United States Army
Corps of Engineers
Alaska District

Proposed Plan
Northeast Cape Air Force Station
Formerly Used Defense Site

St. Lawrence Island, Alaska
FUDS# F10AK096903

July 2007

Purpose:

- Describe the site environmental conditions
- Describe the site-specific cleanup levels
- Describe the alternatives considered
- Present recommended cleanup alternatives
- Request public comment
- Provide information on how the public can be involved in final cleanup decisions.

Sections:

Introduction

The United States Army Corps of Engineers (USACE) and the Alaska Department of Environmental Conservation (ADEC) request your comments on this Proposed Plan for the Northeast Cape Formerly Used Defense Site, located on St. Lawrence Island, Alaska (see Figure 1). The Proposed Plan covers the entire site, as shown on Figure 2.

Final decisions on the preferred alternatives will be made after all comments submitted by the end of the public comment period have been reviewed and considered. Changes to the preferred plan alternatives may be made if public comments or additional data indicate that such changes would result in more appropriate solutions.

After considering all public comments, USACE will prepare a Decision Document which describes the final selected remedy. The Decision Document will include responses to all significant public comments received in a section called the Responsiveness Summary.

View north from the former White Alice Site (2006)

The Department of Defense (DoD) is authorized to carry out a program of environmental restoration at former military sites according to 10 United States Code (USC) 2701(a). The Defense Environmental Restoration Program (DERP) was set up to accomplish this task. The cleanup of Formerly Used Defense Sites (FUDS) is a part of this program. FUDS are those properties that the DoD once owned or used, but no longer controls. These properties range from privately owned farms to National Parks. They also include residential land, schools, and industrial areas. The FUDS program includes former Army, Navy, Marine, Air Force, and other defense properties. Over 600 FUDS have been identified in Alaska.

The DoD can remediate releases of petroleum where the release poses an imminent and substantial endangerment to the public health or welfare or to the environment per 10 USC 2701(b)(2). Although the majority of the areas of concern identified at this site do not include CERCLA-regulated hazardous substances, the preparation of this Proposed Plan follows CERCLA guidance as a matter of administrative convenience.

Site Location and History

Northeast Cape is located on St. Lawrence Island in the Bering Sea, 135 miles southwest of Nome, Alaska, as shown in Figure 1. The Village of Savoonga is the closest community, and is located 60 miles northwest of Northeast Cape. The site is near the northeast side of the island at 63°19' North, 168°58' West, 9 miles west of the northeastern cape of St. Lawrence Island. The Northeast Cape site originally encompassed 4,800 acres, or 7.5 square miles. The site is bounded by Kitnagak Bay to the northeast, Kangighsak Point to the northwest, and the Kinipaghulghat Mountains to the south (Figure 2).

The former military installation operated from about 1954 until

Figure 1. Project Location

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Proposed Plan

Site History (continued)

Demolition of White Alice antennas (2003)

1972 as a surveillance station and a White Alice Communications station. In 1982, the Navy obtained the former White Alice property (26 acres), but did not utilize the site as a communications site. The land transfer was later deemed invalid and property ownership reverted to Sivuqaq, Inc. and Kukulget, Inc.

Demolition of the buildings and all other structures was completed under multiple USACE contracts between 1999 and 2005. The runway, gravel roads, and concrete foundations of some of the structures remain intact.

Investigations have been performed at the Northeast Cape site since the early 1990s.

Phase I of the remedial investigation was conducted during the summer of 1994. Additional sampling was performed as part of Phase II during 1996 and 1998. Additional investigations were conducted during the 2001 and 2002 field seasons as part of Phase III. A final round of remedial investigation, Phase IV, was completed during 2004.

Summary of Preferred Alternatives

The Northeast Cape installation consists of 34 individual sites. A number of sites were grouped into areas of concern (AOC) in the Feasibility Study. Based on the evaluation of alternatives in the Feasibility Study, this Proposed Plan outlines the selected preferred alternatives, summarizes site information, and provides a brief rationale for each decision. The FS evaluated two sites under AOC C Landfills, but a proposed remedial action for the Site 7 Cargo Beach Road Landfill is not included in this Proposed Plan. A decision regarding the Site 7 Landfill will be made in the future after additional information is gathered. Additional details regarding each site, the risk evaluation, historical data, and alternatives are provided in the rest of this document. A brief description of the preferred alternatives is shown below.

Aerial photo of installation (1955)

Sites 1, 2, 5, 12, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 33, and 34. No further action.

