Final

CERCLA
Record of Decision
North Beach Landfill (LF018)
Barrel Bay and Scrap Metal Disposal Area
(LF024/LF026)

Final

EARECKSON AIR STATION, ALASKA

Prepared By

United States Air Force
Pacific Air Forces
Elmendorf AFB, Alaska

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Final

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Acronyms

4, 4'-DDD	4, 4'-dichlorodiphenyldichloroethane
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ARAR	applicable or relevant and appropriate requirements
Army	U.S. Army
AS	Air Station
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
DRO	diesel range organic
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FS	Feasibility Study
GRO	gasoline range organic
IC	institutional control
IRP	Installation Restoration Program
LUC	land use control
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
msl	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
Plan	Eareckson AS Base Wide Plan
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SQuiRTs	Screening Quick Reference Tables
SVOC	semi-volatile organic compound
TCE	trichloroethylene
TPH	Total Petroleum Hydrocarbons
USAF	U.S. Air Force
USC	United States Code
USGS	U.S. Geological Survey
VOC	volatile organic compound
WWII	World War II

1.0 Declaration

1.1 Site Name and Location

Site Name (Number):	North Beach Landfill (LF018) Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)
Facility Name:	Eareckson Air Station (AS), Alaska
Site Location:	Shemya Island, Alaska

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the Selected Remedies for the three Environmental Restoration Program (ERP) sites listed above at Eareckson AS, Alaska. As the lead agency, the U.S. Air Force (USAF) has selected these remedies. This ROD is issued by the USAF in accordance with, and satisfies the requirements of, the:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, 42 United States Code (USC) 9601 et. seq.
- Executive Order 12580, 52 Federal Register 2923 (23 January 1987).
- National Oil and Hazardous Substance Pollution Contingency Plan (NCP), 40 Code of Federal Regulations 300 (to the extent practicable).
- Defense Environmental Restoration Program, 10 USC 2701 et seq.
- Alaska Oil and Hazardous Substance Pollution Control Act, 18 Alaska Administrative Code (AAC) 75.

This ROD is based on documents contained in the Administrative Record file for Eareckson AS, including but not limited to the following:

- 1984 Phase I Records Search (JRB, 1984)
- 1990 Installation Restoration Program (IRP) Stage 1 Final Technical Report (USAF, 1990)
- 1992 Site Investigation (WCC, 1993)
- 1992 IRP Field Investigation Report (USAF, 1993)
- 1993 Site Characterization Summary Report (USAF, 1994b)
- 1994-1996 Remedial Investigation/Feasibility Study (RI/FS) Report, Volumes I – IV (USAF, 1995, 1996a, 1996b, 1996c)
- 1995 IRP Field Program Technical Memorandum (USAF, 1996d)
- 1998, 1999, 2000, and 2004 Eareckson AS Comprehensive Basewide Monitoring Reports (USAF, 1999, 2000, 2001, 2005a)
- 2005 LF018 Sampling Technical Memorandum (USAF, 2005b)

The State of Alaska Department of Environmental Conservation (ADEC) agrees that the selected remedy, properly implemented and maintained, complies with State law. ADEC also agrees with the Air Force determination that action is necessary under CERCLA to protect public health or welfare or the environment at these three ERP sites. The U.S. Environmental Protection Agency (EPA) has been consulted consistent with the requirements of 10 USC 2705 and has chosen to defer to ADEC for regulatory oversight of the ERP at Eareckson AS.

1.3 Assessment of the Sites

Eareckson AS occupies all of Shemya Island, located approximately 1,500 miles southwest of Anchorage, Alaska, at the westernmost tip of the Aleutian Islands. Shemya Island is part of the Near Islands group of the Aleutian Archipelago, and is included within the Alaska Maritime National Wildlife Refuge. The island is approximately 4.5 miles long and 2 miles wide. The island is owned by the U.S. Government. There is no community on the island other than the military and its contractors. The nearest native village is located 350 miles to the east on Atka Island.

The U.S. Army (Army) first developed facilities on Shemya Island in 1943 to support operations against the Japanese occupation forces on nearby islands during World War II (WWII). In 1954, the site was deactivated, turned over to the Civil Aeronautics Authority in 1955, and subsequently leased to Northwest Airlines. In 1958, the USAF returned to Shemya Island to support various strategic intelligence gathering activities. The station was designated as an Air Force Base in 1968 and was redesignated as Eareckson AS in 1994. In 1995, Eareckson AS was downsized and reverted to caretaker status. A work force of 30 to 60 contractor personnel lives and works at the installation. Hazardous and potentially hazardous substances have historically been used or stored at Eareckson AS to support base activities.

1.3.1 North Beach Landfill (LF018)

ERP Site LF018 is located along the northwestern coast of Shemya Island. It covers an area of about 15 acres, bordered on the south by 230-foot high, grass-covered slopes, and on the north by North Beach Road and the Bering Sea. This area was formerly used for the disposal of scrap metal, wood debris, and thousands of empty drums. The drums likely contained liquids that were shipped to the island, including but not limited to cooking oils, petroleum, oils, lubricants, polychlorinated biphenyls (PCBs), solvents, and glycol. A portion/majority of the drums were removed in the early 1980s. A geophysical survey conducted at LF018 in 1992 indicated the presence of large areas of buried metal debris (drums) remaining at the site. The landfill area is currently covered by peat and vegetation.

Since 1992, environmental studies have been conducted at LF18 to characterize the nature and extent of contaminants. The studies included collecting samples of soil, groundwater, and surface water. The samples were analyzed for petroleum hydrocarbons, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, PCBs, and metals. The findings are summarized below by media.

Soils. Thirteen soil samples were collected in 1992 and 1993. Ten of these samples were collected from 10 surface soil sample locations; three additional samples were collected from depths of 3 to 22 feet below ground surface (bgs) in three soil borings. Low levels of total petroleum hydrocarbons (TPHs), magnesium, potassium, and sodium were found in these samples; however, these are probably attributed to background concentrations and not anthropogenic activities (there are no ADEC Method Two cleanup levels for these analytes). Thallium was also found in the soil at concentrations that exceeded the ADEC Method Two cleanup level of 1.9 milligrams per kilogram (mg/Kg) for the migration to groundwater pathway; however, thallium was not used by the USAF and the reported concentrations are most likely the result of analytical error.

Groundwater. Three groundwater monitoring wells were installed at LF018 in 1992. Groundwater was sampled in 1992, 1993, 1994, 1998, 1999, and 2000. Low levels of metals, near the background or cleanup levels, were detected (antimony and lead exceeded their respective ADEC groundwater cleanup levels), however, these are probably attributed to background metal concentrations and not anthropogenic activities. A diesel range organics (DRO) concentration of 0.22 milligrams per liter (mg/L) was detected in a groundwater sample in 1993 which was below the ADEC groundwater cleanup level of 1.5 mg/L; however, a sample collected in 2000 was well below cleanup criteria. No analytes exceeded cleanup criteria in the 2000 sampling event.

Surface Water. In 1993, surface water samples were collected from two ponds. No contaminants were detected at concentrations above background levels or cleanup criteria except for low levels of three inorganics in one surface water sample. Barium, chloride, and manganese exceeded their respective background concentrations and manganese also exceeded the surface water quality standard. Low levels of gasoline range organics (GRO) (0.0072 to 0.0084 mg/L) and DRO (0.071 to 0.14 mg/L) were detected in the surface water samples; however, it is likely that these are biogenic since other petroleum constituents (such as VOCs and SVOCs) were not detected.

Sediment. Three sediment samples from the intertidal zone were collected and analyzed for VOCs, SVOCs, PCBs, pesticides, and metals in 2004. Only metals were detected in the samples, but concentrations were below background concentrations or cleanup levels.

LF018 cannot support unrestricted use due to remaining metal debris buried at the sites. In addition, elevated concentrations of metals have been detected in the soil, groundwater, marine surface water, and marine sediments. ICs are necessary to prevent disturbance of the waste left in place.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Areas within LF018 cannot support unlimited use and unrestricted exposure due to hazardous substances remaining in place after implementation of the selected remedy. Land use restrictions are required as part of this response action and will be achieved through imposition of land use controls (LUCs), otherwise known as institutional controls (ICs) that limit the use and/or exposure to those areas of the property, water resources, that are contaminated. The

USAF is committed to implementing, monitoring, maintaining, and enforcing all components of the selected remedy to ensure that it remains protective of human health and the environment.

1.3.2 Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)

ERP Sites LF024 and LF026 are discussed together because they are located adjacent to one another and have geographic and ecological similarities. The LF024/LF026 sites are located along the southwestern coast of Shemya Island, near Skoot Cove. LF024 includes 9.8 acres of the intertidal zone and flat lands above the coastal bluffs directly north and west of Skoot Cove. LF024 was used as a disposal area for empty 55-gallon drums, most of which formerly contained fuel. In 1984, the majority of these drums were removed from the island by the USAF. LF026 is situated on a bedrock outcrop at the end of a 3-acre finger of land jutting into the ocean on the east side of Skoot Cove. LF026 was used as a disposal area for metal debris, vehicle parts, wood, and other debris. Generally, remote sites in Alaska such as Shemya Island received glycol, solvents, oils, and fuels in metal drums. Therefore, the scrap metal debris at LF026 likely included metal drums that contained hazardous substances and wastes.

Environmental studies have been conducted at LF24/LF26 since 1988 to characterize the nature and extent of contaminants. These studies included collecting samples of soil, groundwater, surface water, and sediment. The samples were analyzed for petroleum hydrocarbons, VOCs, SVOCs, pesticides, PCBs, and metals. The findings are summarized below by media.

Soils. Thirty-eight surface and seven subsurface soil samples were collected at LF024/LF026 from 1988 through 1993. Several metals (antimony, arsenic, cadmium, chromium, lead, and thallium), TPHs, two VOCs (methylene chloride and benzene), and one SVOC (pentachlorophenol) exceeded ADEC Method Two cleanup criteria. The metal detections were either an isolated elevated level or are attributed to background concentrations and not anthropogenic activities. Reported thallium concentrations are believed to be from analytical error. The reported TPH concentrations are most likely attributed to the problematic method (EPA Method 418.1) used to analyze the samples in 1988. It is unlikely that petroleum contamination exists at the site since additional samples analyzed for other petroleum constituents (such as VOCs, SVOCs, and GRO) were either not detected or detected at very low levels. Methylene chloride detections are believed to be from a laboratory contaminant and not associated with the site.

Groundwater. From 1992 to 2000, 16 groundwater samples were collected from monitoring wells in and near the LF024/LF026 area. Only four metals (arsenic, beryllium, cadmium, and thallium) were detected at concentrations above ADEC Groundwater cleanup criteria. The groundwater beneath this area is in hydraulic communication with the brackish surface water of Skoot Cove and, thus, the elevated levels of magnesium, potassium, and sodium may be associated with seawater. The thallium exceedence was only in one of 16 samples collected and is, therefore, probably not associated with the site.

Marine Surface Water. From 1993 to 2000, seven marine surface water samples were collected from three locations within LF024/LF026. Copper and lead were the only contaminants detected at concentrations above the cleanup criteria. Copper and lead

concentrations in 13 of the 14 samples analyzed were either not detected or near surface water cleanup criteria. In 1993, trace levels of DRO (0.051 to 0.070 mg/L) and low levels of several VOCs (less than ADEC water quality criteria) were detected in surface water; however, the VOCs were no longer detected in the surface water in 1998 and 1999.

Marine Sediment. From 1993 to 2000, eight marine sediment samples were collected from two locations within LF024/LF026. Throughout the years of sediment sampling, various metals have been detected, with a few (antimony, arsenic, copper, lead, nickel, and zinc) exceeding benchmark criteria (National Oceanic and Atmospheric Administration [NOAA] Screening Quick Reference Tables [SQuiRTs]) in some of the samples. The metals were either an isolated elevated level or are attributed to background metal concentrations and not anthropogenic activities. Di-n-butyl phthalate was detected once, but is a common laboratory contaminant and is not associated with the site.

LF024/LF026 cannot support unrestricted use due to remaining metal debris buried at the sites. In addition, elevated concentrations of metals have been detected in the soil, groundwater, marine surface water, and marine sediments. ICs are necessary to prevent disturbance of the waste left in place.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Areas within LF024/LF026 cannot support unlimited use and unrestricted exposure due to hazardous substances remaining in place after implementation of the selected remedy. Land use restrictions are required as part of this response action and will be achieved through imposition of LUCs, otherwise known as ICs, that limit the use and/or exposure to those areas of the property, water resources, that are contaminated. The USAF is committed to implementing, monitoring, maintaining, and enforcing all components of the selected remedy to ensure that it remains protective of human health and the environment.

1.4 Description of Selected Remedy

There is buried solid waste remaining at the sites and inorganics in the soil and groundwater at concentrations above the State's cleanup levels, and therefore ICs are necessary under Alaska State regulations. ICs are being implemented as part of closure for ERP Sites LF018 and LF024/LF026 under CERCLA and Alaska State regulations (including but not limited to Title 46 of the Alaska Statutes and the regulations promulgated thereunder).

Remedial alternatives for LF018 and LF024/LF026 at Eareckson AS were developed and evaluated through a Remedial Investigation (RI)/Feasibility Study (FS) (USAF, 1995; 1996a, b, and c). Based on the results of the RI/FS, the USAF selected ICs as the preferred alternative for LF018 and LF024/LF026. The selected remedies fit into the overall site management plan by applying ICs where unrestricted use is not appropriate. The ICs are designed to prevent activities that could affect the performance of the other components (landfill caps) of the selected remedies and maintain current land uses, while protecting human health and the environment.

The USAF will implement, monitor, maintain, and enforce the ICs identified below in accordance with State of Alaska 18 AAC 75.375 and 18 AAC 60.390. The 611th Civil Engineer Squadron will be the point of contact for ICs. A potential risk to human health or the environment might result if the buried waste were to be disturbed or relocated. To mitigate this potential risk, the following ICs will be implemented:

- The Eareckson AS Base General Plan (Plan) will be updated to show the boundaries of ERP Sites LF018 and LF024/LF026 to restrict excavation of soil and use of groundwater at the sites. The Plan will contain a map indicating the locations of the sites, with restrictions on any invasive activities that could potentially compromise the integrity of the cover and expose potential contaminants. Dig permits issued by the Base Operating Contractor are required for any excavation at Eareckson AS. Prior to approving a permit, the Plan will be reviewed to ensure that invasive activities are not taking place within the boundary of the sites where land use has already been restricted.
- In accordance with the landfill post closure requirements of 18 AAC 60.396(b), a deed notice or other instrument will be used to document that: 1) the property was used as a landfill, 2) it may not be suitable for some uses, 3) maintenance and repairs to the property might become necessary to prevent pollution problems at the site, and 4) any activity that results in damage to the final cover of the property must be corrected to control potential pollution problems.
- This remedy has been selected in compliance with state law and the USAF will obtain prior concurrence from ADEC to terminate the ICs, modify current land use, or allow anticipated actions that may disrupt protectiveness of ICs. In the unlikely event that the property is to be transferred, the USAF will notify ADEC at least 30 days prior to any transfer taking place.
- The ICs on the landfills will extend until cleanup levels in 18 AAC 75 have been meet and ADEC approves the land for unrestricted use, to ensure that human and ecological receptors are protected from potential exposures. The effectiveness of the ICs will be evaluated and reported on during each 5-year review.
- The USAF will ensure, as appropriate, that any contractor, tenant, or other authorized occupant of land subject to LUCs in the ROD is informed of the LUCs and is made subject to the requirements of such LUCs.

In addition to the above ICs, the following activities will be conducted:

- A visual inspection of the landfill caps will be conducted concurrently with biennial monitoring activities taking place at other sites at Eareckson AS. The inspection will determine if the landfill caps are thick and extensive enough to properly cover debris, and if significant erosion has occurred or may occur. If the landfill caps are deemed inadequate for any of the above reasons, they will be repaired. If the caps remain in good condition for two consecutive inspections, biennial landfill cap inspections will be discontinued.
- In accordance with the corrective action requirements of 18 AAC 60.815(a) cover thickness and vegetation will be maintained, as necessary, to prevent erosion, promote drainage, and prevent the escape of waste or leachate.
- Any uncovered debris will be removed and disposed of properly.

- Any activity that is inconsistent with IC requirements, objectives, or controls, or any action that might interfere with the protectiveness of the ICs, will be reported to ADEC and addressed by the USAF as soon as practicable after discovery.
- Following each biennial inspection, a report of IC monitoring and cap inspections will be provided to ADEC.
- To verify the conclusion that the historical thallium concentrations are inaccurate and also to resolve uncertainty with other detected metals (see Section 2.6.5), additional surface soil sampling for metals will be performed at LF018 and LF024/LF026. The sampling will be performed using multi increment sampling techniques. There is one Decision Unit for LF018 and two at LF024/LF026 (site boundaries are defined in Section 2.1). Prior to sampling, a work plan will be developed based on ADEC guidance (ADEC, 2009) and submitted for ADEC approval. The sampling will be conducted during the first landfill cap inspection and the results reported to ADEC. The samples will be analyzed for the following metals by EPA method 6020A (7471A for mercury):

Aluminum	Calcium	Magnesium	Silver
Antimony	Chromium	Manganese	Sodium
Arsenic	Cobalt	Mercury	Thallium
Barium	Copper	Nickel	Vanadium
Beryllium	Iron	Potassium	Zinc
Cadmium	Lead	Selenium	

- If the results of the metals re-sampling show that the thallium concentrations are above the applicable cleanup level, the selected remedy will need to be reassessed and additional capping may be required.

1.5 Statutory Determinations

The selected remedies for ERP Sites LF018 and LF024/LF026 are protective of human health and the environment, comply with Federal and State applicable or relevant and appropriate requirements (ARARs), and are cost effective. The remedies comply with State of Alaska requirements under 18 AAC 75.325-390 and 18 AAC 60.390, 60.396(b), and 60.815(a). The selected remedy represents the maximum extent to which permanent solutions can be used in a practicable manner at the site. It provides the best balance or trade-offs in terms of balancing criteria.

The NCP establishes the expectation that treatment will be used to address the principal threats posed by a site whenever practicable (40 Code of Federal Regulations 300.430[a][1][iii][A]). The selected remedies do not use permanent solutions or alternative treatment technologies, nor do the remedies satisfy the statutory preference for treatment as a principal element of the remedy – since excavation and treatment are cost prohibitive. Furthermore, treatment is not required because levels of residual contamination are low, the sites are controlled by the USAF, and land use is restricted.

Because the remedies will result in hazardous substances remaining at LF018 and LF024/LF026 above levels that allow for unrestricted use and unrestricted exposure, a statutory review is

required under CERCLA Section 121(c) and NCP 300.430(f)(5)(iii)(C). This statutory review will be conducted within 5 years after initiation of the remedial action to ensure that the remedies are, or will be, protective of human health and the environment. Each 5-year review under CERCLA will determine if a subsequent 5-year review is warranted. During the first 5-year review, the 2003 risk evaluations for each site will be updated to reflect current regulations and toxicity values and newly acquired data.

1.6 Authorizing Signatures

This signature sheet documents the USAF and ADEC's approval of the remedy selected in this ROD for ERP Sites LF018 and LF024/LF026 at Eareckson AS, Alaska. ADEC agrees that the remedy, properly implemented and maintained, complies with state law. This decision may be reviewed and modified in the future if new information becomes available that indicates the presence of contaminants or exposure routes that might cause an unacceptable risk to human health or the environment.

ROBYN M. BURK, Colonel, USAF
Commander, 611th Air Support Group

Date

JOHN HALVERSON, Environmental Program Manager
Federal Facilities Section, Contaminated Sites Program
Alaska Department of Environmental Conservation

Date

2.0 Decision Summary

The Decision Summary identifies the Selected Remedy for each of the three ERP sites addressed in this ROD, explains how the remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the Administrative Record file that supports the remedy selection decision.

2.1 Site Name, Location, and Description

2.1.1 Site Name and Location

Site Name (Number) and ADEC Database Record Key Number:	North Beach Landfill (LF018) – 198125X904813 Barrel Bay and Scrap Metal Disposal Area (LF024/LF026) – 198125X904814 (LF024) and 199725X904314 (LF026)
Site Location:	Eareckson AS, Alaska
Latitude and Longitude:	52 degrees – 43 minutes North 174 degrees – 07 minutes east of Greenwich
Point of Contact (POC):	Mr. Keith Barnack – Project Manager Keith.barnack@elmendorf.af.mil (907) 552-5160 USAF 611 CES/CEVR 10471 20th Street – Suite 302 Elmendorf AFB, AK 99506-2200

Eareckson AS occupies all of Shemya Island, located approximately 1,500 miles southwest of Anchorage, Alaska, at the westernmost tip of the Aleutian Islands (**Figure 2-1**). Shemya Island is part of the Near Islands group of the Aleutian Archipelago. The island is approximately 4.5 miles long and 2 miles wide. The island is owned by the U.S. Government.

The climate of Shemya Island is marine, with moist conditions and temperature variances moderated by the Pacific Ocean. As a result, Shemya's climate is milder than expected considering the island's latitude. Local weather conditions are influenced by Shemya's location within a fairly persistent low pressure system, referred to as the "Aleutian Low," which causes North Pacific storms to track through the area and perpetuates constant windy and rainy conditions. The often-abundant precipitation and high winds can frequently interfere with air transportation to and from the island.

The most extreme weather occurs during the winter months. The warmest month is August, and the coldest month is January, with measurable precipitation occurring approximately 330 days per year. Average annual measurements at the island's meteorological record include:

- Mean annual temperature – 39.4 degrees Fahrenheit.
- Mean annual precipitation – 30.3 inches (highest precipitation rate occurs from August to December).

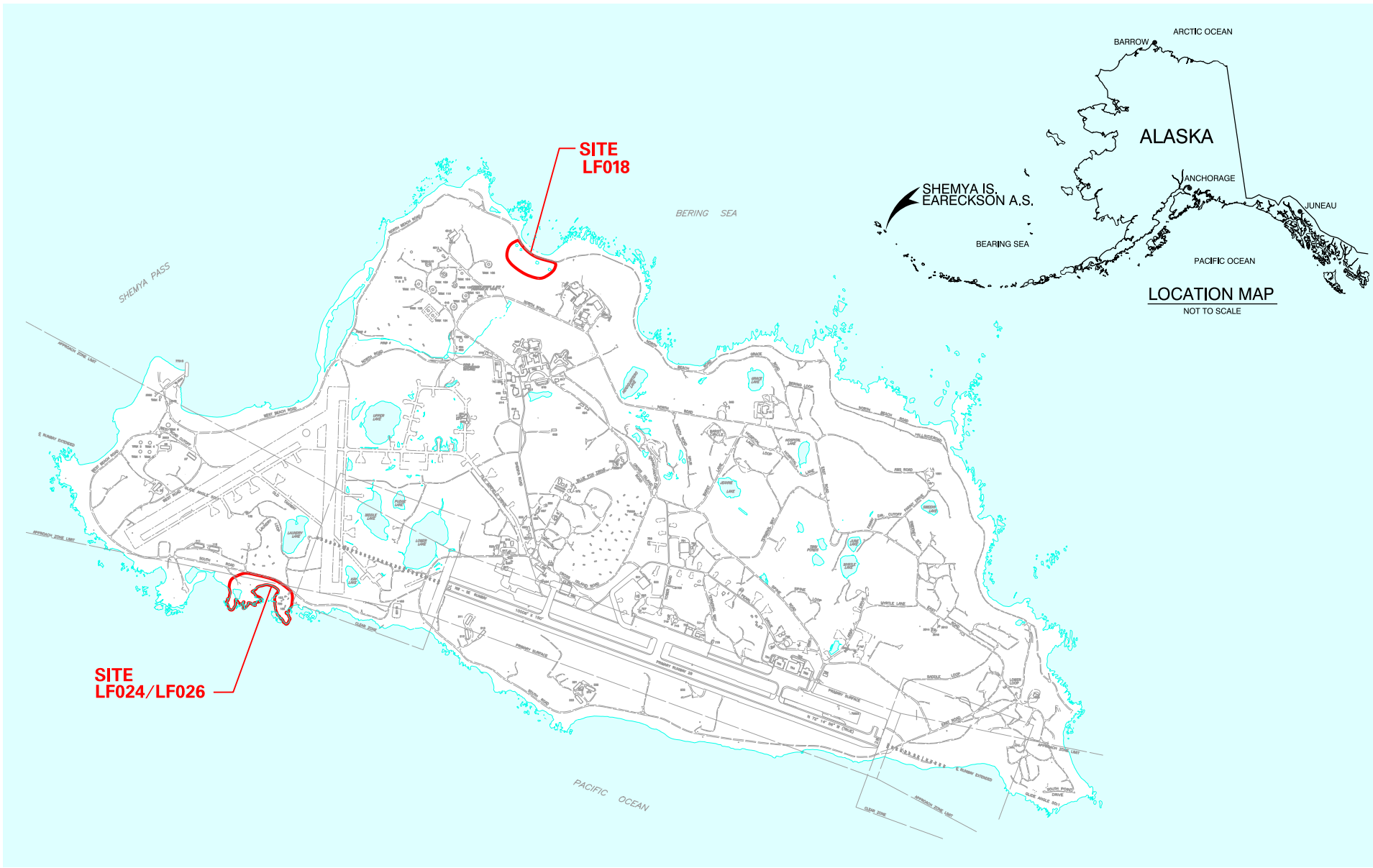


FIGURE 2-1

U.S. AIR FORCE, EARECKSON AIR STATION, ALASKA
LF018 AND LF024/ LF026 CERCLA RECORD OF DECISION

LOCATION AND VICINITY MAP

- Mean annual wind speeds – 15.3 knots (no prevailing wind direction)

2.1.2 Site Descriptions

Figure 2-1 provides an overview of the Eareckson AS installation. The three ERP sites addressed in this ROD are described briefly in the following sections.

2.1.2.1 North Beach Landfill (LF018)

LF018 is located along the northwestern coast of Shemya Island. It covers an area of about 15 acres, bordered on the south by 230-foot high, grass-covered slopes, and on the north by North Beach Road and the Bering Sea (**Figure 2-2**). This area was formerly used for the disposal of scrap metal, wood debris, and thousands of empty drums. A 1961 historical USAF photograph of LF018 shows tens of thousands of drums stacked throughout the area. The drums likely contained liquids that were shipped to the island, including but not limited to cooking oils, petroleum, oils, lubricants, PCBs, solvents, and glycol. A portion of the drums were removed in the early 1980s. A geophysical survey conducted at LF018 in 1992 indicated the presence of large areas of buried metal debris (drums) remaining at the site. The landfill area is currently covered by peat and vegetation.

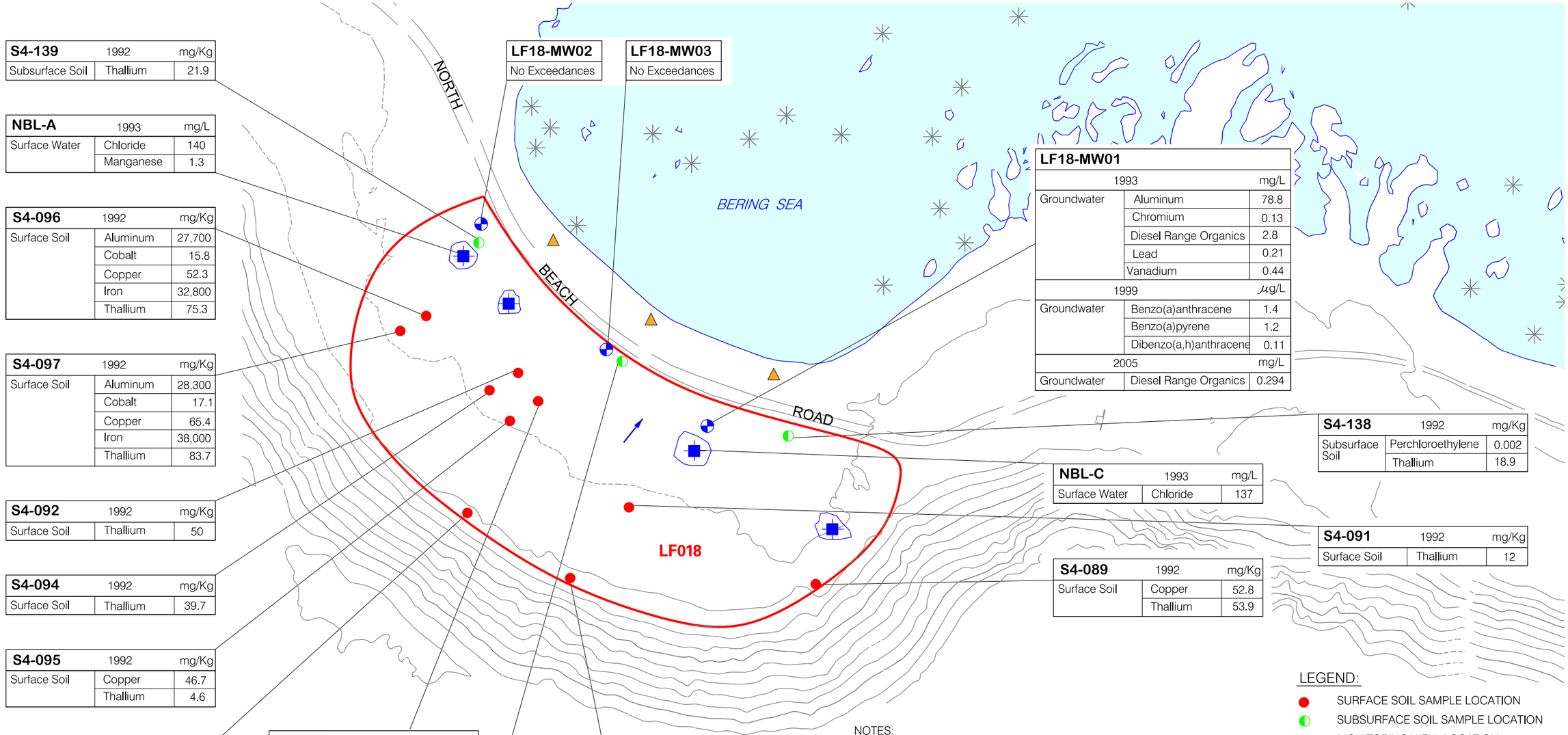
At LF018, upper layers of soil consist of moist peat and sandy organic soils mixed with fill materials and occasional shell fragments to depths ranging from 5 to 10 feet bgs. These materials are directly underlain by moist, gray to green, chlorite-altered, fissile claystone bedrock. The bedrock surface is approximately 5 to 16 feet bgs. Bedrock is shallowest near the bluff and deepest toward the Bering Sea.

Groundwater at LF018 was encountered at a depth of 10 to 14 feet bgs, varying from 3 to 10 feet above mean sea level (msl), and decreasing in elevation to the northeast. Groundwater flows to the Bering Sea in a north-northeasterly direction – following surface topography. Groundwater is not directly or immediately influenced by precipitation, nor is a strong tidal influence apparent.

Ground surface elevations vary from 230 feet above msl on top of the southern slopes, to 30 feet above msl in the main portion of the landfill – continuing to sea level at the North Beach area. Surface water flows from the upland slopes toward the sea in a north-northeasterly direction, following the surface topography. During the 1993 and 1994 investigations, surface water was collected from ephemeral ponds at several locations on the south side of North Beach Road. The ephemeral ponds did not exceed 100 square feet in size and appeared to originate from precipitation events. No drainage channels or flowing water was observed at LF0I8. One dry drainage was identified north of the road leading to the ocean. No seeps were identified at LF018.

2.1.2.2 Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)

LF024 and LF026 are discussed together because they are located adjacent to one another and have geographic and ecological similarities. The LF024/LF026 sites are located along the southwestern coast of Shemya Island, near Skoot Cove (**Figures 2-3** and **2-4**).



S4-139	1992	mg/Kg
Subsurface Soil	Thallium	21.9

NBL-A	1993	mg/L
Surface Water	Chloride	140
	Manganese	1.3

S4-096	1992	mg/Kg
Surface Soil	Aluminum	27,700
	Cobalt	15.8
	Copper	52.3
	Iron	32,800
	Thallium	75.3

S4-097	1992	mg/Kg
Surface Soil	Aluminum	28,300
	Cobalt	17.1
	Copper	65.4
	Iron	38,000
	Thallium	83.7

S4-092	1992	mg/Kg
Surface Soil	Thallium	50

S4-094	1992	mg/Kg
Surface Soil	Thallium	39.7

S4-095	1992	mg/Kg
Surface Soil	Copper	46.7
	Thallium	4.6

S4-098	1992	mg/Kg
Surface Soil	Cobalt	17.5
	Copper	48.3
	Potassium	1,370
	Thallium	62

S4-093	1992	mg/Kg
Surface Soil	Potassium	1,430
	Thallium	72.8

S4-137	1992	mg/Kg
Subsurface Soil	Potassium	1,860
	Thallium	44.8

S4-090	1992	mg/Kg
Surface Soil	Cobalt	19.9
	Copper	66.1
	Iron	41,300
	Magnesium	15,700
	Sodium	2,850
	Thallium	92.4

LF18-MW02
No Exceedances

LF18-MW03
No Exceedances

LF18-MW01		
1993		mg/L
Groundwater	Aluminum	78.8
	Chromium	0.13
	Diesel Range Organics	2.8
	Lead	0.21
	Vanadium	0.44
1999		µg/L
Groundwater	Benzo(a)anthracene	1.4
	Benzo(a)pyrene	1.2
	Dibenzo(a,h)anthracene	0.11
2005		mg/L
Groundwater	Diesel Range Organics	0.294

S4-138	1992	mg/Kg
Subsurface Soil	Perchloroethylene	0.002
	Thallium	18.9

NBL-C	1993	mg/L
Surface Water	Chloride	137

S4-091	1992	mg/Kg
Surface Soil	Thallium	12

S4-089	1992	mg/Kg
Surface Soil	Copper	52.8
	Thallium	53.9

LEGEND:

- SURFACE SOIL SAMPLE LOCATION
- SUBSURFACE SOIL SAMPLE LOCATION
- MONITORING WELL LOCATION
- SURFACE WATER AND SEDIMENT SAMPLE CO-LOCATION
- SEDIMENT SAMPLE LOCATION
- GROUNDWATER FLOW DIRECTION
- ROCK
- CONTOUR LINE
- WATER LINE
- ADEC — ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

NOTES:

1. SAMPLE LOCATIONS REPRESENT FIXED LABORATORY SAMPLING ONLY.
2. CONTAMINANT CONCENTRATIONS ARE SHOWN FOR SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS THAT EXCEED ADEC METHOD II (MIGRATION-TO-GROUNDWATER) OR BACKGROUND CONCENTRATIONS.
3. CONTAMINANT CONCENTRATIONS ARE SHOWN FOR GROUNDWATER RESULTS THAT EXCEED ADEC TABLE C OR BACKGROUND CONCENTRATIONS.
4. CONTAMINANT CONCENTRATIONS ARE SHOWN FOR SURFACE WATER RESULTS THAT EXCEED BACKGROUND CONCENTRATIONS.

NORTH

SCALE IN FEET

0 200

FIGURE 2-2

U.S. AIR FORCE, EARECKSON AIR STATION, ALASKA
LF018 AND LF024/ LF026 CERCLA RECORD OF DECISION

LF018

SITE MAP WITH SAMPLE LOCATIONS

JOB No. 1851213.10010402 TIME: 24-JUN-2010 14:38 FILE: D:\CAD\Proj\afcee\shemya\DecesionDoc2007\LF18-24-26-28\CERCLA Record of Decision-Combined\FINAL\FIG2-2.DGN

SW10W2		
1992		mg/Kg
Subsurface Soil	Thallium	18.3
Groundwater		mg/L
	Cadmium	178
	Magnesium	105
	Potassium	60.1
	Sodium	1,240
	Thallium	0.0161
2000		mg/L
Groundwater	Lead	0.0235

SW10W3		
1992		mg/Kg
Subsurface Soil	Thallium	27.9
Groundwater		mg/L
	Manganese	5.51
	Thallium	0.0116
1993		mg/L
Groundwater	Aluminum	74.2
	Manganese	7.2
	Vanadium	0.59

SW10W1		
1992		mg/Kg
Subsurface Soil	Arsenic	8.3
	Thallium	38.6
Groundwater		mg/L
	Thallium	0.0142
2000		mg/L
Groundwater	Cadmium	0.0081

SW12W1		
1992		mg/Kg
Subsurface Soil	Benzene	0.049
	Thallium	37
Groundwater		mg/L
	Arsenic	0.0628
	Molybdenum	0.0192
	Thallium	0.0127
2000		mg/L
Groundwater	Arsenic	0.0556

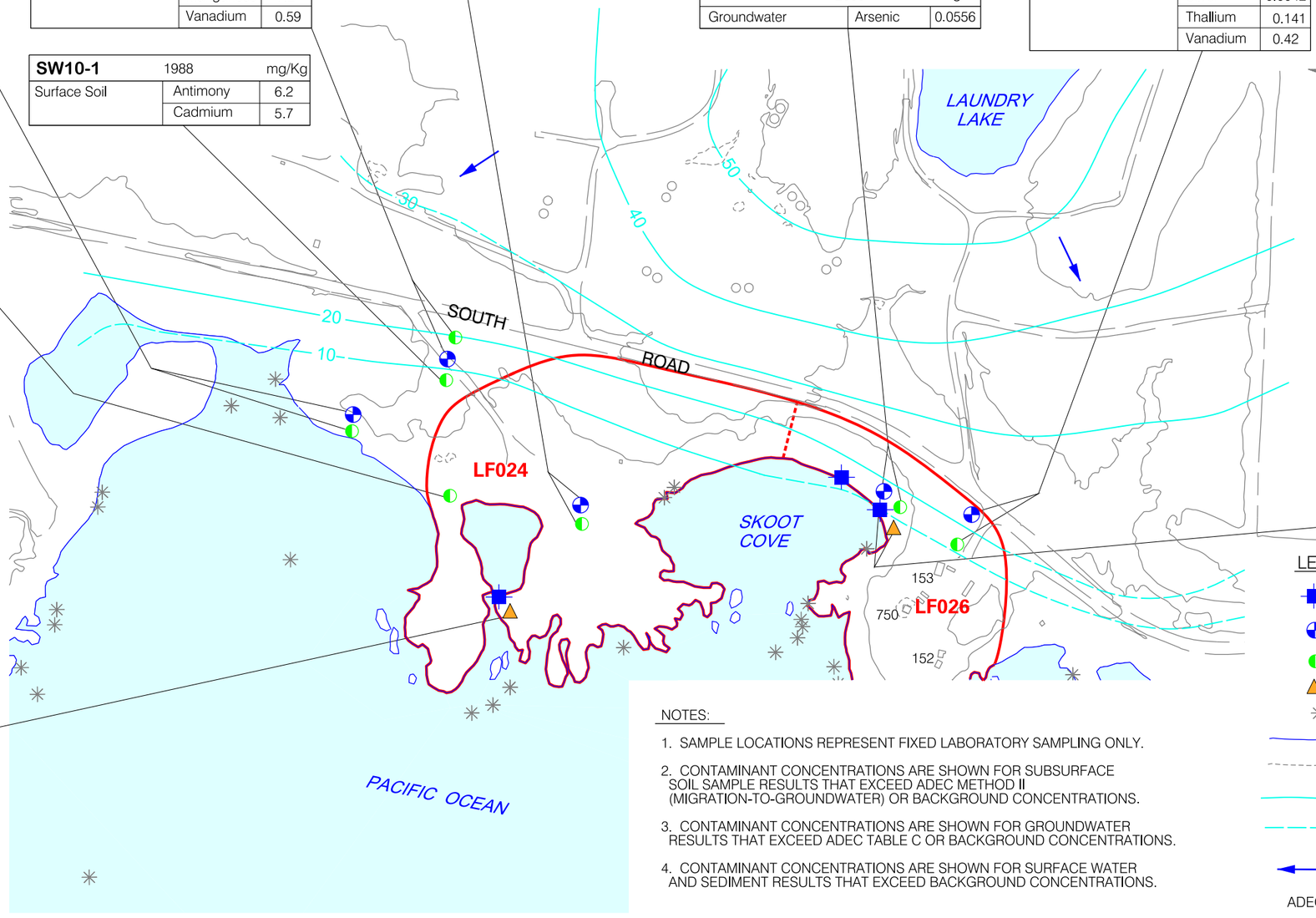
SW12W3	1992	mg/Kg
Subsurface Soil	Manganese	1,100
	Thallium	35
Groundwater		mg/L
	Aluminum	71
	Arsenic	0.0669
	Beryllium	0.0042
	Cadmium	0.0062
	Silver	0.0042
	Thallium	0.141
	Vanadium	0.42

SW10-1	1988	mg/Kg
Surface Soil	Antimony	6.2
	Cadmium	5.7

SW10-2	1998	mg/Kg
Subsurface Soil	Antimony	14
	Arsenic	9.3
	Cadmium	6.8
	Chromium	81.3
	Cobalt	23.2
	Iron	76,800
	Lead	1,620
	Manganese	784

LF24-3		
1994		mg/Kg
Marine Sediment	Calcium	42,000
1998		mg/Kg
Marine Sediment	Aluminum	11,083
Marine Surface Water		mg/L
	Cadmium	0.0003
	Copper	0.0673
	Iron	1.68
	Lead	0.1795
1999		mg/Kg
Marine Sediment	Aluminum	13,200
	Calcium	59,000
Marine Surface Water		mg/L
	Cadmium	0.0006
	Copper	0.017
	Iron	6.11
	Lead	0.0061
2000		mg/Kg
Marine Sediment	Aluminum	10,500
	Calcium	86,500
	Copper	321
Marine Surface Water		mg/L
	Copper	0.0083
	Iron	5.1
	Lead	0.013

Q3SP11		
1993		mg/Kg
Marine Sediment	Barium	49.9
	Iron	484,000
	Manganese	1670
Marine Surface Water		mg/L
	Barium	0.0072
	Chloride	84.2
	Cobalt	0.0035
	Manganese	1.7
1998		mg/Kg
Marine Sediment	Aluminum	13,538
Marine Surface Water		mg/L
	Iron	1.19
	Manganese	0.12
1999		mg/L
Marine Surface Water	Iron	6.6
	Manganese	1.2
2000		mg/Kg
Marine Sediment	Barium	62.9
	Cadmium	0.95
	Chromium	79.6
	Iron	178,000
	Lead	179
	Magnesium	12,800
	Manganese	969
	Nickel	134
	Potassium	3670
	Zinc	570
Marine Surface Water		mg/L
	Iron	8.13
	Manganese	1.81



NOTES:

1. SAMPLE LOCATIONS REPRESENT FIXED LABORATORY SAMPLING ONLY.
2. CONTAMINANT CONCENTRATIONS ARE SHOWN FOR SUBSURFACE SOIL SAMPLE RESULTS THAT EXCEED ADEC METHOD II (MIGRATION-TO-GROUNDWATER) OR BACKGROUND CONCENTRATIONS.
3. CONTAMINANT CONCENTRATIONS ARE SHOWN FOR GROUNDWATER RESULTS THAT EXCEED ADEC TABLE C OR BACKGROUND CONCENTRATIONS.
4. CONTAMINANT CONCENTRATIONS ARE SHOWN FOR SURFACE WATER AND SEDIMENT RESULTS THAT EXCEED BACKGROUND CONCENTRATIONS.

