrier Wall Installation (between wetlands & disposal areas)	$3.20	sf	13,000	$41,600
Site Preparation (Clearing & Grubbing)	$1,785	acre	3.1	$5,534
B. Soil Vapor Extraction				
Extraction Well Installation (HDPE, 20' length)	$1,500	well	20	$30,000
Extraction Well Installation (HDPE, 40' length)	$3,000	well	20	$60,000
Blower/Motor Systems (incl. knockout tank & instrumentation)	$26,742	LS	1	$26,742
Piping (HDPE)	$13.65	lf	1,400	$19,110
Insulation for Piping and Equipment	$4,685	LS	1	$4,685
Pump (from knockout tanks to air stripper)	$500	pump	2	$1,000
HDPE Liner	$4.05	sy	4,270	$17,294
Vapor Extraction System Installation	$11,713	LS	1	$11,713
Electrical	$4,685	LS	1	$4,685
C. Groundwater Extraction and Treatment				
Biopolymer Trench Excavation	$3.25	sf	54,000	$175,500
Collection Trench Installation (w/ piping)	$3.88	sf	54,000	$209,520
Pump (from collection trenches to equalization tank)	$2,600	pump	7	$18,200
Equalization Tank	$12,200	tank	1	$12,200
Piping (HDPE)	$2.70	lf	1,400	$3,780
Water Heating Units	$2,524	each	1	$2,524
Air Heating Units	$8,506	each	1	$8,506
Air Stripping Unit (incl. blower)	$18,683	unit	1	$18,683
Treatment Building	$95	sf	200	$19,000
Pump	$500	pump	2	$1,000
Insulation for Piping and Equipment	$4,166	LS	1	$4,166
Storage Tank	$12,200	tank	1	$12,200
Infiltration System (incl. piping, fittings, filters, emitters)	$14,370	LS	1	$14,370
Infiltration Piping Preparation (punch holes in pipes, install fittings, etc.)	$3,593	LS	1	$3,593
Infiltration Piping Bedding	$21	cy	40	$840
Infiltration Piping Installation	$20	lf	500	$10,000
GW Collection & Air Stripping System Installation	$19,273	LS	1	$19,273
Electrical	$5,269	LS	1	$5,269
TOTAL DIRECT COSTS (TDC)				$1,005,697
CAPITAL INDIRECT COSTS				
A. Contractor's Overhead and Profit (50% TDC)				$502,848
B. Engineering Design (25% TDC)				$251,424
C. Design Studies (25% TDC)				$251,424
D. Health and Safety (3% TDC)				$30,171
TOTAL INDIRECT COSTS				$1,035,868
TOTAL CAPITAL COSTS (Total Direct Costs + Total Indirect Costs)				$2,041,564
II. ANNUAL O&M COSTS				
A. Soil Vapor Extraction Unit O&M (5 years)				
Operations Labor (8 hr/wk @ 52 wks)	$60	hr	416	$24,960
Supervision Labor (4 hr/wk @ 52 wks)	$100	hr	208	$20,800
Electrical Power	$16,000	LS	1	$16,000
Maintenance (8 hr/month @ 12 months)	$100	hr	96	$9,600
B. Air Stripping Unit O&M (30 years)				
Operations Labor (8 hr/wk @ 52 wks)	$60	hr	416	$24,960
Supervision Labor (4 hr/wk @ 52 wks)	$100	hr	208	$20,800
Electrical Power	$14,000	LS	1	$14,000
Treatment Performance (1 water sample/month @ 12 months)	$180	sample	12	$2,160
Maintenance (8 hr/month @ 12 months)	$100	hr	96	$9,600

ESTIMATED COSTS - ALTERNATIVE 4
INTERCEPTION TRENCH, AIR STRIPPING, AND SOIL VAPOR EXTRACTION

ITEM	UNIT COST	UNIT	QUANTITY	COST
C. **Groundwater Monitoring (30 years)**				
Sampling Labor (40 hr/year)	$60	hr	40	$2,400
Sampling Analysis (17 Monitoring wells + 10% dupl)	$180	sample	19	$3,420
Supervision	$100	hr	40	$4,000
Data Evaluation and Reporting	$85	hr	120	$10,200
Supplies and Materials	$600	ls	1	$600
TOTAL O&M COSTS (30 years)				**$3,121,000**
TOTAL CAPITAL AND O&M COSTS				**$5,162,564**
CONTINGENCY (35% of Total Capital and O&M Costs)				$1,806,898
SUBTOTAL (Total Capital and O&M Costs and Contingency)				**$6,969,462**
USACE SIOH (8% Total Capital and O&M Costs and Contingency)				$557,557
TOTAL ESTIMATED PROGRAM COSTS [1]				**$7,500,000**