AOC A Fuel Pumphouse/Pipeline Excavation of petroleum contaminated soils above risk-based cleanup levels.

AOC B Cargo Beach Road Drum Field. Excavation of petroleum contaminated soils above risk-based cleanup levels.

AOC C Housing and Operations Landfill. Land use controls, five-year reviews and long term monitoring.

AOC D Pipeline Break . Land use controls, five-year reviews and natural attenuation.

AOC E Main Operations Complex Excavation of petroleum contaminated soils above risk-based cleanup levels, natural attenuation of subsurface soils and shallow groundwater, long term groundwater monitoring, five-year reviews.

AOC F Drainage Basin. Limited excavation of contaminated sediments, natural attenuation, weirs to reduce sediment transport, five-year reviews.

AOC G Suqitughneq River Five-year reviews.

AOC H White Alice Site. Excavation of petroleum contaminated soils above risk-based cleanup levels.

AOC I PCB-contaminated soils Excavation of PCB contaminated soils above 1 mg/kg.

Land use controls will be implemented at the site. A deed notice informing the landowners that certain areas of the site are not potential drinking water sources will be applied, including a temporary restriction on installation of a drinking water well at the northeast portion of the main complex. Site conditions and requirements for conditional closure will be noted in the ADEC Contaminated Sites Database. Five-year reviews will be conducted, as necessary, for those sites where unlimited use and unrestricted exposure are not achieved.

The estimated cost is $14.6 million, as shown in Table 1. The cost estimate assumes field work over two seasons due to limited available funds per fiscal year. The actual scheduling of field work is conceptual, and will be determined by the remediation contractor.

Risk Assessment Summary

The Final Human Health and Ecological Risk Assessment (MWH, 2004) for the Northeast Cape installation evaluated the potential risks associated with exposure to soil, sediment, shallow subsurface water, groundwater, and subsistence food consumption. The risk assessment included incidental ingestion, dermal contact, and dust inhalation as components of the human exposure for soil. The ingestion of groundwater was evaluated directly and not with the modeled migration to groundwater pathway for soils. The risk assessment also evaluated the subsistence consumption of fish and plants harvested from impacted areas of the Northeast Cape site and from locations in the vicinity of the installation that are not impacted by site activities.

Under a future permanent resident scenario, complete exposure pathways include the incidental ingestion and contact with soils or sediment, dust inhalation, and ingestion or contact with surface or subsurface waters. Potential future human health risks will depend upon the specific site inhabited and the source of potable water. Site-specific risk assessment results are discussed later in each Site Summary section.

Potential sources of drinking water include shallow groundwater beneath the main complex, groundwater upgradient of the main complex, or fresh surface water obtained from the Suqitughneq River.

Subsistence food sources for future seasonal or permanent residents could include plants and fish collected from the site or surrounding locations. The consumption of fish collected from the Suqitughneq River as well as other nearby locations was further evaluated by the Agency for Toxic Substances and Disease Registry (ATSDR, 2005) and they concluded no adverse health effects are likely to result from ingestion of the subsistence-caught fish species.