LEGEND:

- MARINE SURFACE WATER SAMPLE LOCATION
- MONITORING WELL LOCATION
- SUBSURFACE SOIL SAMPLE LOCATION
- MARINE SEDIMENT SAMPLE LOCATION
- ROCK
- WATER LINE
- CONTOUR LINE
- GROUNDWATER LEVEL CONTOUR LINE
- DASHED WHERE INFERRED ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL
- GROUNDWATER FLOW DIRECTION
- ADEC — ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

NORTH

SCALE IN FEET

0 300

FIGURE 2-3

U.S. AIR FORCE, EARECKSON AIR STATION, ALASKA
LF018 AND LF024/ LF026 CERCLA RECORD OF DECISION

LF024/LF026 SITE MAP WITH SAMPLE LOCATIONS, EXCEPT SURFACE SOIL

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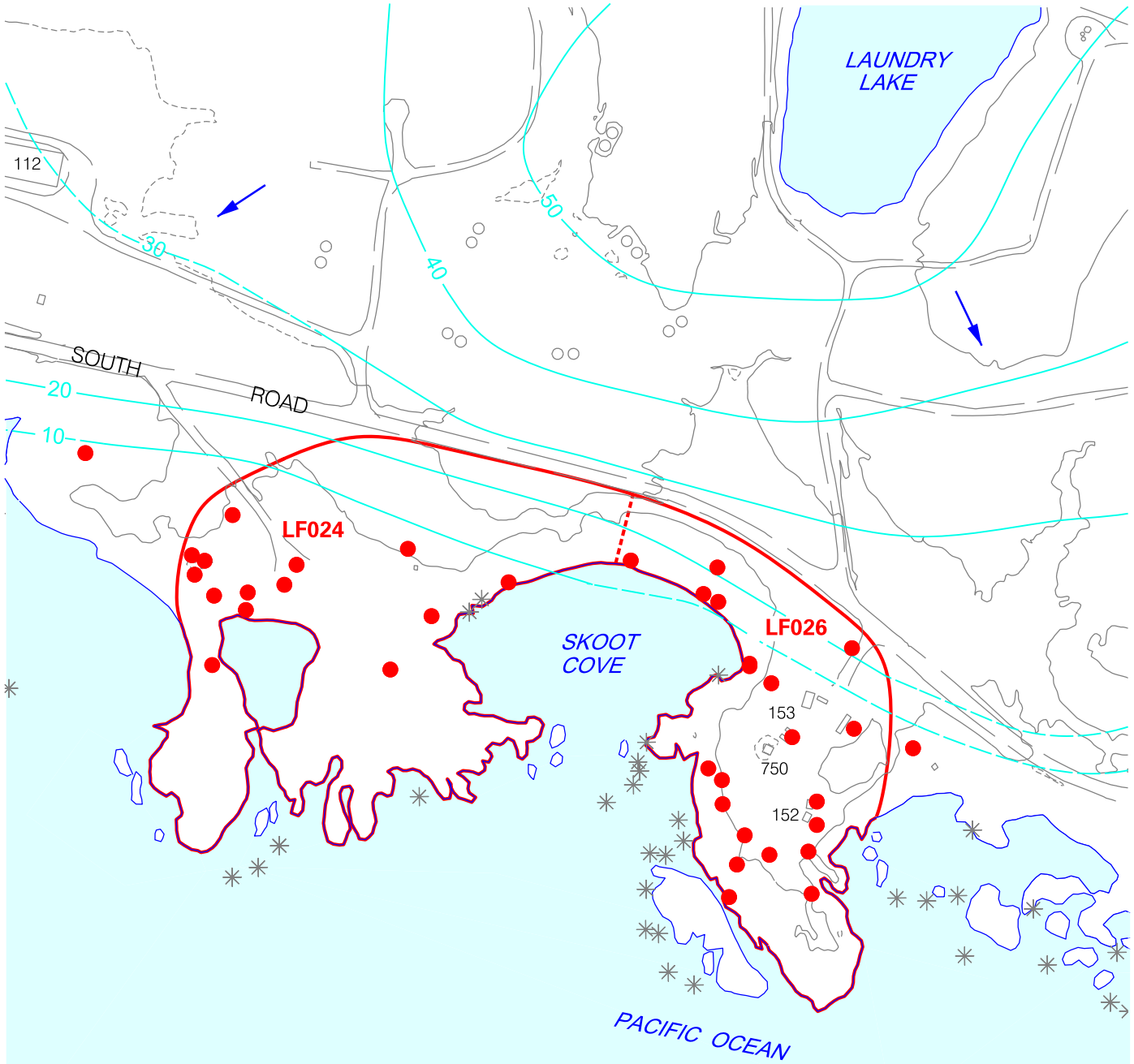

LEGEND:

- SURFACE SOIL SAMPLE LOCATION
- ROCK
- WATER LINE
- CONTOUR LINE
- GROUNDWATER LEVEL CONTOUR LINE
- DASHED WHERE INFERRED ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL
- GROUNDWATER FLOW DIRECTION

NORTH

SCALE IN FEET

0 300

FIGURE 2-4

U.S. AIR FORCE, EARECKSON AIR STATION, ALASKA
LF018 AND LF024/ LF026 CERCLA RECORD OF DECISION

LF024/LF026 SITE MAP WITH SURFACE SOIL SAMPLE LOCATIONS

JOB No. 185213.10010402 TIME: 24-JUN-2010 14:39 FILE: D:\CAD\Proj\afcee\shemyo\DecesionDoc2007\LF18-24-26-28\CERCLA Record of Decision-Combined\FINAL\FIG2-4.DGN

LF024 includes 9.8 acres of the intertidal zone and flat lands above the coastal bluffs directly north and west of Skoot Cove. LF024 was used as a disposal area for empty 55-gallon drums, most of which formerly contained fuel. In 1984, the majority of these drums were removed from the island by the USAF. LF026 is situated on a bedrock outcrop at the end of a 3-acre finger of land jutting into the ocean on the east side of Skoot Cove. LF026 was used as a disposal area for metal debris, vehicle parts, wood, and other debris. Generally, remote sites in Alaska such as Shemya Island received glycol, solvents, oils, and fuels in metal drums. Therefore, the scrap metal debris at LF026 likely included metal drums that contained hazardous substances and wastes.

The primary surficial lithology in the area at LF024/LF026 consists of a silty sand deposit to a depth of 1.5 to 5 feet bgs, underlain by a 4- to 10-foot thick layer of sandy to silty gravel. Bedrock is primarily claystone ranging from 0 feet (outcrops south of the bluffs) to 15 feet bgs. While the predominant bedrock in the area is sedimentary in origin, it is possible that andesite encountered in one borehole is a result of a shallow magmatic intrusion into fracture zones in the sedimentary claystone bedrock. Peat covers the areas outside the landfills to a depth of approximately 5 feet bgs.

Groundwater at LF024/LF026 was encountered at approximately 16 to 19 feet bgs (2 to 7 feet above msl). Water contained in a zone of saturated peat was also common. North of the sources, groundwater was encountered at approximately 15 feet bgs, or 30 feet above msl. The groundwater generally flows south toward the Pacific Ocean and tends to vary in gradient with the surface topography. Several seeps were found along the southern coastline near the source areas, and a few seeps were found upgradient of LF024/LF026.

Monitoring Well SWl0W3, located approximately 200 feet from the ocean, showed minor responses to tide changes. Monitoring wells located closer to the ocean showed tidal influences of up to 2.5 feet.

Upgradient surface-water bodies at LF024/LF026 include Laundry Lake and its associated drainages. Several small, unnamed ponds are also located upgradient of the sites. Precipitation that does not infiltrate the ground follows the surface topography and flows south toward the ocean. The primary surface-water body downgradient of LF024/LF026 is Skoot Cove and the Pacific Ocean. Seeps and small drainages are common along the southern coastline of the sources. Tidal influences along the intertidal area may be as much as 1.5 feet normally, and more during storms.

2.2 Site History and Enforcement Activities

This section provides background information and summarizes the series of investigations that led to this ROD. It describes the response actions undertaken at the sites to address State of Alaska regulations. In accordance with USAF policy, to the extent practicable, National Environmental Policy Act (NEPA) values have been incorporated throughout the approach adopted in reaching the selected remedies culminating in this ROD.

Eareckson AS is one of many USAF installations that are part of a defense communication network and aircraft warning system across Alaska. The Army first developed facilities on Shemya Island in 1943 to support operations against the Japanese occupation forces on the nearby islands during WWII. In 1954, the site was deactivated, and was turned over to the Civil Aeronautics Authority in 1955. In 1958, the USAF returned to Shemya Island to support various USAF and Army strategic intelligence gathering activities. It has remained active in this capacity to the present.

Some wastes were disposed of in landfills, others were burned in fire training pits, and many waste materials (reportedly including hundreds of thousands of drums) were buried in the ground or placed in storage areas across the island.

Most contamination found on the island is related to fuels, oils, and lubricants. Investigations have shown areas of fuel-contaminated soils in, and next to, many of the landfills, fire training pits, and other disposal areas. Fuel-contaminated soils are related to specific sources.

Groundwater contamination is primarily a result of fuel handling activities (i.e., storage tanks and pipelines) and the fire training pits. Contaminants detected in groundwater include benzene, toluene, ethylbenzene, and xylenes (BTEX), which are components of fuel, and trichloroethylene (TCE), which is a solvent commonly used as a degreasing agent.

2.2.1 Previous Investigations

In 1984, recognizing the need to undertake a comprehensive program to investigate and clean up all past contamination problems at Shemya Island, the USAF initiated IRP investigations. Between 1984 and the present, the USAF conducted a variety of IRP activities to identify possible sources of contamination on the island. These activities included record searches (similar to a CERCLA Preliminary Assessment), a Site Investigation, limited source investigations, and multi-media RI sampling at different locations throughout the island. Major IRP site investigations conducted to date involving ERP Sites LF018 and LF024/LF026 are summarized below.

Phase I, Records Search Report (JRB, 1984)

The Phase I report identified 28 source areas at Eareckson AS as potentially containing hazardous material from past activities. Eight of the areas were assessed as having a low potential for contaminant release; the Hazard Assessment Ranking Methodology was used to prioritize the remaining 20 source areas. These source areas were determined to be likely areas containing hazardous waste constituents where significant potential for migration of the potentially hazardous constituents was thought to exist.

IRP Stage 1 Final Technical Report (USAF, 1990)

In 1988, pits were dug into the face of the bluff at LF024/LF026 where dense debris was located. The intent was to determine the width of the disposal area. Surface and subsurface soil samples were collected and a geophysical survey was conducted to assess the extent of the landfills.

1992 Site Investigation (WCC, 1993)

Surface soil samples from the face of the bluff and sediment samples at the beach were collected at LF024 during this 1992 field investigation. Surface soil samples were collected from the face of the bluff at LF026. A groundwater seep sample was collected from a seep emanating from the bluff below LF026.

1992 IRP Investigation (USAF, 1993)

LF018. Surface and subsurface soil samples were collected and a geophysical survey was conducted at LF018. The geophysical survey revealed extensive buried debris, as well as the landfill extent in the east-west direction. Buried debris, fill, and petroleum odors were encountered in trenches excavated to approximately 8 feet bgs. Groundwater with an oily sheen was found at a depth of 7 feet bgs in one trench.

LF024/LF026. A geophysical survey was conducted and surface and subsurface soil, groundwater, and sediment samples were collected from LF024/LF026. Additionally, five groundwater monitoring wells were installed, with subsurface samples collected from each soil boring. The areal extents of the landfills were characterized by a geophysical survey. Metal debris was found buried, mostly along the southern edge of the area – along the top of the bank. The beach area also contained isolated areas of buried metal.

1993 Site Characterization (USAF, 1994b)

Surface water samples from LF018 were analyzed during this investigation. Well points were sampled, and three monitoring wells were installed to investigate groundwater in the area.

RI/FS, Volumes I-IV and Appendices (USAF 1995, 1996a, b, and c)

LF018. During 1993 RI/FS activities, surface water samples were collected from ephemeral ponds in the LF018 area. Three monitoring wells were installed, and soil and groundwater samples were collected. In 1994, groundwater samples were collected from each of the monitoring wells, and sediment samples were collected.

LF024/LF026. In 1993, sediment and surface water samples were collected from a seep and drainage around LF024/LF026. In 1994, sediment and groundwater sampling was conducted. Ecological samples were collected to determine whether potentially hazardous constituents might be affecting receptors in Skoot Cove.

Technical Memorandum, Results of 1995 IRP Field Program (USAF, 1996d)

A groundwater sample was collected at LF18-MW01 in 1995 to monitor off-island discharge of constituents from the landfill area.

Basewide Monitoring Program Reports (USAF 1999, 2000, 2001, 2005a)

LF018. Groundwater at LF018 has been sampled three times (1998, 1999, and 2000) as part of the Eareckson Basewide Monitoring Program. In 2004, sediment samples were collected from in

or just above the intertidal zone where transportation of contaminants from LF018 would be most likely.

LF024/LF026. Groundwater, surface water, and sediment were sampled at LF024/LF026 as part of the Basewide Monitoring Program in 1998, 1999, and 2000.

LF018 Sampling Technical Memorandum (USAF, 2005b)

A groundwater sample was collected at LF018 in 2005 at the request of ADEC.

2.2.2 Remedial Activities Performed

Disturbance of the LF018 area is apparent in a 1961 aerial photograph (USAF, 1996c). This photo shows tens of thousands of drums stacked in the area. Hand-written remarks made in 1971 describing cells of "3,500 barrels" and "4,500 barrels" are made in a 1964 Alaskan Air Command Master Plan Base Map. In a 1986 stereo photograph, LF018 appears much as it does today, with the visible drums having been removed. Based on the presence of drums in 1971 and their absence in 1986, it is assumed that the drums were removed during the USAF Alaska Cleanup Effort in the 1980s. The 1990 Stage 1 Final Technical Report (USAF, 1990) reports that scrap metal was removed from the barrel dump area, and 4- to 12-inch-diameter rock was placed in the old dump site by 1987. The landfill is currently capped by peat.

LF024 was used as a disposal area for empty 55-gallon drums, most of which formerly contained fuel. The number of drums was reported to be in the thousands. In 1984, the majority of these drums were removed from the island by the USAF. As a result of this drum removal effort, the hillsides surrounding LF024 became unstable and considerable sloughing occurred. To stabilize the area, most of LF024 was covered with large rocks in 1987. Various types of metal debris, but no barrels or drums, were observed at the site in 1998 but were not present in 2008.

LF026 was used as a disposal area for metal debris, vehicle parts, wood, and other debris. Much of the site was backfilled with large rocks and graded for stabilization in 1987.

2.3 Community Participation

A number of public participation activities were undertaken by the lead agency (the USAF) following preparation of the Proposed Plan (USAF, 2002) and review by ADEC. The public participation process was performed in a manner consistent with the NCP Section 300.430(f)(3).

Prior to conducting investigations at LF018 and LF024/LF026, the USAF initiated a community relations program for Eareckson AS (USAF, 1994a). Two public meetings were held in Anchorage in 1994 (regarding environmental cleanup at Eareckson AS) and 2002 to discuss findings of the investigations. A community meeting was held at Eareckson AS in 1995 to discuss island-wide environmental investigations. In addition, Fact Sheets and newsletters were published to update the public on the activities being conducted at Eareckson AS.

The public notification for documents available concerning ERP Sites LF018 and LF024/LF026 is presented in **Table 2-1.**

Table 2-1 Public Notification of Document Availability for Sites LF018 and LF024/LF026

Requirement:	**Satisfied by:**
Notice of availability of the Proposed Plan and RI/FS must be made in a widely-read section of a major local newspaper.	Notice of availability of the Proposed Plan for Six Sites, including Sites LF018 and LF024/LF026, was published in the Anchorage Daily News in March 2002.
Notice of availability should consist of the following information: • Site name and location. • Date and location of public meeting. • Identification of lead and support agencies. • Request for public comments. • Public participation opportunities including: - Location of information repositories and Administrative Record file. - Methods by which the public may submit written and oral comments, including a contact person. - Dates of public comment period. - Contact person for the community advisory group (e.g., Restoration Advisory Board) if applicable.	The notice of availability included all of these components.

Key:
RI/FS – Remedial Investigation/Feasibility Study

The public comment period requirements are presented in **Table 2-2**.

No comments on the Proposed Plan were received.

2.4 Current and Potential Future Land and Resource Uses

Current and potential future land and resource uses are the same for the three ERP Sites and are discussed in this section.

Eareckson AS encompasses Shemya Island in its entirety. Shemya Island has no local communities or residents; access to the island is limited to USAF-approved activities only. There are no current plans for any future development at the three ERP sites; therefore, the reasonably anticipated future land use is the same as the current land use – which is Closed Landfill under Industrial Use.

Table 2-2 Public Comment Period Requirements for Sites LF018 and LF024/26

Requirement:	Satisfied by:
Lead agency should make document available to public for review on same date as newspaper notification.	The document was available to the public when the notification of availability was made.
Lead agency must ensure that all information that forms the basis for selecting the response action is included as part of the Administrative Record file and made available to the public during the public comment period.	All data collected and all CERCLA primary documents produced for these sites are available at: http://www.adminrec.com/PACAF.asp.
CERCLA Section 177(a)(2) requires the lead agency to provide the public with a reasonable opportunity to submit written and oral comments on the Proposed Plan. NCP Section 300.430(f)(3)(i) requires the lead agency to allow the public a minimum of 30 days to comment on the RI/FS and the Proposed Plan.	The USAF provided a public comment period for the RI/FS and the Proposed Plan from May 1 to May 31, 2002.
The lead agency must extend the public comment period by at least 30 additional days upon timely request.	The USAF received no requests to extend the public comment period for these three sites.
The lead agency must provide the opportunity for a public meeting to be held at or near the site during the public comment period. A transcript of this meeting must be made available to the public and be maintained in the Administrative Record for the site (pursuant to NCP Section 300.430(f)(3)(i)(E)).	A public meeting was held for LF018 and LF024/LF026 on May 2, 2002, at the Loussac Library in Anchorage, Alaska.

Key:
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
NCP – National Contingency Plan
RI/FS – Remedial Investigation/Feasibility Study
USAF – U.S. Air Force

The groundwater resources beneath and in the vicinity of LF018 and LF024/LF026 are described in Sections 2.1.2.1 and 2.1.2.2, respectively. Groundwater at each of the sites is not currently used for any purposes or expected to be used for any purposes. The shallow aquifers, and their proximity to marine water, limit the usefulness of this resource.

The surface water resources in the vicinity of LF018 and LF024/LF026 are described in Sections 2.1.2.1 and 2.1.2.2, respectively. Surface water at each of the sites is used for aquatic life and wildlife propagation. The surface water at the sites is not currently being used for water supply purposes at Eareckson AS, and there are no plans to develop the surface water as drinking water sources.

2.5 Site Contamination and Risks

The investigations conducted at LF018 and LF024/LF026 have provided information to evaluate the extent of contamination and the associated risks to human health and the environment. The investigation results are summarized below.

The overall objectives of the numerous investigations conducted were to identify source and migration pathways associated with waste disposal operations, and to determine the impacts to human and ecological receptors. In order to achieve these objectives, samples of soil, surface water, sediment, and groundwater were collected for laboratory analysis. A summary of samples collected at LF018 is presented in **Table 2-3** and a summary of samples collected at LF024/LF026 is presented in **Table 2-4**.

An on-site laboratory was established on Shemya Island during the RI/FS. On-site laboratory analyses were subjected to the same quality assurance/quality control procedures as those of a standard, off-site analytical laboratory. Analytical results generated by the on-site laboratory were used as a screening tool to focus the collection of additional samples that were then shipped to an off-site laboratory for more definitive analysis. Field analytical data were not used for evaluation of risk to human health or the environment. The decision to use an on-site laboratory is detailed in the RI/FS Work Plan, which was reviewed and approved by ADEC prior to implementation.

A summary of off-site laboratory results compared to screening levels and background concentrations by environmental media for samples collected at LF018 are listed on Tables A-2 through A-7 and A-13 through A-16 in **Appendix A**. Figure 2-2 depicts sampling locations at LF018 and analytical results that exceed ADEC Method Two soil cleanup levels, ADEC groundwater cleanup levels, or background concentrations.

A summary of off-site laboratory results compared to screening levels and background concentrations by environmental media for samples collected at LF024/LF026 are listed on Tables B-2 through B-11 in **Appendix B**. Figure 2-3 depicts sampling locations at LF024/LF026, except for surface soil locations, and analytical results that exceed ADEC Method Two soil cleanup levels, ADEC groundwater cleanup levels, or background concentrations. Surface soil locations at LF024/LF026 are depicted on Figure 2-4.

The following sections discuss the off-site laboratory results. Contaminants that were retained for the Tier I human and ecological risk assessment are identified. In summary, analytes detected at concentrations in excess of one-tenth the cleanup criteria in 18 AAC 75.341 and 18 AAC 75.345, and/or appropriate ecological screening criteria, were retained for human health and ecological risk assessment as chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs), respectively. A discussion of the risk assessment methods and results are presented in Appendix A for LF018 and in Appendix B for LF024/LF026.

Table 2-3 Sampling Summary for ERP Site LF018, Eareckson Air Station

Media	Year	Laboratory[1]	Number of Samples	BTEX (SW8020)	TPH (E418.1)	VOCs	SVOCs	PPCBs	Metals	GRO	DRO	RRO (AK103)	PAHs (SW8270 SIM)	Common Anions (E300)	P450
Surface Soil	1992	On-site	10	--	✓	--	--	--	--	--	--	--	--	--	--
		Off-site	10	--	--	A	B	C	D	--	--	--	--	--	--
Subsurface Soil	1992	On-site	3	✓	✓	--	--	--	--	--	--	--	--	--	--
		Off-site	3	--	--	A	B	C	D	--	--	--	--	--	--
	1993	On-site	3	✓	--	F	--	--	--	G	G	--	--	--	--
Surface Water	1993	On-site	4	✓	--	F	--	--	--	G	G	--	--	--	--
		Off-site	2	--	--	H	I	J	K	G	L	--	--	✓	--
Sediment	1994	On-site	3	✓	--	F	--	--	--	M	N	--	--	--	✓
	2004	Off-site	3			H	I	O	P	--	--	--	--	--	--
Groundwater	1993	On-site	5	✓	--	F	--	--	--	G	G	--	--	--	--
		Off-site	3	--	--	H	I	J	K	G	L	--	--	✓	--
	1994	On-site	3	✓	--	F	--	--	--	G	G	--	--	--	--
		Off-site	3	--	--	--	I	--	P	--	--	--	--	✓	--
	1995	Off-site	1	--	--	H	I	--	P	--	--	--	--	--	--
	1998	Off-site	2	--	--	H	--	--	P	--	--	--	✓	--	--
	1999	Off-site	2	--	--	H	--	--	P	--	--	--	✓	--	--
	2000	Off-site	1	--	--	H	I	--	P	M	N	✓	✓	--	--

Key:
-- – Analysis not performed.
✓ – Analysis performed.
1 – On-site laboratories consisted of portable gas chromatographs and an infrared spectrophotometer located on Shemya Island. Off-site laboratories were NVLAP accredited laboratories.
A – E624
AK – Alaska Method
B – E625
BTEX – benzene, toluene, ethylbenzene, and xylenes
C – E608
D – Metals SW6010
DRO – diesel range organics
E – EPA Method
EPA – U.S. Environmental Protection Agency
ERP – Environmental Restoration Program
F – SW8010 (tetrachloroethylene and trichloroethylene only)
G – SW8015M
GRO – gasoline range organics
H – SW8260
I – SW8270
J – SW8080
K – Metals (SW6020)
L – SW8100M
M – AK101
N – AK102
NVLAP – National Voluntary Laboratory Accreditation Program
O – SW8082
P – Total Analyte List of Metals (SW6010/7000)
P450 – Rapid screening test using induction of a specific family of cytochrome P450s
PAHs – polynuclear aromatic hydrocarbons
PPCBs – pesticides and polychlorinated biphenyls
RRO – residual range organics
SIM – selective ion monitoring
SVOCs – semi-volatile organic compounds
SW – EPA Solid Waste Method
TPH – total petroleum hydrocarbons
VOCs – volatile organic compounds

Table 2-4 Sampling Summary for ERP Site LF024/LF026, Eareckson Air Station

Media	Year	Laboratory[1]	Number of Samples	BTEX (SW8020)	TPH (E418.1)	TCE/PCE (SW8010)	VOCs	SVOCs	Pest/ PCBs	Metals	GRO	DRO	Cyanide	Common Anions (E300)
Surface Soil	1988	Off-site	4	--	✓	--	A	B	--	C	--	--	--	--
	1992	On-site	28	✓	✓	✓	--	--	--		--	--	--	--
		Off-site	38	--	✓	--	D/A	F/B	G	C	--	--	H	--
Subsurface Soil	1988	Off-site	2	--	✓	--	A	G	--	C	--	--	--	--
	1992	On-site	11	✓	✓	✓	--	--	--	--	--	--	--	--
		Off-site	5	--	✓	--	D/A	F/B	G	I/C	--	--	H	--
	1993	On-site	1	✓	--	✓	--	--	--	--	J	J	--	--
Surface Water	1992	On-site	2	✓	✓	✓	--	--	--	--	--	--	--	--
		Off-site	1	--	--	--	A	B	G	--	--	--	--	
	1993	On-site	6	✓	--	✓	--	--	--	--	J	J	--	
		Off-site	1	--	--	--	A	B	G	C/K	J	L	--	✓
	1998	Off-site	2	--	--	--	M	--	--	C	--	--	--	--
	1999	Off-site	2	--	--	--	M	--	--	C	--	--	--	--
	2000	Off-site	2	--	--	--	--	--	--	C	--	--	--	--
Sediment	1992	Off-site	1	--	--	--	D/A	F/B	G	C	--	--	H	--
	1993	On-site	7	✓	--	✓	--	--	--	--	J	J	--	--
		Off-site	1	--	--	--	M	B	G	C	J	L	--	--
	1994	On-site	4	✓	--	✓	--	--	--	--	J	J	--	--
		Off-site	1	--	--	--	--	B	G	C	--	--	--	✓
	1998	Off-site	2	--	--	--	M	--	--	C	--	--	--	--
	1999	Off-site	2	--	--	--	M	--	--	C	--	--	--	--
	2000	Off-site	2	--	--	--	--	--	--	C	--	--	--	--

Table 2-4 (Cont.) Sampling Summary for ERP Site LF024/LF026, Eareckson Air Station

Media	Year	Laboratory[1]	Number of Samples	BTEX (SW8020)	TPH (E418.1)	TCE/PCE (SW8010)	VOCs	SVOCs	Pest/ PCBs	Metals	GRO	DRO	Cyanide	Common Anions (E300)
Groundwater	1992	On-site	5	✓	--	✓	--	--	--	--	J	J	--	--
		Off-site	5	--	--	--	D	H	N	I	--	--	--	--
	1993	On-site	8	✓	--	✓	--	--	--	--	J	J	--	--
		Off-site	1	--	--	--	--	B	G	C	--	--	--	✓
	1994	On-site	6	✓	--	✓	--	--	--	--	J	J	--	--
		Off-site	1	--	--	--	--	--	--	I	--	--	--	✓
	1998	Off-site	2	--	--	--	M	--	--	C	--	--	--	--
	1999	Off-site	2	--	--	--	M	--	--	C	--	--	--	--
	2000	Off-site	2	--	--	--	--	--	--	C	--	--	--	--

Key:

-- – Analysis not performed.
✓ – Analysis performed.
1 – On-site laboratories consisted of portable gas chromatographs and an infrared spectrophotometer located on Shemya Island. Off-site laboratories were NVLAP accredited laboratories.
A – SW8240
B – SW8270
BTEX – benzene, toluene, ethylbenzene, and xylenes
C – Target Analyte List Metals (SW6010/7000)
D – E624
DRO – diesel range organics
E – EPA Method
EPA – U.S. Environmental Protection Agency
ERP – Environmental Restoration Program
F – E625
G – SW8080
GRO – gasoline range organics
H – SW9010
I – E 200.7
J – SW8015M
K – SW6020
L – SW8100M
M – SW8260
N – E608
NVLAP – National Voluntary Laboratory Accreditation Program
PCBs – polychlorinated biphenyls
PCE – perchloroethylene
Pest – pesticides
SVOCs – semi-volatile organic compounds
SW – EPA Solid Waste Method
TCE – trichloroethylene
TPH – total petroleum hydrocarbons
VOCs – volatile organic compounds

2.5.1 ERP Site LF018

The locations of samples at LF018 containing constituents found at concentrations exceeding regulatory criteria and/or background levels, and the sample concentrations are shown on Figure 2-2 and a summary of samples collected and analyses performed is presented in Table 2-3.

2.5.1.1 Surface Soil

In 1992, analytical results indicated surface soil at LF018 contained detectable levels of TPHs, PCBs, and 4,4'-dichlorodiphenyldichloroethane (DDD); some metals concentrations in the surface soil samples were slightly above background levels. TPH levels ranged from 6.8 to 371 mg/Kg; PCBs ranged from 0.059 to 0.110 mg/Kg; and 4,4'-DDD ranged from 0.0048 to 0.0056 mg/Kg. Aluminum, cobalt, copper, iron, potassium, magnesium, and sodium were detected above background levels. Thallium was detected at all surface soil sample locations (background data are not available for thallium).

The following contaminants were retained as COPCs or COPECs in surface soils at LF018 for the Tier I human health and ecological screening (Appendix A). Bold text indicates the contaminant concentration exceeded ADEC Method Two cleanup levels:

- Aluminum
- **Chromium**
- Magnesium
- **Thallium**
- Barium
- Cobalt
- Manganese
- Vanadium
- **Cadmium**
- **Copper**
- Nickel
- Zinc

Based on current land use and the updated risk assessment, the COPCs and COPECs detected in surface soil at LF018 pose no unacceptable human health risk (Appendix A). An ecological risk was identified for surface soil due to thallium. However, as discussed in Section 2.6.5, the thallium results appear to be erroneous and the surface soils are not anticipated to result in significant ecological impacts.

2.5.1.2 Subsurface Soil

During the 1992 investigation, three subsurface soil samples at LF018 were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. One VOC (perchloroethylene) was detected in one sample at a concentration of 0.002 mg/Kg. Potassium was detected in one sample above background levels. Thallium was also detected in all three samples.

The following contaminants were retained as COPCs or COPECs in subsurface soils at LF018 for the Tier I human health and ecological screening (Appendix A). Bold text indicates the contaminant concentration exceeded ADEC Method Two cleanup levels:

- Barium
- **Chromium**
- Manganese
- Vanadium
- Beryllium
- Cobalt
- **Silver**
- Zinc
- **Cadmium**
- Magnesium
- **Thallium**

Based on current land use and the updated risk assessment, the COPCs and COPECs detected in subsurface soil at LF018 pose no unacceptable human health risk (Appendix A). An ecological risk was identified for subsurface soil due to thallium. However, as discussed in Section 2.6.5, the thallium results appear to be erroneous and the subsurface soils are not anticipated to result in significant ecological impacts.

2.5.1.3 Surface Water

Analytical surface water samples were collected from two ponds at LF018 during the 1993 RI/FS. DRO was detected in both samples at levels of 0.071 and 0.14 mg/L. Chloride and manganese were detected above background levels.

The following contaminants were retained as COPECs in surface water at LF018 for the Tier I ecological screening (Appendix A). Bold text indicates that the contaminant concentration exceeded ADEC surface water quality criteria:

- **Aluminum**
- **Copper**
- Molybdenum
- Barium
- Magnesium
- Acetone
- Cobalt
- Manganese
- Carbon Disulfide

Based on current land use and the updated risk assessment, COPECs detected in surface water at LF018 do pose an ecological risk (Appendix A). The calculated risk is due primarily to aluminum. Human exposure to surface water is not considered a complete pathway on Shemya Island.

2.5.1.4 Sediment

In 1994, three sediment samples were collected from the intertidal area northeast of LF018 and submitted for field screening and P450 analysis. No field-screening constituents (BTEX, TCE/ perchloroethylene, GRO, and DRO) were detected. The P450 analysis indicated that sediments adjacent to LF018 do not contain elevated organic constituent concentrations.

Three sediment samples were collected in 2004 from in or just above the intertidal zone at LF018. Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Metals were detected in the sediment samples, but all were below both the NOAA SQuiRTs and the Shemya Island maximum background concentrations (97.5 percentile) for metals.

No contaminants were retained as COPCs or COPECs in sediments at LF018.

2.5.1.5 Groundwater

Three groundwater monitoring wells were installed at LF018 in 1993. Samples were collected from the three wells over multiple years. Low levels of metals, near the background or cleanup level, were detected. Aluminum, chromium, lead, and vanadium were detected at concentrations slightly above background levels.

Low levels of DRO (0.068 to 2.8 mg/L) were detected in all three groundwater samples collected at LF018 in 1993. During basewide monitoring events in 1999, benzo(a)anthracene,

benzo(a)pyrene, and dibenzo(a,h)anthracene exceeded the ADEC cleanup standards. No analytes exceeded cleanup standards in 2000. In 2005, LF018-MW01 was resampled for DRO and polynuclear aromatic hydrocarbons (PAHs). The sample contained DRO at a level below the ADEC Table C Groundwater Cleanup Level of 1.5 mg/L.

In 1995, a groundwater sample was analyzed to monitor off-island discharge of constituents from LF018 ("marine groundwater"). Ethylbenzene, xylenes, and molybdenum were detected at slightly higher concentrations than in previous samples. However, dichlorobenzene, TCE, SVOCs, and numerous inorganics detected in previous samples were not detected in the 1995 sample.

The following contaminants were retained as COPCs or COPECs in groundwater at LF018 for the Tier I human health and ecological screening (Appendix A). Bold text indicates the contaminant concentration exceeded ADEC Groundwater cleanup levels:

- Aluminum
- Barium
- **Chromium**
- **Lead**
- **Nickel**
- Zinc
- Acetone
- Phenanthrene
- **Antimony**
- Beryllium
- Cobalt
- Manganese
- Silver
- 1,1-Dichloroethane
- Xylenes
- GRO
- **Arsenic**
- Cadmium
- Copper
- Molybdenum
- Vanadium
- 1,3-Dichlorobenzene
- Fluoranthene
- **DRO**

Based on current land use and the updated risk assessment, groundwater at LF018 does pose a risk to humans if it is consumed. The risk drivers are carcinogenic PAHs and antimony. An ecological hazard index (HI) greater than 1 was calculated for groundwater at LF018. This exposure pathway assumes that contaminant concentrations measured in the fresh groundwater at the site migrate to surface marine waters at the same concentrations. This is highly unlikely and the risks are likely overstated.

2.5.2 ERP Site LF024/LF026

The locations of samples at LF024/LF026 containing constituents found at concentrations exceeding regulatory criteria and/or background levels, and the concentrations, are shown on Figure 2-3, and surface soil sample locations are shown on Figure 2-4. A summary of samples collected and analyses performed is presented in Table 2-4.

2.5.2.1 Surface Soil

Surface soil samples were collected from LF024/LF026 during 1992. Several metals, a VOC (methylene chloride), and one SVOC (pentachlorophenol) exceeded cleanup and/or background criteria. Methylene chloride is a common laboratory contaminant and may not be associated with the site. The pentachlorophenol concentration is an isolated exceedence (1 of 36 samples).

The following contaminants were retained as COPCs or COPECs in surface soils at LF024/LF026 for the Tier I human health and ecological screening (Appendix B). Bold text indicates the contaminant concentration exceeded ADEC Method Two cleanup levels:

- Aluminum
- Barium
- **Copper**
- Mercury
- 2-Methylnaphthalene
- Bis(2-Ethylhexyl)phthalate
- Petroleum Hydrocarbons
- 4,4-Dichlorodiphenyltrichloroethane (DDT)
- **Antimony**
- **Cadmium**
- **Lead**
- Molybdenum
- Silver
- Zinc
- Vanadium
- Di-n-butyl phalate
- PCBs
- **Arsenic**
- **Chromium**
- Manganese
- Nickel
- **Thallium**
- **Selenium**
- Benzo(a)pyrene

The updated risk assessment for LF024/LF026 (Appendix B) calculated a cancer risk and a noncancer risk that exceeded the thresholds. Ninety-seven percent of the cancer risk was due to arsenic. Arsenic, together with thallium, contributed to 89 percent of the noncancer risk. Arsenic and thallium at the site are discussed in Section 2.6.5. The calculated ecological risk also exceeded the threshold, primarily due to lead, thallium, and zinc. Lead is expected to be largely non-bioavailable and zinc is an essential nutrient except at very high concentrations. It should be noted that the risk is based on the most protective receptor (snow bunting) that derives 100 percent of its diet from LF024/LF026 – which is highly unlikely.

2.5.2.2 Subsurface Soil

Subsurface soil samples were collected from LF024/LF026 during 1992 and 1993. Several metals and a VOC (benzene) exceeded cleanup and/or background criteria. The metal detections were either an isolated elevated level or are attributed to background concentrations and not anthropogenic activities. The benzene concentration is an isolated exceedence (1 of 7 samples).

The following contaminants were retained as COPCs or COPECs in subsurface soils at LF024/LF026 for the Tier I human health and ecological screening (Appendix B). Bold text indicates the contaminant concentration exceeded ADEC Method Two cleanup levels:

- **Antimony**
- Beryllium
- Manganese
- Zinc
- Vanadium
- Di-n-butyl phalate
- **Arsenic**
- **Cadmium**
- Copper
- **Silver**
- Zinc
- PCBs
- Barium
- **Chromium**
- **Lead**
- **Thallium**
- Bis(2-Ethylhexyl)phthalate
- Petroleum Hydrocarbons

The updated risk assessment for LF024/LF026 (Appendix B) calculated a cancer risk and a noncancer risk that exceeded the thresholds. Similar to the surface soil results, most of the cancer risk was due to arsenic, and arsenic together with thallium contributed to most of the noncancer risk. Arsenic and thallium at the site are discussed in Section 2.6.5. The calculated ecological risk also exceeded the threshold, again primarily due to lead, thallium, and zinc.