NOTES:
(1) Escalation costs are not included

ESTIMATED COSTS - ALTERNATIVE 5
AIR SPARGING AND SOIL VAPOR EXTRACTION OF "HOT SPOT" AND NATURAL ATTENUATION

ITEM	UNIT COST	UNIT	QUANTITY	COST
I. CAPITAL COSTS				
CAPITAL DIRECT COSTS				
A. Preparation Work/Mob & Demob				
Mobilization & Demobilization	$130,000	LS	1	$130,000
Additional Monitoring Well Installation	$40,000	well	2	$80,000
Barrier Wall Excavation (between wetlands & disposal areas)	$2.67	sf	13,000	$34,710
Barrier Wall Installation (between wetlands & disposal areas)	$3.20	sf	13,000	$41,600
Site Preparation (Clearing & Grubbing)	$1,785	acre	1.4	$2,499
B. Soil Vapor Extraction				
Extraction Well Installation (HDPE, 20' length)	$1,500	well	20	$30,000
Blower/Motor System (incl. knockout tank & instrumentation)	$13,400	LS	1	$13,400
Piping (4" HDPE)	$13.65	lf	880	$12,012
Insulation for Piping and Equipment	$2,591	LS	1	$2,591
Pump (from knockout tanks to discharge)	$500	pump	1	$500
HDPE Liner	$4.05	sy	4,270	$17,294
Vapor Extraction System Installation	$6,478	LS	1	$6,478
Electrical	$2,591	LS	1	$2,591
C. Air Sparging				
Sparging Well Installation (PVC, 42' length)	$2,650	well	80	$212,000
Compressor/Motor Systems (incl. instrumentation)	$60,000	LS	1	$60,000
Piping (2" PVC)	$9.20	lf	1,920	$17,664
Insulation for Piping and Equipment	$12,360	LS	1	$12,360
Air Sparging System Installation	$45,933	LS	1	$45,933
Electrical	$22,966	LS	1	$22,966
Treatment Building	$95	sf	200	$19,000
TOTAL DIRECT COSTS (TDC)				**$763,598**
CAPITAL INDIRECT COSTS				
A. Contractor's Overhead and Profit (50% TDC)				$381,799
B. Engineering Design (25% TDC)				$190,899
C. Design Studies (25% TDC)				$190,899
D. Health and Safety (3% TDC)				$22,908
TOTAL INDIRECT COSTS				**$786,506**
TOTAL CAPITAL COSTS (Total Direct Costs + Total Indirect Costs)				**$1,550,103**
II. ANNUAL O&M COSTS				
A. Treatment System O&M (years 1 to 5)				
Operations Labor (8 hr/wk @ 52 wks)	$60	hr	416	$24,960
Supervision Labor (8 hr/wk @ 52 wks)	$100	hr	416	$41,600
Electrical Power (SVE)	$5,500	LS	1	$5,500
Electrical Power (Air Sparging)	$20,900	LS	1	$20,900
Electrical Power (Treatment Building heating, lighting, etc.)	$1,200	LS	1	$1,200
Maintenance (8 hr/month @ 12 months)	$100	hr	96	$9,600
B. Treatment System O&M (years 6 to 30)				
Operations Labor (8 hr/month @ 12 months)	$60	hr	96	$5,760
Supervision Labor (8 hr/month @ 12 months)	$100	hr	96	$9,600
Electrical Power (SVE)	$1,400	LS	1	$1,400
Electrical Power (Air Sparging)	$5,250	LS	1	$5,250
Electrical Power (Treatment Building heating, lighting, etc.)	$1,200	LS	1	$1,200
Maintenance (8 hr/month @ 12 months)	$100	hr	96	$9,600
C. Groundwater Monitoring (30 years)				
Sampling Labor (40 hr/year)	$60	hr	40	$2,400
Sampling Analysis - VOCs (17 wells + 10% dupl)	$180	sample	19	$3,420
Sampling Analysis (2) (9 wells + 10% dupl)	$360	sample	10	$3,600
Sampling Analysis (3) (9 wells + 10% dupl)	$145	sample	10	$1,450
Supervision	$100	hr	40	$4,000
Data Evaluation and Reporting	$85	hr	160	$13,600
Supplies and Materials	$600	ls	1	$600

ESTIMATED COSTS - ALTERNATIVE 5
AIR SPARGING AND SOIL VAPOR EXTRACTION OF "HOT SPOT" AND NATURAL ATTENUATION

ITEM	UNIT COST	UNIT	QUANTITY	COST
TOTAL O&M COSTS (30 years)				**$2,211,150**
TOTAL CAPITAL AND O&M COSTS				**$3,761,253**
CONTINGENCY (35% of Total Capital and O&M Costs)				$1,316,439
SUBTOTAL (Total Capital and O&M Costs and Contingency)				**$5,077,692**
USACE SIOH (8% Total Capital and O&M Costs and Contingency)				$406,215
TOTAL ESTIMATED PROGRAM COSTS (1)				**$5,500,000**

NOTES:

(1) Escalation costs are not included

(2) Analysis for parameters which can indicate biodegradation of chlorinated solvents (e.g., NO_3-nitrogen, NO_2-nitrogen, NH_3-nitrogen, total Kjeldahl nitrogen, total phosphorus, SO4, soluble iron, methane, ethane, ethene, sulfide, TOC, BOD)