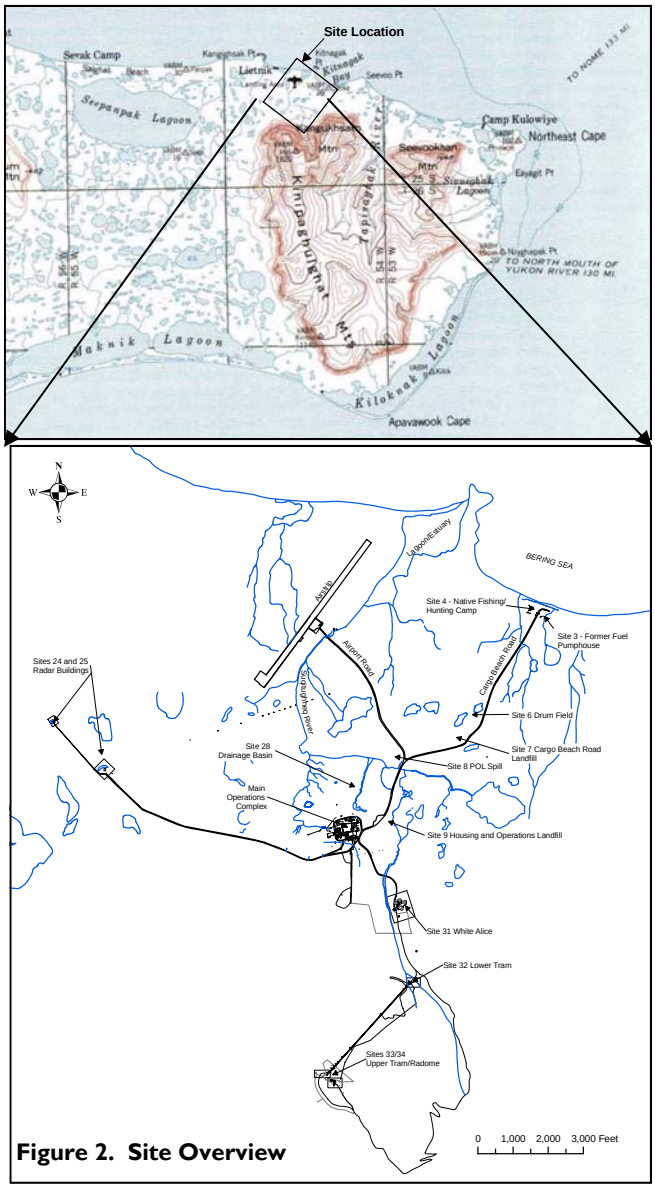


Figure 2. Site Overview

Table 1. Estimated Cost of Preferred Alternatives

FIELD SEASON #1		**FIELD SEASON #2**	
Mobilization/Demobilization (Year 1)	$4,700,000	Mobilization/Demobilization (Year 2)	$1,500,000
Field Work (Year 1) *		Field Work (Year 2)	
AOC E - Excavate/Dispose 6,000 CY POL soil at Main Operations Complex	$3,600,000	AOC A - Excavate/Dispose 60 CY POL soil at Fuel Pumphouse and Pipeline	$100,000
AOC I - Excavate/Dispose 260 CY PCB soil at Sites 13 and 31	$200,000	AOC B - Excavate/Dispose 2,700 CY POL soil at Cargo Beach Road Drum Field	$750,000
		AOC D - Natural Attenuation of Pipeline Break	$160,000
		AOC F - Excavate/Dispose 2,200 CY POL soil and Construct 2 Weirs at Drainage Basin	$2,140,000
		AOC H - Excavate/Dispose 15 CY POL soil at White Alice Site	$80,000
Land Use Controls Set-Up	$200,000	Land Use Controls Implementation	$70,000
Subtotal - YEAR 1	**$8,700,000**	**Subtotal - YEAR 2**	**$4,800,000**
		Long Term Monitoring & 5 Year Reviews	**$1,100,000**
		TOTAL	**$14,600,000**

* actual scheduling of field work to be determined by selected remediation contractor

Proposed Plan

Remedial Action Objectives and Proposed Cleanup Levels

Upper Tram Towers (2002)

The Remedial Action Objectives for the Northeast Cape site are to protect human health and the environment; and comply with applicable Federal, State and local laws and regulations. The remedial actions will prevent current and future exposure to contamination that exceeds the risk-based, site-specific cleanup standards.

Chemical-specific applicable, or relevant and appropriate requirements (ARARs) for Northeast Cape include regulations promulgated by the State of Alaska in the Oil and Other Hazardous Substances Pollution Control Regulations, Title 18 Alaska Administrative Code, Chapter 75. Under these regulations, groundwater cleanup levels are specified in 18 AAC 75.345 Table C. The ADEC regulations also allow alternate cleanup levels for soil and sediment to be developed based on site-specific conditions or a risk assessment, following methods specified in 18 AAC 75.340.

The proposed cleanup levels for soil, sediment, groundwater, and surface water at Northeast Cape are discussed below and in more detail in the Feasibility Study. A secondary remedial action objective is to prevent migration of contaminants in soils to surrounding surface waters. Remedial actions will minimize impacts to sensitive areas (e.g., wetlands).

As part of the remedial investigation process, the levels of contaminants in soil, sediment, groundwater, and surface water were compared to risk-based screening levels and regulatory cleanup criteria.

Cargo Beach (2006)

Soil

Site-specific soil cleanup levels were calculated based on a future permanent resident scenario that assumed lifetime exposure to contaminated soils through incidental ingestion (e.g., eating soil), inhalation (e.g., dust), or dermal (skin) contact. These soil cleanup levels are protective of human health and the environment and are proposed for all Areas of Concern at Northeast Cape. The proposed cleanup levels are listed in Table 2.