2.5.2.3 Marine Surface Water

From 1992 to 2000, marine surface water samples were collected from three locations at LF024/LF026. In 1993, trace levels (below cleanup criteria) of DRO and low levels of several VOCs were detected in the surface water; however, in 1999 the VOCs were no longer at detectable concentrations. No organic contaminants were detected above cleanup criteria in 1998. Surface water quality standards and/or background levels for barium, cadmium, cobalt, copper, iron, lead, and/or manganese were exceeded in surface water samples collected at LF024/LF026 from 1993 to 1999. In 2000, cadmium, copper, and lead were detected at levels exceeding the applicable ADEC water quality criteria.

The following contaminants were retained as COPECs in marine surface water at LF024/LF026 for the Tier I ecological screening (Appendix B). Bold text indicates that the contaminant concentration exceeded ADEC surface water quality criteria:

- Aluminum
- Barium
- **Cadmium**
- Chromium
- Cobalt
- **Copper**
- **Lead**
- **Manganese**
- Molybdenum
- Vanadium
- Zinc
- 1,3-Dichlorobenzene
- 2-Hexanone
- 4-Methyl-2-Pentanone
- Acetone
- Carbon Disulfide
- GRO
- DRO

Based on the updated risk assessment for LF024/LF026 (Appendix B), the calculated ecological risk exceeded the threshold, primarily due to aluminum, copper, lead, and manganese. However, human exposure to marine surface water is not considered a complete pathway on Shemya Island.

2.5.2.4 Marine Sediment

Marine sediment samples were collected from two locations at LF024/LF026 between 1993 and 2000. Throughout the years of sediment sampling, various metals were detected, with a few exceeding cleanup criteria. The metals were either an isolated elevated level or are attributed to background metal concentrations and not the result of human activities. In 2000, 10 metals were detected in one sediment sample above background levels; six were detected at levels exceeding the NOAA benchmark criteria. Three metals were detected above background levels in the second sediment sample collected in 2000; only one exceeded the NOAA benchmark criteria.

The following contaminants were retained as COPECs in marine sediment water at LF024/LF026 for the Tier I ecological screening (Appendix B). Bold text indicates that the contaminant concentration exceeded NOAA benchmark criteria:

- Aluminum
- **Antimony**
- **Arsenic**
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- **Copper**
- **Lead**
- Manganese
- **Mercury**
- Molybdenum
- **Nickel**
- Selenium
- Thallium
- Vanadium
- Zinc
- Methylene Chloride
- Bis(2-ethylhexyl)phthalate
- Di-n-butyl phthalate

Based on the updated risk assessment for LF024/LF026 (Appendix B), the calculated ecological risk exceeded the threshold, primarily due to arsenic, copper, lead, nickel, and zinc. However, human exposure to marine sediment is not considered a complete pathway on Shemya Island.

2.5.2.5 Groundwater

From 1992 to 2000, groundwater samples were collected from five monitoring wells in and near LF024/LF026. Aluminum, arsenic, beryllium, cadmium, magnesium, manganese, molybdenum, potassium, silver, sodium, and vanadium were detected in one or more samples at concentrations above cleanup criteria and/or background concentrations. Thallium was detected at concentrations above cleanup criteria in all five monitoring wells. No contaminants were detected above cleanup criteria in 1998. During the 2000 monitoring event, a number of metals were detected at levels above background, but only arsenic, cadmium, and lead were detected at concentrations exceeding 18 AAC 75.345 Table C groundwater cleanup levels.

The following contaminants were retained as COPECs in groundwater at LF024/LF026 for the Tier I ecological screening (Appendix B). Bold text indicates the contaminant concentration exceeded ADEC Groundwater cleanup levels:

- Aluminum
- Beryllium
- Cobalt
- Manganese
- Nickel
- **Vanadium**
- Carbon Disulfide
- Dibenzofuran
- GRO
- **Arsenic**
- **Cadmium**
- Copper
- Mercury
- Silver
- Zinc
- Chloromethane
- Diethyl phthalate
- DRO
- Barium
- Chromium
- **Lead**
- Molybdenum
- **Thallium**
- Acetone
- Xylenes
- 2-Methylnapthalene

Based on the updated risk assessment for LF024/LF026 (Appendix B), the calculated ecological risk exceeded the threshold, primarily due to aluminum. This exposure pathway assumes that contaminant concentrations measured in the fresh groundwater at the site migrate to surface marine waters at the same concentrations. This is highly unlikely and the risks are likely overstated. Human risk was not calculated. Salt water intrusion into the aquifer makes it unlikely that the groundwater at LF024/LF026 would be used as a drinking water source.

2.5.3 Identification of Chemicals of Concern

This section identifies those chemicals associated with exceedances of 18 AAC 75. These exceedances do not necessarily mean that there is unacceptable risk at the site. Based upon current site conditions, industrial closed landfill, there is no unacceptable risk.

The chemicals and media of concern for ERP Sites LF018 and LF024/LF026 are presented in **Tables 2-5** through **2-8**.

Table 2-5 Contaminants of Concern for ERP Site LF018, Eareckson Air Station

Media	Chemical of Concern	Concentration		Frequency of Detection	Cleanup Criteria[1]
		Minimum	Maximum		
Groundwater (mg/L)	Antimony	ND	0.02	13%	0.006
	Arsenic	ND	0.0089	10%	0.010
	Lead	ND	0.019	67%	0.015
	Benzo(a)anthracene	ND	0.0014	29%	0.0012
	Benzo(b)pyrene	ND	0.0012	29%	NE
	Benzo(b)flouranthene	ND	0.0018	29%	0.0012
	Indeno(1,2,3-cd)pyrene	ND	0.00054	29%	0.0012

Key:
% – percent
1 – From ADEC 18 AAC 75.345 Table C
ERP – Environmental Restoration Program
mg/L – milligrams per liter
ND – not detected
NE – not established

Table 2-6 Contaminants of Ecological Concern for ERP Site LF018, Eareckson Air Station

Media	Chemical of Concern	Concentration		Frequency of Detection	Cleanup Criteria[1]
		Minimum	Maximum		
Surface Soil (mg/Kg)	Aluminum	8,870	28,300	100%	NE
	Thallium	4.6	92.4	100%	1.9
	Zinc	25.6	94.2	100%	4,100
Subsurface Soil (mg/Kg)	Thallium	17.3	44.8	100%	1.9
	Zinc	41.7	87.6	100%	4,100
Fresh Surface Water (mg/L)	Aluminum	0.24	0.6	100%	0.087
	Copper	0.0063	0.012	100%	0.006
Marine Surface Water[2] (mg/L)	Aluminum	2.8	78.8	100%	NE
	Copper	0.006	0.43	100%	0.0031
	Lead	0.012	0.21	100%	0.0081
	Manganese	18	82.3	100%	0.1
	Nickel	0.033	0.14	100%	0.0082
	Silver	0.0021	0.0032	100%	0.0019
	Zinc	0.1	0.83	100%	0.081

Key:
% – percent
1 – From ADEC 18 AAC 75.341 Table B1 for surface and subsurface soils and 18 AAC 70.020 for fresh and marine surface water.
2 – Contaminant concentrations listed for marine surface water are results from fresh groundwater that is assumed to be hydraulically connected to marine surface water.
ERP – Environmental Restoration Program
mg/Kg – milligrams per kilogram
mg/L – milligrams per liter
NE – not established

Table 2-7 Contaminants of Concern for ERP Site LF024/LF026, Eareckson Air Station

Media	Chemical of Concern	Concentration		Frequency of Detection	Cleanup Criteria[1]
		Minimum	Maximum		
Surface Soil (mg/Kg)	Antimony	5.7	30.1	100%	3.6
	Arsenic	1.2	53.1	100%	3.9
	Cadmium	0.49	18	100%	5.0
	Chromium	3.9	70.5	100%	25
	Selenium	0.76	39	100%	3.4
	Thallium	0.47	77	100%	1.9
	Vanadium	15.2	136	100%	580
	Methylene Chloride	0.005	0.019	100%	0.016
	Pentachlorophenol	0.21	0.21	100%	0.047
Subsurface Soil (mg/Kg)	Antimony	6.2	14	100%	3.6
	Arsenic	8.3	9.3	100%	3.9
	Cadmium	0.7	6.8	100%	5.0
	Chromium	14	81.3	100%	25
	Thallium	18.3	38.6	100%	1.9
	Benzene	0.009	0.049	100%	0.025

Key:
% – percent
1 – From ADEC 18 AAC 75.341 Table B1
ERP – Environmental Restoration Program
mg/Kg milligrams per kilogram

Table 2-8 Contaminants of Ecological Concern for ERP Site LF024/LF026, Eareckson Air Station

Media	Chemical of Concern	Concentration		Frequency of Detection	Cleanup Criteria[1]
		Minimum	Maximum		
Surface Soil (mg/Kg)	Aluminum	6,510	28,100	100%	NE
	Antimony	5.7	30.1	100%	3.6
	Arsenic	1.2	53.1	100%	3.9
	Barium	6.7	561	100%	1100
	Cadmium	0.49	18	100%	5.0
	Chromium	3.9	70.5	100%	25
	Cobalt	3.5	24.2	100%	NE
	Copper	16.5	892	100%	460
	Lead	10.5	1740	100%	400
	Selenium	0.76	39	100%	3.4
	Thallium	0.47	77	100%	1.9

Table 2-8 (Cont.)
Contaminants of Ecological Concern for ERP Site LF024/LF026, Eareckson Air Station

Media	Chemical of Concern	Concentration		Frequency of Detection	Cleanup Criteria[1]
		Minimum	Maximum		
Surface Soil (Cont.) (mg/Kg)	Zinc	38.4	919	100%	4100
	Bis(2-ethylhexyl)phthalate	0.04	2.9	100%	13
	Di-n-butyl phthalate	0.046	5	100%	80
	PCB (total)	0.036	0.173	100%	1
	4,4-DDT	0.0025	0.034	100%	7.3
Subsurface Soil (mg/Kg)	Antimony	6.2	14	100%	3.6
	Barium	15.4	380	100%	1100
	Cadmium	0.7	6.8	100%	5.0
	Chromium	14	81.3	100%	25
	Cobalt	5.9	23.2	100%	NE
	Copper	17.7	131	100%	460
	Lead	348	1,620	100%	400
	Thallium	18.3	38.6	100%	1.9
	Zinc	49.6	2,110	100%	4100
	Bis(2-ethylhexyl)phthalate	0.041	5.3	100%	13
	Di-n-butyl phthalate	0.95	0.95	100%	80
Marine Surface Water (mg/L)	Aluminum	0.081	0.54	100%	NE
	Arsenic	ND	0.0025	80%	0.036
	Copper	ND	0.067	75%	0.0031
	Lead	ND	0.18	50%	0.0081
	Manganese	0.037	1.8	100%	0.1
	Zinc	ND	0.032	67%	0.081
Marine Sediment (mg/Kg)	Antimony	ND	4.2	50%	0.63
	Arsenic	5.1	49.3	100%	7.24
	Cadmium	ND	0.95	43%	0.38
	Chromium	9.2	79.6	100%	49
	Copper	10.6	321	100%	18.7
	Lead	3.1	179	100%	30
	Mercury	ND	0.05	17%	0.13
	Nickel	8.8	134	100%	15
	Zinc	34	570	100%	94
	Bis(2-ethylhexyl)phthalate	0.078	0.11	100%	0.182

Key:
% – percent
1 – From ADEC 18 AAC 75.341 Table B1 for surface and subsurface soils; 18 AAC 70.020 for marine surface water; and NOAA SQuiRT values for marine sediment

ERP – Environmental Restoration Program
mg/Kg – milligrams per kilogram
mg/L – milligrams per liter
NE – not established

2.6 Cleanup Levels

Specific promulgated standards (i.e., ARARs) for petroleum hydrocarbons, VOCs SVOCs, PAHs, PCBs, pesticides, and metals exist in ADEC regulations for soil, surface water, and groundwater. The State of Alaska has promulgated soil and groundwater cleanup levels in 18 AAC 75 *Oil and Hazardous Substances Pollution Control Regulations*. Surface water standards are provided in 18 AAC 70 *Water Quality Standards*.

Potential cleanup levels for media at LF018 and LF024/LF026 are generally based on ADEC and other regulatory cleanup levels (where available) or Shemya Island maximum background concentration (97.5 percentile, see **Appendix C**), whichever is greater. Regulatory correspondence and comments are provided in **Appendix D**. Cleanup levels to allow for unrestricted use for soil, groundwater, surface water, and sediment are discussed in the following sections, along with a discussion of naturally-occurring metal concentrations.

2.6.1 Soil Cleanup Levels For Unrestricted Use

ADEC 18 AAC 75.340 provides four methods that may be used for developing soil cleanup levels. Method One applies only to petroleum contamination. Method Two applies to both petroleum and non-petroleum contamination and is generally applicable at all contaminated sites in Alaska, unless use of Method Three or Method Four cleanup levels is specifically approved. Method Three allows development of site-specific cleanup levels using standard equations provided in ADEC guidance. Method Four allows development of risk-based cleanup levels from a site-specific risk assessment.

The tabulated soil cleanup levels provided in ADEC 18 AAC 75.341 Method Two, Tables B1 and B2, Soil Cleanup Levels (Under 40-Inch Zone) (hereinafter referred to as ADEC Method Two cleanup levels) are potentially applicable for LF018 and LF024/LF026. These levels are protective of human health and the environment, allow for unlimited use and unrestricted exposure, and are appropriate for use at Eareckson AS. The following soil potential cleanup levels are applicable for analytes detected at the sites:

a. The ADEC 18 AAC 75.341 Method Two, Tables B1 and B2, Soil Cleanup Levels for the Under 40-Inch Zone, Inhalation, Ingestion, or Migration-to-Groundwater, whichever is more stringent, or

b. The Shemya Island maximum background concentration (97.5 percentile, see Appendix C), whichever is greater.

2.6.2 Groundwater Cleanup Levels For Unrestricted Use

ADEC groundwater cleanup criteria are listed in 18 AAC 75.345. Specific values are listed in 18 AAC 75.345, Table C for groundwater that is, or may be, used as a drinking water source. Alternatively, groundwater cleanup levels can be derived from a site-specific risk assessment, subject to ADEC approval.

Although groundwater at LF018 and LF024/LF026 are not current or potential drinking water sources, the following criteria are applicable as groundwater potential cleanup levels at these sites:

a. ADEC 18 AAC 75.345 Table C, Groundwater Cleanup Levels, or

b. Shemya Island maximum background concentration (97.5 percentile, see Appendix C), whichever is greater.

2.6.3 Surface Water Cleanup Levels For Unrestricted Use

Surface water criteria provided in ADEC 18 AAC 70 are protective of human health (water supply and water recreation uses) and the environment (aquatic life and wildlife propagation).

The following criteria are potentially applicable as cleanup levels for surface water at LF018 and LF024/LF026:

a. ADEC, 18 AAC 70 Water Quality Standards, or

b. The Shemya Island maximum background concentration (97.5 percentile, see Appendix C), whichever is greater.

2.6.4 Sediment Cleanup Levels For Unrestricted Use

With respect to cleanup levels, sediments are distinguished from soil by the degree to which they are submerged in water. The substrate in wetlands or streambeds that is submerged more than half of the year is considered sediment; the substrate in areas that are never or only occasionally submerged is considered soil.

Although there are no sediment cleanup levels established in regulation, Alaska water quality regulations (18 AAC 70) state that sediment contamination may not cause adverse effects on aquatic life. Therefore, sediment sample results were screened against background concentrations and Threshold Effects Level and Probable Effects Level values, as published in the NOAA SQuiRTS.

2.6.5 Naturally-Occurring Metals

Metals occur naturally in soil, groundwater, surface water, and sediments, and it can be difficult to differentiate natural background levels from metals concentrations due to human activity at contaminated sites. A “multiple lines of evidence” approach, which considers the likelihood that specific metals would result from human activity at a site, along with the distribution of metal detections and any background metal concentration data, is useful to evaluate whether any metals may be present at elevated concentrations due to human activity.

Background concentrations of metals in several environmental media on Shemya Island were derived in the 1995 RI/FS report (USAF, 1995). Background samples were collected in 1988, 1992, and 1994. In addition, data from the 1993 basewide sampling event was used in determining background concentrations. Samples were collected from surface soil, subsurface

soil, freshwater sediments, marine sediments, fresh surface water, marine water, and fresh groundwater.

Statistical properties of the data sets were examined to identify multiple, independent distributions that might be attributable to differences between background distributions and elevated concentrations as a result of releases from contaminant sources. Once the apparent background distribution was identified, summary statistics were developed for the data. These statistics were then used to estimate appropriate statistical ranges of the background distribution, including the 0.025 to 0.975 interquantile ranges that encompass the central 95 percent of the apparent background distributions. The derived 0.975 quantile indicates that 97.5 percent of the naturally occurring metal concentrations are expected to be below that concentration. The background data is provided in Appendix C.

In the 1980s, the U.S. Geological Survey (USGS) conducted a study of element concentrations in Alaska soils consisting of collecting samples from 266 locations throughout Alaska, including the Aleutians Islands, and analyzing samples for 43 chemical elements (USGS, 1987). This study provides insight into the range of element concentrations naturally found in Alaskan soils. Results of this study are cited in the following, individual metal discussions to provide additional data in evaluating natural levels of metals detected on Shemya Island.

Several metals were detected at concentrations that are above the background concentration ranges derived in the 1995 RI/FS report and were identified as primary risk drivers at LF018 or LF024/LF026. These metals are discussed below.

Aluminum is the most common metal in the earth's crust and third-most common element in the earth's crust. Its abundance is over 8 percent (80,000 mg/Kg). Concentrations found by the USGS in Alaska soils ranged from 12,000 to 100,000 mg/Kg. Aluminum is identified as a risk driver in groundwater and surface water at LF024/LF026. Water samples were run on a total basis (not filtered) and given aluminum's abundance, it is likely that the aluminum concentration quantified in the water samples included aluminum found in sediments inadvertently collected with the water.

Arsenic concentrations reported at LF024/LF026 are above the derived background levels for Shemya Island. It was identified as a primary risk driver in soil and sediment at LF024/026. Arsenic is found in herbicides and pesticides, alloyed with lead (it makes lead harder, similar to antimony) and wood-preservatives. The most common use of arsenic in the U.S. over the last 40 years has been in lumber treated with chromate copper arsenate (CCA). Herbicides and pesticides are not known to have been disposed of at the sites. It is possible that lead and treated lumber were buried at LF024/LF026. However, if this were the case, one would expect to find much higher arsenic concentrations in the soil. The maximum concentrations detected were 53.1 mg/Kg in surface soil and 9.3 mg/Kg in subsurface soil. The USGS study documented arsenic concentrations in soils across Alaska ranging from less than 10 mg/Kg to 750 mg/Kg, indicating that natural concentrations vary widely. In addition, similar to thallium, aluminum can interfere with arsenic quantification in EPA Method SW6010.

Background concentrations for thallium were not derived in the 1995 RI/FS. Thallium was also not analyzed for during the USGS study. Other studies from the contiguous U.S. suggest that the expected natural concentrations of thallium in Shemya Island soils would be less than 1 mg/Kg. Reported concentrations in soil samples from LF018 and LF024/LF026 are much higher than 1 mg/Kg (up to 92.4 mg/Kg) and appear to be erroneous. The relatively high levels of thallium reported would only be expected around industrial sources such as smelters, coal plants, and cement plants, none of which operated on Shemya Island. The most plausible explanation for the high reported thallium concentrations at the sites is an error in the analysis. As discussed above, there is known interference between certain elements when analyzed by EPA Method 6010. Aluminum is a known interferent of thallium.

2.7 Remedial Action Objectives

Remedial action objectives (RAOs) provide a general description of what the cleanup will accomplish. These goals typically serve as the design basis for remedial alternatives.

2.7.1 ERP Site LF018

The RAOs for LF018 are to protect human health and the environment from unacceptable exposure to low-level contamination in soil, surface water, and groundwater, as well as to prevent potential contact with landfill material. The RAOs at LF018 are:

- Restrict activities at the site to prevent exposure to contaminants in the landfill.
- Prevent the migration of contaminants to surface water and groundwater.
- Maintain cover thickness and vegetation, as necessary, to prevent erosion and promote drainage.

Potential contaminant migration will be minimized by restricting any invasive activities that might compromise the integrity of the landfill including: excavation, well installation, construction, or any other activity that has the potential to damage the landfill cover.

To ensure that the RAOs are achieved, the following performance criteria are applicable at LF018:

- ADEC-approved cover thickness.
- Grading to promote drainage without erosion.
- Revegetating the site.

These criteria are fulfilled.

2.7.2 ERP Site LF024/LF026

The RAOs for LF024/LF026 are to protect human health and the environment from unacceptable exposure to low-level contamination in soil, marine sediment, and groundwater, as well as to prevent potential contact with landfill material. The RAOs at LF024/LF026 are:

- Restrict activities at the site to prevent exposure to contaminants in the landfill.
- Prevent the migration of contaminants to surface water and groundwater.
- Maintain cover thickness and vegetation, as necessary, to prevent erosion and promote drainage.

Potential contaminant migration will be minimized by restricting any invasive activities that might compromise the integrity of the landfill including: excavation, well installation, construction, or any other activity that has the potential to damage the landfill cover.

To ensure that the RAOs are achieved, the following performance criteria are applicable at LF024/LF026:

- ADEC-approved cover thickness.
- Grading to promote drainage without erosion.
- Revegetating the site.

These criteria are fulfilled.

2.8 Description of Alternatives

The remedial alternatives that were evaluated to address site risks at LF018 and LF024/LF026 are described below.

Alternative 1 – No Action. Under the No Action alternative, each site would be left in its current state, without any activities to monitor, control, or mitigate exposure to contaminants. Natural processes might increase or decrease contaminant concentrations at LF018 and LF024/LF026. No further sampling would be conducted at the sites to monitor the movement of contaminants, or the rate at which contaminant concentrations are increasing or decreasing.

Alternative 2 – ICs. Under this alternative, several tasks would be conducted to further delineate and control access to the sites. The purpose of these tasks would be to clearly identify the boundaries of LF018 and LF024/LF026, limit site access to properly trained personnel, and ensure the viability of the soil cover.

Alternative 3 – ICs and Monitoring. Under this alternative, ICs would be implemented, and the sites would be monitored for contaminant concentrations in soil, surface water, sediments, and groundwater.

Alternative 4 – Removal. Under this alternative, the landfills would be excavated and the materials removed from Shemya Island. Potential contaminants would thus be removed and no further action would be required.

2.9 Comparative Analysis of Alternatives

In accordance with the NCP, the four alternatives for ERP Sites LF018 and for LF024/LF026 were evaluated using the nine criteria described in Section 121(b) of CERCLA and the NCP 300.430(f)(5)(i). **Table 2-9**, applicable to each site, shows a comparative analysis of these alternatives using the nine criteria.

Table 2-9 Comparison of Alternatives Using CERCLA Criteria

CERCLA Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Institutional Controls and Monitoring	Alternative 4 Removal
Protective of Human Health and Environment		√	√	√
Compliant with ARARs		√	√	√
Long-Term Effectiveness and Permanence		√	√	√
Reduction of Toxicity, Mobility, and Volume through Treatment				√[1]
Short-Term Effectiveness		√	√	
Implementability	√	√	√	√
Cost	√ **$0**	√ $0.5M	√ $0.75M	$20M
State Acceptance		√	√	√
Community Acceptance		√	√	√

Key:
√ – Alternative meets the evaluation criteria
1 – Only mobility is reduced by this option
CERCLA – Comprehensive Environmental Restoration, Compensation, and Liability Act
M – million

2.9.1 Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs.

All of the alternatives, except the No Action alternative, are protective of human health and the environment by eliminating, reducing, or controlling risks posed by each site through engineering controls and/or ICs. Alternatives 2 and 3 would provide adequate protection from exposure due to the direct contact or soil ingestion. However, perpetual cover maintenance would be required to ensure total protectiveness. Any breach in the cover would potentially expose individuals to contamination. Alternative 4 would provide the greatest degree of protection due to the total removal all the landfill contents.

2.9.2 Compliance with Applicable or Relevant and Appropriate Requirements

Sections 121(d) of CERCLA and 300.430(f)(ii)(B) of NCP require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations that are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those State standards that are identified in a timely manner and that are more stringent than Federal requirements may be applicable.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situation sufficiently similar to those encountered at the CERCLA site that their use is well-suited to a particular site. Only those State standards that are identified in a timely manner and are more stringent that Federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of Federal and State environmental statues.

All alternatives, except the No Action alternative, will meet potential location and action-specific ARARs. However, the landfill removal alternative is anticipated to have many action-specific ARARs including requirements under the Resource Conservation and Recovery Act (RCRA) and numerous transportation and disposal requirements.

2.9.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Each alternative, except the No Action alternative, provides some degree of long-term protection. Alternative 4 provides the greatest degree of long-term effectiveness and permanence with the removal of contaminants.

2.9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

None of the alternatives include treatment as a component of the remedy. Therefore, except for Alternative 4, the alternatives would not reduce the toxicity, mobility, or volume of contamination through treatment at the sites. Alternative 4 would reduce the mobility of contaminants by placing the waste in a lined landfill designed to contain the waste.

2.9.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

Alternative 4 would take several years to complete. There would be potential risks to construction workers during the excavation and treatment of the landfill – primarily associated with equipment movement and exposure to contaminated soil. Workers would be required to wear appropriate levels of protection to avoid exposure during excavation and treatment activities.

Alternative 3 could potentially expose workers to contaminants during monitoring activities; however, this risk would be low. Alternative 1 would not be an effective alternative because current risks from potential subsurface activities would continue to exist. Alternative 2 would provide the greatest short-term effectiveness because the ICs would restrict subsurface activities and potential exposure to contaminants.

2.9.6 Implementability

Implementability addresses the technical administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

Alternative 4 would be the most difficult to implement due to the remoteness of Eareckson AS. Barges would most likely be used to transport the excavated landfill material from the island and this would entail several barges. Barging in and out of Eareckson AS is logistically challenging due to the bad weather. Alternatives 2 and 3 would cause someone to travel to Eareckson AS. Any travel to Eareckson AS is logistically challenging. Alternative 1 would be the easiest to implement.

2.9.7 Cost

The estimated present worth costs for the alternatives for each site, including the No Action alternative, range from $0 million for Alternative 1 to $20 million for Alternative 4. Alternative 3 could cost approximately $0.75 million for the first 5 years.

Assuming the landfills contain no hazardous waste, an estimated cost to excavate and remove LF018 and LF024/LF026 from Eareckson AS is $20 million dollars for each landfill. If portions of the landfill are found to contain hazardous materials, the associated costs for removal would be considerable more than the estimated $20 million dollars.

2.9.8 State Acceptance

The State has expressed its support for Alternatives 2, 3, and 4. The State does not believe that Alternative 1 provides adequate protection of human health and the environment.

2.9.9 Community Acceptance

During the public comment period, no comments were received.

2.10 Selected Remedy

The selected remedy for LF018 and LF024/LF026 is Alternative 2 – Institutional Controls (ICs). The overall protectiveness of the remedy was demonstrated in the comparative analysis of the alternatives discussed in Section 2.9. The selected remedy satisfies the overall protectiveness and compliance with chemical-specific ARARs criteria, while being the most favorable alternative with respect to short-term effectiveness and cost. The selected remedy meets the RAOs through ICs.

2.10.1 Summary of the Rationale for the Selected Remedy

The USAF and ADEC believe that the selected remedy at each ERP site meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives. The remedy is expected to satisfy the following statutory requirements CERCLA Section 121(b):

- Threshold criteria
  - Protection of human health and the environment
  - Compliance with ARARs
- Balancing criteria
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost
- Modifying criteria
  - State agency acceptance
  - Community acceptance

Selecting Alternative 2 as the remedy for LF018 and LF024/26 was based on the following benefits:

- The remedy is protective of human health and complies with 18 AAC 75.375 and 18 AAC 60. The locations of LF018 and LF024/26 will be placed on appropriate maps and documents to ensure that subsurface activities are restricted, which will reduce potential risk to human health and the environment through contact.

- The selected remedy is easy and inexpensive to implement as opposed to excavation and removal, which would put workers at risk for accidents during excavation.
- ICs will provide the greatest short-term effectiveness, because ICs will restrict subsurface activities and potential exposure to contaminants immediately.

ICs are easily implemented and the most cost-effective remedy compliant with ARARs and protective of human health and the environment. The remedy outlined above is considered to best meet the remedial action objectives and the NCP evaluation criteria. ICs are significantly lower in cost than remedial alternatives, such as soil removal and treatment or groundwater treatment.

2.10.2 Description of the Selected Remedy

The USAF will implement, monitor, maintain, and enforce the ICs identified below in accordance with State of Alaska 18 AAC 75.375. The performance objectives of the ICs are the RAOs set forth in Section 2.7 of this ROD. The 611th Civil Engineer Squadron will be the point of contact for ICs. A potential risk to human health or the environment might result if the buried waste were to be disturbed or relocated. To mitigate this potential risk, the following ICs will be implemented:

- The Eareckson AS Base General Plan (Plan) will be updated to show the boundaries of the three ERP sites to restrict excavation of soil and use of groundwater. The boundary for LF018 is shown on Figure 2-2 and the boundary for LF024/LF026 is shown on Figure 2-4. The Plan will contain a map indicating the locations of LF018 and LF024/LF026, with restrictions on any invasive activities that could potentially compromise the integrity of the cover and expose potential contaminants. Dig permits issued by the Base Operating Contractor are required for any excavation at Eareckson AS. Prior to approving a permit, the Plan will be reviewed to ensure that invasive activities are not taking place within the boundary of the sites where land use has already been restricted.
- In accordance with the landfill post closure requirements of 18 AAC 60.396(b), a deed notice or other instrument will be used to document that: 1) the property was used as a landfill, 2) it may not be suitable for some uses, 3) maintenance and repairs to the property might become necessary to prevent pollution problems at the site, and 4) any activity that results in damage to the final cover of the property must be corrected to control potential pollution problems.
- This remedy has been selected in compliance with state law and the USAF will obtain prior concurrence from ADEC to terminate the ICs, modify current land use, or allow anticipated actions that may disrupt the protectiveness of ICs. In the unlikely event that the property is to be transferred, the USAF will notify ADEC at least 30 days prior to any transfer taking place.
- The ICs on the landfills will extend until cleanup levels in 18 AAC 75 have been meet and ADEC approves the land for unrestricted use, to ensure that human and ecological receptors are protected from potential exposures. The effectiveness of the ICs will be evaluated and reported on during each 5-year review.

- The USAF will ensure, as appropriate, that any contractor, tenant, or other authorized occupant of land subject to LUCs in the ROD is informed of the LUCs and is made subject to the requirements of such LUCs.

In addition to the above ICs, the following activities will be conducted:

- A visual inspection of the landfill caps will be conducted concurrently with biennial monitoring activities taking place at other sites at Eareckson AS. The inspection will determine if the landfill caps are thick and extensive enough to properly cover debris, and if significant erosion has occurred or may occur. If the landfill caps are deemed inadequate for any of the above reasons, they will be repaired.
- In accordance with the corrective action requirements of 18 AAC 60.815(a) cover thickness and vegetation will be maintained, as necessary, to prevent erosion, promote drainage, and prevent the escape of waste or leachate.
- Any uncovered debris will be removed and disposed of properly.
- Any activity that is inconsistent with IC requirements, objectives, or controls, or any action that might interfere with the protectiveness of the ICs, will be reported to ADEC and addressed by the USAF as soon as practicable after discovery.
- Following each biennial inspection, a report of IC monitoring and cap inspections will be provided to ADEC.
- To verify the conclusion that the historical thallium concentrations are inaccurate and also to resolve uncertainty with other detected metals (see Section 2.6.5), additional surface soil sampling for metals will be performed at LF018 and LF024/LF026. The sampling will be performed using multi increment sampling techniques. The Decision Unit for LF018 is the boundary depicted on Figure 2-2. Sampling at LF024/LF026 will consist of two Decision Units, the boundary depicted on Figure 2-4 for LF024 is one Decision Unit and the boundary depicted on Figure 2-4 for LF026 is the second Decision Unit. Prior to sampling, a work plan will be developed based on ADEC guidance (ADEC, 2009) and submitted for ADEC approval. The sampling will be conducted during the first landfill cap inspection and the results reported to ADEC. The samples will be analyzed for the following metals by EPA Method 6020A (7471A for mercury):

Aluminum	Calcium	Magnesium	Silver
Antimony	Chromium	Manganese	Sodium
Arsenic	Cobalt	Mercury	Thallium
Barium	Copper	Nickel	Vanadium
Beryllium	Iron	Potassium	Zinc
Cadmium	Lead	Selenium	

- If the results of the metals re-sampling show that the thallium concentrations are above the applicable cleanup level, the selected remedy will need to be reassessed and additional capping may be required.

2.11 Statutory Determinations

Laws and regulations established by the State of Alaska are applicable to ERP Sites LF018 and LF024/LF026.

2.11.1 Protection of Human Health and the Environment

The selected remedies are protective of human health and the environment by preventing disturbance of buried waste and potential exposure to contaminated material at LF018 and LF024/LF026. Exposure pathways have been eliminated in the short-term by preventing dermal contact, ingestion, and inhalation of contaminants.

2.11.2 Compliance with State Regulations

The chemical-specific and action-specific Alaska regulations applicable to LF018 and LF024/LF026 are listed in **Table 2-10**.

Table 2-10 Applicable State Regulations

Citation	Description	Rationale
Action-Specific		
Alaska Oil and Other Hazardous Substance Pollution Control Regulations 18 AAC 75.375 – Institutional Controls	Defines situations where institutional controls are required and specifies criteria for their use.	Institutional controls (land use controls) are a component of the selected remedies.
Alaska Water Quality Standards 18 AAC 70.015 – Antidegradation Policy	Describes the states policy on impacts to water quality.	The sites are adjacent to surface water.
Solid Waste Management 18 AAC 60.815-860 – Corrective Action for Problems Discovered During Visual and Surface Water Monitoring or During an Inspection	Describes actions to be taken if problems are discovered during an inspection.	The remedies include periodic inspections of the soil covers.
Chemical-Specific		
Alaska Oil and Other Hazardous Substance Pollution Control Regulations (as amended through December 30, 2006) 18 AAC 75.340-350 – Soil, Groundwater, and Surface Water Cleanup Levels	Defines cleanup levels for hazardous substances in soil, groundwater, and surface water.	The remedies must meet cleanup levels specified in 18 AAC 75.340-350.
Alaska Water Quality Standards 18 AAC 70.020 – Water Quality Criteria	Lists water quality criteria for classes of use of the state's water.	The remedies must meet the applicable criteria listed in this section.

Key:
AAC – Alaska Administrative Code

2.11.3 Cost-Effectiveness

As discussed in the NCP, a remedy is cost effective if its costs are proportional to its overall effectiveness. The selected remedies were determined to be cost-effective because they provide overall protection of human health and the environment, long- and short-term effectiveness, and compliance with ARARs, at an acceptable cost as discussed in Section 2.9 (Comparative Analysis of Alternatives). ICs with maintenance of the covers are far cheaper than the other alternative remedies, while still providing adequate protectiveness. The selected remedies for LF018 and LF024/LF026 provide the best overall effectiveness of all alternatives considered proportional to their costs.

2.11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedies represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at LF018 and LF024/LF026. Of those alternatives that are protective of human health and the environment and that comply with ARARs, the selected remedies provide the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

Since excavation and removal of the landfills at Eareckson AS is cost prohibitive ($20M each), and does not provide additional protectiveness above other remedies in relationship to its cost, the use of permanent solutions and treatment technologies are not practicable for LF018 and LF024/LF026. The selected remedies afford the best balance of tradeoffs as compared to the other options.

2.11.5 Expected Outcomes of Selected Remedy

Following implementation of the selected remedy, the land use at LF018 and LF024/LF026 will remain the same – Closed Landfill under Industrial Use. Risk reduction is achieve by continuing to limit exposure and future releases.

2.11.6 Preference for Treatment as a Principal Element

The selected remedies must use treatment to address the principal threats posed by LF018 and LF024/LF026. The selected remedies do not fulfill the statutory preference for treatment as a principal element. Treatment of the landfill contents would involve cost prohibitive excavation and shipment to an approved RCRA transport, storage, and disposal facility (TSDF) located outside Alaska. There are currently no onsite treatment technologies applicable to LF018 and LF024/LF026.

2.11.7 Five-Year Review Requirement

Pursuant to NCP Section 300.430(f)(4)(ii), a 5-year review will be performed since contaminants remain at the sites above levels that allow for unrestricted land use and unrestricted exposure. The 5-year review will evaluate the protectiveness of the ICs. This review will ensure that the remedial alternative remains protective of human health and the environment. Each 5-year review under CERCLA will determine if a subsequent 5-year review is warranted.

During the first 5-year review, the 2003 risk evaluations for each site will be updated to reflect current regulations and toxicity values and newly acquired data.

2.11.8 Principal Threat Wastes

The NCP states that treatment that reduces the toxicity, mobility, or volume of the principal threat wastes will be used to the extent practicable. The principal threat concept refers to the source materials considered to be highly toxic or highly mobile that generally cannot be reliably controlled in place or present a significant risk to human health or the environment should exposure occur. Source material is material that contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater or air, or that acts as a source for direct exposure. There are no source materials or principal threat wastes at ERP Sites LF018 and LF024/LF026.

2.12 Documentation of Significant Changes

There have been no significant changes to the proposed remedies presented in the Proposed Plan for ERP Sites LF018 and LF024/LF026.

3.0 References

Alaska Department of Environmental Conservation (ADEC). 18 AAC 75 Oil and Hazardous Substances Pollution Control Regulations.

ADEC. 18 AAC 70 Water Quality Standards.

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APPENDIX A

SITE LF018 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

APPENDIX A

IRP SITE LF18 (NORTH BEACH LANDFILL)
HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

1.0 INTRODUCTION

An updated risk assessment was conducted for the United States Air Force (Air Force) Installation Restoration Program (IRP) Site LF18 (North Beach Landfill) at Eareckson Air Station (AS) Shemya Island, Alaska. Human health and ecological risk assessments were previously prepared for LF18, as documented in an Remedial Investigation/Feasibility Study (RI/FS) (USAF, 1996), and Basewide Monitoring Report (USAF, 2000). The Air Force is updating the data and risk evaluation methods used in these documents to facilitate decision making for LF18. This updated risk assessment was conducted in accordance with: the methods and assumptions described in the *Technical Memorandum, Final Risk Assessment Assumptions for Decision Documents,* (USAF, 2001), hereafter referred to as the Risk Assessment Assumptions Technical Memorandum (RAATM); Alaska regulations in 18 Alaska Administrative Code (AAC) 75); and risk assessment methods described in the Alaska Department of Environmental Conservation's (ADEC's) *Risk Assessment Procedures Manual* (ADEC, 2000a).

The results of the human health risk assessment are described in Section 2.0, and the ecological risk assessment results are presented in Section 3.0.

2.0 HUMAN HEALTH RISK EVALUATION

The human health risk evaluation includes a screening procedure to identify chemicals of potential concern (COPCs) for human receptors, and Tier I human health risk assessment. Analytes detected in site media were compared to one-tenth the ADEC Method Two Criteria, consistent with procedures described in the RAATM. Analytes detected at concentrations in excess of one-tenth the ADEC Method Two Criteria were retained as COPCs. Carcinogenic COPCs were included in Tier I cumulative cancer risk screening and compared to an acceptable risk criterion of 1.0×10^{-5}. Noncarcinogenic COPCs were included in an evaluation of cumulative noncancer hazard and compared to an acceptable hazard index (HI) of 1.0. The results of Tier I screening were evaluated in a Tier I refinement step to identify the potential need for a Tier II human health risk assessment. The results of COPC identification, Tier I risk screening, and Tier I refinement for LF18 are described in the following subsections.

2.1 Identification of Chemicals of Potential Concern (COPCs)

Environmental investigations for LF18 included sampling surface and subsurface soils, fresh groundwater, marine groundwater, fresh surface water, and marine sediment. Surface and subsurface soils data were compared to the lesser of one-tenth the ADEC 18 AAC 75.341 Method Two Soil Cleanup Levels (Under 40-inch Zone) for the ingestion, inhalation, and

migration-to-groundwater pathways derived from Tables B1 and B2 (18 AAC 75.345). Groundwater data were compared to one-tenth the ADEC Groundwater Cleanup Levels, Table C (18 AAC 75.345(b)(1)). Tier I human health risk screening was not performed for fresh surface water or marine sediment, consistent with the RI/FS (USAF, 1996) and the updated conceptual site model included in the RAATM. Details on the selection of COPCs for LF18 are presented in Tables A-3 through A-7, and the results of COPC screening are summarized below.