(3) Bacteria enumeration

ESTIMATED COSTS - ALTERNATIVE 6
SOIL VAPOR EXTRACTION OF "HOT SPOT"

ITEM	UNIT COST	UNIT	QUANTITY	COST
I. CAPITAL COSTS				
CAPITAL DIRECT COSTS				
A. Preparation Work/Mob & Demob				
Mobilization & Demobilization	$130,000	LS	1	$130,000
Additional Monitoring Well Installation	$40,000	well	2	$80,000
Site Preparation (Clearing & Grubbing)	$1,785	acre	1.4	$2,499
B. Soil Vapor Extraction				
Extraction Well Installation (HDPE, 40' length)	$3,000	well	10	$30,000
Blower/Motor System (incl. knockout tank & instrumentation)	$26,500	LS	1	$26,500
Piping (4" HDPE)	$13.65	lf	500	$6,825
Insulation for Piping and Equipment	$3,483	LS	1	$3,483
Pump (from knockout tanks to discharge)	$500	pump	3	$1,500
HDPE Liner	$4.05	sy	2,100	$8,505
Vapor Extraction System Installation	$8,706	LS	1	$8,706
Electrical	$3,483	LS	1	$3,483
C. Groundwater Treatment				
Equalization Tank	$12,200	tank	1	$12,200
Piping (HDPE)	$2.70	lf	1,400	$3,780
Water Heating Units	$2,524	each	1	$2,524
Air Heating Units	$8,506	each	1	$8,506
Air Stripping Unit (incl. blower)	$18,683	unit	1	$18,683
Treatment Building	$95	sf	200	$19,000
Infiltration System (incl. piping, fittings, filters, emitters)	$14,370	LS	1	$14,370
Infiltration Piping Preparation (punch holes in pipes, install fittings,	$3,593	LS	1	$3,593
Infiltration Piping Bedding	$21	cy	40	$840
Infiltration Piping Installation	$20	lf	500	$10,000
TOTAL DIRECT COSTS (TDC)				**$394,996**
CAPITAL INDIRECT COSTS				
A. Contractor's Overhead and Profit (50% TDC)				$197,498
B. Engineering Design (25% TDC)				$98,749
C. Design Studies (25% TDC)				$98,749
D. Health and Safety (3% TDC)				$11,850
TOTAL INDIRECT COSTS				**$406,846**
TOTAL CAPITAL COSTS (Total Direct Costs + Total Indirect Costs)				**$801,841**
II. ANNUAL O&M COSTS				
A. Treatment System O&M (years 1 to 5)				
Operations Labor (8 hr/wk @ 52 wks)	$60	hr	416	$24,960
Supervision Labor (8 hr/wk @ 52 wks)	$100	hr	416	$41,600
Electrical Power (SVE)	$5,500	LS	1	$5,500
Electrical Power (Treatment Building heating, lighting, etc.)	$1,200	LS	1	$1,200
Maintenance (8 hr/month @ 12 months)	$100	hr	96	$9,600
B. Treatment System O&M (years 6 to 30)				
Operations Labor (8 hr/month @ 12 months)	$60	hr	96	$5,760
Supervision Labor (8 hr/month @ 12 months)	$100	hr	96	$9,600
Electrical Power (SVE)	$1,400	LS	1	$1,400
Electrical Power (Treatment Building heating, lighting, etc.)	$1,200	LS	1	$1,200
Maintenance (8 hr/month @ 12 months)	$100	hr	96	$9,600
C. Groundwater Monitoring (30 years)				
Sampling Labor (40 hr/year)	$60	hr	40	$2,400
Sampling Analysis - VOCs (17 wells + 10% dupl)	$180	sample	19	$3,420
Sampling Analysis (2) (9 wells + 10% dupl)	$360	sample	10	$3,600
Sampling Analysis (3) (9 wells + 10% dupl)	$145	sample	10	$1,450
Supervision	$100	hr	40	$4,000
Data Evaluation and Reporting	$85	hr	160	$13,600
Supplies and Materials	$600	ls	1	$600

ESTIMATED COSTS - ALTERNATIVE 6
SOIL VAPOR EXTRACTION OF "HOT SPOT"

ITEM	UNIT COST	UNIT	QUANTITY	COST
TOTAL O&M COSTS (30 years)				**$1,975,400**
TOTAL CAPITAL AND O&M COSTS				**$2,777,241**
CONTINGENCY (35% of Total Capital and O&M Costs)				$972,034
SUBTOTAL (Total Capital and O&M Costs and Contingency)				**$3,749,276**
USACE SIOH (8% Total Capital and O&M Costs and Contingency)				$299,942
TOTAL ESTIMATED PROGRAM COSTS (1)				**$4,000,000**

NOTES:

(1) Escalation costs are not included

(2) Analysis for parameters which can indicate biodegradation of chlorinated solvents (e.g., NO_3-nitrogen, NO_2-nitrogen, NH_3-nitrogen, total Kjeldahl nitrogen, total phosphorus, SO4, soluble iron, methane, ethane, ethene, sulfide, TOC, BOD)

(3) Bacteria enumeration