The Feasibility Study also evaluated the migration to groundwater pathway and calculated soil cleanup levels based on the potential for contaminants in soil to impact a current or future drinking water source. The migration to groundwater pathway is not applicable at most areas of Northeast Cape due to the presence of permafrost, low water yields, and intermittent seasonal availability.

Cleanup levels based on the migration to groundwater pathway are not proposed for Northeast Cape. The Main Complex is the only impacted area at Northeast Cape where this pathway may be considered complete, since the shallow groundwater at this location is a potential future drinking water source. Impacts to the shallow groundwater will be addressed directly and the proposed risk-based cleanup levels based on the soil ingestion pathway are protective of current and future human receptors at the Main Complex.

The Feasibility Study contains more detailed information on the input parameters, assumptions, and equations utilized to calculate the proposed cleanup levels.

Table 2. Proposed Soil Cleanup Levels Ingestion Pathway

Chemical of Concern	Cleanup Level (mg/kg)
Benzene	2
Ethylbenzene	21
Naphthalene	120
Polychlorinated Biphenyls (PCBs)	1
Diesel Range Organics (DRO)	9,200
Residual Range Organics (RRO)	9,200

Surface Water

Surface water cleanup levels are the same as the groundwater cleanup levels, assuming the water is used as a drinking water source. In addition, surface water must meet water quality standards as promulgated by the State of Alaska in 18 AAC 70.

The water quality criteria for petroleum hydrocarbons, oil, and grease are set out in a table in regulation at 18 AAC 70.020 (b). For petroleum the cleanup levels are 0.010 milligrams per Liter (mg/L) total aromatic hydrocarbons (TAH) and 0.015 mg/L total aqueous hydrocarbons (TAqH). TAH is the sum of concentrations of benzene, toluene, ethylbenzene, and xylenes, commonly called BTEX. TAqH is the sum of concentrations of TAH (BTEX) plus the polycyclic aromatic hydrocarbons (PAH).

Measuring stream flow in the Suqitughneq River (2002)

Groundwater

Groundwater cleanup levels were developed in the Feasibility Study. The primary area of concern with contaminated groundwater is the vicinity of the Main Operations Complex. The shallow groundwater at this location is considered a potential future drinking water source. The shallow groundwater at low-lying tundra areas of the Northeast Cape site (Sites 3, 4, 6, 7, and 9) is not a current or reasonably expected potential future drinking water source.

The tundra north of the Suqitughneq River and near the Bering Sea contains percolated rainfall and seasonally-thawed water within the active layer of the shallow soils. The shallow groundwater in these areas is not always available. Monitoring wells installed in tundra areas are extremely slow to recharge, and the volume of water is unreliable and insufficient to support sustained yields for either subsistence or permanent residents water needs. Shallow groundwater is anticipated to be available for use only during the short summer season and therefore would not be a feasible source of drinking water for year-round residents. Areas of shallow groundwater near the Bering Sea could also be impacted by saltwater intrusion, which would affect its usability.

Groundwater cleanup levels for the Main Complex are based on the 18 AAC 75.345 (b)(1) Table C levels. Cleanup levels for Tundra Areas are based on 18 AAC 75.345(b)(2) which states groundwater must meet a concentration equal to 10 times the cleanup levels in Table C, based on a determination of groundwater use made under 18 AAC 75.350 that groundwater is not a current or reasonably expected potential future drinking water source. Table 3 summarizes the proposed groundwater cleanup levels for contaminants of concern.

Areas with non-drinking water designations include the Fuel Pumphouse at Cargo Beach (Sites 3 and 4) and the Drum Field (Site 6) and Landfills (Sites 7 and 9). The ADEC concurs (letter dated May 24, 2007) that the shallow unconsolidated waters in these tundra areas have poor transmissivity, poor storage, are associated with discontinuous permafrost, and are very unlikely to be transported to a potential drinking water source.

East side of Site 7 Cargo Beach Road Landfill

Table 3. Proposed Groundwater Cleanup Levels

Chemical of Concern	Non-Drinking Water	Main Complex
	Cleanup Level [b] (mg/L)	Cleanup Level [a] (mg/L)
Arsenic	0.5	0.05
Lead	0.15	0.015
Nickel	1.0	--
Zinc	110	--
Diesel Range Organics (DRO)	15	1.5
Gasoline Range Organics (GRO)	--	1.3
Residual Range Organics (RRO)	11	1.1
Benzene	--	0.005
Ethylbenzene	--	0.7

Notes:
[a] value is from Table C of 18 AAC 75.345, Table C
[B] value based on 18 AAC 75.345(b)(2)
-- no value, not considered a chemical of concern

Proposed Plan

Sediment

Estuary and Suqitughneq River near Airport Road bridge (2006)

Sediment cleanup levels were developed for continuously submerged sediments at Areas of Concern at Northeast Cape. Sediments that are intermittently submerged (i.e., ephemeral ponds, wet tundra) were treated as soil for the purpose of evaluating sites for potential contamination, see Table 2 for soil cleanup levels.