Analytes detected in surface soils at LF18 measured by United States Environmental Protection Agency (EPA) Method (E) 418.1 (Tables A-2 through A-4) included:

- Various inorganics
- A volatile organic compound (VOC) – acetone
- Semi-volatile organic compounds (SVOCs) – bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, and polychlorinated biphenyls (PCBs)
- A pesticide – DDD (dichlorodiphenyldichloroethane)
- Petroleum hydrocarbons

Based on the results of COPC screening, only inorganic constituents and petroleum hydrocarbons were retained as COPCs for evaluation in the Tier I human health risk assessment. Since there are no ADEC Table B1 Soil Cleanup Levels currently available for magnesium, this analyte was retained as a COPC for further consideration in the Tier I risk assessment.

Analytes detected in subsurface soils are presented in Tables A-2, A-5, and A-6. They included:

- Inorganics; a VOC (tetrachloroethene [PCE]); SVOCs (bis(2-ethylhexyl)phthalate, diethyl phthalate, and di-n-butyl phthalate); and petroleum hydrocarbons measured by Method E418.1.
- Diesel range organics (DRO) measured by EPA Solid Waste Method (SW) 8100.

Based on the results of COPC screening, only inorganic constituents and petroleum hydrocarbons were retained as COPCs for evaluation in the Tier I human health risk assessment. Since there are no ADEC Table B1 Soil Cleanup Levels currently available for magnesium, this analyte was retained as a COPC.

Analytes detected in fresh groundwater are presented in Tables A-2 and A-7. They included: inorganics; VOCs (1,2,4-trichlorobenzene, ethylbenzene, and xylenes); various polynuclear aromatic hydrocarbons (PAHs); and gasoline range organics (GRO), DRO, and residual range organics. Based on the results of COPC screening, inorganic constituents, several PAHs, and petroleum hydrocarbons were retained as COPCs for evaluation in the Tier I human health risk assessment.

2.2 Tier I Human Health Risk Assessment

Tier I human health risk screening results for LF18 are summarized in Tables A-1 and A-2. No carcinogenic COPCs were identified in surface soils, and noncarcinogenic COPCs resulted in a total cumulative noncancer HI of 0.19 (Tables A-1 and A-8). Consequently, surface soils do not

pose a significant human health concern. Since there are no ADEC Table B1 Soil Cleanup Levels currently available for magnesium, this analyte was not included in Tier I human health screening. However, this analyte is generally of low concern for human health. Furthermore, LF18 is covered, and potential exposure pathways between surface soils and human receptors are currently incomplete.

Comparison of maximum surface soil concentrations to available ADEC Method Two, Table B1 Soil Cleanup Levels, Migration-to-Groundwater Pathway indicate that surface soils do not pose a risk to groundwater (Tables A-1 and A-9). It should be noted that migration-to-groundwater criteria are not currently available for magnesium; therefore, this analyte was not included in screening for potential impacts on groundwater. However, groundwater at LF18 flows towards the Bering Sea, is tidally influenced, and is not a viable drinking water resource. Furthermore, the Air Force is planning to impose institutional controls on groundwater use in the vicinity of this former landfill.

The Tier I cumulative cancer risk and noncancer HI estimates for subsurface soils were 2.3×10^{-6} and 0.15, respectively (Tables A-1 and A-10). These estimates are less than ADEC screening cancer risk and noncancer HI criteria of 1.0×10^{-5} and 1.0, respectively. Consequently, subsurface soils at LF18 are not anticipated to pose a significant human health concern. Furthermore, LF18 is currently covered, and potential exposure pathways between subsurface soils and human receptors are currently incomplete.

Comparison of maximum concentrations of COPCs in subsurface soil to available ADEC Method Two, Table B1 Soil Cleanup Levels, Migration-to-Groundwater Pathway indicate that subsurface soils do not pose a risk to groundwater (Tables A-1 and A-11). As for surface soils, migration-to-groundwater criteria are not currently available for magnesium; therefore, this analyte was not included in screening for potential impacts on groundwater. However, groundwater at LF18 flows towards the Bering Sea, is tidally influenced, and is not a viable drinking water resource. Furthermore, the Air Force is planning to impose institutional controls on groundwater use in the vicinity of this former landfill.

The Tier I cumulative cancer risk and noncancer HI for 'fresh' groundwater were estimated as 1.2×10^{-4} and 4.0, respectively (Tables A-1 and A-12). Carcinogenic PAHs are responsible for 90 percent of the cumulative cancer risk, and antimony is responsible for 83 percent of the HI. It should be noted that groundwater samples were not filtered prior to analysis; therefore, dissolved concentrations of PAHs and inorganics in groundwater are most likely lower than those measured. In addition, groundwater at LF18 is tidally influenced and both 'fresh' and marine groundwater samples were collected from the *same* wells. It is extremely unlikely, therefore, that groundwater in the vicinity of LF18 would ever be used as a drinking water source. Finally, the Air Force is planning to impose institutional controls on groundwater use in the vicinity of this former landfill. Consequently, groundwater at IRP Site LF18 is not anticipated to pose a significant human health concern.

3.0 ECOLOGICAL RISK EVALUATION

The ecological risk evaluation included a screening procedure to identify chemicals of potential ecological concern (COPECs), as well as a Tier I ecological risk assessment. Analytes detected

in site media were compared to one-tenth the appropriate ecological screening criteria, consistent with procedures described in the RAATM. Analytes detected at concentrations in excess of one-tenth available ecological screening criteria were retained as COPECs and included in an estimate of the cumulative Tier I ecological HI. The Tier I ecological HI was compared to a screening HI criterion of 1.0. The results of Tier I ecological screening were evaluated in a Tier I refinement step to identify the potential need for a Tier II ecological risk assessment. The results of COPEC identification, Tier I ecological risk screening, and Tier I ecological refinement for LF18 are described in the following subsections.

3.1 Identification of Chemicals of Potential Ecological Concern (COPECs)

Environmental investigations for IRP Site LF18 included sampling of surface and subsurface soils, fresh groundwater, marine groundwater, fresh surface water, and marine sediment. Surface and subsurface soils data were compared to one-tenth the lesser of site-specific ecological risk-based screening concentrations (ERBSCs) for soils for terrestrial receptors of concern, as described in the RAATM. Surface water data, and results for groundwater that is in potential communication with surface water, were compared to one-tenth the appropriate surface water quality criteria, as described in the RAATM. Tier I human health risk screening was not performed for freshwater or marine sediments, since freshwater sediments were not sampled and investigation results for marine sediments were non-detect. Details on the selection of COPECs for LF18 are presented in Tables A-13 through A-16, and the results of COPEC screening are summarized below.

Analytical results for media sampled at LF18 were previously described in Section 2.0. Based on the results of COPEC screening for surface soils, various inorganic constituents, PCBs, and petroleum hydrocarbons were retained as COPECs for evaluation in the Tier I ecological risk assessment (Tables A-1, A-2, and A-13). Since soil ERBSCs are not available for magnesium, manganese, and vanadium, these analytes were retained as COPECs for further consideration in the Tier I risk assessment.

Based on the results of COPEC screening for subsurface soils, only inorganic constituents and petroleum hydrocarbons were retained as COPECs for evaluation in the Tier I ecological risk assessment (Tables A-1, A-2, and A-14). Since soil ERBSCs are not available for magnesium, manganese, and vanadium, these analytes were retained as COPECs.

Analytes detected in marine groundwater are presented in Tables A-2 and A-15. They included: inorganics, various VOCs, SVOCs (bis(2-ethylhexyl)phthalate and isophorone), PAHs, GRO, and DRO. Based on the results of COPEC screening for marine groundwater, the following analytes were retained as COPECs for evaluation in the Tier I ecological risk assessment: various inorganics; VOCs (1,1-dichloroethane, 1,3-dichlorobenzene, acetone, and xylenes); and PAHs (fluoranthene and phenanthrene). Marine surface water criteria are not currently available for barium, chromium, cobalt, magnesium, molybdenum, vanadium, 1,1-dichloroethane, 1,3-dichlorobenzene, acetone, xylenes, GRO, and DRO. Therefore, these analytes were retained as COPECs for consideration in the Tier I ecological risk assessment.

Fresh surface water samples were collected from four ephemeral ponds in the area of LF18. Analytes detected in fresh surface water are presented in Tables A-2 and A-16. They included: inorganics; VOCs (1,2,4-trichlorobenzene, acetone, and carbon disulfide); various PAHs; and GRO and DRO. Based on the results of COPEC screening for fresh surface water, the inorganics, aluminum, copper, and manganese were retained as COPECs for evaluation in the Tier I ecological risk assessment. Fresh surface water criteria are not currently available for barium, cobalt, magnesium, molybdenum, acetone, carbon disulfide, GRO, and DRO. Therefore, these analytes were retained as COPECs for consideration in the Tier I ecological risk assessment.

3.2 Tier I Ecological Risk Assessment

Tier I ecological risk screening results for LF18 are summarized in Tables A-1 and A-2. A total ecological HI of 27 was estimated for LF18 surface soils, due primarily to the presence of thallium detected at a maximum concentration of 92.4 milligrams per kilogram (mg/Kg – Tables A-1 and A-17). However, there are no known site-related sources of thallium at Eareckson AS. In addition, LF18 is covered, and potential exposure pathways between surface soils and ecological receptors are currently incomplete. Because the excess ecological HI for surface soils is associated with inorganics at relatively low concentrations and the site is currently covered, surface soils are not anticipated to result in significant ecological impacts.

A total ecological HI of 13 was estimated for LF18 subsurface soils, due primarily to the presence of thallium at a maximum detected concentration of 44.8 mg/Kg (Tables A-1 and A-18). As described above, there are no known, site-related sources of thallium at Eareckson AS. Because the excess ecological HI for subsurface soils is associated with inorganics at relatively low concentrations, and LF18 is currently covered, subsurface soils are not anticipated to pose a significant ecological hazard.

The total ecological HI for marine groundwater at LF18 was estimated as 1,130 (Tables A-1 and A-19). Inorganics were the primary risk drivers in groundwater, with aluminum responsible for 80 percent of the total ecological HI. The maximum concentration of aluminum measured in marine groundwater was less than two-fold higher than the mean background concentration for aluminum in Eareckson AS groundwater. As previously described, however, groundwater samples were not filtered prior to analysis, and dissolved COPEC concentrations are most likely lower than those measured. In addition, the ecological HI is based on hazards to marine aquatic species assuming no attenuation or dilution of concentrations between groundwater monitoring locations and the receptor exposure point (i.e., the Bering Sea). Consequently, ecological HI's for groundwater represent worst-case estimates.

A total ecological HI of 9.5 was estimated for LF18 fresh surface water, due primarily to the presence of aluminum (Tables A-1 and A-20). The maximum concentration of aluminum detected in pond samples (0.6 milligrams per liter) is approximately two times the mean background concentration for Eareckson AS surface water. As was the case for groundwater, surface water samples were not filtered prior to analysis and dissolved concentrations of inorganics (including aluminum) are most likely lower than those measured. Based on the above, the total ecological HI for LF18 fresh surface water is believed to be overestimated.

Freshwater sediment samples were not collected from the ephemeral ponds, but marine sediment samples collected from down gradient intertidal areas were non-detect for surface water analytes.

4.0 RISK EVALUATION FOR PETROLEUM HYDROCARBONS

Consistent with ADEC's *Guidance on Calculating Cumulative Risk, Draft Final* (ADEC, 2000b), petroleum hydrocarbons were not included in the Tier I cumulative risk screening results described above. However, petroleum hydrocarbons of varying types and concentrations were detected in most media, as summarized in Table A-2. These results are described below in terms of potential impacts on human health and the environment.

Petroleum hydrocarbons as measured by Method E418.1 were detected at a maximum concentration of 371 mg/Kg in surface soils and 1,373 mg/Kg in subsurface soils. It should be noted that the analytical method used (E418.1) measures petroleum hydrocarbons in the carbon range C10 to C38, as well as biogenic hydrocarbons (i.e., hydrocarbons derived from natural sources such as peat, roots, and waxes). Measurements of DRO in subsurface soil based on Method SW8100 (maximum detected concentration equal to 85 mg/Kg) support an assumption that Method E418.1 results overestimate petroleum hydrocarbon concentrations in LF18 soils. In addition, concentrations of GRO, DRO, and residual range organics (as measured by Alaska Method [AK]101, AK102, and AK103, respectively) in groundwater samples collected from the site were all below ADEC 18 AAC 75.345 Table C Groundwater Cleanup Levels (Table 2, ROD). Because Methods AK101, AK102, and AK103 are currently prescribed by ADEC, and results based on these methods are more recent than those measured using Methods E418.1, SW8015, and SW8100, it suggests that petroleum hydrocarbons in LF18 soils are having minimal impact on groundwater quality. Although not directly comparable, concentrations of GRO (SW8105) and DRO (SW8100) in fresh surface water were also below ADEC 18 AAC 75.345 Table C Groundwater Cleanup Levels. Finally, LF18 is currently covered and direct exposure of human and ecological receptors to surface and subsurface soils associated with the former North Beach Landfill are incomplete. Based on the above, petroleum hydrocarbons present at LF18 are not believed to pose a significant risk to human health or the environment.

5.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2000a. Risk Assessment Procedures Manual. ADEC, Division of Spill Prevention and Response, Contaminated Sites Remediation Program. June.

ADEC. 2000b. Guidance on Calculating Cumulative Risk, Draft Final. ADEC, Division of Spill Prevention and Response, Contaminated Sites Remediation Program. October.

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USAF. 2001. Technical Memorandum, Final Risk Assessment Assumptions Report. Prepared by Montgomery Watson for the United States Air Force. 08 June.

TABLE A-1
SUMMARY OF TIER I SCREENING RISK ASSESSMENT RESULTS FOR SITE LF18
EARECKSON AS, ALASKA

	Human Health Tier I Risk Screening Results					Ecological Tier I Risk Screening Results			
Media	**Cancer Risk[a]**	**HI[b]**	**Risk Drivers[c]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**	**Ecological HI[d]**	**Risk Drivers[e]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**
Surface Soil	na	0.19	None	na	na	**27**	Aluminum	28,300	10,678
							Thallium[f]	92.4	na
							Zinc	94.4	30.98
Migration-to-GW Pathway	na	na	None[g]	na	na	na	na	na	na
Subsurface Soil	2.3×10^{-6}	0.15	None	na	na	**13**	**Thallium**[h]	44.8	na
							Zinc	87.6	39.1
Migration-to-GW Pathway	na	na	None[g]	na	na	na	na	na	na
Fresh Groundwater	**1.2×10^{-4}**	**4.0**	**Antimony**[i]	0.02	nd	na	na	na	na
			Arsenic	0.0089	0.0061				
			Lead	0.019	0.0079				
			Benzo(a)anthracene[i]	0.0014	na				
			Benzo(b)pyrene[i]	0.0012	na				
			Benzo(b)fluoranthene[i]	0.0018	na				
			Dibenz(a,h)anthracene[i]	0.00011	na				
			Indeno(1,2,3-cd)pyrene[i]	0.00054	na				
Marine Groundwater	na	na	na	na	na	**1,130**	**Aluminum**[j]	78.8	ND
							Copper	0.43	ND
							Lead	0.21	ND
							Manganese	3.6	ND
							Nickel	0.14	ND
							Silver	0.0032	ND
							Zinc	0.83	ND

TABLE A-1
SUMMARY OF TIER I SCREENING RISK ASSESSMENT RESULTS FOR SITE LF18
EARECKSON AS, ALASKA

	Human Health Tier I Risk Screening Results					Ecological Tier I Risk Screening Results			
Media	**Cancer Risk[a]**	**HI[b]**	**Risk Drivers[c]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**	**Ecological HI[d]**	**Risk Drivers[e]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**
Fresh Surface Water	na	na	na	na	na	**9.5**	**Aluminum**[k]	0.6	0.27
							Copper	0.012	0.0078
Fresh Sediment	na	na	na	na	na	ns	ns	ns	ns
Marine Sediment	na	na	na	na	na	ND	ND	ND	ND

Notes:
% - percent
a - Cumulative Tier I cancer risk; includes ingestion and inhalation pathways COPCs.
ADEC - Alaska Department of Environmental Conservation
b - Cumulative Tier I hazard index; includes ingestion and inhalation pathways for COPCs.
c - Chemicals shown are associated with an exceedence of ADEC cumulative risk or hazard criteria. Bolding indicates the primary risk drivers.
COPCs - chemicals of potential concern
COPECs - chemicals of potential environmental concern
d - Cumulative Tier I ecological hazard index; calculated for the most protective receptor and exposure route for each COPEC.
e - COPECs that exceed a chemical-specific HI equal to 1.0.
f - Thallium is responsible for 81% of the total ecological HI.
g - No COPCs in this medium exceed ADEC Table B1 Soil Cleanup Levels for Migration-to-Groundwater Pathway.
GW - groundwater
h - Thallium is responsible for 85% of the total ecological HI.
HI - hazard index
i - Polynuclear aromatic hydrocarbons are responsible for 90% of the total cumulative cancer risk, and antimony is responsible for 83% of the total cumulative HI. Groundwater samples were not filtered.
j - Aluminum is responsible for 80% of the total ecological HI. Groundwater samples were not filtered.
k - Aluminum is responsible for 73% of the total ecological HI. Surface water samples were not filtered.
mg/Kg - milligrams per kilogram
mg/L - milligrams per liter
na - not applicable
ND - not detected
ns - not sampled

Bold indicates exceedence of a risk or hazard criterion.

TABLE A-2
SUMMARY OF ANALYTICAL AND SCREENING RESULTS FOR TOTAL PETROLEUM HYDROCARBONS
SITE LF18 - NORTH BEACH LANDFILL
EARECKSON AIR STATION, ALASKA

Medium/Constituent	Analytical Method	Concentration (mg/Kg) Maximum	Concentration (mg/Kg) Minimum	Number of Samples	Number of Detects	Frequency	Criteria [a] Groundwater	Criteria [a] Soils Ingestion	Criteria [a] Soils Migration to GW	Exceedance (Yes/No)
Surface Soil										
Petroleum Hydrocarbons	E418.1	371	6.8	16	16	100%	na	na	na	--
Subsurface Soil										
Petroleum Hydrocarbons	E418.1	1373.086	67.1912	5	5	100%	na	na	na	--
Diesel Range Organics	SW8100	85	ND	4	1	25%	na	na	na	--
Fresh Groundwater										
Gasoline Range Organics	SW8015	3.3	ND	9	2	22%	na	na	na	--
Diesel Range Organics	SW8100	1.3	ND	9	2	22%	na	na	na	--
Gasoline Range Organics	AK101	0.021	0.021	1	1	100%	1.3	na	na	No
Diesel Range Organics	AK102	0.22	0.22	1	1	100%	1.5	na	na	No
Residual Range Organics	AK103	0.262	0.262	1	1	100%	1.1	na	na	No
Marine Groundwater										
Gasoline Range Organics	SW8015	0.021	0.0054	4	4	100%	na	na	na	--
Diesel Range Organics	SW8100	2.8	0.068	5	5	100%	na	na	na	--
Fresh Surface Water										
Gasoline Range Organics	SW8015	0.0084	ND	7	3	43%	na	na	na	--
Diesel Range Organics	SW8100	0.14	ND	7	3	43%	na	na	na	--

Notes:

% - percent
-- - no criteria available
a - Source: Alaska Department of Environmental Conservation, 18 Alaska Administrative Code 75.
AK - Alaska Method
E - EPA Method
EPA - United States Environmental Protection Ageny
GW - groundwater
mg/Kg - milligrams per kilogram
ND - non-detect
na - not available
SW - EPA Solid Waste Method

TABLE A-3
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING
FOR SURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Surface Soils Concentration (mg/Kg) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	COPC? (Yes/No)
Inorganics								
Aluminum	28,300	8,870	10	10	100%	10678	na	Yes
Barium	131	6.6	10	10	100%	25.71	710	No
Beryllium	0.32	0.32	1	1	100%	2.19	0.19	No
Cadmium	1.8	0.91	7	7	100%	0.235	10.1	No
Chromium	22.8	3.3	10	10	100%	7.04	50.7	No
Cobalt	19.9	6.8	10	10	100%	9.36	na	Yes
Copper	65.4	25.1	10	10	100%	17.92	na	Yes
Magnesium	15,500	4,270	10	10	100%	5078	na	Yes
Manganese	805	176	10	10	100%	156	na	Yes
Nickel	20.6	6.2	10	10	100%	15.96	203	No
Silver	2.8	0.45	9	9	100%	3.037	50.7	No
Thallium	92.4	4.6	10	10	100%	na	0.04	Yes
Vanadium	137	12.8	10	10	100%	43.44	71	Yes
Zinc	94.2	25.6	10	10	100%	30.98	3040	No
VOCs								
Acetone	0.014	0.003	8	8	100%	na	1010	No
SVOCs								
bis(2-Ethylhexyl)phthalate	0.091	0.091	1	1	100%	na	59.3	No
Di-n-butyl phthalate	0.14	0.14	2	2	100%	na	1010	No
PCB (Total)	0.11	0.059	5	5	100%	na	1	No
Pesticides								
4,4-DDD	0.0056	0.0048	3	3	100%	na	3.46	No

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark criteria, or United States Environmental Protection Agency Soil Screening Levels.
COPC - chemical of potential concern
DDD - dichlorodiphenyldichloroethane
mg/Kg - milligrams per kilogram
na - not available
PCBs - polychlorinated biphenyls
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE A-4
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING
MIGRATION-TO-GROUNDWATER PATHWAY FOR SURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

	Surface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Inorganics								
Aluminum	28,300	8,870	10	10	100%	10678	na	Yes
Barium	131	6.6	10	10	100%	25.71	110	Yes
Beryllium	0.32	0.32	1	1	100%	2.19	4.2	No
Cadmium	1.8	0.91	7	7	100%	0.235	0.5	Yes
Chromium	22.8	3.3	10	10	100%	7.04	2.6	Yes
Cobalt	19.9	6.8	10	10	100%	9.36	na	Yes
Copper	65.4	25.1	10	10	100%	17.92	na	Yes
Magnesium	15,500	4,270	10	10	100%	5078	na	Yes
Manganese	805	176	10	10	100%	156	na	Yes
Nickel	20.6	6.2	10	10	100%	15.96	8.7	Yes
Silver	2.8	0.45	9	9	100%	3.037	2.1	No
Thallium	92.4	4.6	10	10	100%	na	0.04	Yes
Vanadium	137	12.8	10	10	100%	43.44	340	No
Zinc	94.2	25.6	10	10	100%	30.98	910	No
VOCs								
Acetone	0.014	0.003	8	8	100%	na	0.1	No
SVOCs								
bis(2-Ethylhexyl)phthalate	0.091	0.091	1	1	100%	na	120	No
Di-n-butyl phthalate	0.14	0.14	2	2	100%	na	170	No
PCBs (Total)	0.11	0.059	5	5	100%	na	1	No
Pesticides								
4,4-DDD	0.0056	0.0048	3	3	100%	na	4.7	No

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark Criteria (Migration-to-Groundwater Pathway), or United States Environmental Protection Agency Soil Screening Levels.
COPC - chemical of potential concern
DDD - dichlorodiphenyldichloroethane
mg/Kg - milligrams per kilogram
na - not available
PCBs - polychlorinated biphenyls
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE A-5
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING
FOR SUBSURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Subsurface Soils Concentration (mg/Kg) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	COPC? (Yes/No)
Inorganics								
Aluminum	17,700	8,490	3	3	100%	19114	na	No
Barium	47.2	10.5	3	3	100%	35.3	710	No
Beryllium	0.43	0.29	2	2	100%	ND	0.19	Yes
Cadmium	1.4	0.81	3	3	100%	0.119	10.1	No
Chromium	20.7	11	3	3	100%	16.3	50.7	No
Cobalt	10.8	5.6	3	3	100%	8.66	na	Yes
Copper	51.4	27.8	3	3	100%	76.8	na	No
Magnesium	11,600	7,940	3	3	100%	6299	na	Yes
Manganese	499	271	3	3	100%	241	na	Yes
Nickel	15.1	12.2	3	3	100%	79.63	203	No
Silver	3.1	1.1	2	2	100%	3	50.7	No
Thallium	44.8	17.3	3	3	100%	na	0.04	Yes
Vanadium	103	47.1	3	3	100%	66.7	71	Yes
Zinc	87.6	41.7	3	3	100%	39.1	3040	No
VOCs								
Tetrachloroethene	0.002	0.002	1	1	100%	na	8	No
SVOCs								
bis(2-Ethylhexyl)phthalate	0.06	0.06	1	1	100%	na	59.3	No
Diethyl phthalate	1	1	1	1	100%	na	8110	No
Di-n-butyl phthalate	0.16	0.16	1	1	100%	na	1010	No

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark Criteria, or United States Environmental Protection Agency Soil Screening Levels. Criteria for subsurface soil are derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil.
COPC - chemical of potential concern
mg/Kg - milligrams per kilogram
na - not available
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE A-6
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING
MIGRATION-TO-GROUNDWATER PATHWAY FOR SUBSURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

	Subsurface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Inorganics								
Aluminum	17,700	8,490	3	3	100%	19114	na	No
Barium	47.2	10.5	3	3	100%	35.3	110	No
Beryllium	0.43	0.29	2	2	100%	ND	4.2	No
Cadmium	1.4	0.81	3	3	100%	0.119	0.5	Yes
Chromium	20.7	11	3	3	100%	16.3	2.6	Yes
Cobalt	10.8	5.6	3	3	100%	8.66	na	Yes
Copper	51.4	27.8	3	3	100%	76.8	na	No
Magnesium	11,600	7,940	3	3	100%	6299	na	Yes
Manganese	499	271	3	3	100%	241	na	Yes
Nickel	15.1	12.2	3	3	100%	79.63	8.7	No
Silver	3.1	1.1	2	2	100%	3	2.1	Yes
Thallium	44.8	17.3	3	3	100%	na	0.04	Yes
Vanadium	103	47.1	3	3	100%	66.7	340	No
Zinc	87.6	41.7	3	3	100%	39.1	910	No
VOCs								
Tetrachloroethene	0.002	0.002	1	1	100%	na	0.003	No
SVOCs								
bis(2-Ethylhexyl)phthalate	0.06	0.06	1	1	100%	na	120	No
Diethyl phthalate	1	1	1	1	100%	na	19	No
Di-n-butyl phthalate	0.16	0.16	1	1	100%	na	170	No

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark Criteria (Migration-to-Groundwater Pathway), or United States Environmental Protection Agency Soil Screening Levels. Criteria for subsurface soil is derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil.
COPC - chemical of potential concern
mg/Kg - milligrams per kilogram
na - not available
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE A-7
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING
FOR FRESH GROUNDWATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Fresh Groundwater Concentration (mg/L) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/L)	Benchmark Criteria[a] (mg/L)	COPC? (Yes/No)
Inorganics								
Aluminum	13	0.1577	8	8	100%	10.82	0.005	Yes
Antimony	0.02	ND	8	1	13%	ND	0.0006	Yes
Arsenic	0.0089	ND	10	1	10%	0.0061	0.005	Yes
Barium	0.04	ND	8	7	88%	0.125	0.2	No
Beryllium	0.0004	ND	8	1	13%	0.00078	0.0004	No
Cadmium	0.001	ND	12	3	25%	0.0009	0.0005	Yes
Chromium	0.009	ND	12	6	50%	0.0162	0.01	No
Cobalt	0.0074	ND	8	2	25%	0.0153	na	No
Copper	0.053	ND	8	6	75%	0.049	0.13	No
Lead	0.019	ND	12	8	67%	0.0079	0.0015	Yes
Magnesium	23	9.7365	8	8	100%	25.89	na	No
Manganese	0.71	0.161	8	8	100%	1.17	0.005	No
Molybdenum	0.89	ND	7	1	14%	0.003	na	Yes
Nickel	0.006	ND	8	1	13%	0.0328	0.01	No
Vanadium	0.068	ND	8	6	75%	0.0574	0.026	Yes
Zinc	0.056	ND	8	6	75%	0.118	1.1	No
VOCs								
1,2,4-Trichlorobenzene	0.0025	ND	7	3	43%	na	0.007	No
Ethylbenzene	0.0009	ND	7	1	14%	na	0.07	No
Total Xylenes	0.0038	ND	16	2	13%	na	1	No
Polynuclear Aromatic Hydrocarbons								
Acenaphthene	0.000097	ND	7	1	14%	na	0.22	No
Anthracene	0.0004	ND	7	2	29%	na	1.1	No
Benzo(a)anthracene	0.0014	ND	7	2	29%	na	0.0001	Yes
Benzo(a)pyrene	0.0012	ND	7	2	29%	na	0.00002	Yes
Benzo(b)fluoranthene	0.0018	ND	7	2	29%	na	0.0001	Yes
Benzo(g,h,i)perylene	0.00068	ND	7	2	29%	na	na	Yes
Benzo(k)fluoranthene	0.00071	ND	7	3	43%	na	0.001	No
Chrysene	0.0014	ND	7	2	29%	na	0.01	No
Dibenzo(a,h)anthracene	0.00011	ND	7	1	14%	na	0.00001	Yes
Fluoranthene	0.0021	ND	7	2	29%	na	0.146	No
Fluorene	0.00013	ND	7	1	14%	na	0.146	No
Indeno(1,2,3-cd)pyrene	0.00054	ND	7	2	29%	na	0.0001	Yes
Phenanthrene	0.00078	ND	7	2	29%	na	na	Yes
Pyrene	0.0025	ND	7	2	29%	na	0.11	No

TABLE A-7
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING
FOR FRESH GROUNDWATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Fresh Groundwater Concentration (mg/L) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/L)	Benchmark Criteria[a] (mg/L)	COPC? (Yes/No)
Petroleum Hydrocarbons								
GRO (AK101)	0.021	0.021	1	1	100%	na	0.13	No
DRO (AK102)	0.22	0.22	1	1	100%	na	0.15	Yes
RRO (AK103)	0.262	0.262	1	1	100%	na	0.11	Yes

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Table C Groundwater Cleanup Level or the United States Environmental Protection Agency Maximum Contaminant Level.
AK - Alaska Method
COPC - chemical of potential concern
DRO - diesel range organics
GRO - gasoline range organics
RRO - residual range organics
mg/L - milligrams per liter
na - not available
VOCs - volatile organic compounds

TABLE A-8
TIER I HUMAN HEALTH CUMULATIVE RISK CALCULATION
FOR SURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

			Inhalation				Ingestion				Cumulative Risk	
	Maximum Concentration	Benchmark Criteria[a]	Tier I Benchmark		Cancer	Non Cancer	Tier I Benchmark		Cancer	Non Cancer	Cancer	Non Cancer
Constituent	(mg/Kg)	(mg/Kg)	Carcinogen	Noncarcinogen	Risk	Hazard	Carcinogen	Noncarcinogen	Risk	Hazard	Risk	Hazard
Inorganics												
Aluminum	28,300	na	na	na	--	--	na	na	--	--	--	--
Cobalt	19.9	na	na	na	--	--	na	na	--	--	--	--
Copper	65.4	na	na	na	--	--	na	na	--	--	--	--
Magnesium	15,500	na	na	na	--	--	na	na	--	--	--	--
Manganese	805	na	na	na	--	--	na	na	--	--	--	--
Thallium	92.4	0.4	na	na	--	--	na	na	--	--	--	--
Vanadium	137	710	na	na	--	--	na	710	--	0.19	--	**0.19**
				Hazard Index (HI):	--	--			--	**0.19**	--	**0.19**

Notes:

-- - not calculated

a - Benchmark Criteria is equal to the Alaska Department of Environmental Conservation Soil Benchmark Criteria, or the United States Environmental Protection Agency Soil Screening Levels

mg/Kg - milligrams per kilogram

na - not available

TABLE A-9
TIER I HUMAN HEALTH RISK SCREENING
MIGRATION-TO-GROUNDWATER PATHWAY FOR SURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Migration-to-Groundwater Cleanup Level (mg/Kg) Carcinogen	Migration-to-Groundwater Cleanup Level (mg/Kg) Noncarcinogen	Criterion Exceeded (Yes/No)
Inorganics					
Aluminum	28,300	na	na	na	--
Barium	131	1,100	na	1,100	No
Cadmium	1.8	5	na	5	No
Chromium	22.8	26	na	26	No
Cobalt	19.9	na	na	na	--
Copper	65.4	na	na	na	--
Magnesium	15,500	na	na	na	--
Manganese	805	na	na	na	--
Nickel	20.6	87	na	87	No
Thallium	92.4	0.4	na	na	--

Notes:

-- - no criteria available
a - Benchmark Criteria is equal to the Alaska Department of Environmental Conservation Soil Benchmark Criterion - Migration-to-Groundwater Pathway
mg/Kg - milligrams per kilogram
na - not available

TABLE A-10
TIER I HUMAN HEALTH CUMULATIVE RISK CALCULATION
FOR SUBSURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

			Inhalation				Ingestion				Cumulative Risk	
Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Tier I Benchmark Carcinogen	Tier I Benchmark Noncarcinogen	Cancer Risk	Non Cancer Hazard	Tier I Benchmark Carcinogen	Tier I Benchmark Noncarcinogen	Cancer Risk	Non Cancer Hazard	Cancer Risk	Non Cancer Hazard
Inorganics												
Beryllium	0.43	1.9	na	na	--	--	1.9	507	2.3E-06	0.00085	**2.3E-06**	**0.00085**
Cobalt	10.8	na	na	na	--	--	na	na	--	--	--	--
Magnesium	11,600	na	na	na	--	--	na	na	--	--	--	--
Manganese	499	na	na	na	--	--	na	na	--	--	--	--
Thallium	44.8	0.4	na	na	--	--	na	na	--	--	--	--
Vanadium	103	710	na	na	--	--	na	710	--	0.145	--	**0.15**
		Summed Risk/Hazard Index (HI):			**--**	**--**			**2.3E-06**	**0.15**	**2.3E-06**	**0.15**

Notes:

-- - not calculated

a - Benchmark Criteria is equal to the Alaska Department of Environmental Conservation Soil Benchmark Criteria, or the United States Environmental Protection Agency Soil Screening Levels Criteria for subsurface soil is derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil

mg/Kg - milligrams per kilogram

na - not available

TABLE A-11
TIER I HUMAN HEALTH RISK SCREENING
MIGRATION-TO-GROUNDWATER PATHWAY FOR SUBSURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Migration-to-Groundwater Cleanup Level (mg/Kg) Carcinogen	Migration-to-Groundwater Cleanup Level (mg/Kg) Noncarcinogen	Criterion Exceeded? (Yes/No)
Inorganics					
Cadmium	1.4	5	na	5	No
Chromium	20.7	26	na	26	No
Cobalt	10.8	na	na	na	--
Magnesium	11,600	na	na	na	--
Manganese	499	na	na	na	--
Silver	3.1	21	na	21	No
Thallium	44.8	0.4	na	na	--
Volatile Organic Compounds					
Tetrachloroethene	0.002	0.003	0.03	na	No

Notes:

-- - no criteria available

a - Benchmark Criteria is equal to the Alaska Department of Environmental Conservation Soil Benchmark Criteria, Migration-to-Groundwater Pathway Criteria for subsurface soil is derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil

mg/Kg - milligrams per kilogram

na - not available

TABLE A-12
TIER I HUMAN HEALTH RISK SCREENING
FOR FRESH GROUNDWATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/L)	Benchmark Criteria[a] (mg/L)	Ingestion			
			Cleanup Level		Cancer Risk	Non-Cancer Hazard
			Carcinogen	Noncarcinogen		
Inorganics						
Aluminum	13	0.05	na	na	--	--
Antimony	0.02	0.006	na	6	--	3.3
Arsenic	0.0089	0.05	0.01	5	8.2E-06	0.18
Cadmium	0.001	0.05	na	5	--	0.20
Lead[b]	0.019	0.015	na	na	--	--
Molybdenum	0.89	na	na	na	--	--
Vanadium	0.068	0.26	na	26	--	0.26
Polynuclear Aromatic Hydrocarbons						
Benzo(a)anthracene	0.0014	0.001	0.001	na	1.4E-05	
Benzo(a)pyrene	0.0012	0.0002	0.0002	na	6.0E-05	
Benzo(b)fluoranthene	0.0018	0.001	0.001	na	1.8E-05	--
Benzo(g,h,i)perylene	0.00068	na	na	na	--	--
Dibenzo(a,h)anthracene	0.00011	0.0001	0.0001	na	1.1E-05	--
Indeno(1,2,3-cd)pyrene	0.00054	0.001	0.001	na	5.4E-06	--
Phenanthrene	0.00078	na	na	na	--	--
Petroleum Hydrocarbons						
DRO (AK102)	0.22	1.5	na	na	--	--
RRO (AK103)	0.262	1.1	na	na	--	--
			Summed Risk/Hazard Index (HI):		**1.2E-04**	**4**

Notes:

-- - not calculated
a - Groundwater Benchmark Criteria is equal to ADEC's Table C Groundwater Cleanup Level or the United States Environmental Protection Agency's Maximum Contaminant Level
b - Lead is not included in the cumulative risk calculation, per ADECs *Guidance on Calculating Cumulative Risk - Final Draft* (December 15, 2000)
c - Petroleum hydrocarbons as DRO, GRO, or RRO are not included in the cumulative risk calculation, per *ADEC's Guidance on Calculating Cumulative Risk - Final Draft (December 15, 2000)*
ADEC - Alaska Department of Environmental Conservation
DRO - Diesel range organics
GRO - gasoline range organics
mg/L - milligrams per liter
na - not available
RRO - residual range organics

TABLE A-13
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING - SURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Surface Soils Concentration (mg/Kg) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	COPEC? (Yes/No)
Inorganics								
Aluminum	28,300	8,870	10	10	100%	10678	1950	Yes
Barium	131	6.6	10	10	100%	25.71	24.7	Yes
Beryllium	0.32	0.32	1	1	100%	2.19	1.45	No
Cadmium	1.8	0.91	7	7	100%	0.235	0.408	Yes
Chromium	22.8	3.3	10	10	100%	7.04	7.11	Yes
Cobalt	19.9	6.8	10	10	100%	9.36	4.44	Yes
Copper	65.4	25.1	10	10	100%	17.92	31.3	Yes
Magnesium	15,500	4,270	10	10	100%	5078	na	Yes
Manganese	805	176	10	10	100%	156	na	Yes
Nickel	20.6	6.2	10	10	100%	15.96	430	No
Silver	2.8	0.45	9	9	100%	3.037	118	No
Thallium	92.4	4.6	10	10	100%	na	0.415	Yes
Vanadium	137	12.8	10	10	100%	43.44	na	Yes
Zinc	94.2	25.6	10	10	100%	30.98	6.94	Yes
VOCs								
Acetone	0.014	0.003	8	8	100%	na	0.273	No
SVOCs								
bis(2-Ethylhexyl)phthalate	0.091	0.091	1	1	100%	na	0.585	No
Di-n-butyl phthalate	0.14	0.14	2	2	100%	na	0.178	No
PCBs (Total)	0.11	0.059	5	5	100%	na	0.0585	Yes
Pesticides								
4,4-DDD	0.0056	0.0048	3	3	100%	na	1.68	No

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the ecological risk-based screening concentration (ERBSC).
COPEC - chemical of potential ecological concern
DDD - dichlorodiphenyldichloroethane
mg/Kg - milligrams per kilogram
na - not available
PCBs - polychlorinated biphenyls
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE A-14
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING - SUBSURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Subsurface Soils Concentration (mg/Kg) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	COPC? (Yes/No)
Inorganics								
Aluminum	17,700	8,490	3	3	100%	19114	1950	No
Barium	47.2	10.5	3	3	100%	35.3	24.7	Yes
Beryllium	0.43	0.29	2	2	100%	ND	1.45	No
Cadmium	1.4	0.81	3	3	100%	0.119	0.408	Yes
Chromium	20.7	11	3	3	100%	16.3	7.11	Yes
Cobalt	10.8	5.6	3	3	100%	8.66	4.44	Yes
Copper	51.4	27.8	3	3	100%	76.8	31.3	No
Magnesium	11,600	7,940	3	3	100%	6299	na	Yes
Manganese	499	271	3	3	100%	241	na	Yes
Nickel	15.1	12.2	3	3	100%	79.63	430	No
Silver	3.1	1.1	2	2	100%	3	118	No
Thallium	44.8	17.3	3	3	100%	na	0.415	Yes
Vanadium	103	47.1	3	3	100%	66.7	na	Yes
Zinc	87.6	41.7	3	3	100%	39.1	6.94	Yes
VOCs								
Tetrachloroethene	0.002	0.002	1	1	100%	na	0.561	No
SVOCs								
bis(2-Ethylhexyl)phthalate	0.06	0.06	1	1	100%	na	0.585	No
Diethyl phthalate	1	1	1	1	100%	na	601	No
Di-n-butyl phthalate	0.16	0.16	1	1	100%	na	0.178	No

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the ecological risk-based screening concentration (ERBSC). Criteria for subsurface soil is derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil.
COPEC - chemical of potential ecological concern
mg/Kg - milligrams per kilogram
na - not available
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE A-15
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING - MARINE GROUNDWATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Marine Groundwater Concentration (mg/L) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/L)	Benchmark Criteria[a, b] (mg/L)	COPEC? (Yes/No)
Inorganics								
Aluminum	78.8	2.8	7	7	100%	ND	0.0087[c]	Yes
Arsenic	0.023	0.0053	4	4	100%	ND	0.0036	Yes
Barium	0.27	0.065	5	5	100%	ND	na	Yes
Beryllium	0.0027	0.0009	4	4	100%	ND	0.00053[c]	Yes
Cadmium	0.0026	0.0006	5	5	100%	0.0005	0.00093	Yes
Chromium	0.13	0.0054	6	6	100%	ND	na	Yes
Cobalt	0.071	0.011	4	4	100%	ND	na	Yes
Copper	0.43	0.006	6	6	100%	ND	0.00031	Yes
Lead	0.21	0.012	5	5	100%	ND	0.00081	Yes
Magnesium	82.3	18	7	7	100%	1200	na	No
Manganese[e]	3.6	0.25	7	7	100%	ND	0.1	Yes
Molybdenum	0.0085	0.003	4	4	100%	ND	na	Yes
Nickel	0.14	0.033	4	4	100%	ND	0.00082	Yes
Silver	0.0032	0.0021	3	3	100%	ND	0.000012[c]	Yes
Thallium	0.0008	0.0008	2	2	100%	na	0.004[c]	No
Vanadium	0.44	0.095	5	5	100%	ND	na	Yes
Zinc	0.83	0.1	5	5	100%	ND	0.0081	Yes
VOCs								
1,1-Dichloroethane	0.00019	0.00012	3	3	100%	na	na	Yes
1,2,4-Trichlorobenzene	0.0019	0.0018	2	2	100%	na	0.0129	No
1,2-Dichlorobenzene	0.00018	0.00018	1	1	100%	na	0.0129	No
trans-1,2-Dichloroethene	0.00017	0.00017	1	1	100%	na	2.24[d]	No
1,3-Dichlorobenzene	0.00099	0.00073	2	2	100%	na	na	Yes
1,4-Dichlorobenzene	0.0014	0.00012	6	6	100%	na	0.0129	No
Acetone	0.0022	0.0018	2	2	100%	na	na	Yes
Methylene chloride	0.00017	0.00016	2	2	100%	na	0.64	No
Toluene	0.0001	0.0001	1	1	100%	na	0.5	No
Total Xylenes	0.0004	0.00014	3	3	100%	na	na	Yes
Trichloroethene	0.00034	0.0003	3	3	100%	na	2.19[c]	No
SVOCs								
bis(2-Ethylhexyl)phthalate	0.017	0.0029	2	2	100%	na	0.036	No
Isophorone	0.0011	0.0011	1	1	100%	na	0.129[d]	No
Polynuclear Aromatic Hydrocarbons								
Benzo(a)anthracene	0.0013	0.0013	1	1	100%	na	0.003[d]	No
Benzo(b)fluoranthene	0.0011	0.0011	1	1	100%	na	0.003[d]	No

TABLE A-15
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING - MARINE GROUNDWATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Marine Groundwater Concentration (mg/L) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/L)	Benchmark Criteria[a, b] (mg/L)	COPEC? (Yes/No)
Polynuclear Aromatic Hydrocarbons (cont.)								
Fluoranthene	0.0025	0.0015	2	2	100%	na	0.0016	Yes
Indeno(1,2,3-cd)pyrene	0.0011	0.0011	1	1	100%	na	0.003[d]	No
Naphthalene	0.0015	0.0015	1	1	100%	na	0.062[c]	No
Phenanthrene	0.0021	0.0019	2	2	100%	na	0.00046	Yes
Pyrene	0.0016	0.0016	1	1	100%	na	0.003[d]	No
Petroleum Hydrocarbons								
Gasoline Range Organics	0.021	0.0054	4	4	100%	na	na	Yes
Diesel Range Organics	2.8	0.068	5	5	100%	na	na	Yes

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the United States Environmental Protection Agency NAWQC, or an alternate water quality criteria.
b - Alternate sources of water quality criteria include, in order of preference: (1) NAWQC-Freshwater Chronic, (2) NAWQC-Marine Acute, or (3) NAWQC-Freshwater Acute.
c - Value is equal to the NAWQC-Freshwater Chronic Value.
d - Value is equal to the NAWQC-Marine Acute Value divided by 10.
e - Lowest Chronic Value (LCV) observed in freshwater daphnids. Source: Oak Ridge National Laboratory, 1996. Marine Groundwater Criteria are based upon Marine Surface Water Chronic Criteria.
COPEC - chemical of potential ecological concern
mg/L - milligrams per liter
NAWQC - National Ambient Water Quality Criteria
na - not available
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE A-16
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING - FRESH SURFACE WATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Fresh Surface Water Concentration (mg/L) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/L)	Benchmark Criteria[a, b] (mg/L)	COPEC? (Yes/No)
Inorganics								
Aluminum	0.6	0.24	3	3	100%	0.27	0.0087	Yes
Barium	0.0085	0.0052	3	3	100%	0.0052	na	Yes
Cobalt	0.0013	0.0007	3	3	100%	0.0009	na	Yes
Copper	0.012	0.0063	3	3	100%	0.0078	0.0009	Yes
Lead	0.0022	0.0022	1	1	100%	0.0026	0.00025	No
Magnesium	24.6	13	3	3	100%	10.02	na	Yes
Manganese[c]	1.3	0.24	3	3	100%	0.16	0.1	Yes
Molybdenum	0.0015	0.0008	2	2	100%	0.0006	na	Yes
Volatile Organic Compounds								
1,2,4-Trichlorobenzene	0.003	ND	2	1	50%	na	0.005	No
Acetone	0.0036	0.0027	3	3	100%	na	na	Yes
Carbon Disulfide	0.00046	ND	2	1	50%	na	na	Yes
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.0000775	ND	2	1	50%	na	0.003[d]	No
Benzo(a)anthracene	0.000219	ND	2	1	50%	na	0.003[d]	No
Benzo(a)pyrene	0.000184	ND	2	1	50%	na	0.003[d]	No
Benzo(b)fluoranthene	0.000258	ND	2	1	50%	na	0.003[d]	No
Benzo(g,h,i)perylene	0.000101	ND	2	1	50%	na	0.003[d]	No
Chrysene	0.000157	ND	2	1	50%	na	0.003[d]	No
Fluoranthene	0.000274	ND	2	1	50%	na	0.0016[e]	No
Fluorene	0.000102	ND	2	1	50%	na	0.003[d]	No
Indeno(1,2,3-cd)pyrene	0.0000894	ND	2	1	50%	na	0.003[d]	No
Naphthalene	0.000049	ND	3	1	33%	na	0.062	No
Phenanthrene	0.000076	0.000076	1	1	100%	na	0.00063	No
Pyrene	0.000275	ND	2	1	50%	na	0.003[d]	No
Petroleum Hydrocarbons								
Gasoline Range Organics	0.0084	0.0072	3	3	100%	na	na	Yes
Diesel Range Organics	0.14	0.071	3	3	100%	na	na	Yes

Notes:

% - percent

a - Benchmark Criteria is equal to one-tenth the United States Environmental Protection Agency's NAWQC, or an alternate water quality criteria.

b - Alternate sources of water quality criteria include, in order of preference: (1) NAWQC-Marine Chronic; (2) NAWQC-Freshwater Acute; or (3) NAWQC-Marine Acute.

c - Lowest Chronic Value observed in freshwater daphnids. Source: Oak Ridge National Laboratory, 1996.

d - Value is equal to the NAWQC-Marine Acute Value divided by 10.

e - Value is equal to the NAWQC-Marine Chronic Value.

COPEC - chemical of potential ecological concern

mg/L - milligrams per liter

na - not available

NAWQC - National Ambient Water Quality Criteria

TABLE A-17
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR SURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Ecological Hazard
Inorganics			
Aluminum	28,300	19,500	1.5
Barium	131	247	0.53
Cadmium	1.8	4.08	0.44
Chromium	22.8	71.1	0.32
Cobalt	19.9	44.4	0.45
Copper	65.4	313	0.21
Magnesium	15,500	na	--
Manganese	805	na	--
Thallium	92.4	4.15	22
Vanadium	137	na	--
Zinc	94.2	69.4	1.4
Semi-volatile Organic Componds			
PCBs (Total)	0.11	0.585	0.19
		Hazard Index (HI):	**27**

Notes:

-- - not calculated
a - Benchmark Criteria is equal to the ecological risk-based screening concentration (ERBSC).
mg/Kg - milligrams per kilogram
na - not available
PCBs - polychlorinated biphenyls

TABLE A-18
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR SUBSURFACE SOILS AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Ecological Hazard
Inorganics			
Barium	47.2	247	0.19
Cadmium	1.4	4.08	0.34
Chromium	20.7	71.1	0.29
Cobalt	10.8	44.4	0.24
Magnesium	11,600	na	--
Manganese	499	na	--
Thallium	44.8	4.15	11
Vanadium	103	na	--
Zinc	87.6	69.4	1.3
		Hazard Index (HI):	**13**

Notes:
-- - not calculated
a - Benchmark Criteria is equal to the ecological risk-based screening concentration (ERBSC). Criteria for subsurface soil is derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil.
mg/Kg - milligrams per kilogram
na - not available

TABLE A-19
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR MARINE GROUNDWATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/L)	Benchmark Criteria[a] (mg/L)	Ecological Hazard
Inorganics			
Aluminum	78.8	0.087	906
Arsenic	0.023	0.036	0.64
Barium	0.27	na	--
Beryllium	0.0027	0.0053	0.51
Cadmium	0.0026	0.0093	0.28
Chromium	0.13	na	--
Cobalt	0.071	na	--
Copper	0.43	0.0031	139
Lead	0.21	0.0081	26
Manganese	3.6	1	3.6
Molybdenum	0.0085	na	--
Nickel	0.14	0.0082	17
Silver	0.0032	0.00012	27
Vanadium	0.44	na	--
Zinc	0.83	0.081	10
Volatile Organic Compounds			
1,1-Dichloroethane	0.00019	na	--
1,3-Dichlorobenzene	0.00099	na	--
Acetone	0.0022	na	--
Total Xylenes	0.0004	na	--
Polynuclear Aromatic Hydrocarbons			
Fluoranthene	0.0025	0.016	0.16
Phenanthrene	0.0021	0.0046	0.46
Petroleum Hydrocarbons[b]			
GRO	0.021	na	--
DRO	2.8	na	--
		Hazard Index (HI):	**1130**

Notes:
-- - not calculated
a - Benchmark Criteria is equal to the United States Environmental Protection Agency National Ambient Water Quality Criteria or an alternate water quality criteria.
b - Petroleum hydrocarbons as DRO, GRO, or RRO not included in the cumulative risk calculation, per Alaska Department of Environmental Conservation's *Guidance on Calculating Cumulative Risk* - Final Draft (December 15, 2000).
GRO - gasoline range organics
DRO - diesel range organics
mg/L - milligrams per liter
na - not available
RRO - residual range organics

TABLE A-20
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FRESH SURFACE WATER AT LF18
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/L)	Benchmark Criteria[a] (mg/L)	Ecological Hazard
Inorganics			
Aluminum	0.6	0.087	6.9
Barium	0.0085	na	--
Cobalt	0.0013	na	--
Copper	0.012	0.009	1.3
Magnesium	24.6	na	--
Manganese	1.3	1	1.3
Molybdenum	0.0015	na	--
Volatile Organic Compounds			
Acetone	0.0036	na	--
Carbon Disulfide	0.00046	na	--
Petroleum Hydrocarbons[b]			
Gasoline Range Organics	0.0084	na	--
Diesel Range Organics	0.14	na	--
		Hazard Index:	**9.5**

Notes:
-- - not calculated
a - Benchmark Criteria is equal to the United States Environmental Protection Agency's National Ambient Water Quality Criteria or an alternate water quality criteria.
b - Petroleum hydrocarbons as diesel range organics, gasoline range organics, or residual range organics not included in the cumulative risk calculation, per the Alaska Department of Environmental Conservation's *Guidance on Calculating Cumulative Risk* - Final Draft (December 15, 2000).
mg/L - milligrams per liter
na - not available

APPENDIX B

SITE LF024/26 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

APPENDIX B

IRP SITE LF24/LF26 (BARREL BAY AND SCRAP METAL DISPOSAL AREA) HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

1.0 INTRODUCTION

This updated Tier I screening risk assessment was conducted for the United States Air Force (Air Force) Installation Restoration Program (IRP) LF24/LF26 (Barrel Bay and Scrap Metal Disposal Area) at Eareckson Air Station (AS). Human health and ecological risk assessments were previously prepared for IRP Site LF24/LF26, as documented in the *Eareckson Air Station Remedial Investigation/Feasibility Study* (USAF, 1996), and *Basewide Monitoring Report* (USAF, 1999). The Air Force is updating the risk assessments in response to comments received from the Alaska Department of Environmental Conservation (ADEC) on the draft Decision Document for Site LF24/LF26 (ADEC, 2000a), and to provide consistency with current Alaska regulations (e.g., 18 Alaska Administrative Code 75) and risk assessment methods described in ADEC's *Risk Assessment Procedures Manual* (ADEC, 2000b). The results of the updated screening risk assessment are presented below.

2.0 Methods

The specific methods and assumptions used in the revised Tier I screening risk assessment for Site LF24/LF26 are described in the *Technical Memorandum – Risk Assessment Assumptions for Decision Documents, Final* (USAF, 2001), hereafter referred to as the Risk Assessment Assumptions Technical Memorandum (RAATM). Briefly, analytes detected in sampled media were compared to one-tenth the ADEC Method Two Criteria, and/or appropriate ecological screening criteria, consistent with procedures described in the RAATM. Analytes detected at concentrations in excess of one-tenth the ADEC Method Two Criteria, and/or appropriate ecological screening criteria, were retained as chemicals of potential concern (COPCs) or chemicals of potential ecological concern (COPECs), respectively. Carcinogenic COPCs were included in Tier I cumulative cancer risk screening and compared to an acceptable risk criterion of 1.0×10^{-5}. Noncarcinogenic COPCs were included in an evaluation of cumulative noncancer hazard and compared to an acceptable hazard index (HI) of 1.0. Where ecological habitats and exposure pathways are present, COPECs were identified and included in an estimate of the total ecological HI. The Tier I ecological HI was compared to a screening HI criterion of 1.0.

3.0 Results

A revised Tier I screening risk assessment was completed for LF24/LF26. Consistent with ADEC's *Guidance on Calculating Cumulative Risk, Draft Final* (ADEC, 2001), petroleum hydrocarbons were excluded from the calculation of Tier I cumulative cancer risk and noncancer hazard estimates. Tier I cumulative risk estimates for analytes other than petroleum hydrocarbons are summarized in Section 3.1, and screening results for petroleum hydrocarbons are presented in Section 3.2.

3.1 Tier I Cumulative Risk Estimates

Tier I cumulative risk screening was conducted on COPCs or COPECs identified in soil, groundwater, marine surface water, and marine sediment. Summary results of the Tier I risk assessment for Site LF24/LF26 are presented in Tables B-1 and B-2. The COPC and COPEC selection process for analytes detected in each media sampled at LF24/LF26 is presented in Tables B-3 through B-11. Cumulative risk screening for identified COPCs and COPECs is presented in Tables B-12 through B-20.

3.1.1 Surface and Subsurface Soils

Tier I cumulative cancer risk and noncancer HI estimates for surface soils were 1.0×10^{-4} and 14, respectively (Table B-1). Arsenic is responsible for 97 percent of the total cumulative cancer risk. However, there are no known sources of arsenic contamination at Eareckson AS. The maximum concentration of arsenic detected in site surface soils was 30.1 milligrams per kilogram (mg/Kg). As per ADEC guidance (ADEC, 2001), it may be appropriate to calculate the cumulative risk estimate both including arsenic and excluding arsenic. When arsenic is excluded from the risk estimate for Site LF24/LF26, the remaining cumulative cancer risk is less than 1.0×10^{-5}. Arsenic and thallium are responsible for 89 percent of the total cumulative (noncancer) HI. As is the case for arsenic, there are no known sources of thallium at Eareckson AS. Surface soils were screened against ADEC 18 AAC 75.341 Method Two for the Under 40-Inch Zone, Migration-to-Groundwater criteria (Table B-4). Several inorganics (antimony, arsenic, cadmium, chromium, and selenium), methylene chloride, and pentachlorophenol exceeded their respective Migration-to-Groundwater criteria. However, groundwater at LF24/LF26 is migrating towards the Pacific Ocean and it is unlikely that it would ever be used as a public drinking water supply. Consequently, surface soils at LF24/LF26 are not anticipated to pose a significant human health concern.

A total ecological HI of 69 was estimated for LF24/LF26 surface soils, due primarily to the presence of lead, thallium, and zinc (Tables B-1 and B-7). Elevated soil-lead concentrations are anticipated in a scrap metal disposal site; however, such inorganic forms are largely non-bioavailable. There are no known site-related sources of thallium at Eareckson AS, and zinc is an essential nutrient and non-toxic, except at extremely high concentrations. Minor contributions to the ecological HI estimate resulted from other metals (aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, and selenium), several semi-volatile organic compounds (SVOCs – bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, and total polychlorinated biphenyls [PCBs]), and a pesticide (4,4-DDT). However, maximum concentrations of arsenic, chromium, cobalt, bis(2-ethylhexyl)phthalate and total PCBs were less than their respective Tier I ecological risk-based screening levels (ERBSCs). Di-n-butyl phthalate is a ubiquitous plasticizer and common laboratory contaminant, and was also detected in background soil samples and in laboratory blank samples (USAF, 1996a and b). For the remaining chemicals, it should be noted that ERBSCs were calculated for the most protective receptor (i.e., the snow bunting), the most protective exposure pathway (i.e., consumption of invertebrates), and the assumption that 100 percent of the snow bunting's diet is derived from LF24/LF26. These highly protective assumptions tend to result in an overestimate of the ecological HI. Based on the above, LF24/LF26 surface soils are not anticipated to result in significant ecological impacts.

Tier I human health cancer risk and noncancer HI estimates for subsurface soils were 2.0×10^{-5} and 6.5, respectively (Table B-1). Arsenic is responsible for 85 percent of the estimated cumulative cancer risk, and thallium is responsible for 83 percent of the total cumulative HI. However, there are no known sources of arsenic or thallium at Eareckson AS. If arsenic and thallium are excluded from the cancer risk and HI estimates for subsurface soils, the remaining cancer risk and HI estimates are less than 1.0×10^{-5} and 1.0, respectively. Subsurface soils were screened against ADEC 18 AAC 75.341 Method Two for Under 40-Inch Zone, Migration-to-Groundwater criteria (Table B-6). Antimony, arsenic, cadmium, chromium, and benzene exceeded their respective Migration-to-Groundwater criteria. However, groundwater at LF24/LF26 is migrating towards the Pacific Ocean and it is unlikely that it would ever be used as a public drinking water supply. Consequently, subsurface soils at LF24/LF26 are not anticipated to pose a significant human health concern.

A total ecological HI of 56 was estimated for LF24/LF26 subsurface soils, due primarily to the presence of lead, thallium, and zinc (Tables B-1 and B-8). Elevated soil-lead concentrations are anticipated in a scrap metal disposal site; however, such inorganic forms are largely non-bioavailable. There are no known site-related sources of thallium at Eareckson AS, and zinc is an essential nutrient and non-toxic, except at extremely high concentrations. Minor contributions to the ecological HI estimate resulted from antimony, barium, cadmium, chromium, cobalt, copper, bis(2-ethylhexyl)phthalate, and di-n-butyl phthalate. However, maximum concentrations of antimony, cobalt, copper, bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were less than Tier I ERBSCs. In addition, bis(2-ethylhexyl)phthalate and di-n-butyl phthalate are ubiquitous plasticizers and common laboratory contaminants, and were detected in background soil samples (USAF, 1996a and b). As was the case for surface soils, it should be noted that ERBSCs were calculated for the most protective receptor and using the most protective exposure pathways and assumptions. Finally, exposure to subsurface soil represents an incomplete exposure pathway for ecological receptors, unless soils are disturbed. Based on the above, subsurface soils are not anticipated to result in significant ecological impacts.

3.1.2 Groundwater

Marine groundwater samples are actually fresh groundwater samples collected for evaluation of risk to the marine environment. For LF24/LF26, the total ecological HI for groundwater was estimated as 1,008 (Table B-1). Inorganics were the primary risk drivers in groundwater; with aluminum responsible for 85 percent of the total ecological HI. It should be noted, however, that groundwater samples were not filtered prior to analysis, and *dissolved* COPEC concentrations are most likely lower than those measured. In addition, the ecological HI is based on hazards to marine aquatic species assuming no attenuation or dilution of concentrations between groundwater monitoring locations and the receptor exposure point (i.e., the Pacific Ocean). Consequently, ecological HIs for groundwater represent worst-case estimates. The results of biological studies indicate that adverse impacts to marine aquatic receptors are not occurring at LF24/LF26.

3.1.3 Marine Surface Water and Sediment

Tier I human health risks were not evaluated for marine surface water and sediment, consistent with the *Eareckson Air Station Remedial Investigation/Feasibility Study* (USAF, 1996a and b) and the updated conceptual site model included in the RAATM (USAF, 2001). Marine surface water and sediment samples were collected from tidal areas of LF24/LF26 and were evaluated in a Tier I ecological risk assessment.

A total ecological HI of 54 was estimated for marine surface water, due primarily to the presence of aluminum, copper, lead, and manganese (Table B-1). As was the case for groundwater, marine surface water samples were not filtered prior to analysis and *dissolved* concentrations of COPECs are most likely lower than those measured. A total ecological HI of 34 was estimated for marine sediment. The presence of arsenic, copper, lead, nickel, and zinc in marine sediment accounted for 86 percent of the ecological HI for this medium. It should be noted that three offshore sediment samples were collected from Scoot Cove and submitted for P450 analysis to evaluate whether or not marine sediments contain elevated organic chemical concentrations. In addition, a replicate sample of one of the sediment samples was collected to evaluate the bioavailability of leached metals to marine organisms (i.e., a chronic 10-day test with *Rhepoxynius arbronius*). No significant toxicity was observed, and the results of the P450 analyses and toxicity test support the conclusion that COPECs are not migrating into the marine environment at levels that would impact marine aquatic receptors.

3.2 Petroleum Hydrocarbon Screening

Consistent with ADEC's *Guidance on Calculating Cumulative Risk* (ADEC, 2001), petroleum hydrocarbons were not included in the Tier I cumulative risk screening results described above. However, petroleum hydrocarbons of varying types and concentrations were detected in most media, as summarized in Table B-2.

Petroleum hydrocarbons, as measured by U.S. Environmental Protection Agency (EPA) Method E418.1, were detected at a maximum concentration of 371 mg/Kg in surface soils and 1,373 mg/Kg in subsurface soils. It should be noted that the analytical method used (EPA Method 418.1) measures petroleum hydrocarbons in the carbon range C10 to C38, as well as biogenic hydrocarbons (i.e., hydrocarbons derived from natural sources such as peat, roots, and waxes). Therefore, EPA Method 418.1 results might not be directly comparable to ADEC 18 AAC 75.341 Method Two for Under 40-Inch Zone, Table B2 Soil Cleanup Levels for petroleum hydrocarbons. It should be noted, however, that concentrations of gasoline range organics (GRO) and diesel range organics (DRO) measured in groundwater samples analyzed using EPA Solid Waste Method (SW)8015 and SW8100, respectively, were 0.081 milligrams per liter (mg/L) and 1.2 mg/L. These concentrations are below ADEC 18 AAC 75.345 Table C Groundwater Cleanup Levels for GRO and DRO. There are currently no cleanup levels available for marine surface water.

These results suggest that petroleum hydrocarbons present in site soils are having minimal impact on groundwater or surface water quality in the vicinity of LF24/LF26. Based on the

above, petroleum hydrocarbons present at LF24/LF26 are not believed to pose a significant risk to human health or the environment.

4.0 REFERENCES

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TABLE B-1
SUMMARY OF TIER I RISK SCREENING RESULTS FOR SITE LF24/LF26
EARECKSON AIR STATION, ALASKA

	Human Health Tier I Risk Screening Results					Ecological Tier I Risk Screening Results			
Media	**Cancer Risk[a]**	**HI[b]**	**Risk Drivers[c]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**	**Ecological HI[d]**	**Risk Drivers[e]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**
Surface Soil	**1.0 x 10^{-4}**	**14**	Antimony	30.1	nd	**69**	Aluminum	28,100	10,678
			Arsenic [f]	53.1	2.02		Antimony	30.1	nd
			Cadmium	18	0.235		Arsenic	53.1	2.02
			Chromium	70.5	7.04		Barium	561	25.71
			Thallium [f]	77	na		Cadmium	18	0.235
			Vanadium	136	43.4		Chromium	70.5	7.04
							Cobalt	24.2	9.36
							Copper	892	17.92
							Lead [g]	1,740	5.9
							Selenium	39.0	nd
							Thallium [g]	77	na
							Zinc [g]	919	30.98
							bis(2-Ethylhexyl)phthalate	2.9	na
							Di-n-butyl phthalate	5	na
							PCB (total)	0.173	na
							4,4-DDT	0.034	na
Migration-to-GW	na	na	**Antimony** [h]	30.1	nd	na	na	na	na
Pathway			**Arsenic** [h]	53.1	2.02				
			Cadmium [h]	18	0.235				
			Chromium [h]	70.5	7.04				
			Selenium [h]	39	nd				
			Methylene chloride [h]	0.019	na				
			Pentachlorophenol [h]	0.21	na				
Subsurface Soil	**2.0 x 10^{-5}**	**6.5**	**Arsenic** [i]	9.3	2.26	**56**	Antimony	14	nd
			Thallium [i]	38.6	na		Barium	380	35.3
							Cadmium	6.8	0.119
							Chromium	81.3	16.3
							Cobalt	23.2	8.66
							Copper	131	17.92
							Lead [j]	1,620	2.28
							Thallium [j]	38.6	na
							Zinc [j]	2,110	39.1
							bis(2-Ethylhexyl)phthalate	5.3	na
							Di-n-butyl phthtalate	0.95	na

TABLE B-1
SUMMARY OF TIER I RISK SCREENING RESULTS FOR SITE LF24/LF26
EARECKSON AIR STATION, ALASKA

	Human Health Tier I Risk Screening Results					Ecological Tier I Risk Screening Results			
Media	**Cancer Risk[a]**	**HI[b]**	**Risk Drivers[c]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**	**Ecological HI[d]**	**Risk Drivers[e]**	**Maximum Concentration (mg/Kg, mg/L)**	**Background Concentration (mg/Kg, mg/L)**
Migration-to-GW Pathway	na	na	**Antimony** [k]	14	nd	na	na	na	na
			Arsenic [k]	9.3	2.26				
			Cadmium [k]	6.8	0.119				
			Chromium [k]	81.3	16.3				
			Benzene [k]	0.049	na				
Marine Groundwater	na	na	na	na	na	**1,008**	**Aluminum** [l]	74.2	nd
							Arsenic	0.067	nd
							Beryllium	0.004	nd
							Cadmium	0.0081	0.0005
							Copper	0.255	nd
							Lead	0.042	nd
							Manganese	7.2	nd
							Mercury	0.001	na
							Nickel	0.075	nd
							Silver	0.004	nd
							Thallium	0.141	na
							Zinc	0.7	nd
							Diethyl phthalate	0.002	na
							2-Methylnaphthalene	0.021	na
Marine Surface Water	na	na	na	na	na	**54**	**Aluminum** [m]	0.54	nd
							Arsenic	0.0025	nd
							Copper [m]	0.067	nd
							Lead [m]	0.18	nd
							Manganese [m]	1.8	0.1
							Zinc	0.032	nd
Marine Sediment	na	na	na	na	na	**34**	Antimony	4.2	0.838
							Arsenic [n]	49.3	11.32
							Cadmium	0.95	0.2
							Chromium	79.6	12.32
							Copper [n]	321	18.3
							Lead [n]	179	1.69
							Mercury	0.05	nd
							Nickel [n]	134	20.84
							Zinc [n]	570	29.23
							bis(2-Ethylhexyl)phthalate	0.11	na

TABLE B-1
SUMMARY OF TIER I RISK SCREENING RESULTS FOR SITE LF24/LF26
EARECKSON AIR STATION, ALASKA

Notes:

% - percent

a - Cumulative Tier I cancer risk; includes ingestion and inhalation pathways for COPCs.

ADEC - Alaska Department of Environmental Conservation

b - Cumulative Tier I hazard index; includes ingestion and inhalation pathways for COPCs.

c - Chemicals shown contribute to an exceedence of ADEC cumulative risk or hazard criteria. Bolding indicates the primary risk drivers.

COPC - chemical of potential concern

COPEC - chemical of potential ecological concern

d - Cumulative Tier I ecological hazard index; calculated for the most protective receptor and exposure route for each COPEC.

e - COPECs that contribute to an ecological HI greater than 1.0.

f - Arsenic is responsible for 97% of the total cumulative cancer risk and thallium is responsible for 79% of the total cumulative HI. If arsenic is excluded from the risk calculation, the remaining cumulative cancer risk is less than 1.0 x 10-5.

g - Lead, thallium, and zinc are responsible for 60% of the total ecological HI.

h - The indicated chemicals exceed the ADEC Table B1 Soil Cleanup Levels for Migration-to-Groundwater Pathway.

HI - hazard index

i - Arsenic is responsible for 85% of the total cumulative cancer risk. If arsenic is excluded from the risk calculation, the remaining cumulative cancer risk is less than 1.0 x 10-5. Thallium is responsible for 83% of the total cumulative HI.

j - Zinc is responsible for 54% of the total ecological HI; lead and thallium are responsible for 15% and 29% of the total HI, respectively.

k - The indicated chemicals exceed the ADEC Table B1 Soil Cleanup Levels for Migration-to-Groundwater Pathway.

l - Aluminum is responsible for 85% of the total cumulative HI. Groundwater samples were not filtered.

m - Aluminum, copper, lead, and manganese are responsible for 98% of the total cumulative HI. Lead is responsible for 83% of the total cumulative HI. Surface water samples were not

mg/Kg - milligrams per kilogram

mg/L - milligrams per liter

n - Arsenic, copper, lead, nickel, and zinc are responsible for 86% of the total cumulative HI.

na - not applicable

nd - not detected

ns - not sampled

Bold indicates exceedence of a risk or hazard criterion.

TABLE B-2
SUMMARY OF SCREENING RESULTS FOR TOTAL PETROLEUM HYDROCARBONS FOR SITE LF24/LF26
EARECKSON AIR STATION, ALASKA

Medium/Constituent	Analytical Method	Concentration (mg/Kg, mg/L) Maximum	Concentration (mg/Kg, mg/L) Minimum	Number of Samples	Number of Detects	Frequency	Criteria (mg/Kg, mg/L)[a] Groundwater	Criteria (mg/Kg, mg/L)[a] Soils Ingestion	Criteria (mg/Kg, mg/L)[a] Soils Migration to GW	Exceedance (Yes/No)
Surface Soil										
Petroleum Hydrocarbons	E418.1	16,000	380	4	4	100%	na	na	na	NC
Subsurface Soil										
Petroleum Hydrocarbons	E418.1	14,000	1200	2	2	100%	na	na	na	NC
Marine Groundwater										
Gasoline Range Organics	SW8015	0.081	0.081	1	1	100%	na	na	na	NC
Diesel Range Organics	SW8100	1.2	1.2	1	1	100%	na	na	na	NC
Marine Surface Water										
Gasoline Range Organics	SW8015	0.0074	0.0061	2	2	100%	na	na	na	NC
Diesel Range Organics	SW8100	0.070	0.051	2	2	100%	na	na	na	NC

Notes:
% - percent
a - Source: Alaska Department of Environmental Conservation 18 Alaska Administrative Code 75.
E - EPA Method
EPA - United States Environmental Protection Agency
GW - groundwater
mg/Kg - milligrams per kilogram
mg/L - milligrams per liter
na - not available
NC - no criteria
SW - EPA Solid Waste Method

TABLE B-3
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER 1 HUMAN HEALTH SCREENING IN SURFACE SOILS AT LF24/LF26
EARECKSON AIR STATION, ALASKA

	Surface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Inorganics								
Aluminum	28,100	6,510	33	33	100%	10,678	10,100	Yes
Antimony	30.1	5.7	5	5	100%	ND	4.06	Yes
Arsenic	53.1	1.2	16	16	100%	2.02	0.55	Yes
Barium	561	6.7	33	33	100%	25.71	710	No
Beryllium	0.6	0.19	11	11	100%	2.19	0.19	No
Cadmium	18	0.49	28	28	100%	0.235	10.1	Yes
Chromium	70.5	3.9	33	33	100%	7.04	50.7	Yes
Cobalt	24.2	3.5	34	34	100%	9.36	203	No
Copper	892	16.5	34	34	100%	17.92	406	Yes
Lead	1,740	10.5	11	11	100%	5.9	40	Yes
Magnesium	18,000	4,570	34	34	100%	5,078	na	No[b]
Manganese	968	127	34	34	100%	156	1,420	No
Mercury	0.23	0.16	2	2	100%	na	1.75	No
Molybdenum	1.4	0.99	3	3	100%	ND	50.7	No
Nickel	62.4	8.2	33	33	100%	15.96	203	No
Selenium	39	0.76	3	3	100%	ND	50.7	No
Silver	9.3	0.25	19	19	100%	3.037	50.7	No
Thallium	77	0.47	24	24	100%	na	0.04	Yes
Vanadium	136	15.2	33	33	100%	43.44	71	Yes
Zinc	919	38.4	33	33	100%	30.98	3040	No
VOCs								
Acetone	0.006	0.006	1	1	100%	na	1010	No
Chloroform	0.002	0.001	2	2	100%	na	0.32	No
Methylene chloride	0.019	0.005	8	8	100%	na	18.1	No
Methl ethyl ketone	1	0.65	2	2	100%	na	6,080	No
SVOCs								
bis(2-Ethylhexyl)phthalate	2.9	0.04	14	14	100%	na	59.3	No
Diethyl phthalate	0.13	0.058	2	2	100%	na	8110	No
Di-n-butyl phthalate	5	0.046	6	6	100%	na	1010	No
Pentachlorophenol	0.21	0.21	1	1	100%	na	3.5	No
PCBs (Total)	0.173	0.036	5	5	100%	na	1	No
Pesticides								
4,4-DDD	0.015	0.0021	3	3	100%	na	3.46	No
4,4-DDE	0.0027	0.0026	2	2	100%	na	2.44	No
4,4-DDT	0.034	0.0025	6	6	100%	na	2.44	No
Endrin	0.0021	0.0021	1	1	100%	na	3.04	No
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.068	0.068	1	1	100%	na	3040	No
Benzo(a)anthracene	0.13	0.13	1	1	100%	na	1.14	No
Benzo(a)pyrene	0.33	0.33	1	1	100%	na	0.11	Yes

TABLE B-3
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER 1 HUMAN HEALTH SCREENING IN SURFACE SOILS AT LF24/LF26
EARECKSON AIR STATION, ALASKA

	Surface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Polynuclear Aromatic Hydrocarbons (cont.)								
Benzo(b)fluoranthene	0.3	0.3	1	1	100%	na	1.14	No
Benzo(g,h,i)perylene	0.27	0.27	1	1	100%	na	300	No
Benzo(k)fluoranthene	0.27	0.27	1	1	100%	na	11.4	No
Chrysene	0.39	0.39	1	1	100%	na	114	No
Fluoranthene	0.068	0.068	1	1	100%	na	406	No
Indeno(1,2,3-c,d)pryene	0.3	0.3	1	1	100%	na	1.14	No
2-Methylnaphthalene	0.46	0.46	1	1	100%	na	4,100	No
Pyrene	0.08	0.08	1	1	100%	na	304	No
Petroleum Hydrocarbons								
Petroleum Hydrocarbons	16,000	380	4	4	100%	na	na	Yes

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark Criteria, United States Environmental Protection Agency Soil Screening Levels, or Calculated Cleanup Levels.
b - Magnesium eliminated as a COPC based on its status as a common essential nutrient.
COPC - chemical of potential concern
DDD - Dichlorodiphenyldichloroethane
DDE - Dichlorodiphenyldichloroethene
DDT - Dichlorodiphenyltrichloroethane
mg/Kg - milligrams per kilogram
na - not available
ND - non-detect
PCBs - polychlorinated biphenyls
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE B-4
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING IN MIGRATION-TO-GROUNDWATER PATHWAY FOR SURFACE SOILS AT LF24/LF26 EARECKSON AIR STATION, ALASKA

Constituent	Surface Soils Concentration (mg/Kg) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	COPC? (Yes/No)
Inorganics								
Aluminum	28,100	6,510	33	33	100%	10678	na	Yes
Antimony	30.1	5.7	5	5	100%	ND	0.36	Yes
Arsenic	53.1	1.2	16	16	100%	2.02	0.2	Yes
Barium	561	6.7	33	33	100%	25.71	110	Yes
Beryllium	0.6	0.19	11	11	100%	2.19	4.2	No
Cadmium	18	0.49	28	28	100%	0.235	0.5	Yes
Chromium	70.5	3.9	33	33	100%	7.04	2.6	Yes
Cobalt	24.2	3.5	34	34	100%	9.36	43.9	No
Copper	892	16.5	34	34	100%	17.92	700	Yes
Lead	1,740	10.5	11	11	100%	5.9	na	Yes
Magnesium	18,000	4,570	34	34	100%	5078	na	No[b]
Manganese	968	127	34	34	100%	156	440	Yes
Mercury	0.23	0.16	2	2	100%	na	0.14	Yes
Molybdenum	1.4	0.99	3	3	100%	ND	4.91	No
Nickel	62.4	8.2	33	33	100%	15.96	8.7	Yes
Selenium	39	0.76	3	3	100%	ND	0.35	Yes
Silver	9.3	0.25	19	19	100%	3.037	2.1	Yes
Thallium	77	0.47	24	24	100%	na	0.04	Yes
Vanadium	136	15.2	33	33	100%	43.44	340	No
Zinc	919	38.4	33	33	100%	30.98	910	Yes
VOCs								
Acetone	0.006	0.006	1	1	100%	na	1	No
Chloroform	0.002	0.001	2	2	100%	na	0.034	No
Methylene chloride	0.019	0.005	8	8	100%	na	0.0015	Yes
Methl ethyl ketone	1	0.65	2	2	100%	na	6.0	No
SVOCs								
bis(2-Ethylhexyl)phthalate	2.9	0.04	14	14	100%	na	120	No
Diethyl phthalate	0.13	0.058	2	2	100%	na	19	No
Di-n-butyl phthalate	5	0.046	6	6	100%	na	170	No
Pentachlorophenol	0.21	0.21	1	1	100%	na	0.001	Yes
PCBs (Total)	0.173	0.036	5	5	100%	na	1	No
Pesticides								
4,4-DDD	0.015	0.0021	3	3	100%	na	4.7	No
4,4-DDE	0.0027	0.0026	2	2	100%	na	15	No
4,4-DDT	0.034	0.0025	6	6	100%	na	8.8	No
Endrin	0.0021	0.0021	1	1	100%	na	0.03	No
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.068	0.068	1	1	100%	na	430	No
Benzo(a)anthracene	0.13	0.13	1	1	100%	na	0.6	No
Benzo(a)pyrene	0.33	0.33	1	1	100%	na	0.3	Yes

TABLE B-4
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING IN MIGRATION-TO-GROUNDWATER PATHWAY FOR SURFACE SOILS AT LF24/LF26 EARECKSON AIR STATION, ALASKA

Constituent	Surface Soils Concentration (mg/Kg) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	COPC? (Yes/No)
Polynuclear Aromatic Hydrocarbons (cont.)								
Benzo(b)fluoranthene	0.3	0.3	1	1	100%	na	2	No
Benzo(g,h,i)perylene	0.27	0.27	1	1	100%	na	150	No
Benzo(k)fluoranthene	0.27	0.27	1	1	100%	na	20	No
Chrysene	0.39	0.39	1	1	100%	na	62	No
Fluoranthene	0.068	0.068	1	1	100%	na	210	No
Indeno(1,2,3-c,d)pryene	0.3	0.3	1	1	100%	na	5.4	No
2-Methylnaphthalene	0.46	0.46	1	1	100%	na	4.3	No
Pyrene	0.08	0.08	1	1	100%	na	150	No
Petroleum Hydrocarbons								
Petroleum Hydrocarbons	16,000	380	4	4	100%	na	na	Yes

Notes:

% - percent

a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark Criteria (Migration-to-Groundwater Pathway), United States Environmental Protection Agency Soil Screening Levels, or Calculated Cleanup Level

b - Magnesium eliminated as a COPC based on its status as a common essential nutrient.