Several areas at Northeast Cape contain predominantly continuously submerged sediments, including the Suqitughneq River and Estuary (AOC G), portions of the Drainage Basin (AOC F), and the Pipeline Break (AOC D).

Contaminants of potential concern in sediment at these sites were identified using ecological screening criteria and human health standards. Sediment sampling data was compared with a range of existing risk-based sediment screening levels from various information sources.

Sediments were analyzed for petroleum hydrocarbons as well as hazardous constituents. Petroleum is not a hazardous waste under CERCLA, but is regulated by the state of Alaska as a pollutant. Screening and cleanup levels for petroleum hydrocarbons in sediment are not available. Thus, the evaluation of petroleum hydrocarbons in sediments relied primarily on the concentration of individual polycyclic aromatic hydrocarbons (PAHs) and other constituents.

Ecological effects of contaminants in the Drainage Basin and Suqitughneq River were evaluated in the site-specific ecological risk assessment. Based on the conceptual site model and available chemical data, there were no predicted adverse ecological effects in the Suqitughneq River. The Drainage Basin has the potential for adverse ecological effects on benthic organisms or small rodents, but these impacts have not been confirmed.

The proposed cleanup levels for continuously submerged sediments are shown in Table 4. The sediment cleanup levels are risk-based numbers protective of biological resources (including acute and chronic effects) and represent no significant health risk to humans. Risk-based sediment cleanup levels were derived from several sources, including the State of Washington, Sediment Minimum Cleanup Levels, or consensus-based Probable Effects Concentrations (PEC) developed by MacDonald et al. for the USEPA, Great Lakes National Program Office. Sediment minimum cleanup levels represent minor adverse effects which do not result in significant human health risk. Probable effects concentrations represent levels above which harmful effects are likely to be observed.

The proposed cleanup levels for bulk petroleum hydrocarbons (DRO/RRO) were calculated based on potential human health exposure via the incidental ingestion/dermal contact routes, using a future residential scenario. The cleanup level is also protective of ecological resources.

The proposed cleanup level for PCBs is shown on a dry-weight basis, normalized for organic carbon content. The cleanup level conservatively assumes the sediments contain 1% total organic carbon. Actual organic carbon concentrations in the sediments of Northeast Cape vary considerably, and range from 2.5% - 5.5% in the Suqitughneq River, to 14% in the Drainage Basin. Higher levels of organic carbon would result in a higher PCB cleanup level.

Table 4. Sediment Cleanup Levels

Chemical of Concern	Cleanup Level mg/kg DW
PAHs	
2 –methylnaphthalene [a]	0.6
Acenaphthene [a]	0.5
Benzo(g,h,i)perylene [b]	1.7
Fluoranthene [b]	2.0
Fluorene [a]	0.8
Indeno(1,2,3-cd)pyrene [b]	3.2
Naphthalene [a]	1.7
Phenanthrene [a]	4.8
Total LPAH [a]	7.8
Total HPAH [a]	9.6
PCBs [a,b]	0.7
METALS	
Chromium [a]	270
Lead [a]	530
Zinc [a]	960
DRO [c]	3,500
RRO [c]	3,500

Notes:
[a] Washington State Administrative Code WAC 173-204-520, Table III, Sediment Minimum Cleanup Level (WAC, 1995)
[b] MacDonald et al, Consensus-based Probable Effects Concentration (PEC) (USEPA, 2002)
[c] protective of human health, future residents based on the incidental ingestion/dermal contact routes, exposure frequency 90 days/year, and a target HQ of 0.1

DRO – diesel range organics
DW – dry weight
HPAH – high molecular weight PAHs
LPAH – low molecular weight PAHs
mg/kg – milligrams per kilogram
PAHs – polynuclear aromatic hydrocarbons
PCBs – polychlorinated biphenyls
RRO – residual range organics

Evaluation of Remedial Alternatives

Sampling the Suqitughneq River (2001)

The Corps of Engineers considered the following remedial alternatives for each site:

No Further Action. No further action (NFA) is the appropriate response action when no additional remedial actions are necessary to protect human health and the environment, based on established cleanup levels and regulatory standards. NFA is required to be used as a baseline to compare all other responses.