COPC - chemical of potential concern

DDD - Dichlorodiphenyldichloroethane

DDE - Dichlorodiphenyldichloroethene

DDT - Dichlorodiphenyltrichloroethane

mg/Kg - milligrams per kilogram

na - not available

ND - non-detect

PCBs - polychlorinated biphenyls

SVOCs - semi-volatile organic compounds

VOCs - volatile organic compounds

TABLE B-5
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING
IN SUBSURFACE SOILS AT LF24/LF26
EARECKSON AIR STATION, ALASKA

	Subsurface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Inorganics								
Aluminum	17,000	7,620	7	7	100%	19,114	10100	No
Antimony	14	6.2	2	2	100%	ND	4.06	Yes
Arsenic	9.3	8.3	2	2	100%	2.26	0.55	Yes
Barium	380	15.4	7	7	100%	35.3	710	No
Beryllium	0.6	0.28	4	4	100%	ND	0.19	Yes
Cadmium	6.8	0.7	7	7	100%	0.119	10.1	No
Chromium	81.3	14	7	7	100%	16.3	50.7	Yes
Cobalt	23.2	5.9	7	7	100%	8.66	203	No
Copper	131	17.7	7	7	100%	76.8	406	No
Lead	1,620	348	2	2	100%	2.28	40	Yes
Magnesium	13,800	5,860	7	7	100%	6,299	na	No[b]
Manganese	1,100	290	7	7	100%	241	1420	No
Molybdenum	1	1	1	1	100%	21.41	50.7	No
Nickel	45.3	12.3	7	7	100%	79.63	203	No
Silver	12	0.57	3	3	100%	3	50.7	No
Thallium	38.6	18.3	5	5	100%	na	0.04	Yes
Vanadium	113	37.9	7	7	100%	66.7	71	Yes
Zinc	2,110	49.6	7	7	100%	39.1	3040	No
VOCs								
Acetone	0.021	0.021	1	1	100%	na	1010	No
Benzene	0.049	0.009	2	2	100%	na	0.86	No
Methyl ethyl ketone	0.95	0.59	2	2	100%	na	6080	No
Toluene	0.15	0.002	4	4	100%	na	18	No
Total Xylenes	0.016	0.005	2	2	100%	na	8.1	No
SVOCs								
bis(2-Ethylhexyl)phthalate	5.3	0.041	6	6	100%	na	59.3	No
Di-n-butyl phthalate	0.95	0.95	1	1	100%	na	1010	No
PCBs (Total)	0.11	0.11	1	1	100%	na	1	No
Petroleum Hydrocarbons								
Petroleum Hydrocarbons	14,000	1,200	2	2	100%	na	na	Yes

Notes:

% - percent

a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark Criteria (Migration-to-Groundwater Pathway), United States Environmental Protection Agency Soil Screening Levels, or Calculated Cleanup Levels. Criteria for subsurface soil is derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil.

b - Magnesium eliminated as a COPC based on its status as a common essential nutrient.

COPC - chemical of potential concern

mg/Kg - milligrams per kilogram

na - not available

ND - non-detect

PCBs - polychlorinated biphenyls

SVOCs - semi-volatile organic compounds

VOCs - volatile organic compounds

TABLE B-6
SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR TIER I HUMAN HEALTH SCREENING IN MIGRATION-TO-GROUNDWATER PATHWAY FOR SUBSURFACE SOILS AT LF24/LF26 EARECKSONAIR STATION, ALASKA

	Subsurface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Inorganics								
Aluminum	17,000	7,620	7	7	100%	19,114	na	No
Antimony	14	6.2	2	2	100%	ND	0.36	Yes
Arsenic	9.3	8.3	2	2	100%	2.26	0.2	Yes
Barium	380	15.4	7	7	100%	35.3	110	Yes
Beryllium	0.6	0.28	4	4	100%	ND	4.2	No
Cadmium	6.8	0.7	7	7	100%	0.119	0.5	Yes
Chromium	81.3	14	7	7	100%	16.3	2.6	Yes
Cobalt	23.2	5.9	7	7	100%	8.66	43.9	No
Copper	131	17.7	7	7	100%	76.8	700	No
Lead	,620	348	2	2	100%	2.28	na	Yes
Magnesium	13,800	5,860	7	7	100%	6,299	na	No[b]
Manganese	1,100	290	7	7	100%	241	440	Yes
Molybdenum	1	1	1	1	100%	21.41	4.91	No
Nickel	45.3	12.3	7	7	100%	79.63	8.7	No
Silver	12	0.57	3	3	100%	3	2.1	Yes
Thallium	38.6	18.3	5	5	100%	na	0.04	Yes
Vanadium	113	37.9	7	7	100%	66.7	340	No
Zinc	2110	49.6	7	7	100%	39.1	910	Yes
VOCs								
Acetone	0.021	0.021	1	1	100%	na	1	No
Benzene	0.049	0.009	2	2	100%	na	0.002	Yes
Methyl ethyl ketone	0.95	0.59	2	2	100%	na	6.0	No
Toluene	0.15	0.002	4	4	100%	na	0.54	No
Total Xylenes	0.016	0.005	2	2	100%	na	7.8	No
SVOCs								
bis(2-Ethylhexyl)phthalate	5.3	0.041	6	6	100%	na	120	No
Di-n-butyl phthalate	0.95	0.95	1	1	100%	na	170	No
PCBs (Total)	0.11	0.11	1	1	100%	na	1	No
Petroleum Hydrocarbons								
Petroleum Hydrocarbons	14,000	1,200	2	2	100%	na	na	Yes

Notes:

% - percent

a - Benchmark Criteria is equal to one-tenth the Alaska Department of Environmental Conservation Soil Benchmark Criteria (Migration-to-Groundwater Pathway), United States Environmental Protection Agency Soil Screening Levels, or Calculated Cleanup Levels. Criteria for subsurface soil is derived from surface soil as they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil.

b - Magnesium eliminated as a COPC based on its status as a common essential nutrient.

COPC - chemical of potential concern

mg/Kg - milligrams per kilogram

na - not available

ND - non-detect

PCBs - polychlorinated biphenyls

SVOCs - semi-volatile organic compounds

VOCs - volatile organic compounds

TABLE B-7
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING IN SURFACE SOILS AT LF24/LF26 EARECKSON AIR STATION, ALASKA

	Surface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPEC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Inorganics								
Aluminum	28,100	6,510	33	33	100%	10,678	1950	Yes
Antimony	30.1	5.7	5	5	100%	ND	1.42	Yes
Arsenic	53.1	1.2	16	16	100%	2.02	5.59	Yes
Barium	561	6.7	33	33	100%	25.71	24.7	Yes
Beryllium	0.6	0.19	11	11	100%	2.19	1.45	No
Cadmium	18	0.49	28	28	100%	0.235	0.408	Yes
Chromium	70.5	3.9	33	33	100%	7.04	7.11	Yes
Cobalt	24.2	3.5	34	34	100%	9.36	4.44	Yes
Copper	892	16.5	34	34	100%	17.92	31.3	Yes
Lead	1,740	10.5	11	11	100%	5.9	19.1	Yes
Magnesium	18,000	4,570	34	34	100%	5,078	na	No[b]
Manganese	968	127	34	34	100%	156	na	Yes
Mercury	0.23	0.16	2	2	100%	na	17.2	No
Molybdenum	1.4	0.99	3	3	100%	ND	na	Yes
Nickel	62.4	8.2	33	33	100%	15.96	430	No
Selenium	39	0.76	3	3	100%	ND	0.593	Yes
Silver	9.3	0.25	19	19	100%	3.037	118	No
Thallium	77	0.47	24	24	100%	na	0.415	Yes
Vanadium	136	15.2	33	33	100%	43.44	na	Yes
Zinc	919	38.4	33	33	100%	30.98	6.94	Yes
VOCs								
Acetone	0.006	0.006	1	1	100%	na	0.273	No
Chloroform	0.002	0.001	2	2	100%	na	4.03	No
Methylene chloride	0.019	0.005	8	8	100%	na	0.292	No
Methl ethyl ketone	1	0.65	2	2	100%	na	24.5	No
SVOCs								
bis(2-Ethylhexyl)phthalate	2.9	0.04	14	14	100%	na	0.585	Yes
Diethyl phthalate	0.13	0.058	2	2	100%	na	601	No
Di-n-butyl phthalate	5	0.046	6	6	100%	na	0.178	Yes
Pentachlorophenol	0.21	0.21	1	1	100%	na	26.2	No
PCBs (Total)	0.173	0.036	5	5	100%	na	0.0585	Yes
Pesticides								
4,4-DDD	0.015	0.0021	3	3	100%	na	1.68	No
4,4-DDE	0.0027	0.0026	2	2	100%	na	0.181	No
4,4-DDT	0.034	0.0025	6	6	100%	na	0.00162	Yes
Endrin	0.0021	0.0021	1	1	100%	na	0.821	No
Polynuclear Aromatic Hydrocarbons								
Anthracene	0.068	0.068	1	1	100%	na	1.11	No
Benzo(a)anthracene	0.13	0.13	1	1	100%	na	2	No
Benzo(a)pyrene	0.33	0.33	1	1	100%	na	2.2	No

TABLE B-7
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING IN SURFACE SOILS AT LF24/LF26 EARECKSON AIR STATION, ALASKA

	Surface Soils					Mean	Benchmark	
	Concentration (mg/Kg)		Number of		Detection	Background	Criteria[a]	COPEC?
Constituent	Maximum	Minimum	Samples	Detects	Frequency	(mg/Kg)	(mg/Kg)	(Yes/No)
Polynuclear Aromatic Hydrocarbons (cont.)								
Benzo(b)fluoranthene	0.3	0.3	1	1	100%	na	2.22	No
Benzo(g,h,i)perylene	0.27	0.27	1	1	100%	na	1.04	No
Benzo(k)fluoranthene	0.27	0.27	1	1	100%	na	2.22	No
Chrysene	0.39	0.39	1	1	100%	na	2.03	No
Fluoranthene	0.068	0.068	1	1	100%	na	1.5	No
Indeno(1,2,3-c,d)pryene	0.3	0.3	1	1	100%	na	2.12	No
2-Methylnaphthalene	0.46	0.46	1	1	100%	na	na	Yes
Pyrene	0.08	0.08	1	1	100%	na	1.54	No
Petroleum Hydrocarbons								
Petroleum Hydrocarbons	16,000	380	4	4	100%	na	na	Yes

Notes:

% - percent

a - Benchmark Criteria is equal to one-tenth the ecological risk-based screening concentration (ERBSC).

b - Magnesium eliminated as a COPEC based on its status as a common essential nutrient.

COPEC - Chemical of potential ecological concern

DDD - Dichlorodiphenyldichloroethane

DDE - Dichlorodiphenyldichloroethene

DDT - Dichlorodiphenyltrichloroethane

mg/Kg - milligrams per kilogram

na - not available

ND - non-detect

PCBs - polychlorinated biphenyls

SVOCs - semi-volatile organic compounds

VOCs - volatile organic compounds

TABLE B-8
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING IN SUBSURFACE SOILS AT LF24/LF26 EARECKSON AIR STATION, ALASKA

Constituent	Subsurface Soils Concentration (mg/kg) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	COPEC? (Yes/No)
Inorganics								
Aluminum	17,000	7,620	7	7	100%	19,114	1950	No
Antimony	14	6.2	2	2	100%	ND	1.42	Yes
Arsenic	9.3	8.3	2	2	100%	2.26	5.59	Yes
Barium	380	15.4	7	7	100%	35.3	24.7	Yes
Beryllium	0.6	0.28	4	4	100%	ND	1.45	No
Cadmium	6.8	0.7	7	7	100%	0.119	0.408	Yes
Chromium	81.3	14	7	7	100%	16.3	7.11	Yes
Cobalt	23.2	5.9	7	7	100%	8.66	4.44	Yes
Copper	131	17.7	7	7	100%	76.8	31.3	Yes
Lead	1,620	348	2	2	100%	2.28	19.1	Yes
Magnesium	13,800	5,860	7	7	100%	6,299	na	No[b]
Manganese	1100	290	7	7	100%	241	na	Yes
Molybdenum	1	1	1	1	100%	21.41	na	No
Nickel	45.3	12.3	7	7	100%	79.63	430	No
Silver	12	0.57	3	3	100%	3	118	No
Thallium	38.6	18.3	5	5	100%	na	0.415	Yes
Vanadium	113	37.9	7	7	100%	66.7	na	Yes
Zinc	2,110	49.6	7	7	100%	39.1	6.94	Yes
VOCs								
Acetone	0.021	0.021	1	1	100%	na	0.273	No
Benzene	0.049	0.009	2	2	100%	na	2.24	No
Methyl ethyl ketone	0.95	0.59	2	2	100%	na	24.5	No
Toluene	0.15	0.002	4	4	100%	na	4.72	No
Total Xylenes	0.016	0.005	2	2	100%	na	0.67	No
SVOCs								
bis(2-Ethylhexyl)phthalate	5.3	0.041	6	6	100%	na	0.585	Yes
Di-n-butyl phthalate	0.95	0.95	1	1	100%	na	0.178	Yes
PCBs (Total)	0.11	0.11	1	1	100%	na	0.0585	Yes
Petroleum Hydrocarbons								
Petroleum Hydrocarbons	14,000	1,200	2	2	100%	na	na	Yes

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the ecological risk-based screening concentration. Criteria for subsurface soil is derived from surface soil since they are considered to be the same matrix; there is no difference in regulatory criteria for surface and subsurface soils.
b - Magnesium eliminated as a COPEC based on its status as a common essential nutrient.
COPEC - chemical of potential ecological concern.
mg/Kg - milligrams per kilogram
na - not available
ND - non-detect
PCBs - polychlorinated biphenyls
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE B-9
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING IN MARINE GROUNDWATER AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Marine Groundwater Concentration (mg/L) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/L)	Benchmark Criteria[a, b] (mg/L)	COPEC? (Yes/No)
Inorganics								
Aluminum	74	0.27	16	16	100%	ND	0.0087[c]	Yes
Antimony	0.044	ND	8	6	75%	ND	0.05	No
Arsenic	0.067	ND	13	11	85%	ND	0.0036	Yes
Barium	0.33	0.018	16	16	100%	ND	na	Yes
Beryllium	0.0040	ND	14	8	57%	ND	0.00053[c]	Yes
Cadmium	0.0081	ND	14	12	86%	0.0005	0.00093	Yes
Chromium	0.081	ND	16	15	94%	ND	na	Yes
Cobalt	0.066	ND	15	14	93%	ND	na	Yes
Copper	0.26	0.0021	16	16	100%	ND	0.00031	Yes
Lead	0.042	0.0036	11	11	100%	ND	0.00081	Yes
Magnesium	218	21	16	16	100%	1200	na	No[d]
Manganese[e]	7.2	0.21	16	16	100%	ND	0.1	Yes
Mercury	0.001	ND	6	1	17%	na	0.000094	Yes
Molybdenum	0.019	ND	9	6	67%	ND	na	Yes
Nickel	0.075	ND	15	12	80%	ND	0.00082	Yes
Selenium	0.002	ND	7	2	29%	ND	0.0071	No
Silver	0.004	ND	13	5	38%	ND	0.000012[c]	Yes
Thallium	0.141	ND	13	7	54%	na	0.004[c]	Yes
Vanadium	0.59	0.0076	16	16	100%	ND	na	Yes
Zinc	0.7	0.019	16	16	100%	ND	0.0081	Yes
VOCs								
Acetone	0.011	ND	4	2	50%	na	na	Yes
Benzene	0.003	ND	6	2	33%	na	0.07	No
Carbon Disulfide	0.004	ND	4	2	50%	na	na	Yes
Chloromethane	0.0011	ND	4	1	25%	na	na	Yes
Ethylbenzene	0.00020	ND	5	1	20%	na	0.0043[d]	No
Toluene	0.0024	ND	6	3	50%	na	0.5	No
Total Xylenes	0.0020	ND	11	2	18%	na	na	Yes
SVOCs								
bis(2-Ethylhexyl)phthalate	0.0020	0.0010	2	2	100%	na	0.036	No
Dibenzofuran	0.0016	0.0010	2	2	100%	na	na	Yes
Diethyl phthalate	0.0020	0.0020	1	1	100%	na	0.00034	Yes
Polynuclear Aromatic Hydrocarbons								
Acenaphthene	0.0010	0.0010	1	1	100%	na	0.071	No
Fluorene	0.0023	0.0020	2	2	100%	na	0.003[f]	No
2-Methylnaphthalene	0.021	0.012	2	2	100%	na	0.003[f]	Yes
Naphthalene	0.014	ND	6	2	33%	na	0.062[c]	No

TABLE B-9
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING
IN MARINE GROUNDWATER AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Marine Groundwater Concentration (mg/L) Maximum	Minimum	Number of Samples	Detects	Detection Frequency	Mean Background (mg/L)	Benchmark Criteria[a, b] (mg/L)	COPEC? (Yes/No)
Petroleum Hydrocarbons								
Gasoline Range Organics	0.081	0.081	1	1	100%	na	na	Yes
Diesel Range Organics	1.2	1.2	1	1	100%	na	na	Yes

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the United States Environmental Protection Agency NAWQC, or an alternate water quality criteria.
b - Alternate sources of water quality criteria include, in order of preference: (1) NAWQC - Freshwater Chronic, (2) NAWQC - Marine Acute, and (3) NAWQC - Freshwater Acute.
c - Value is equal to the NAWQC - Freshwater Chronic Value.
COPEC - chemical of potential ecological concern
d - Magnesium eliminated as a COPEC based on its status as a common essential nutrient.
e - Lowest Chronic Value (LCV) observed in freshwater daphnids. Source: Oak Ridge National Laboratory, 1996.
f - Value is equal to the NAWQC - Marine Acute Value divided by 10.
mg/L - milligrams per liter
na - not available
ND - non-detect
NAWQC - National Ambient Water Quality Criteria
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

Marine Groundwater Criteria are based upon Marine Surface Water Chronic Criteria.

TABLE B-10
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING IN MARINE SURFACE WATER AT LF24/LF26 EARECKSON AIR STATION, ALASKA

	Marine Surface Water Concentration (mg/L)		Number of			Mean	Benchmark	
Constituent	Maximum	Minimum	Samples	Detects	Detection Frequency	Background (mg/L)	Criteria[a, b] (mg/L)	COPEC? (Yes/No)
Inorganics								
Aluminum	0.54	0.081	5	5	100%	ND	0.0087[c]	Yes
Arsenic	0.0025	ND	5	4	80%	ND	0.0036	No
Barium	0.0070	ND	5	4	80%	ND	na	Yes
Cadmium	0.00060	ND	3	2	67%	ND	0.00011	Yes
Chromium	0.0030	ND	3	1	33%	ND	na	Yes
Cobalt	0.0040	ND	5	2	40%	ND	na	Yes
Copper	0.067	ND	4	3	75%	ND	0.00031	Yes
Lead	0.18	ND	4	2	50%	ND	0.00081	Yes
Magnesium	64	7.0	5	5	100%	1200	na	No[d]
Manganese[e]	1.8	0.037	5	5	100%	ND	0.10	Yes
Molybdenum	0.00080	ND	4	2	50%	ND	na	Yes
Vanadium	0.012	ND	3	2	67%	ND	na	Yes
Zinc	0.032	ND	3	2	67%	ND	0.0081	Yes
VOCs								
1,2-Dichlorobenzene	0.00020	ND	3	1	33%	na	0.0129	No
1,3-Dichlorobenzene	0.0010	ND	3	1	33%	na	na	Yes
1,4-Dichlorobenzene	0.00020	ND	3	1	33%	na	0.0129	No
2-Hexanone	0.010	ND	2	1	50%	na	na	Yes
4-Methyl-2-Pentanone	0.0026	0.0026	1	1	100%	na	na	Yes
Acetone	0.0020	ND	2	1	50%	na	na	Yes
Carbon Disulfide	0.00050	ND	2	1	50%	na	na	Yes
SVOCs								
bis(2-Ethylhexyl)phthalate	0.012	0.012	1	1	100%	na	0.036	No
Petroleum Hydrocarbons								
Gasoline Range Organics	0.0074	0.0061	2	2	100%	na	na	Yes
Diesel Range Organics	0.070	0.051	2	2	100%	na	na	Yes

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the United States Environmental Protection Agency NAWQC, or an alternate water quality criteria.
b - Alternate sources of water quality criteria include, in order of preference: (1) NAWQC - Freshwater Chronic, (2) NAWQC - Marine Acute, and (3) NAWQC - Freshwater Acute.
c - Value is equal to the NAWQC - Freshwater Chronic Value.
COPEC - chemical of potential ecological concern
d - Magnesium eliminated as a COPEC based on its status as a common essential nutrient.
e - Lowest Chronic Value (LCV) observed in freshwater daphnids. Source: Oak Ridge National Laboratory, 1996.
mg/L - milligrams per liter
na - not available
ND - non-detect
NAWQC - National Ambient Water Quality Criteria
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE B-11
SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR TIER I ECOLOGICAL SCREENING IN MARINE SEDIMENT AT LF24/LF26 EARECKSON AIR STATION, ALASKA

	Marine Sediment Concentration (mg/Kg)		Number of			Mean	Benchmark	
Constituent	Maximum	Minimum	Samples	Detects	Detection Frequency	Background (mg/Kg)	Criteria[a] (mg/Kg)	COPEC? (Yes/No)
Inorganics								
Aluminum	15,400	644	12	12	100%	4,896	na	Yes
Antimony	4.2	ND	6	3	50%	0.838	0.2	Yes
Arsenic	49.3	5.1	12	12	100%	11.32	0.82	Yes
Barium	62.9	8.9	12	12	100%	17.24	na	Yes
Beryllium	0.28	ND	10	9	90%	0.19	na	Yes
Cadmium	0.95	ND	7	3	43%	0.2	0.12	Yes
Chromium	79.6	9.2	13	13	100%	12.32	8.1	Yes
Cobalt	25.3	3.4	11	11	100%	4.66	na	Yes
Copper	321	10.6	11	11	100%	18.3	3.4	Yes
Lead	179	3.1	11	11	100%	1.69	4.7	Yes
Magnesium	12,800	1,000	12	12	100%	6,324	na	No[b]
Manganese	1,670	136	12	12	100%	246	na	Yes
Mercury	0.05	ND	6	1	17%	ND	0.015	Yes
Molybdenum	6.7	ND	5	2	40%	1.54	na	Yes
Nickel	134	8.8	11	11	100%	20.84	2.1	Yes
Selenium	8.5	ND	6	3	50%	0.24	na	Yes
Thallium	23.7	ND	6	2	33%	ND	na	Yes
Vanadium	76.5	41.9	12	12	100%	45.88	na	Yes
Zinc	570	34	11	11	100%	29.23	15	Yes
VOCs								
Methylene chloride	0.011	ND	9	5	56%	na	na	Yes
SVOCs								
bis(2-Ethylhexyl)phthalate	0.11	0.078	4	4	100%	na	0.0182	Yes
Di-n-butyl phthalate	1.6	1.6	1	1	100%	na	1.1	Yes

Notes:
% - percent
a - Benchmark Criteria is equal to one-tenth the United States Environmental Protection Agency's Office of Solid Waste and Emergency Response Value, the National Oceanic and Atmospheric Administration Effects Range Low Value, or the Florida Department of Environmental Protection Threshold Effects Level criteria for marine sediment.
b - Magnesium eliminated as a COPEC based on its status as a common essential nutrient.
COPEC - chemical of potential ecological concern
mg/Kg - milligrams per kilogram
na - not available
ND - non-detect
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

TABLE B-12
TIER I HUMAN HEALTH CUMULATIVE RISK CALCULATION
FOR SURFACE SOILS AT LF24/LF26
EARECKSON AIR STATION, ALASKA

			Inhalation				Ingestion				Cumulative Risk	
	Maximum Concentration	Benchmark Criteria[a]	Tier I Benchmark		Cancer	Non-Cancer	Tier I Benchmark		Cancer	Non-Cancer	Cancer	Non-Cancer
Constituent	(mg/Kg)	(mg/Kg)	Carcinogen	Noncarcinogen	Risk	Hazard	Carcinogen	Noncarcinogen	Risk	Hazard	Risk	Hazard
Inorganics												
Aluminum	28,100	101,000	na	na	nc	nc	na	101,000	nc	0.28	nc	0.28
Antimony	30.1	40.6	na	na	nc	nc	na	40.6	nc	0.74	nc	0.74
Arsenic	53.1	5.5	na	na	nc	nc	5.5	30.4	9.7E-05	1.7	9.7E-05	1.7
Cadmium	18	101	na	na	nc	nc	na	101	nc	0.18	nc	0.18
Chromium	70.5	507	na	na	nc	nc	na	507	nc	0.14	nc	0.14
Copper	892	4,060	na	na	nc	nc	na	4,060	nc	0.22	nc	0.22
Lead[b]	1,740	400	na	na	nc	nc	na	na	nc	nc	nc	nc
Thallium	77	7.1	na	na	nc	nc	na	7.1		11	nc	11
Vanadium	136	710	na	na	nc	nc	na	710	nc	0.19	nc	0.19
Polynuclear Aromatic Hydrocarbons												
Benzo(a)pyrene	0.33	1.1	na	na	nc	nc	1.1	na	3.0E-06	nc	3.0E-06	nc
Petroleum Hydrocarbons												
Petroleum Hydrocarbons	16,000	na	na	na	nc	nc	na	na	nc	nc	nc	nc
				SUM	**nc**	**nc**			**1.0E-04**	**14.3**	**1.0E-04**	**14**

Notes:

a - Benchmark Criteria is equal to ADEC Soil Benchmark Criteria, or the United States Environmental Protection Agency Soil Screening Levels.

ADEC - Alaska Department of Environmental Conservation

b - Per ADEC's *Guidance on Calculating Cumulative Risk, Final Draft* (December 15, 2000), lead is not included in the cumulative risk calculation for human receptors.

mg/Kg - milligrams per kilogram

na - not available

nc - not calculated

Criteria for subsurface soil is derived from surface soil, since they are considered to be the same matrix; there is no difference in regulatory criteria for surface and subsurface soil.

TABLE B-13
TIER I RISK SCREENING
FOR SURFACE SOILS MIGRATION-TO-GROUNDWATER PATHWAY AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Migration to Groundwater		
			Cleanup Level (mg/Kg)		Criterion Exceedance
			Carcinogen	Noncarcinogen	(Yes/No)
Inorganics					
Aluminum	28,100	na	na	na	na
Antimony	30.1	3.6	na	3.6	Yes
Arsenic	53.1	2	2	na	Yes
Barium	561	1100	na	1,100	No
Cadmium	18	5	na	5	Yes
Chromium	70.5	26	na	26	Yes
Copper	892	7000	na	7,000	No
Lead	1,740	na	na	na	na
Manganese	968	4440	na	4,440	No
Mercury	0.23	1.4	na	1.4	No
Nickel	62.4	87	na	87	No
Selenium	39	3.5	na	3.5	Yes
Silver	9.3	21	na	21	No
Thallium	77	51	na	51	Yes
Zinc	919	9100	na	9,100	No
VOCs					
Methylene chloride	0.019	0.015	0.015	na	Yes
SVOCs					
Pentachlorophenol	0.21	0.01	0.01	na	Yes
Polynuclear Aromatic Hydrocarbons					
Benzo(a)pyrene	0.33	3	3	na	No
Petroleum Hydrocarbons					
Petroleum Hydrocarbons	16,000	na	na	na	na

Notes:

a - Benchmark Criteria is equal to the Alaska Department of Environmental Conservation Soil Benchmark Criteria (Migration-to-Groundwater pathway), the United States Environmental Protection Agency Soil Screening Levels, or Calculated Cleanup Levels.

mg/Kg - milligrams per kilogram

na - not available

SVOCs - semi-volatile organic compounds

VOCs - volatile organic compounds

Criteria for subsurface soil is derived from surface soil since they are considered to be the same matrix; there is no difference in regulatory criteria for surface and subsurface soils.

TABLE B-14
TIER I HUMAN HEALTH CUMULATIVE RISK CALCULATION
FOR SUBSURFACE SOILS AT LF24/LF26
EARECKSON AIR STATION, ALASKA

			Inhalation				Ingestion				Cumulative Risk	
Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Tier I Benchmark Carcinogen	Tier I Benchmark Noncarcinogen	Cancer Risk	Non-Cancer Hazard	Tier I Benchmark Carcinogen	Tier I Benchmark Noncarcinogen	Cancer Risk	Non-Cancer Hazard	Cancer Risk	Non-Cancer Hazard
Inorganics												
Antimony	14	40.6	na	na	nc	nc	na	40.6	nc	0.34	nc	0.34
Arsenic	9.3	5.5	na	na	nc	nc	5.5	30.4	1.7E-05	0.31	1.7E-05	0.31
Beryllium	0.6	1.9	na	na	nc	nc	1.9	507	3.2E-06	0.0012	3.2E-06	0.0012
Chromium	81.3	507	na	na	nc	nc	na	507	nc	0.16	nc	0.16
Lead[b]	1,620	400	na	na	nc	nc	na	na	nc	nc	nc	nc
Manganese	1,100	14,200	na	na	nc	nc	na	14,200	nc	0.077	nc	0.08
Thallium	38.6	7.1	na	na	nc	nc	na	7.1	nc	5.4	nc	5.4
Vanadium	113	710	na	na	nc	nc	na	710	nc	0.16	nc	0.16
Petroleum Hydrocarbons												
Petroleum Hydrocarbons	14,000	na	na	na	nc	nc	na	na	nc	nc	nc	nc
				SUM	**nc**	**nc**			**2.0E-05**	**6.5**	**2.0E-05**	**6.49**

Notes:
A - Benchmark Criteria is equal to ADEC Soil Benchmark Criteria, or the United States Environmental Protection Agency Soil Screening Levels.
ADEC - Alaska Department of Environmental Conservation
b - Per ADEC's *Guidance on Calculating Cumulative Risk, Final Draft* (December 15, 2000), lead is not included in the cumulative risk calculation for human receptors.
mg/Kg - milligrams per kilogram
na - not applicable
nc - not calculated

Criteria for subsurface soil is derived from surface soil since they are considered to be the same matrix; there is no difference in reglatory criteria for surface and subsurface soil.

TABLE B-15
TIER I RISK SCREENING
FOR SUBSURFACE SOILS MIGRATION-TO-GROUNDWATER PATHWAY AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Migration to Groundwater Cleanup Level (mg/Kg) Carcinogen	Migration to Groundwater Cleanup Level (mg/Kg) Noncarcinogen	Criterion Exceedance (Yes/No)
Inorganics					
Antimony	14	3.6	na	3.6	Yes
Arsenic	9.3	2	2	na	Yes
Barium	380	1100	na	1,100	No
Cadmium	6.8	5	na	5	Yes
Chromium	81.3	26	na	26	Yes
Lead	1,620	na	na	na	na
Manganese	1,100	4,440	na	4,440	No
Silver	12	21	na	21	No
Thallium	38.6	51	na	51	No
Zinc	2,110	9100	na	9,100	No
VOCs					
Benzene	0.049	0.02	0.02	na	Yes
Petroleum Hydrocarbons					
Petroleum Hydrocarbons	14,000	na	na	na	na

Notes:
a - Benchmark Criteria is equal to the Alaska Department of Environmental Conservation Soil Benchmark Criteria (Migration-to-Groundwater pathway), or the United States Environmental Protection Agency Soil Screening Levels.
mg/Kg - milligrams per kilogram
na - not available
VOCs - volatile organic compounds

Criteria for subsurface soil is derived from surface soil since they are considered to be the same matrix; there is no difference in regulatory criteria for surface soil and subsurface soil.

TABLE B-16
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR SURFACE SOILS AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Ecological Hazard
Inorganics			
Aluminum	28,100	19,500	1.4
Antimony	30.1	14.2	2.1
Arsenic	53.1	55.9	0.95
Barium	561	247	2.3
Cadmium	18	4.08	4.4
Chromium	70.5	71.1	0.99
Cobalt	24.2	44.4	0.55
Copper	892	313	2.8
Lead	1,740	191	9.1
Manganese	968	na	nc
Molybdenum	1.4	na	nc
Selenium	39	5.93	6.6
Thallium	77	4.15	19
Vanadium	136	na	nc
Zinc	919	69.4	13
SVOCs			
bis(2-Ethylhexyl)phthalate	2.9	5.85	0.50
Di-n-butyl phthalate	5	1.78	2.8
PCBs (Total)	0.173	0.585	0.30
Pesticides			
4,4-DDT	0.034	0.0162	2.1
Polynuclear Aromatic Hydrocarbons			
2-Methylnaphthalene	0.46	na	nc
Petroleum Hydrocarbons			
Petroleum Hydrocarbons	16,000	na	nc
		SUM	**69**

Notes:
a - Benchmark Criteria is equal to the ecological risk-based screening concentration (ERBSC).
DDT - Dichlorodiphenyltrichloroethane
mg/Kg - milligrams per kilogram
na - not applicable
nc - not calculated
PCBs - polychlorinated biphenyls
SVOCs - semi-volatile organic compounds

Criteria for subsurface soil is derived from surface soil since they are considered to be the same matrix; there is no difference in regulatory criteria for surface and subsurface soils.

TABLE B-17
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR SUBSURFACE SOILS AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Ecological Hazard
Inorganics			
Antimony	14	14.2	0.99
Arsenic	9.3	55.9	0.17
Barium	380	247	1.5
Cadmium	6.8	4.08	1.7
Chromium	81.3	71.1	1.1
Cobalt	23.2	44.4	0.52
Copper	131	313	0.42
Lead	1,620	191	8.5
Manganese	1,100	na	nc
Thallium	38.6	4.15	9.3
Vanadium	113	na	nc
Zinc	2,110	69.4	30
SVOCs			
bis(2-Ethylhexyl)phthalate	5.3	5.85	0.91
Di-n-butyl phthalate	0.95	1.78	0.53
PCBs (Total)	0.11	0.585	0.19
Petroleum Hydrocarbons			
Petroleum Hydrocarbons	14,000	na	nc
		SUM	**56**

Notes:
a - Benchmark Criteria is equal to the ecological risk-based screening concentration (ERBSC).
mg/Kg - milligrams per kilogram
na - not available
nc - not calculated
PCBs - polychlorinated biphenyls
SVOCs - semi-volatile organic compounds

Criteria for subsurface soil is derived from surface soil since they are considered to be the same matrix; there is no difference in regulatory criteria for surface and subsurface soils.