Land Use Controls. Land use controls make use of restrictions to minimize exposure to contaminants at a site. The restrictions can be physical, such as erecting a fence, or take the form of land management practices, such as requiring special building permits or not allowing new wells in a particular area.

Site-specific Actions. A feasibility study (FS) evaluated multiple alternatives for nine groups of sites, referred to as Areas of Concern A through I. The FS provided a detailed analysis of the various alternatives considered, ranging from natural attenuation, on-site treatment including phytoremediation, landfarming, thermal treatment, and in-situ chemical oxidation, to excavation and off-site disposal.

The Corps of Engineers evaluated the remedial alternatives based on the nine evaluation criteria established under CERCLA, as shown in Table 5. A general comparison of each alternative considered in the Feasibility Study is shown in Table 12 based on these evaluation criteria.

Although the Feasibility Study considered phytoremediation and landfarming as viable alternatives at many areas of concern, these technologies are not recommended as preferred alternatives at any site. Phytoremediation and landfarming were not selected based on stakeholder input and other potential uncertainties associated with implementing these types of treatments at the remote and cold environment of St. Lawrence Island.

The proposed remedial actions focus on meeting target cleanup goals by natural attenuation or excavation of the contaminated soils. However, the decision to thermally treat the soils onsite versus offsite transportation for treatment/disposal should be determined by the selected remediation contractor after a detailed analysis of the ability to meet the performance goals within reasonable cost and time.

Table 5. Nine Criteria for Evaluation of Alternatives Under CERCLA

Criteria	*Definition*
Overall Protection of Human Health and the Environment	How well does the alternative protect human health and the environment through elimination, reduction, or control of contaminated areas?
Compliance with Applicable or Relevant and Appropriate Requirements	Does the alternative meet cleanup standards and comply with applicable state and federal laws?
Short-term effectiveness	Are there potential adverse effects to either human health or the environment during construction or implementation of the alternative?
Long-term effectiveness and Permanence	How well does the alternative protect human health and the environment after cleanup, and area there any risks remaining at the site?
Reduction of Toxicity, Mobility, and Volume through Treatment	Does the alternative effectively treat the contamination to significantly reduce the toxicity, mobility, and volume of the hazardous substance?
Implementability	Is the alternative both technically and administratively feasible? Has the technology been used successfully at similar areas?
Cost	What are the capital and operating and maintenance costs of the alternative?
Community Acceptance	What are the community's comments or concerns about the alternatives considered and about the preferred alternative? Does the community generally support or oppose the preferred alternative?
State Acceptance	Does the state regulatory agency (ADEC) support or oppose the preferred alternative?

Proposed Plan

Site Summary - No Further Remedial Action Planned

Sites Recommended for No Further Action

1	Burn Site Southeast of Airstrip
2	Airport Terminal and Landing Strip
5	Cargo Beach
12	Gasoline Tank Area
14	Emergency Power/ Operations Building
16	Paint and Dope Storage Building
17	General Supply Warehouse and Mess Hall Warehouse
18	Housing Facilities and Squad Headquarters
20	Air Force Aircraft Control Warning Building
21	Wastewater Treatment Facility
22	Water Wells and Water Supply Building
23	Power and Communication Line Corridors
24	Receiver Building Area
25	Direction Finder Area
26	Former Construction Camp
29	Suqitughneq River and Estuary
33	Upper Tram Terminal
34	Upper Camp

A number of individual sites at the Northeast Cape installation have been investigated and do not require further actions to address potential hazardous or toxic wastes. Areas proposed for No Further Remedial Action Planned (NFRAP) include Sites 1, 2, 5, 12, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 33, and 34. Additional details on each specific site are summarized in the following sections. The locations of areas proposed for no further action are shown on Figure 3.

Site 1 - Burn Site Southeast of Airstrip

An area near the airstrip was reportedly used as a burn pit or perhaps for fire training. Field observations and sampling in the vicinity have not revealed any evidence of these activities. The airstrip is located on a low, flat ridge parallel to the lower Suqitughneq River drainage. The airstrip appears to have been constructed by plowing back the active layer of peaty soil to frozen ground, placing rocky fill on the frozen ground, and grading the surface with gravel and sand.

Miscellaneous debris consisting of wires/cables between the airstrip and main complex were removed from the tundra by Bristol Environmental Engineering and Construction Services, Inc. during the 2005 field season.

Soil samples were collected in 2004 during the Phase IV remedial investigation and analyzed for fuel constituents and Resource Conservation and Recovery Act (RCRA) metals. The contaminants of potential concern are DRO and RRO. DRO concentrations ranged from 387 to an estimated 1,870 mg/kg. RRO concentrations ranged from 4,550 to an estimated 19,300 mg/kg.

Assuming future residential use at Site 1, the primary exposure pathway is incidental ingestion/ contact with contaminated soils. The migration to groundwater pathway is not applicable because the shallow groundwater at this location is not a reasonably expected potential drinking water source. The proposed soil cleanup levels are 9,200 mg/kg DRO and 9,200 mg/kg RRO.

RRO is the only contaminant of concern that exceeded the proposed cleanup level at one location. However, the isolated detection of RRO does not exceed the ADEC's maximum allowable concentration of 22,000 mg/kg in 18 AAC 75 Table B2. The area affected is limited in extent, and it is highly unlikely a human receptor would be exposed for long enough duration to pose a potential risk.

The concentration of RRO detected at the site does not represent a risk to human health or the environment, including downgradient surface water. In addition, the detected analytes will decrease with time due to natural attenuation.

No further action is proposed for Site 1.

Site 2 - Airport Landing Strip and Terminal

Airport terminal building prior to demolition (2001)

The airport terminal area consisted of two buildings, an operations/control tower and transformer shed, and the gravel apron pad located on the southeast side of the airstrip. An above ground storage tank (AST) was also located at the southeast corner of the tower building.

The terminal building and other miscellaneous debris were removed in 2003; including 44 tons of inert waste, 3 tons of scrap metal, and 2 tons of asbestos-containing materiel (ACM). The AST (1,000-gallon) was removed in 2000 by Nugget Construction. The transformers were removed in 1995 by Northwest Enviroservices.

Soil samples were collected during the 1994 and 1998 remedial investigation and analyzed for benzene/toluene/ ethylbenzene/xylenes (BTEX), fuels, metals, PAHs, and polychlorinated biphenyls (PCBs). DRO ranged from 8.2 to 376 mg/kg, whereas RRO ranged from 45 to 120 mg/kg. No other compounds were detected above screening levels.

Site 2 - Airport Landing Strip and Terminal (continued)

The detected contaminants do not exceed the proposed risk-based cleanup levels, and do not pose a risk to human health or the environment.

No further action is proposed for Site 2.

Cargo Beach, view east (2006)

Site 5 - Cargo Beach

The Cargo Beach area is immediately north of the hunting and fishing camp and extends west and east from the Cargo Beach Road. The area was used for barge off loading operations.

Bristol Environmental removed exposed debris at the Cargo Beach site during the 2003 and 2005 field seasons. A total of 26 tons of inert waste were transported off-island for disposal in 2003. Additional piles of miscellaneous debris and scrap metal were removed in 2005.

Chemical contamination has not been detected at this site.

No further action is proposed for Site 5.

Cargo Beach, view west (2006)

Site 12 - Gasoline Tank Area

This site contained two ASTs (approximately 30,000 and 15,000 gallons) used for gasoline storage and a fuel pump inside a shed immediately east of the two tanks.

During the 1994 investigation, no evidence of spills or leaks was observed around the tanks. Site 12 was sampled during the Phase II remedial investigation, to verify the ASTs had not contributed to contamination of the surrounding gravel soils. Six soil samples were collected in 1999 and analyzed for petroleum hydrocarbons and BTEX. The sampling results indicated DRO concentrations ranged from 29 to 140 mg/kg, RRO ranged from 230 to 560 mg/kg, and benzene was not detected. The soil does not pose a potential risk to human health or the environment and does not exceed the proposed cleanup levels. The tanks were removed in 2000. No further action is proposed for Site 12.