TABLE B-18
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR MARINE GROUNDWATER AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/L)	Benchmark Criteria[a] (mg/L)	Ecological Hazard
Inorganics			
Aluminum	74.2	0.087	853
Arsenic	0.067	0.036	1.9
Barium	0.33	na	nc
Beryllium	0.004	0.0053	0.75
Cadmium	0.0081	0.0093	0.87
Chromium	0.081	na	nc
Cobalt	0.066	na	nc
Copper	0.255	0.0031	82
Lead	0.042	0.0081	5.2
Manganese[f]	7.2	1	7.2
Mercury	0.0010	0.00094	1.1
Molybdenum	0.019	na	nc
Nickel	0.075	0.0082	9.1
Silver	0.0040	0.00012	33
Thallium	0.14	0.04	3.5
Vanadium	0.59	na	nc
Zinc	0.7	0.081	8.6
VOCs			
Acetone	0.011	na	nc
Carbon Disulfide	0.0040	na	nc
Chloromethane	0.0011	na	nc
Total Xylenes	0.0020	na	nc
SVOCs			
Dibenzofuran	0.0016	na	nc
Diethyl phthalate	0.002	0.0034	0.59
Polynuclear Aromatic Hydrocarbons			
2-Methylnaphthalene	0.021	0.03	0.70
Petroleum Hydrocarbons			
Gasoline Range Organics	0.081	na	nc
Diesel Range Organics	1.2	na	nc
		SUM	**1008**

Notes:

a - Benchmark Criteria is equal to the United States Environmental Protection Agency Ambient Water Quality Criteria, or an alternate water quality criteria.

b - Per the Alaska Department of Environmental Conservation's *Guidance on Calculating Cumulative Risk, Final Draft* (December 15, 2000), petroleum hydrocarbons as diesel range organics, gasoline range organics, or residual range organics are not included in the cumulative risk calculations.

mg/L - milligrams per liter

na - not available

nc - not calculated

SVOCs - semi-volatile organic compounds

VOCs - volatile organic compounds

TABLE B-19
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR MARINE SURFACE WATER AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/L)	Benchmark Criteria[a] (mg/L)	Ecological Hazard
Inorganics			
Aluminum	0.54	0.087	6.2
Arsenic	0.0025	0.036	0.07
Barium	0.0070	na	nc
Cadmium	0.00060	0.0011	0.55
Chromium	0.0030	na	nc
Cobalt	0.0040	na	nc
Copper	0.067	0.0031	22
Lead	0.18	0.0081	22
Manganese	1.8	1	1.8
Molybdenum	0.00080	na	nc
Vanadium	0.012	na	nc
Zinc	0.032	0.081	0.40
VOCs			
1,3-Dichlorobenzene	0.0010	na	nc
2-Hexanone	0.010	na	nc
4-Methyl-2-Pentanone	0.0026	na	nc
Acetone	0.0020	na	nc
Carbon Disulfide	0.00050	na	nc
Petroleum Hydrocarbons[b]			
Gasoline Range Organics	0.0074	na	nc
Diesel Range Organics	0.070	na	nc
		SUM	**53**

Notes:

a - Benchmark Criteria is equal to the United States Environmental Protection Agency Ambient Water Quality Criteria, or an alternate water quality criteria.

b - Per the Alaska Department of Environmental Conservation's *Guidance on Calculating Cumulative Risk, Final Draft* (December 15, 2000), petroleum hydrocarbons as diesel range organics, gasoline range organics, or residual range organics are not included in the cumulative risk calculations.

mg/L - milligrams per liter

na - not available

nc - not calculated

VOCs - volatile organic compounds

TABLE B-20
TIER I ECOLOGICAL CUMULATIVE RISK CALCULATION
FOR MARINE SEDIMENT AT LF24/LF26
EARECKSON AIR STATION, ALASKA

Constituent	Maximum Concentration (mg/Kg)	Benchmark Criteria[a] (mg/Kg)	Ecological Hazard
Inorganics			
Aluminum	15,400	na	nc
Antimony	4.2	2	2.1
Arsenic	49.3	8.2	6.0
Barium	62.9	na	nc
Beryllium	0.28	na	nc
Cadmium	0.95	1.2	0.79
Chromium	79.6	81	1.0
Cobalt	25.3	na	nc
Copper	321	34	9.4
Lead	179	47	3.8
Manganese	1,670	na	nc
Mercury	0.05	0.15	0.33
Molybdenum	6.7	na	nc
Nickel	134	21	6.4
Selenium	8.5	na	nc
Thallium	23.7	na	nc
Vanadium	76.5	na	nc
Zinc	570	150	3.8
VOCs			
Methylene chloride	0.011	na	nc
SVOCs			
bis(2-Ethylhexyl)phthalate	0.11	0.182	0.60
Di-n-butyl phthalate	1.6	11	0.15
		SUM	**34**

Notes:
a - Benchmark Criteria is equal to the United States Environmental Protection Agency OSWER Value, the National Oceanic and Atmospheric Administration ER-L, or the FDEP TEL criteria for marine sediment.
mg/Kg - milligrams per kilogram
na - not available
nc - not calculated
SVOCs - semi-volatile organic compounds
VOCs - volatile organic compounds

APPENDIX C

SHEMYA ISLAND BACKGROUND DATA

Appendix C - Summary of Background Data for Shemya Island, Alaska

Constituent	Background Surface Soil Data (mg/kg)					Background Subsurface Soil Data (mg/kg)					Background Freshwater Sediment Data (mg/kg)				
	Mean	0.025-0.975 Interquantile Range		Maximum[1]	Distribution[2]	Mean	0.025-0.975 Interquantile Range		Maximum[1]	Distribution[2]	Mean	0.025-0.975 Interquantile Range		Maximum[1]	Distribution[2]
Aluminum	10678	0	24715	22000	N	19114	7131	41799	31000	LN	9709	3006	16413	17300	LN
Antimony	ND	ND	ND	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	-
Arsenic	2.02	0	5.26	4.8	N	2.26	0	5.74	5.3	N	4.11	0.02	8.19	8.2	LN
Barium	25.71	0	65.42	80	N	35.3	0	90.31	100	N	24.44	0	49.07	50.1	N
Beryllium	2.19	0.23	8.75	7.8	LN	ND	ND	ND	ND	-	0.161	0.063	0.345	0.099	LN
Cadmium	0.235	0	0.591	0.63	N	0.119	0	0.269	0.24	N	0.15	0	0.311	0.2	N
Calcium	8224	0	24814	32000	N	8679	0	34977	45000	N	77064	247	526066	266000	LN
Chloride															
Chromium	7.04	0	14.98	13	N	16.3	2.83	53.54	33	LN	13.06	5.74	20.37	18.1	LN
Cobalt	9.36	4.83	13.89	15	LN	8.66	0	21.27	21	N	4.61	0.61	8.61	9.6	LN
Copper	17.92	0	42.67	50	N	76.8	0	378.1	510	N	18.3	2.43	34.16	34.4	LN
Fluoride															
Iron	14683	185	29181	29000	LN	22060	2681	41439	40000	LN	18919	0	42274	57100	N
Lead	5.9	0	19.93	21	N	2.28	0	5.12	4.5	N	7.71	0	24.99	32.7	N
Magnesium	5078	0	11816	12000	N	6299	0	14950	14000	N	5956	268	11644	10300	LN
Manganese	156	0	522	610	N	241	0	627	560	N	328	0	935	1290	N
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	-
Molybdenum	ND	ND	ND	ND	-	21.41	0	110.65	1.3	N	0.492	0	1.196	1.5	N
Nickel	15.96	0	33.54	33.8	N	79.63	0	439.86	602	N	27.58	9.22	45.93	43.8	LN
Nitrate-N															
Nitrite-N															
Ortho-phosphate-P															
Potassium	730.5	200	1261	1200	LN	568	0	1269	1300	N	506	130	883	895	LN
Selenium	ND	ND	ND	ND	-	26.9	5.7	48.1	52	LN	0.3	0.047	0.553	1.4	LN
Silver	3.037	0.268	5.806	0.47	LN	3	0	9.57	1.3	N	0.396	0	1.092	1.55	N
Sodium	1782	783	2781	2600	LN	1614	348	4786	3600	LN	1205	196	4070	4475	LN
Sulfate															
Thallium											ND	ND	ND	ND	-
Vanadium	43.44	0	103.21	94	N	66.7	10.3	123	140	LN	51.68	15.62	87.74	84	LN
Zinc	30.98	7.17	88.7	76	LN	39.1	0	89.9	86	N	46.75	6.14	87.37	92.5	LN

Appendix C - Summary of Background Data for Shemya Island, Alaska

	Background Marine Sediments (mg/kg)					Background Groundwater Data (mg/L)					Background Fresh Surface Water Data (mg/L)				
		0.025-0.975					0.025-0.975					0.025-0.975			
Constituent	Mean	Interquantile Range		Maximum[1]	Distribution[2]	Mean	Interquantile Range		Maximum[1]	Distribution[2]	Mean	Interquantile Range		Maximum[1]	Distribution[2]
Aluminum	4896	0	10092	7400	N	10.82	0	34.87	41.7	N	0.27	0.0456	0.897	0.6	LN
Antimony	0.838	0	3.364	0.055	N	ND	ND	ND	ND	-	ND	ND	ND	ND	-
Arsenic	11.32	0.47	59.37	49.3	LN	0.0061	0	0.0176	0.024	N	0.0025	0.0021	0.0029	0.003	LN
Barium	17.24	0	48.52	49.9	N	0.125	0.005	0.66	0.49	LN	0.0052	0.0035	0.007	0.008	LN
Beryllium	0.19	0	0.539	0.26	N	0.00078	0	0.002	0.0028	N	ND	ND	ND	ND	-
Cadmium	0.2	0	0.568	0.077	N	0.0009	0	0.0022	0.0027	N	ND	ND	ND	ND	-
Calcium	12744	1316	24172	23100	LN	65.68	0	151.96	156	N	31.73	3.17	129.59	73	LN
Chloride						89.31	0	293.77	987	N	60.92	38.95	82.88	91.7	LN
Chromium	12.32	2.14	22.5	19.9	LN	0.0162	0	0.048	0.074	N	ND	ND	ND	ND	-
Cobalt	4.66	0	9.84	8.7	N	0.0153	0.0004	0.0868	0.071	LN	0.0009	0	0.0022	0.0035	N
Copper	18.3	0	39.49	37.7	N	0.049	0.003	0.233	0.24	LN	0.0078	0	0.0159	0.02	N
Fluoride						0.512	0.093	1.645	2.6	LN	0.243	0	0.547	0.66	N
Iron	15108	1034	29182	24800	LN	34.61	0	121.56	180	N	1.84	0	5.08	6.8	N
Lead	1.69	0	3.5	3.4	N	0.0079	0	0.0197	0.026	N	0.0026	0	0.0057	0.0074	N
Magnesium	6324	1027	11620	10200	LN	25.89	0	63.38	97.5	N	10.02	3.42	23.15	24.6	LN
Manganese	246	0	504	406	N	1.17	0	3.64	5.4	N	0.16	0	0.432	0.47	N
Mercury	ND	ND	ND	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	-
Molybdenum	1.54	0	6.55	6.7	N	0.003	0.00025	0.0128	0.018	LN	0.0006	0.0002	0.0009	0.0015	LN
Nickel	20.84	1.24	99.9	77.2	LN	0.0328	0	0.1053	0.14	N	0.0052	0.0038	0.0065	0.0072	LN
Nitrate-N															
Nitrite-N															
Ortho-phosphate-P															
Potassium	850	0	1719	1370	N	6.52	1.02	22.45	33.1	LN	3.53	0	7.41	8.2	N
Selenium	0.24	0	0.49088	0.29	N	0.0016	0.00055	0.0027	0.0032	LN	0.0016	0.0006	0.0026	0.0031	LN
Silver	0.143	0.072	0.214	0.19	LN	0.00061	0.00004	0.0012	0.0021	LN	ND	ND	ND	ND	-
Sodium	1615	0	4548	4430	N	64.16	2.86	125.45	168	LN	48.37	22.91	90.35	104	LN
Sulfate						24.68	0.77	137.42	195	LN	11.8	1.63	42.71	51.9	LN
Thallium	ND	ND	ND	ND	-	ND	ND	ND	ND	-	ND	ND	ND	ND	-
Vanadium	45.88	10.18	81.57	70.9	LN	0.0574	0	0.2028	0.35	N	0.0053	0.0033	0.0074	0.0096	LN
Zinc	29.23	0	62.89	58.3	N	0.118	0.008	0.545	0.43	LN	0.021	0	0.0563	0.068	N

Appendix C - Summary of Background Data for Shemya Island, Alaska

Constituent	Background Marine Surface Water (mg/L)				
	Mean	0.025-0.975 Interquantile Range		Maximum[1]	Distribution[2]
Aluminum	ND	ND	ND	1.8[3]	-
Antimony	ND	ND	ND	ND	-
Arsenic	ND	ND	ND	ND	-
Barium	ND	ND	ND	ND	-
Beryllium	ND	ND	ND	ND	-
Cadmium	0.0005	0	0.00108	0.00084	N
Calcium	428	241	614	570	LN
Chloride	17250	16124	18376	17600	LN
Chromium	ND	ND	ND	ND	-
Cobalt	ND	ND	ND	ND	-
Copper	ND	ND	ND	ND	-
Fluoride					
Iron	ND	ND	ND	2.6[3]	-
Lead	ND	ND	ND	ND	-
Magnesium	1200	1200	1200	1200	LN
Manganese	ND	ND	ND	ND	-
Mercury	NA	NA	NA	NA	-
Molybdenum	ND	ND	ND	ND	-
Nickel	ND	ND	ND	ND	-
Nitrate-N	ND	ND	ND	1.05[3]	-
Nitrite-N	ND	ND	ND	ND	-
Ortho-phosphate-P	ND	ND	ND	ND	-
Potassium	332.5	322.7	342.3	340	LN
Selenium	ND	ND	ND	ND	-
Silver	ND	ND	ND	ND	-
Sodium	9950	9754	10146	10000	LN
Sulfate					
Thallium					
Vanadium	ND	ND	ND	ND	-
Zinc	ND	ND	ND	ND	-

Notes:

[1]Maximum value detected in background samples.

[2]Apparent background distribution: N = normal, LN = lognormal

[3]Detected in only one sample

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

NA = not analyzed

ND = nondetect

Statistics for parameters in shaded boldface are based on a majority of nondetected values; the maximum detected value in background samples, rather than the calculated value, will be used as an estimate of the 97.5-percentile value.

APPENDIX D

REGULATORY COMMENTS AND CORRESPONDENCE

STATE OF ALASKA

SARAH PALIN, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

555 Cordova Street
Anchorage, AK 99501
PHONE: (907) 269-3077
FAX: (907) 269-7649
www.dec.state.ak.us

File # 2649.38.018
2649.38.024
2649.38.026

November 26, 2008

Keith Barnack, Remedial PM
United States Air Force
611 Air Support Group
Environmental Restoration Section
10471 20th Street Ste 302
Elmendorf AFB, AK 99506-2200

Re: Draft CERCLA Record of Decision for LF018 and LF024/LF026 dated October 2008, Eareckson Air Station, Alaska

Dear Mr. Barnack:

The Alaska Department of Environmental Conservation (ADEC) Federal Facilities Oversight group received a copy of the Draft version of the CERCLA Record of Decision for North Beach Landfill (LF018), and Barrel Bay and Scrap Metal Disposal Area (LF024/LF026) at Eareckson Air Station in our office on October 20, 2008.

We have completed our review of the Draft Record of Decision and have provided comments on the Review Comments Form that is attached to this letter.

Thank you for providing a copy of the October 2008 version of the Draft Record of Decision for LF018 and LF024/LF026. I look forward to a response to comments and working through these issues to produce a final document that we can agree upon. If you have any questions regarding this letter, please contact me at 907-269-3077 or jonathan.schick@alaska.gov.

Sincerely,

Jonathan Schick
Environmental Program Specialist

G:\SPAR\SPAR-CS\38 Case Files (Contaminated Sites)\2649 Eareckson\2649.38.026 EARECKSON SCRAP METAL DISPOSAL SITE LF26\26 Nov 2008 Draft CERCLA ROD Landfills review ltr.doc

REVIEW COMMENTS

PROJECT: Eareckson Air Station

DOCUMENT: DRAFT CERCLA Record of Decision LF018, LF024, and LF026

DATE: November 26, 2008 **REVIEWER: Jonathan Schick** **PHONE:** 907 269-3077	**Action taken on comment by:**

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1	Section1. 4	Please add citations of Alaska Solid Waste Regulations for closure (18 AAC 60.390), post closure (18 AAC 60.396 (b)), and corrective action (18 AAC 60.815 (a)). The closure section requires an adequate cover (2 feet of soil) over the waste. The post closure section requires a deed notice or other instrument to document the landfill location and implications. The deed notice should include language to indicate that (1) the property was used as a landfill, (2) it may not be suitable for some uses, (3) maintenance and repairs to the property might become necessary to prevent pollution problems at the site, and (4) any activity that results in damage to the final cover of the property must be corrected to control potential pollution problems. The corrective action section requires that the owner or operator shall take action to correct the change, damage, or violation, to prevent the escape of waste or leachate, and to clean up waste that was disposed of in an unauthorized manner." Remaining solid waste on the surface of the landfill is considered to be waste that was disposed of in an unauthorized manner.			
2	Figure 3	In the Notes section, #3, please replace the word			

REVIEW COMMENTS

PROJECT: Eareckson Air Station

DOCUMENT: DRAFT CERCLA Record of Decision LF018, LF024, and LF026

DATE: November 26, 2008 **REVIEWER: Jonathan Schick** **PHONE:** 907 269-3077	**Action taken on comment by:**

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		"taht" with that.			
3	Figure 2-2	Please provide any available groundwater data for the other 2 monitoring wells depicted on the figure, whether in the text or on the figure to demonstrate that there were no exceedences in the samples from these two well locations.			
4	Section 2.5.3	In this section the text states that subsurface perched water deposits are not considered to be true groundwater resources. The State defines groundwater in 18 AAC 75.990 as: "water in the saturated zone, for the purposes of evaluating whether the groundwater is a drinking water source under 18 AAC 75.350; or water beneath the surface of the soil, for the purposes of evaluating whether the water will act as a transport medium for hazardous substance migration. Please remove the text that states that the perched water is not considered to be true groundwater.			
5	Section 2.5.3.2	In the first sentence of this section please clarify the measurement that is 2 to 7 feet ***above*** MSL. There are several instances in the recently submitted RODs that the distinction of above or below msl is not stated. Please perform a universal document check for "msl" to ensure that they are all properly identified as above or below msl.			

REVIEW COMMENTS

PROJECT: Eareckson Air Station

DOCUMENT: DRAFT CERCLA Record of Decision LF018, LF024, and LF026

DATE: November 26, 2008 **REVIEWER: Jonathan Schick** **PHONE:** 907 269-3077	**Action taken on comment by:**

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
6	Section 2.6.2.3	A background level should be established for Eareckson for Thallium as it is pervasive in almost all of the samples collected. An evaluation of the ecological and human health risks is recommended and additional clean fill may be required to cover the current landfill cap that is impacted by high levels of Thallium which is commonly used in electronic equipment that may have been disposed of at these landfill sites.			
7	Section 2.12.2	It may not be appropriate to discontinue the landfill inspections if after two consecutive inspections return reports of the cap in good condition. Site inspections should be continued for a minimum of 5 years when this ROD will be reviewed. At that point a revised inspection schedule can be proposed.			
8	Section 2.12.2	Please include in this section a schedule for landfill cap inspection reports to be submitted to the State for review. These reports should be produced and submitted concurrent with the biennial inspections.			
9	Section 2.12.2	Bullet 2 under ICs: Please explain how a change in the Base Master Plan could affect the ICs.			
10	Section 2.12.2	A bullet should be added to the ICs section to establish a periodic schedule to report on the			

REVIEW COMMENTS **PROJECT: Eareckson Air Station**

DOCUMENT: DRAFT CERCLA Record of Decision LF018, LF024, and LF026

DATE: November 26, 2008 **REVIEWER: Jonathan Schick** **PHONE:** 907 269-3077	**Action taken on comment by:**

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		effectiveness and maintenance of the ICs. A 5 year review would be adequate as a form of notification that he ICs are still in place and are effective.			
11	Section 2.12.2	Please provide the State with survey data and an up to date map showing the extent of the ICs. This will help us to accurately depict the restricted area on the State's IC database.			
12	Section 2.12.2	In the IC section the State is concerned about being notified in the event of a property transfer. Please include language that states that the ADEC will be notified at least 30 days prior to transfer to give us an opportunity to make sure that the ICs are sufficient at the time and sufficiently detailed in the transfer documents.			
13	Section 2.12.2	In the third bullet regarding ICs, please rephrase this portion of the document to state that this remedy has been selected under state law and the USAF will obtain ADEC concurrence to modify or terminate the IC's, modify land use….			

REVIEW COMMENTS **PROJECT: Eareckson Air Station Decision Documents**
DOCUMENT: CERCLA Decision Document LF18 and LF024/LF026
LOCATION: Eareckson Air Station, Shemya Island, Alaska

		DATE: November 26, 2008 **REVIEWER:** Jonathan Schick (ADEC)	
Item/ Code.	**Page/Para**	**ADEC COMMENTS**	**RESPONSE**
1	Section 1.4	Please add citations of Alaska Solid Waste Regulations for closure (18 AAC 60.390), post closure (18 AAC 60.396(b)), and corrective action (18 AAC 60.815(a)). The closure section requires an adequate cover (2 feet of soil) over the waste. The post closure section requires a deed notice or other instrument to document the landfill location and implications. The deed notice should include language to indicate that (1) the property was used as a landfill, (2) it may not be suitable for some uses, (3) maintenance and repairs to the property might become necessary to prevent pollutions problems at the site, and (4) any activity that results in damage to the final cover of the property must be corrected to control potential pollution problems. The corrective action section requires that the owner or operator shall take action to correct the change, damage, or violation, to prevent the escape of waste or leachate, and to clean up waste that was disposed of in an unauthorized manner.	The comment will be incorporated. Additional descriptions of the remedies for each of the sites will also be added into this section.
2	Figure 3	In the Notes section, #3, please replace the word "taht" with that.	The correction will be made.
3	Figure 2-2	Please provide any available groundwater data for the other two monitoring wells depicted on the figure, whether in the text or on the figure to demonstrate that there were no exceedences in the sample from these two well locations.	The comment will be incorporated. Boxes will be added to Figure 2-2 showing that the wells have been sampled and will list any constituents that exceeded ADEC Groundwater cleanup limits or background concentrations (metals).
4	Section 2.5.3	In this section the text states that subsurface perched water deposits are not considered to be true groundwater resources. The State defines groundwater in 18 AAC 75.990 as: "water in the saturated zone, for the purposes of evaluating whether the groundwater is drinking water source under 18 AAC 75.350; or water beneath the surface of the soil, for the purposes of evaluating whether water will act as a transport medium for hazardous substance migration. Please remove the text that states that the perched water is not considered to be true groundwater.	The comment will be incorporated. Text stating that perched water is not considered to be true groundwater will be removed and the section will be revised to be more consistent with the State's definition of groundwater.
5	Section 2.5.3.2	In the first sentence of this section please clarify the measurement that is 2 to 7 feet ***above*** MSL. There are several instances in the recently submitted RODs that the distinction of above or below msl is not stated. Please perform a universal document check for "msl" to ensure that they are all properly identified as above or below msl.	The comment will be incorporated. The complete report will be reviewed to ensure that data are properly indicated whether they are above or below msl.
6	Section 2.6.2.3	A background level should be established for Eareckson for Thallium as it is pervasive in almost all of the samples collected. An evaluation of the ecological and human health risks is recommended and additional clean fill may be required to cover the current	A risk assessment was conducted and is included as Appendix B.

REVIEW COMMENTS **PROJECT: Eareckson Air Station Decision Documents**
DOCUMENT: CERCLA Decision Document LF18 and LF024/LF026
LOCATION: Eareckson Air Station, Shemya Island, Alaska

		DATE: November 26, 2008 **REVIEWER:** Jonathan Schick (ADEC)	
Item/ Code.	**Page/Para**	**ADEC COMMENTS**	**RESPONSE**
		landfill cap that is impacted by high levels of Thallium which is commonly used in electronic equipment that may have been disposed of at these landfill sites.	The Air Force believes that the reported thallium concentrations are false positives and that actual thallium concentrations are far lower. Thallium was analyzed for by EPA Method 6010 which has known issues with other metals being quantified as thallium (particularly aluminum). A discussion of thallium false positives will be added to the ROD in Section 2.6.2.2. In addition, a soil sampling event for thallium will be added to the ROD to verify this conclusion.
7	Section 2.12.2	It may not be appropriate to discontinue the landfill inspections if after two consecutive inspections return reports of the cap in good condition. Site inspections should be continued for a minimum of 5 years when this ROD will be reviewed. At that point a revised inspection schedule can be proposed.	The comment will be incorporated. The text will be modified accordingly.
8	Section 2.12.2	Please include in this section a schedule for landfill cap inspection reports to be submitted to the State for review. These reports should be produced and submitted concurrent with the biennial inspections.	The comment will be incorporated. The text will be modified accordingly.
9	Section 2.12.2	Bullet 2 under ICs: Please explain how a change in the Base Master Plan could affect the ICs.	A change in the Base Master Plan could affect the sites if development is proposed on or near the sites. However, this bullet does appear to be redundant as the third bullet specifies obtaining ADEC concurrence prior to modifying current land use at the sites. Therefore, the second bullet will be deleted.
10	Section 2.12.2	A bullet should be added to the ICs section to establish a periodic schedule to report on the effectiveness and maintenance of the ICs. A 5 year review would be adequate as a form of notification that the ICs are still in place and are effective.	The last bullet in this section will be modified to state that the reporting of IC effectiveness will occur during at the 5 year review.
11	Section 2.12.2	Please provide the State with survey data and an up to date map showing the extent of the ICs. This will help us to accurately depict the restricted area on the State's IC database.	Per the discussion on 2/10/09 the site figures in the ROD will suffice to depict the extent of the ICs. The first bullet in Section 2.12.2 will be modified to state this.

REVIEW COMMENTS **PROJECT: Eareckson Air Station Decision Documents**
DOCUMENT: CERCLA Decision Document LF18 and LF024/LF026
LOCATION: Eareckson Air Station, Shemya Island, Alaska

		DATE: November 26, 2008 **REVIEWER:** Jonathan Schick (ADEC)	
Item/ Code.	**Page/Para**	**ADEC COMMENTS**	**RESPONSE**
12	Section 2.12.2	In the IC section the State is concerned about being notified in the event of a property transfer. Please include language that states that the ADEC will be notified at least 30 days prior to the transfer to give us enough opportunity to make sure that the ICs are sufficient at the time and sufficiently detailed in the transfer documents.	The comment is noted. Language indicating that the State will be provided notice at least 30 days prior to the transfer of the property will be incorporated into the third bullet in this section.
13	Section 2.12.2	In the third bullet regarding ICs, please rephrase this portion of the document to state that this remedy has been selected under state law and the USAF will obtain ADEC concurrence to modify or terminate the IC's, modify land use…	The comment will be incorporated. Section 2.12.2, third bullet, will be modified as requested.

"Schick, Jonathan S (DEC)" <jonathan.schick@alaska.gov>
02/11/2009 11:59 AM

To keith.barnack@elmendorf.af.mil
cc "Halverson, John E (DEC)" <john.halverson@alaska.gov>, Richard Girouard <Richard.Girouard@us.mwhglobal.com>
bcc
Subject Eareckson ROD meeting

Keith,

I looked further into our issue with the surface water sampling requirements at FT02 in the Abandoned drum disposal area, and while I understand that we had agreed to limiting the surface water monitoring to RRO in the Proposed Plan stage, doing so would not provide adequate documentation to support future site closure. To close out contaminated sites where surface waters have been impacted by a release of petroleum or hazardous substances, it is necessary to document the contamination is not causing a violation of the Alaska water quality standards. I copied the following excerpt from the ADEC Technical Memorandum 01-005 R.1 from January 30, 2001 entitled Application of Water Quality Standards to Contamination Cleanup Projects. The memo clarifies how the water quality standards apply during cleanup of contaminated sites that are impacting surface waters.

While risk assessments can be used to develop groundwater cleanup levels they cannot be used to develop surface water cleanup levels less stringent the WQS. The WQS are the regulatory action level for surface water and cannot be waived by cleanup project managers. Risk assessments are nonetheless helpful, as they may be the basis for establishing actions levels if there are no WQS for a chemical, or for helping to prioritize the level of action and resources applied to clean-up. Water quality regulations do not adopt any specific numeric criteria for sediments; therefore risk assessments can also be useful for determining cleanup levels for sediments under the WQS.

The water quality standards specify that TAqH in the water column may not exceed 15 µg/L and that TAH in the water column may not exceed 10 µg/L. In addition, there may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration [18AAC70.020(b)(17)(A)(i), 18AAC70.020(b)(17)(B)(ii), and 18AAC70.020(b)(17)(C)].

Based on this, the state's position is to insist that the surface water at FT02 be monitored for the TAH and TAqH constituents until the applicable levels have been reached. If this were a CERCLA decision document, these levels would be ARARs. Because it isn't a CERCLA document, ARARs do not come into play, but the monitoring and data are required to demonstrate compliance.

Regarding the discussion on Thallium in the ROD for the landfills, we can be more flexible. Although state regulations do not allow the RP to use a risk assessment from one site to defend a position at another site, we do understand that there can be interference with the thallium levels in the presence of elevated iron and aluminum levels. Therefore, the state's recommendation is to collect one additional sample at each of the landfills and analyze them for thallium by 6020 and try to establish a more accurate thallium concentration. Otherwise, there is evidence that the levels of thallium could pose a risk to human health through direct contact. Because these elevated levels were reported from the surface soils this is cause for concern.

Please let me know if this would be an acceptable compromise from your perspective and let me know if you want to discuss further.

Thanks for taking the time to meet with me yesterday,

Jonathan Schick
Environmental Program Specialist
ADEC Contaminated Sites Program
(907) 269-3077

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

SARAH PALIN, GOVERNOR

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Anchorage, AK 99501
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File # 2649.38.018
2649.38.024
2649.38.026

May 15, 2009

Keith Barnack, Remedial PM
United States Air Force
611 Air Support Group
Environmental Restoration Section
10471 20th Street Ste 302
Elmendorf AFB, AK 99506-2200

Re: Pre-final "CERCLA Record of Decision for North Beach Landfill (LF018) and Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)", Eareckson Air Station, dated March 2009

Dear Mr. Barnack:

The Alaska Department of Environmental Conservation (ADEC) Federal Facilities Oversight group received a copy of the document referenced above on April 1, 2009. We have completed our review and provided comments in the attached table.

The ROD needs additional clarification with respect to CERCLA and non-CERCLA response actions and authorities. If there are no CERCLA hazardous substances present at concentrations that trigger the need for a remedy, the document should be a no further action ROD under CERCLA. It should then describe how the Air Force will meet the State requirements for contaminated sites cleanup and landfill closures; ARARs, the nine criteria in the NCP, and Air Force lead agency authority would not apply. The comments provided in the attached table were developed to address this scenario.

Alternatively, the Air Force could re-write the ROD to assume, based on knowledge of past use, that the landfills do contain CERCLA hazardous substances and pose a threat of a release of those substances. Institutional Controls could be the selected as a CERCLA remedy because there is currently no unacceptable risk (assuming all the other comments are addressed and support this statement) and proper land management would help prevent future risks. The NCP, ARARs, etc would need to be addressed in appropriate sections of the ROD.

The ROD concludes that inorganics found at elevated concentrations are the result of laboratory analytical error, in the case of thallium, or are the result of collecting non-filtered

water samples. The results from these samples are qualitatively dismissed and limited additional sampling is proposed to verify the assumptions used to dismiss them. The additional sampling should be conducted prior to finalizing the ROD to avoid the need for a ROD amendment or an Explanation of Significant Differences, if these assumptions are found to be incorrect.

The 2003 updated risk assessments were attached to a previous version of the draft ROD. However, we have not been able to find a previously submitted copy in our records or the on-line administrative record, nor have we found any record of DEC concurring with the documents. The 2003 risk assessment documents are not complete risk assessment and raise several questions. The conclusions of the ROD are based on the Risk Assessments that are incomplete and have not been reviewed and approved by the ADEC and they will need to be revised to comply with the State's requirements.

I look forward to working with you to address these issues and develop and final ROD for these sites. If you have any questions regarding this letter, please contact me at 907-269-3077 or jonathan.schick@alaska.gov.

Sincerely,

Jonathan Schick
Environmental Program Specialist

Attachment: DEC comments on Pre-final ROD for LF018 and LF024/LF026

Cc: Jennifer Currie, DOL (via email)
John Halverson, DEC (via email)

Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
Eareckson AS, Alaska
Document Date: March 2009
Commenter: Jonathan Schick ADEC
Comments Developed: May 15, 2009

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
1.	1-1	1.1	Please change the language in this section that states that Shemya is part of the Alaska Maritime National Wildlife Refuge. Shemya was transferred to the Department of Defense so that the land would not revert back to USFWS management. The USAF has primary jurisdiction over the land. It is within the boundary of the AMNWR, but it is excluded from the refuge. Shemya Island has been withdrawn since 1913 (EO 1733) and the U.S. Air Force has been using the entire island since WWII. Public Law 106-554 (114 Stat. 2763A....approved on December 21,2000) gave "primary jurisdiction, custody, and control over Shemya Island and its appurtenant waters" to the U.S. Air Force [Appendix D, Section 302(a)], leaving Fish and Wildlife Service (Department of the Interior) secondary jurisdiction. Appendix D, Section 302(c) states that "This section shall not be construed as altering any existing property rights of the State of Alaska or any private person."	
2.	1-2		Please delete the dates included after the reference to ADEC when citing regulations here and throughout the document. For example, this section should simply state, "Alaska Oil and Hazardous Substance Pollution Control Act, 18 AAC 75 (ADEC)". The basis for the dates that were listed is unclear.	
3.	1-2	1.3.1	Please change the text to clearly state that some drums remain in the landfill, where it now only states that the majority of the drums were removed.	
4.	1-2	1.3.1	This section states that there was metal, wood and plastic debris noted on the surface in 1993 and 1994. Does solid waste remain exposed at the ground surface at the site? If so, additional cover material should be placed over the waste as part of the landfill closure.	
5.	1-3	1.4	The last sentence in the first paragraph should be moved to the second paragraph and be revised to state, "However, there is buried solid waste remaining at the sites and inorganics in the soil and groundwater at concentrations above the State's cleanup levels, and therefore ICs are necessary under Alaska State regulations."	

Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
Eareckson AS, Alaska
Document Date: March 2009
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Comments Developed: May 15, 2009

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
6.	1-5	1.5	If a remedy is being selected under CERCLA, in the second paragraph please end the second sentence after the words balancing criteria. If the remedy is solely to address State regulatory requirements, the NCP does not apply and the second sentence should be deleted.	
7.	1-7	1.7	Please delete the words "previously undiscovered".	
8.	2-4	2.1.2	See comment 4.	
9.	2-4	2.1.2	For non-CERCLA response action, the text stating "As the lead agency for remedial activities" and "As the support agency" should be deleted from the second to last paragraph in this section.	
10.	2-7	2.2	The last sentence in the second paragraph and the first two sentences in the third paragraph should be deleted.	
11.	2-15	2.6.1.2	See comment 4.	
12.	2-16	2.6.2.1	See comment 3.	
13.	2-16	2.6.2.1	The 10 times rule no longer exists. Unless there is a previously agreed upon formal approval of its application at these sites, then it does not apply. Otherwise, please remove the reference to the 10 times rule.	

Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
Eareckson AS, Alaska
Document Date: March 2009
Commenter: Jonathan Schick ADEC
Comments Developed: May 15, 2009

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
14.	2-20	2.6.2.3	In this section and the following section please provide additional detail where terms like "low levels" or "slightly higher" are used. These terms are vague, leave room for interpretation and do not add substantive information to the document. It should state whether they results exceed background and cleanup levels. Tables should be added comparing analytical results to background levels, ecological screening levels and cleanup levels (this should also be done in section 2.6.2.4).	
15.	2-20	2.6.2.4	Please list out the metals that exceeded the cleanup level, as the VOCs and SVOCs are listed later in the sentence.	
16.	2-23	2.6.2.4	In the second paragraph on this page the text states, "Throughout the years of sediment sampling, various metals were detected, with a few exceeding cleanup criteria." Please list the few metals that exceeded the cleanup criteria for sediment samples at the site.	
17.	2-23	2.6.2.4	The last sentence of the second paragraph states, "The presence of these metals in both sediment samples might be more related to marine influences than to the landfills as sources." The words might be more related are vague and leave room for interpretation and do not add substantive information to the document.	
18.	2-23	2.6.2.4	In the last paragraph in this section please specify what "applicable cleanup levels" are being referred to (Table C, 10 times Table C, Water Quality Criteria?).	
19.	2-24 thru 2-31	2.8	This section describes a summary of the site risks. The subsections under it describe risk assessments conducted in 1996 and an update in 2003. The 2003 updated risk assessments were attached to a previous version of the draft ROD. However, we have been unable to find a previously submitted copy in our records or the on-line administrative record, nor have we found any record of DEC concurring with the documents. The 2003 risk assessment documents are not complete risk assessment and raise several questions.	
20.	2-27	2.8.1.2	The paragraph describing the 2003 HHERA for LF024/026 describes excess cancer and non-cancer risks driven primarily by arsenic in soil, it then states that if you exclude the arsenic there is no unacceptable risk. Again, including tables to show the range of concentrations in soil and the background levels would help in evaluating the appropriateness of the text.	

Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
Eareckson AS, Alaska
Document Date: March 2009
Commenter: Jonathan Schick ADEC
Comments Developed: May 15, 2009

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
21.	2-31	2.8.2.1	The ecological risk assessment indicates potential unacceptable risk for LF018. For surface and subsurface soil it states the primary risk driver was thallium and that it was believed to be naturally occurring. Please include supporting information on background levels of thallium and other inorganics and a reference to where the data is located. For groundwater and surface water it also notes an unacceptable risk based on the HI. The primary risk driver is noted to be aluminum but the risk was dismissed because the samples were not filtered and may not have been representative of dissolved contaminant levels. Re-sampling from the surface water and monitoring wells, using low flow sampling techniques and filtering the samples (if necessary) should be done to resolve this uncertainty rather than just dismissing it. It also states "...marine sediment samples collected from downgradient intertidal areas were non-detect for surface water analytes." What does that mean? Risk assessment summary tables should be included.	
22.	2-29 thru 2-31	2.8.2.2	The ecological risk assessment for LF024/026 describes potential unacceptable risks. Lead, thallium and zinc were identified as risk drivers for surface soil, but again were qualitatively dismissed as being thought to be non-bioavailable (lead), not having known sources (thallium), and being non-toxic except at extremely high levels (zinc). Inorganics in groundwater, surface water, and sediment were measured at concentrations that indicate exceedance of regulatory risk levels. The water results were qualitatively dismissed as being from non-filtered samples. The sediment results were dismissed based on P450 analysis, which appears to be for evaluating exposure to and uptake of organic compounds, and one chronic 10-day toxicity test. These uncertainties need to be more adequately addressed.	
23.	2-32	2.10	The text in this section appears to be irrelevant. This section should describe the alternatives that were included in the Proposed Plan for the site.	

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Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
24.	2-33	2.12	This section should state the remedy is no further action under CERCLA and that Institutional Controls will be developed and maintained to comply with State law and limit potential future risk. The last paragraph should be revised to state that institutional controls are legal or administrative tools used to control future land use and can be used to help ensure engineering controls are maintained. Signs, fences, and caps or covers are engineering controls.	
25.	2-33	2.12.1	This section should state the remedy is being selected to meet the requirements in 18 AAC 75.375 and the landfill closure requirements in 18 AAC 60. The NCP criteria do not apply to non-CERCLA actions.	
	2-35	2.12.2	DEC does not concur that collecting and analyzing one additional soil sample for thallium will address the uncertainty over the prior thallium results. A more representative sampling and analysis approach needs to be agreed upon. DEC recommends the additional sampling and analysis be conducted prior to signing the ROD to address this data gap. Otherwise a ROD amendment or an Explanation of Significant Difference will likely be required if thallium is determined to be a contaminant of concern at the site(s).	
22.	2-36	Table 2-9	The heading should be changed to "Applicable State Regulations". Additional regulations should be added include the Alaska Water Quality Standards in 18 AAC70.015 and 70.020Alaska Solid Waste regulations in 18 AAC 60.815-860; and the institutional control requirements in 18 AAC 75.375. ARARs don't apply to non-CERCLA actions.	
23.	2-27	2.8.2	This section should refer the reader to Appendix A and B for the 2003 risk assessment.	
24.	Appendix A		Cleanup levels have been updated since this risk assessment was performed in 2003. Therefore the COPC screening and risk calculations need to be re-visited and amended.	

Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
Eareckson AS, Alaska
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Comments Developed: May 15, 2009

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
25.	Appendix B		Cleanup levels have been updated since this risk assessment was performed in 2003. Therefore the COPC screening and risk calculations need to be re-visited and amended.	
26.	Appendix B		Lead was a major risk driver at LF024/026 but it was downplayed assuming it's not bioavailable because it was due to scrap metal, This should be demonstrated if that was the case (TCLP analysis, bioavailability studies). Arsenic was also a risk driver but since there were no known site sources it was also dismissed. However, if site concentrations are not in line with background, then it has to be considered site related whether the source is known or not.	
27.	Appendix A and B		These Risk Assessments are not adequate. They more closely resemble a risk evaluation. They do not include required information regarding the sample ID or location for any of the sample results that are cited. A proper risk assessment would look at all of the possible exposure scenarios and make site specific adjustments. This document only assumes one exposure pathway at a time instead of the cumulative risk from multiple pathways that a receptor could be exposed to.	
28.	Appendix A and B		What is marine groundwater? Please define this term or just call it groundwater. It was agreed to that the wells that are adjacent to the coast would be compared to surface water quality standards because they are at the point of compliance, but this should be described in the text.	
29	Appendix A and B		In Section 4.0 of Appendix A and Section 3.2 of Appendix B the text states that petroleum hydrocarbons as measured by Method E418.1 were detected at a maximum concentration of 371 mg/kg in surface soils and 1,373 mg/kg in subsurface soils. This appears to be a cut and paste error but because no sample IDs are cited in the document, it is not possible to determine where these maximum detected levels were found.	

Richard Girouard

From: Barnack, Keith Civ USAF 611 ASG 611 CES/CEAR [Keith.Barnack@ELMENDORF.af.mil]
Sent: Tuesday, July 07, 2009 2:30 PM
To: Schick, Jonathan S (DEC)
Cc: Mattson, Steve Civ USAF PACAF 611 CES/CEAR; Richard Girouard
Subject: Eareckson RTCs LF ROD
Attachments: RTC Pre-Final LF ROD JUL 09.doc

Jonathan: Attached are the second round of RTCs to ADEC comments on the ROD for LF018, LF024, and LF026. Let us know if our RTCs are acceptable. Thanks:

Keith

// signed //

Keith J. Barnack
Remedial Project Manager
611 CES/CEAR
10471 20th ST, STE 302
Elmendorf AFB AK 99506-2200
DSN 317-552-5160
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Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
Eareckson Air Station, Alaska
Document Date: March 2009
Commenter: Jonathan Schick; ADEC
Comments Developed: May 15, 2009

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Air Force Response
1.	1-1	1.1	Please change the language in this section that states that Shemya is part of the Alaska Maritime National Wildlife Refuge. Shemya was transferred to the Department of Defense so that the land would not revert back to USFWS management. The USAF has primary jurisdiction over the land. It is within the boundary of the AMNWR, but it is excluded from the refuge. Shemya Island has been withdrawn since 1913 (EO 1733) and the U.S. Air Force has been using the entire island since WWII. Public Law 106-554 (114 Stat. 2763A…approved on December 21, 2000) gave "primary jurisdiction, custody, and control over Shemya Island and its appurtenant waters" to the U.S. Air Force [Appendix D, Section 302(a)], leaving Fish and Wildlife Service (Department of the Interior) secondary jurisdiction. Appendix D, Section 302(c) states that "This sectioni shall not be construed as altering any existing property rights of the State of Alaska or any private person."	The text is correct as is. Public Law 106-554 Appendix D, Section 302(a) states that "Shemya Island and its appurtenant waters (including submerged lands) shall continue to be included within the Alaska Maritime National Wildlife Refuge and the National Wildlife Refuge System…"
2.	1-2		Please delete the dates included after the reference to ADEC when citing regulations here and throughout the document. For example, this section should simply state, "Alaska Oil and Hazardous Substance Pollution Control Act, 18 AAC 75 (ADEC)." The basis for the dates that were listed is unclear.	The dates will be deleted.
3.	1-2	1.3.1	Please change the text to clearly state that some drums remain in the landfill, where it now only states that the majority of the drums were removed.	The text will be revised to clarify that drums remain.
4.	1-2	1.3.1	This section states that there was metal, wood and plastic debris noted on the surface in 1993 and 1994. Does solid waste remain exposed at the ground surface at the site? If so, additional cover material should be placed over the waste as	There is no exposed waste at the site. The text will be revised to clarify this.

Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
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Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Air Force Response
			part of the landfill closure.	
5.	1-3	1.4	The last sentence in the first paragraph should be moved to the second paragraph and be revised to state, "However, there is buried solid waste remaining at the sites and inorganics in the soil and groundwater at concentrations above the State's cleanup levels, and therefore ICs are necessary under Alaska State regulations."	The text will be revised.
6.	1-5	1.5	If a remedy is being selected under CERCLA, in the second paragraph please end the second sentence after the words balancing criteria. If the remedy is solely to address State regulatory requirements, the NCP does not apply and the second sentence should be deleted.	The section will be revised.
7.	1-7	1.7	Please delete the words "previously undiscovered."	They will be deleted.
8.	2-4	2.1.2	See comment 4.	There is no exposed waste at the site. The text will be revised to clarify this.
9.	2-4	2.1.2	For non-CERCLA response action, the text stating "As the lead agency for remedial activities" and "As the support agency" should be deleted from the second to last paragraph in this section.	The ROD is going to be revised as a CERCLA document.
10.	2-7	2.2	The last sentence in the second paragraph and the first two sentences in the third paragraph should be deleted.	The sentences will be deleted.
11.	2-15	2.6.1.2	See comment 4.	There is no exposed waste at the site. The text will be revised to clarify this.
12.	2-16	2.6.2.1	See comment 3.	The text will be revised to clarify that drums remain.
13.	2-16	2.6.2.1	The 10 times rule no longer exists. Unless there is a previously agreed upon formal approval of its application at these sites,	The reference will be removed.

Alaska Department of Environmental Conservation
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Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Air Force Response
			then it does not apply. Otherwise, please remove the reference to the 10 times rule.	
14.	2-20	2.6.2.3	In this section and the following section please provide additional detail where terms like "low levels" or "slightly higher" are used. These terms are vague and leave room for interpretation and do not add substantive information to the document. It should state whether the results exceed background and cleanup levels. Tables should be added comparing analytical results to background levels, ecological screening levels and cleanup levels (this should also be done in section 2.6.2.4).	The descriptive terms will be changed or clarified. There are tables in Appendix A and Appendix B which compare results to screening levels and cleanup levels. Reference to these tables will be added to the text in Sections 2.6.2.3 and 2.6.2.4.
15.	2-20	2.6.2.4	Please list out the metals that exceeded the cleanup level, as the VOCs and SVOCs are listed later in the sentence.	The metals exceeding cleanup levels will be listed (the specific cleanup level will be referenced). Additional discussion of metal concentrations in Alaskan soils by others (USGS) as well as activities that can release these metals to the environment will also be discussed. These metals were listed and ruled out as contaminants in the agreed upon Air Force and ADEC finalized Proposed Plan.
16.	2-23	2.6.2.4	In the second paragraph on this page the text states, "Throughout the years of sediment sampling, various metals were detected, with a few exceeding the cleanup criteria." Please list the few metals that exceeded the cleanup criteria for sediment samples at the site.	The metals exceeding cleanup levels will be listed (the specific cleanup level will be referenced). Additional discussion of metal concentrations in Alaskan soils by others (USGS) as well as activities that can release these metals to the environment will also be discussed. These metals were listed and ruled out as contaminants in the agreed upon Air Force and ADEC finalized Proposed Plan..
17.	2-23	2.6.2.4	The last sentence of the second paragraph states, "The presence of these metals in both sediment samples might be more related to marine influences than to the landfills as sources." The words "might be more related" are vague and leave room for interpretation and do not add substantive information to the document.	The sentence will be deleted

Alaska Department of Environmental Conservation
Comments on the Pre-Final CERCLA ROD for LF018 and LF024/026
Eareckson Air Station, Alaska
Document Date: March 2009
Commenter: Jonathan Schick; ADEC
Comments Developed: May 15, 2009

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18.	2-23	2.6.2.4	In the last paragraph in this section please specify what "applicable cleanup levels" are being referred to (Table C, 10 times Table C, Water Quality Criteria?)	The cleanup levels will be specified.
19.	2-24 thru 2-31	2.8	This section describes a summary of the site risks. The subsections under it describe risk assessments conducted in 1996 and an update in 2003. The 2003 updated risk assessments were attached to a previous version of the draft ROD. However, we have been unable to find a previously submitted copy in our records or the on-line administrative record, nor have we found any record of DEC concurring with the documents. The 2003 risk assessment documents are not complete risk assessment and raise several questions.	The risk assessments were reviewed by ADEC and documentation demonstrating this has been forwarded (29 May 2009). As agreed to by the parties involved at the time, the updated risk assessments were not meant to be a full assessment, rather a Tier I screening based on the *Final Risk Assessment Assumptions for Decision Documents Technical Memorandum* (2001), which was developed with ADEC input, to confirm that the site conditions did not merit a full risk assessment.
20.	2-27	2.8.1.2	The paragraph describing the 2003 HHERA for LF024/026 describes excess cancer and non-cancer risks driven primarily by arsenic in soil, it then states that if you exclude the arsenic there is no unacceptable risk. Again, including tables to show the range of concentrations in soil and the background levels would help in evaluating the appropriateness of the text.	Table B-3 in Appendix B lists these values and will be referenced in the text. There were no industrial or military operations that would have discharged these metals so they are naturally occurring. Alaska as a state is known to have elevated arsenic levels associated with naturally occurring mineral deposits.
21.	2-31	2.8.2.1	The ecological risk assessment indicates potential unacceptable risk for LF018. For surface and subsurface soil it states the primary risk driver was thallium and that it was believed to be naturally occurring. Please include supporting information on background levels of thallium and other inorganics and a reference to where the data is located. For groundwater and surface water it also notes an unacceptable risk based on the HI. The primary risk driver is noted to be aluminum but the risk was dismissed because the samples were not filtered and may not have been representative of dissolved contaminant levels. Re-sampling from the surface and monitoring wells, using low flow sampling techniques and filtering the samples (if necessary) should be done to resolve	Thallium was listed as a chemical detected above cleanup criteria in the Proposed Plan for LF018 along with the preferred remedial alternative of institutional controls. Thallium was ruled out in the agreed upon AF and ADEC finalized Proposed Plan. The Air Force maintains that there were no activities on Shemya Island that would release thallium and, therefore, it is not a contaminant requiring cleanup. Although it is possible that aluminum metal is buried in the landfill, it is essentially insoluble and would not migrate into groundwater or surface water at the site unless highly acidic or alkaline conditions were present. Recent sampling in the LF018 area as part of another project measured pH in groundwater ranging from 7.2 to 7.9 and pH in surface water

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			this uncertainty rather than just dismissing it. It also states "…marine sediment samples collected from downgradient intertidal areas were non-detect for surface water analytes." What does that mean? Risk assessment summary tables should be included.	at 6.8 – nearly neutral. The aluminum measured was naturally present in solids collected with the water samples and that further sampling is not necessary. The last sentence, concerning the marine sediment samples, in this section will be deleted. Risk assessment summary tables are included in Appendix A. Table A-1 is an overall summary of the 2003 risk assessment results.
22.	2-29 thru 2-31	2.8.2.2	The ecological risk assessment for LF024/026 describes potential unacceptable risks. Lead, thallium and zinc were identified as risk drivers for surface soil, but again were qualitatively dismissed as being non-toxic except at extremely high levels (zinc). Inorganics in groundwater, surface water, and sediment were measured at concentrations that indicate exceedance of regulatory risk levels. The water results were qualitatively dismissed as being from non-filtered samples. The sediment results were dismissed based on P450 analysis, which appears to be for evaluating exposure to and uptake of organic compounds, and one chronic 10-day toxicity test. These uncertainties need to be more adequately addressed.	These metals were listed as a chemicals detected above cleanup criteria in the Proposed Plan for LF024/026 along with the preferred remedial alternative of institutional controls. These metals were ruled out in the agreed upon AF and ADEC finalized Proposed Plan. There were no activities at these sites that would release thallium and, therefore, it is not a contaminant requiring cleanup. The maximum lead concentration, which was used to calculate the hazard index (HI), was found in just one location at site LF024. Nearly all of the other soil samples collected at LF024/LF026 contained lead at concentrations below the residential cleanup level of 400 mg/kg. The conservative inputs into the risk calculations substantially over estimates the risk posed by lead.
23.	2-32	2.10	The text in this section appears to be irrelevant. This section should describe the alternatives that were included in the Proposed Plan for the site.	The section will be revised to include discussions on alternatives.
24.	2-33	2.12	This section should state the remedy is no further action under CERCLA and that Institutional Controls will be developed and maintained to comply with State law and limit potential future risk. The last paragraph should be revised to state that institutional	Concur. The last paragraph in the section will be revised.

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			controls are legal or administrative tools used to control future land use and can be used to help ensure engineering controls are maintained. Signs, fences, and caps or covers are engineering controls.	
25.	2-33	2.12.1	This section should state the remedy is being selected to meet the requirements in 18 AAC 75.375 and the landfill closure requirements in 18 AAC 60. The NCP criteria do not apply to non-CERCLA actions.	Concur.
26.	2-35	2.12.2	DEC does not concur that collecting and analyzing one additional soil sample for thallium will address the uncertainty over the prior thallium results. A more representative sampling and analysis approach needs to be agreed upon. DEC recommends the additional sampling and analysis be conducted prior to signing the ROD to address this data gap. Otherwise a ROD amendment or an Explanation of Significant Difference will likely be required if thallium is determined to be a contaminant of concern at the site(s).	Disagree. Thallium was listed as a chemical detected above cleanup criteria in the Proposed Plan for LF018 and LF024/LF026 along with the preferred remedial alternative of institutional controls and no additional sampling. This comment contradicts your 18 February 2009 email. At our 10 February 2009 meeting at MWH we discussed the thallium sampling comment from your 26 November 2008 comments. At that meeting I only agreed to accomplish the thallium sampling if done after ROD signature as LTM as a painless way to proceed and move on. You stated you would discuss this with John Halverson and your 18 February 2009 email agreed to sampling under LTM. But now your 15 May 2009 comments have reversed. Again, thallium was ruled out as a COC in the agreed upon AF and ADEC finalized Proposed Plan. There were no AF industrial or military activities that would have produced thallium as a by-product. The thallium analytical concentrations are the result of a known interference in the analytical method where thallium concentrations are bias high by aluminum. This proposed sampling will not alter the selected remedy.
27.	2-36	Table 2-9	The heading should be changed to "Applicable State Regulations." Additional regulations should be added	The additional regulations will be added to the table.

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			including the Alaska Water Quality Standards in 18 AAC 70.015 and 70.020; Alaska Solid Waste regulations in 18 AAC 60.815-860: and the institutional control requirements in 18 AAC 75.375. ARARS don't apply to non-CERCLA actions.	
28.	2-27	2.8.2	This section should refer the reader to Appendix A and B for the 2003 risk assessment.	The reference will be added.
29.	Appendix A		Cleanup levels have been updated since this risk assessment was performed in 2003. Therefore the COPC screening and risk calculations need to be re-visited and amended.	Screening for COPCs was performed by comparing analyte concentrations to one-tenth the ADEC Method Two Cleanup Levels and/or ecological screening criteria. There are no indications performing an updated risk assessment will change the selected remedy, thus a recalculation will be a waste of valuable resources and time.
30.	Appendix B		Cleanup levels have been updated since this risk assessment was performed in 2003. Therefore the COPC screening and risk calculations need to be re-visited and amended.	Screening for COPCs was performed by comparing analyte concentrations to one-tenth the ADEC Method Two Cleanup Levels and/or ecological screening criteria. There are no indications performing an updated risk assessment will change the selected remedy, thus a recalculation will be a waste of valuable resources and time.
31.	Appendix B		Lead was a major risk driver at LF024/026 but it was downplayed assuming it's not bioavailable because it was due to scrap metal. This should be demonstrated if that was the case (TCLP analysis, bioavailability studies). Arsenic was also a risk driver but since there were no known site sources it was also dismissed. However, if site concentrations are not in line with background, then it has to be considered site related whether the source is known or not.	The maximum lead concentration, which was used to calculate the hazard index (HI), was found in just one location at site LF024. Nearly all of the other soil samples collected at LF024/LF026 contained lead at concentrations below the residential cleanup level of 400 mg/kg. The conservative inputs into the risk calculations substantially over estimates the risk posed by lead. Lead was listed as a chemical detected above cleanup criteria in the Proposed Plan for LF018 and LF024/LF026 along with the preferred remedial alternative of institutional controls and no additional sampling. Lead was ruled out in the agreed upon AF and ADEC finalized Proposed Plan. Alaska as a state is known to have elevated arsenic levels

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				associated with naturally occurring mineral deposits. There has been no industrial or military operations that produce arsenic as a by-product at this installation.
32.	Appendix A and B		These Risk Assessments are not adequate. They more closely resemble a risk evaluation. They do not include required information regarding the sample ID or location for any of the sample results that are cited. A proper risk assessment would look at all of the possible exposure scenarios and make site specific adjustments. This document only assumes one exposure pathway at a time instead of the cumulative risk from multiple pathways that a receptor could be exposed to.	As agreed to by the parties involved at the time, the updated risk assessments were not meant to be a full assessment, rather a Tier I screening based on the *Final Risk Assessment Assumptions for Decision Documents Technical Memorandum* (2001), which was developed with ADEC input, to confirm that the site conditions did not merit a full risk assessment. There are no indications performing an updated risk assessment will change the selected remedy, thus a recalculation will be a waste of valuable resources and time.
33.	Appendix A and B		What is marine groundwater? Please define this term or just call it groundwater. It was agreed to that the wells that are adjacent to the coast would be compared to surface water quality standards because they are at the point of compliance, but this should be described in the text.	The term "marine groundwater" refers to groundwater that is assumed to discharge to marine surface waters. At sites where groundwater is expected to discharge to the surface, the use of the term is meant to distinguish between groundwater flow that may result in contaminant exposure to fresh water ecological receptors versus marine ecological receptors. These receptors differ and have differing responses to contaminant exposure.
34.	Appendix A and B		In Section 4.0 of Appendix A and Section 3.2 of Appendix B the text states that petroleum hydrocarbons as measured by Method E418.1 were detected at a maximum concentration of 371 mg/kg in surface soils and 1,373 mg/kg in subsurface soils. This appears to be a cut and paste error but because no sample IDs are cited in the document, it is not possible to determine where these maximum detected levels were found.	The numbers in the text in Appendix B are incorrect; however, the correct values are listed in Table B-2. In Appendix B, Section 3.2, the first sentence in the second paragraph should be: "Petroleum hydrocarbons as measured by U.S. Environmental Protection Agency (EPA) Method E418.1 were detected at a maximum concentration of 16,000 mg/kg in surface soils and 14,000 mg/kg in subsurface soils."

Richard Girouard

From: Barnack, Keith Civ USAF 611 ASG 611 CES/CEAR [Keith.Barnack@ELMENDORF.af.mil]
Sent: Thursday, October 15, 2009 2:29 PM
To: Schick, Jonathan S (DEC)
Cc: Halverson, John E (DEC); Mattson, Steve Civ USAF PACAF 611 CES/CEAR; Richard Girouard; Klasen, James F Civ USAF 11 AF 11AF/JACE; Verplancke, Glen D Civ USAF PACAF AFCEE/EXHP
Subject: RE: Eareckson Meeting 30 Sep 09

Jonathan: We accept ADEC's conditions outlined in your email below dated 9 Oct 09. We will press forward to finish these RODS. I anticipate having draft finals in February 2010. The long lag time is due to time needed to secure additional funding to finish this contract. Thanks:

Keith

// signed //

Keith J. Barnack
Remedial Project Manager
611 CES/CEAR
10471 20th ST, STE 302
Elmendorf AFB AK 99506-2200
DSN 317-552-5160
COM (907) 552-5160
keith.barnack@elmendorf.af.mil

-----Original Message-----
From: Schick, Jonathan S (DEC) [mailto:jonathan.schick@alaska.gov]
Sent: Friday, October 09, 2009 12:39 PM
To: Barnack, Keith Civ USAF 611 ASG 611 CES/CEAR
Cc: Halverson, John E (DEC); Mattson, Steve Civ USAF PACAF 611 CES/CEAR
Subject: RE: Eareckson Meeting 30 Sep 09

Keith,

Sorry for the delayed response to your email but we were all out of the office in Program Meetings in Fairbanks this week.

I wanted to briefly summarize the discussions and outcomes from our meeting on Wed September 30th regarding the Landfill and Fire Training Ground RODs.

Our conversations were mainly focused on the metals remaining on-site at the landfills and it was agreed that sampling for these metals would occur as part of the long term monitoring program at the landfills in either the summer of 2010 or the summer of 2011. We also agreed that if there is a risk demonstrated in the next round of sampling then the remedy will be reevaluated at that time to make sure that it is still protective. If the established ICs are found to not be protective then additional capping may be necessary.

Additional language will need to be added to the ROD to describe the sampling methodology. We discussed the possibility of using the Multi-Incremental Sampling techniques to give us a defensible average concentration for the extent of the surface soil in within the landfill boundaries. I would like to see analysis for all metals so that we have a good idea for what kinds of levels are remaining out there on the surface with the latest sampling methodology with the least amount of interference possible.

We also discussed the need to revisit the risk evaluation performed on the site in 2003 because of changes in cleanup levels and toxicity values that may affect the listed contaminants of concern. We have discussed this issue in-house with our risk assessor and it was agreed that the risk evaluation will need to be revisited to determine if any analytes would need to be added to the list of COCs because of a change in the toxicity value, or if any of the previously identified COCs would be carried further through the risk evaluation because of a change in the toxicity value. Many of these values have changed since the risk evaluation was performed in 2003. I discussed this with John Halverson, and we agreed that it would be more sensible to re-visit the risk calculations once we have the data from the next round of sampling then all of the data should be reviewed and compared to the most current toxicity values. It is required for the 5-Year Review that all of the Toxicity values for the COCs are reviewed to see if the remedy is still protective.

So, the risk evaluation will be reviewed and re-run to see if the new values change the level of risk at the site, and to reevaluate the protectiveness of the remedy at the time of the 5-year review.

For the Fire Training Ground sites, we discussed the protectiveness of MNA and agreed that there is no established trend in the data but that due to the nature of the COCs it should be attenuating naturally and the monitoring data will be reviewed at the 5-year review to determine if the selected remedy is still protective.

I am anticipating another round of Pre-Final RODs so that we can review the proposed sampling methodologies for the landfills and FTGs for the monitoring programs and to also review any new language that has been inserted regarding the background metals and the land use status issues.

Unfortunately, I have not had a chance to finalize our comments on the MMRP work because of my travels, but they will be sent to you in the early part of next week.

Have a great weekend and I will be in touch early next week.

Jonathan Schick

Environmental Program Specialist

ADEC Contaminated Sites Program

(907) 269-3077

From: Barnack, Keith Civ USAF 611 ASG 611 CES/CEAR [mailto:Keith.Barnack@ELMENDORF.af.mil]
Sent: Tuesday, October 06, 2009 2:48 PM
To: Schick, Jonathan S (DEC)
Cc: Halverson, John E (DEC); Mattson, Steve Civ USAF PACAF 611 CES/CEAR
Subject: Eareckson Meeting 30 Sep 09
Importance: High

Jonathan: Reference our meeting on 30 Sep 09 on the FT and LF ongoing DDs. Any word on the LF risk assessment issue resolution? Also, we are still awaiting the MMRP comments. Thanks:

Keith

// signed //

Keith J. Barnack

Remedial Project Manager

611 CES/CEAR

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STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

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File # 2649.38.018
2649.38.024
2649.38.026

May 10, 2010

Keith Barnack, Remedial PM
United States Air Force
611 Air Support Group
Environmental Restoration Section
10471 20th Street Ste 302
Elmendorf AFB, AK 99506-2200

Re: Pre-final (v.2) CERCLA Record of Decision for North Beach Landfill (LF018) and Barrel Bay and Scrap Metal Disposal Area (LF024/LF026), Eareckson Air Station, dated April 2010

Dear Mr. Barnack:

The Alaska Department of Environmental Conservation (ADEC) Federal Facilities Oversight group received a copy of the document referenced above on April 7, 2010. We have completed our review and provided comments in the attached table.

I look forward to working with you to address these issues and develop and final ROD for these sites. If you have any questions regarding this letter, please contact me at 907-269-3077 or jonathan.schick@alaska.gov.

Sincerely,

Jonathan Schick
Environmental Program Specialist

Attachment: DEC comments on Pre-final ROD for LF018 and LF024/LF026

Alaska Department of Environmental Conservation
Comments on the Prefinal CERCLA Record of Decision North Beach Landfill (LF018) Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)
Eareckson Air Station, Alaska
Document Date: April 2010
Commenter: Jonathan Schick; ADEC
Comments Developed: April 22, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
1.	1-1	1.2	Please refer to comment #2 from the May 15 comment response form regarding the deletion of the dates associated with the reference to ADEC when citing regulations	
2.	1-5	1.4	Please refer to comment #5 from the May 15 comment response form. The text in this section was not adequately revised as it does not specify that the soil and groundwater have been impacted with inorganics. The suggested language was, However, there is buried solid waste remaining at the sites and inorganics in the soil and groundwater at concentrations above the State's cleanup levels, and therefore ICs are necessary under Alaska State regulations."	
3.	1-6	1.4	In the 4th bullet on this page, the text states that the ICs on the landfills will extend until cleanup levels in 18 AAC 75 have been met and the land becomes suitable for unrestricted use. Because the sites in question are landfills, the land will always require ICs to prevent disturbance of the landfill cap and exposure of the buried solid waste per 18 AAC 60.396 referenced in bullet #2.	
4.	1-7	1.5	Please remove the text in the first paragraph of this section, "while also considering the bias against offsite treatment and disposal and considering state and community acceptannce" as there is no such bias as far as the State is concerned. The sentence should end after the words "balancing criteria."	
5.	1-7	1.4	Please clarify the reason for collecting an additional MI sample for metals at the site to refute the 1990's data where the aluminum levels may have interfered with the reported concentrations of thallium and other metals. The full suite of TAL metals should be analyzed in these MI samples.	
6.	2-3	2.1.2.1	Please clearly state that drums remain buried at the site similar to the way that it was declared in Section 1.3.1	
7.	2-21	2.5.2.4	Please delete the last sentence in the first paragraph of this section that reads, "The presence of these metals in both sediment samples might be more related to marine influences than to the landfills as a source."	

Alaska Department of Environmental Conservation
Comments on the Prefinal CERCLA Record of Decision North Beach Landfill (LF018) Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)
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Comments Developed: April 22, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
8.	2-22	2.5.2.5	Please specify the cleanup levels being referred to in the last sentence of the first paragraph in this section. (18 AAC 75.345 Table C groundwater cleanup levels)	
9.	2-31	Table 2-9	Alternative 4 (Removal) would reduce the toxicity, mobility, and volume of the waste at the site, please amend this table. Per our discussion on 5 May 2010, we agreed that the removal of the buried wastes at the landfill would not impact the volume or toxicity of the wastes, but would reduce its mobility as it would be placed in a lined impermeable landfill suited to contain wastes. Consider adding a check mark to the table possibly with a qualifier that states that the mobility would be reduced in selecting Alternative 4.	
10.	2-33	2.9.4	Please amend the text in this section as Alternative 4 (Removal) would reduce the toxicity, mobility, and volume of the waste at the site. Per our discussion on 5 May 2010, we agreed that the removal of the buried wastes at the landfill would not impact the volume or toxicity of the wastes, but would reduce its mobility as it would be placed in a lined impermeable landfill suited to contain wastes.	
11.	2-35	2.10.2	In the 4th bullet in this section, the text states that the ICs on the landfills will extend until cleanup levels in 18 AAC 75 have been met and the land becomes suitable for unrestricted use. Because the sites in question are landfills, the land will always require ICs to prevent disturbance of the landfill cap and exposure of the buried solid waste per 18 AAC 60.396 referenced in bullet #2. On 5 May 2010 we discussed amending the language to require ADEC approval prior to any changes to the ICs if the land use ever changes so that the buried wastes have been removed and the soils and groundwater have attenuated to below the cleanup levels.	
12.	2-37	Table 2-10	Please change the heading for this Table 2-10 to "Applicable State Regulations"	
13.	2-37	Table 2-10	Please add a space/dash between 340 and 350 in row 4 column 3 of this table so that the reference to the cleanup levels reads, 18 AAC 75.340-350	

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Comments Developed: April 22, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
1.	1-1	1.2	Please refer to comment #2 from the May 15 comment response form regarding the deletion of the dates associated with the reference to ADEC when citing regulations	Dates associated with ADEC regulations have been deleted.
2.	1-5	1.4	Please refer to comment #5 from the May 15 comment response form. The text in this section was not adequately revised as it does not specify that the soil and groundwater have been impacted with inorganics. The suggested language was, However, there is buried solid waste remaining at the sites and inorganics in the soil and groundwater at concentrations above the State's cleanup levels, and therefore ICs are necessary under Alaska State regulations."	The suggested text has been added to this section.
3.	1-6	1.4	In the 4th bullet on this page, the text states that the ICs on the landfills will extend until cleanup levels in 18 AAC 75 have been met and the land becomes suitable for unrestricted use. Because the sites in question are landfills, the land will always require ICs to prevent disturbance of the landfill cap and exposure of the buried solid waste per 18 AAC 60.396 referenced in bullet #2.	Although unlikely, the bullet was added to state explicitly that IC's *could* end at some point if the wastes are removed and any contaminated media has been removed/remediated. Text has been added to the bullet stating that ADEC approval is required.
4.	1-7	1.5	Please remove the text in the first paragraph of this section, "while also considering the bias against offsite treatment and disposal and considering state and community acceptannce" as there is no such bias as far as the State is concerned. The sentence should end after the words "balancing criteria."	The requested revision has been made.
5.	1-7	1.4	Please clarify the reason for collecting an additional MI sample for metals at the site to refute the 1990's data where the aluminum levels may have interfered with the reported concentrations of thallium and other metals. The full suite of TAL metals should be analyzed in these MI samples.	A reference to Section 2.6.5, where the metals uncertainty is discussed, has been added to the last bullet. TAL metals have also been added to the last bullet.
6.	2-3	2.1.2.1	Please clearly state that drums remain buried at the site similar to the way that it was declared in Section 1.3.1	The text has been revised.

Alaska Department of Environmental Conservation
Comments on the Prefinal CERCLA Record of Decision North Beach Landfill (LF018) Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)
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Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
7.	2-21	2.5.2.4	Please delete the last sentence in the first paragraph of this section that reads, "The presence of these metals in both sediment samples might be more related to marine influences than to the landfills as a source."	The sentence has been deleted.
8.	2-22	2.5.2.5	Please specify the cleanup levels being referred to in the last sentence of the first paragraph in this section. (18 AAC 75.345 Table C groundwater cleanup levels)	*18 AAC 75.345 Table C groundwater cleanup levels* was added to the text.
9.	2-31	Table 2-9	Alternative 4 (Removal) would reduce the toxicity, mobility, and volume of the waste at the site, please amend this table. Per our discussion on 5 May 2010, we agreed that the removal of the buried wastes at the landfill would not impact the volume or toxicity of the wastes, but would reduce its mobility as it would be placed in a lined impermeable landfill suited to contain wastes. Consider adding a check mark to the table possibly with a qualifier that states that the mobility would be reduced in selecting Alternative 4.	A check mark was added along with a qualifier.
10.	2-33	2.9.4	Please amend the text in this section as Alternative 4 (Removal) would reduce the toxicity, mobility, and volume of the waste at the site. Per our discussion on 5 May 2010, we agreed that the removal of the buried wastes at the landfill would not impact the volume or toxicity of the wastes, but would reduce its mobility as it would be placed in a lined impermeable landfill suited to contain wastes.	The section has been revised.
11.	2-35	2.10.2	In the 4th bullet in this section, the text states that the ICs on the landfills will extend until cleanup levels in 18 AAC 75 have been met and the land becomes suitable for unrestricted use. Because the sites in question are landfills, the land will always require ICs to prevent disturbance of the landfill cap and exposure of the buried solid waste per 18 AAC 60.396 referenced in bullet #2. On 5 May 2010 we discussed amending the language to require ADEC approval prior to any changes to the ICs if the land use ever changes so that the buried wastes have been removed and the soils and groundwater have attenuated to below the cleanup levels.	The bullet has been revised.
12.	2-37	Table 2-10	Please change the heading for this Table 2-10 to "Applicable State Regulations"	The title has been changed.

Alaska Department of Environmental Conservation
Comments on the Prefinal CERCLA Record of Decision North Beach Landfill (LF018) Barrel Bay and Scrap Metal Disposal Area (LF024/LF026)
Eareckson Air Station, Alaska
Document Date: April 2010
Commenter: Jonathan Schick; ADEC
Comments Developed: April 22, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
13.	2-37	Table 2-10	Please add a space/dash between 340 and 350 in row 4 column 3 of this table so that the reference to the cleanup levels reads, 18 AAC 75.340-350	The requested change was made.

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

SEAN PARNELL, GOVERNOR

555 Cordova Street
Anchorage, AK 99501
PHONE: (907) 269-3077
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www.dec.state.ak.us

File # 2649.38.018
2649.38.024
2649.38.026

May 28, 2010

Keith Barnack, Remedial PM
United States Air Force
611 Air Support Group
Environmental Restoration Section
10471 20th Street Ste 302
Elmendorf AFB, AK 99506-2200

Re: Pre-final (v.3) CERCLA Record of Decision for North Beach Landfill (LF018) and Barrel Bay and Scrap Metal Disposal Area (LF024/LF026), Eareckson Air Station, dated April 2010

Dear Mr. Barnack:

The Alaska Department of Environmental Conservation (ADEC) Federal Facilities Oversight group received a copy of the document referenced above on May 13, 2010. We have completed our review and provided comments in the attached table.

I look forward to working with you to address these issues and develop and final ROD for these sites. If you have any questions regarding this letter, please contact me at 907-269-3077 or jonathan.schick@alaska.gov.

Sincerely,

Jonathan Schick
Environmental Program Specialist

Attachment: DEC comments on Pre-final ROD V.3 for LF018 and LF024/LF026

G:\SPAR\SPAR-CS\38 Case Files (Contaminated Sites)\2649 Eareckson\2649.38.026 EARECKSON SCRAP METAL DISPOSAL SITE LF26\28 May 2010 Pre-Final v3 CERCLA ROD Landfills review ltr.doc

Alaska Department of Environmental Conservation
Comments on the CERCLA Record of Decision for LF018, and LF024/LF026
Eareckson Air Station, Alaska
Document Date: May 2010
Commenter: Jonathan Schick; ADEC
Comments Developed: May 27, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
1.	1-2	1.2	Please amend the first two sentences on this page so that it reads, " The State of Alaska Department of Conservation (ADEC) agrees that the selected remedy, properly implemented and maintained, complies with State law. ADEC also agrees with the Air Force determination that action is necessary under CERCLA…"	
2.	1-2	1.2	Please provide documentation or additional detail regarding the consultation with the EPA.	
3.	1-2	1.3.1	Please clarify the site description at the end of the first paragraph in this section so that it reads, "A portion/majority of the drums were removed in the early 1980s."	
4.	1-3	1.3.1	Please clarify throughout this section whether or not the "low levels" or "elevated concentrations" of contaminants exceed the cleanup level or not.	
5.	1-4	1.3.2	Please delete the sentence at the end of the soils sub-section that reads, "The benzene and pentachlorophenol are isolated exceedences and probably not associated with LF024/LF026. This is speculative and does not add any substantive information to the document. Furthermore, this is a landfill site, so despite the isolated detection, we cannot rule out the potential that items were disposed of that contained both of these contaminants.	
6.	1-7	1.4	Please add a bullet to this list that states that if the thallium concentrations are re-sampled and the results are above the applicable cleanup level, the selected remedy will need to be reassessed and additional capping may be required.	
7.	1-8 (labeled as 1-2)	1.6	Please amend the second sentence in this section so that it reads, "ADEC agrees that the remedy, properly implemented and maintained, complies with state law."	
8.	2-3	2.1.2.1	Please amend the third to last sentence in this section so that it reads, "A portion of the drums were removed in the early 1980s."	

Alaska Department of Environmental Conservation
Comments on the CERCLA Record of Decision for LF018, and LF024/LF026
Eareckson Air Station, Alaska
Document Date: May 2010
Commenter: Jonathan Schick; ADEC
Comments Developed: May 27, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
9.	2-10	2.2.2	Please amend the fifth sentence in this section so that it reads, " In a 1986 stereo photograph, LF018 appears much as it does today, with the visible drums having been removed."	
10.	2-17 through 2-19	2.5.1.2 through 2.5.1.5	In this and the following sections please clarify whether or not the detections exceed the cleanup levels. Please add to the text to compare the reported results to the applicable cleanup levels.	
11.	2-19	2.5.2.1	Please amend the 4th sentence in this section and delete the 5th sentence so that it reads, "The pentachlorophenol concentration is an isolated exceedence." The rest of the sentence is speculative and does not contribute to the document. ~~Waste with wood preservative could have been disposed of in the landfill. Furthermore, t~~This is a landfill site, so it is likely that ~~despite the isolated detection, we cannot rule out the potential that~~ items were disposed of that contained pentachlorophenol. Alternatively, what is the suspected source?	
12.	2-20	2.5.2.2	Please amend the last sentence in the first paragraph of this section so that it reads, "The benzene concentration is an isolated exceedence (1 of 7 samples)." This is a landfill site so it is likely ~~despite the isolated detection, we cannot rule out the potential~~ that items were disposed of that contained benzene. Alternatively, what is the suspected source?	
13.	Table 2-5 through 2-8		Please include the applicable cleanup level or screening level for the various contaminants on these tables so that the reader has a better understanding of what the detected levels mean in terms of the degree of impact at the site.	
14.	2-34	2.9.9	Please delete the second sentence in this section as it is speculative and the lack of comments does not necessarily imply that the community did not reject the proposed alternative. Stating that no comments were received is sufficient.	
15.	2-36	2.10.2	Please add a bullet to this list that states that if the thallium results from ~~concentrations are~~ re-sampling ~~ed and the results~~ are above the applicable cleanup level, the selected remedy will need to be reassessed and additional capping may be required.	
16.				

Alaska Department of Environmental Conservation
Comments on the CERCLA Record of Decision for LF018, and LF024/LF026
Eareckson Air Station, Alaska
Document Date: May 2010
Commenter: Jonathan Schick; ADEC
Comments Developed: May 27, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
17.				
18.				
19.				
20.				
21.				

Alaska Department of Environmental Conservation
Comments on the CERCLA Record of Decision for LF018, and LF024/LF026
Eareckson Air Station, Alaska
Document Date: May 2010
Commenter: Jonathan Schick; ADEC
Comments Developed: May 27, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
1.	1-2	1.2	Please amend the first two sentences on this page so that it reads, " The State of Alaska Department of Conservation (ADEC) agrees that the selected remedy, properly implemented and maintained, complies with State law. ADEC also agrees with the Air Force determination that action is necessary under CERCLA…"	Concur.
2.	1-2	1.2	Please provide documentation or additional detail regarding the consultation with the EPA.	The USEPA was sent the Proposed Plan on 1 May 2002 and the AF received no comments. Any 611 CES CERCLA ROD's PP are sent to the EPA for review. In the past conversations with Gusmano or Duncan, USEPA, they have stated they generally don't have time for review and comments on ERA documents and leave it to ADEC, but at times do get involved with some PCBs sites and/or high profile sites. I, Barnack, recently talked with Gusmano on 1 April 2010 at an ADEC meeting on a Cape Romanzof (complex PCB site) and he reaffirmed my previous statement. Only minor changes from the PP are in the ROD and are more stringent (sampling when no sampling was proposed).
3.	1-2	1.3.1	Please clarify the site description at the end of the first paragraph in this section so that it reads, "A portion/majority of the drums were removed in the early 1980s."	Concur.
4.	1-3	1.3.1	Please clarify throughout this section whether or not the "low levels" or "elevated concentrations" of contaminants exceed the cleanup level or not.	Comparisons to ADEC Method Two and Groundwater cleanup levels will be added to this section.

Alaska Department of Environmental Conservation
Comments on the CERCLA Record of Decision for LF018, and LF024/LF026
Eareckson Air Station, Alaska
Document Date: May 2010
Commenter: Jonathan Schick; ADEC
Comments Developed: May 27, 2010

Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
5.	1-4	1.3.2	Please delete the sentence at the end of the soils sub-section that reads, "The benzene and pentachlorophenol are isolated exceedences and probably not associated with LF024/LF026. This is speculative and does not add any substantive information to the document. Furthermore, this is a landfill site, so despite the isolated detection, we cannot rule out the potential that items were disposed of that contained both of these contaminants.	Concur.
6.	1-7	1.4	Please add a bullet to this list that states that if the thallium concentrations are re-sampled and the results are above the applicable cleanup level, the selected remedy will need to be reassessed and additional capping may be required.	Concur.
7.	1-8 (labeled as 1-2)	1.6	Please amend the second sentence in this section so that it reads, "ADEC agrees that the remedy, properly implemented and maintained, complies with state law."	Concur.
8.	2-3	2.1.2.1	Please amend the third to last sentence in this section so that it reads, "A portion of the drums were removed in the early 1980s."	Concur.
9.	2-10	2.2.2	Please amend the fifth sentence in this section so that it reads, " In a 1986 stereo photograph, LF018 appears much as it does today, with the visible drums having been removed."	Concur.
10.	2-17 through 2-19	2.5.1.2 through 2.5.1.5	In this and the following sections please clarify whether or not the detections exceed the cleanup levels. Please add to the text to compare the reported results to the applicable cleanup levels.	Bulleted COPCs and COPECs that exceed ADEC Method Two or Groundwater cleanup levels will be listed in **bold** text. The text will be revised to inform the reader of this. Additional text will be added to point out which contaminants exceed these levels.
11.	2-19	2.5.2.1	Please amend the 4th sentence in this section and delete the 5th sentence so that it reads, "The pentachlorophenol concentration is an isolated exceedence." The rest of the sentence is speculative and does not contribute to the document. This is a landfill site, so it is likely that items were disposed of that contained pentachlorophenol. Alternatively, what is the suspected source?	The text will be changed to simply state that the pentachlorophenol is an isolated exceedance. No other source is suspected.

Alaska Department of Environmental Conservation
Comments on the CERCLA Record of Decision for LF018, and LF024/LF026
Eareckson Air Station, Alaska
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Commenter: Jonathan Schick; ADEC
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Cmt. No.	Pg. & Line	Sec.	Comment/Recommendation	Response
12.	2-20	2.5.2.2	Please amend the last sentence in the first paragraph of this section so that it reads, "The benzene concentration is an isolated exceedence (1 of 7 samples)." This is a landfill site so it is likely that items were disposed of that contained benzene. Alternatively, what is the suspected source?	The text will be changed to simply state that the benzene is an isolated exceedance. No other source is suspected.
13.	Table 2-5 through 2-8		Please include the applicable cleanup level or screening level for the various contaminants on these tables so that the reader has a better understanding of what the detected levels mean in terms of the degree of impact at the site.	A column will be add listing the ADEC Method Two or Groundwater cleanup level.
14.	2-34	2.9.9	Please delete the second sentence in this section as it is speculative and the lack of comments does not necessarily imply that the community did not reject the proposed alternative. Stating that no comments were received is sufficient.	Concur.
15.	2-36	2.10.2	Please add a bullet to this list that states that if the thallium results from re-sampling are above the applicable cleanup level, the selected remedy will need to be reassessed and additional capping may be required.	The same text added to Section 1.4 (comment #6) will be add to this section.

Richard Girouard

From: Barnack, Keith Civ USAF PACAF 611 CES/CEAR [Keith.Barnack@ELMENDORF.af.mil]
Sent: Friday, June 18, 2010 12:11 PM
To: Richard Girouard
Subject: FW: EAS LF ROD prefinal version 4

Importance: High

Rick: Good to go! Have a good weekend. Thanks:

Keith

// signed //

Keith J. Barnack
Remedial Project Manager
611 CES/CEAR
10471 20th ST, STE 302
Elmendorf AFB AK 99506-2200
DSN 317-552-5160
COM (907) 552-5160
keith.barnack@elmendorf.af.mil

-----Original Message-----
From: Schick, Jonathan S (DEC) [mailto:jonathan.schick@alaska.gov]
Sent: Friday, June 18, 2010 11:31 AM
To: Barnack, Keith Civ USAF PACAF 611 CES/CEAR
Subject: RE: EAS LF ROD prefinal version 4

The amendments look good to me. You can send over a signed version of you like. John should be back middle of next week and then he can sign it too.
Have a great weekend.

Jonathan Schick
Environmental Program Specialist
ADEC Contaminated Sites Program
(907) 269-3077

-----Original Message-----
From: Barnack, Keith Civ USAF PACAF 611 CES/CEAR [mailto:Keith.Barnack@ELMENDORF.af.mil]
Sent: Friday, June 18, 2010 11:15 AM
To: Schick, Jonathan S (DEC)
Cc: Richard Girouard
Subject: FW: EAS LF ROD prefinal version 4
Importance: High

Jonathan: For your quick review of highlighted changes; If I can this back today or Monday it would be greatly appreciated. Thanks:

Keith

// signed //

Keith J. Barnack
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-----Original Message-----
From: Richard Girouard [mailto:Richard.Girouard@us.mwhglobal.com]
Sent: Friday, June 18, 2010 10:55 AM
To: Barnack, Keith Civ USAF PACAF 611 CES/CEAR
Subject: EAS LF ROD prefinal version 4

Keith,

Attached is the latest version of the Land Fill ROD for Eareckson. As before, it is just the text (no figs or appx) with the changes shown in blue.

Let me know if you have any questions.

Thanks,

Rick

MWHlogo_Tagline.jpg

Rick Girouard, P.E.

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