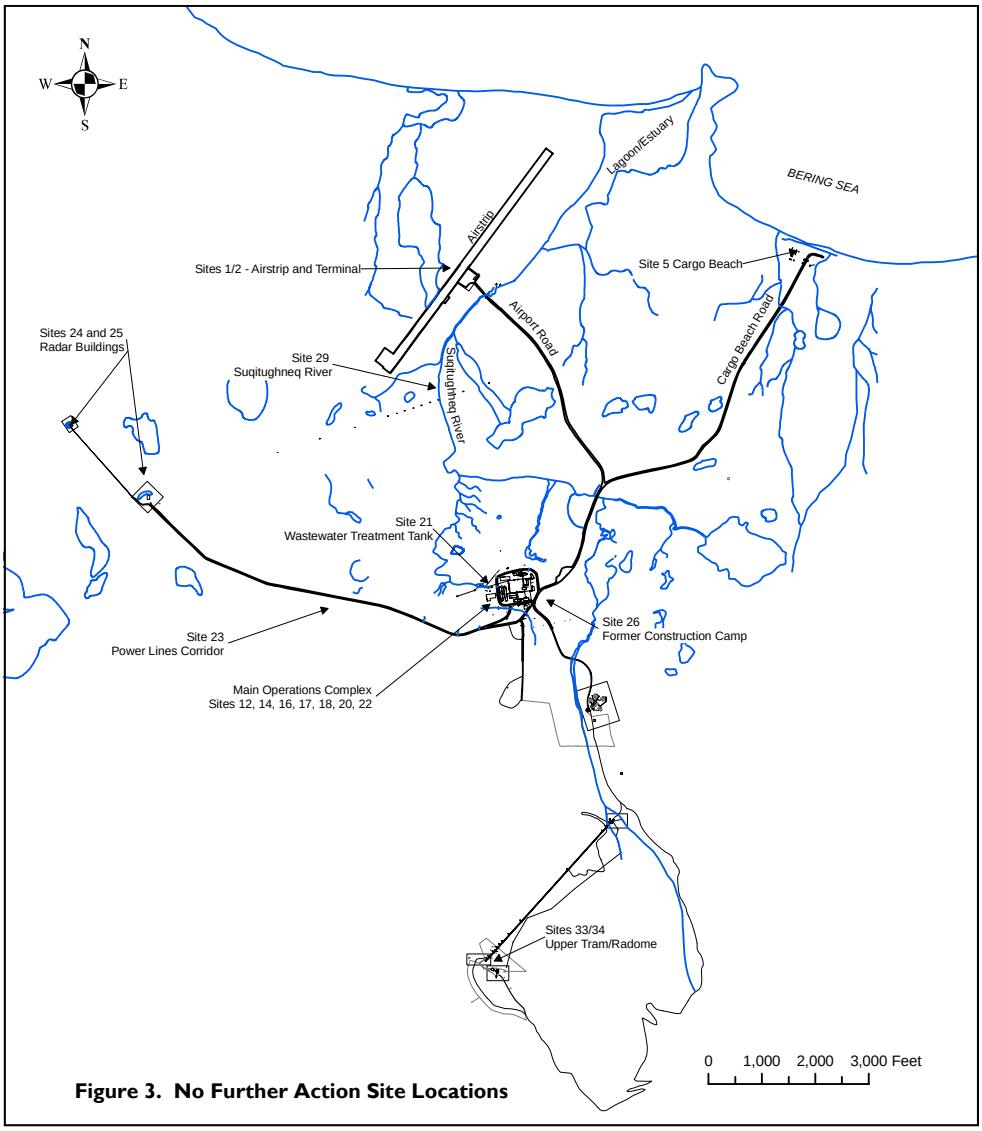


Figure 3. No Further Action Site Locations

Proposed Plan

Site 14 - Emergency Power Building

Building 98 Emergency Power during demolition (2001)

This site includes Building 98 and the immediately adjacent area. A 5,000-gallon AST was located on the south side of the building, as well as a transformer pad.

The building and tank were removed in 2001. PCB-contaminated soils, approximately 7.2 tons, were also excavated and disposed offsite during the 2005 field season.

The primary contaminant of concern is PCBs in soil. Historical soil sampling (1998 and 2001) indicated PCBs were present near a former concrete transformer pad area at concentrations ranging from 0.2 to 19 mg/kg. Two discrete areas of contaminated soil were identified and excavated during the 2005 field season to a depth of 1.5 and 3.0 feet below ground surface.

Soil confirmation samples were collected from the bottom of each excavation and verified that no PCBs remain above 1 mg/kg. The concentration of PCBs at the bottom of each excavation was 0.206 and 0.0526 mg/kg, respectively.

No further action is proposed for Site 14.

Site 16 - Paint and Dope Storage Building

Building 98 Emergency Power, concrete pad post demolition (2005)

This site consisted of a wood-framed building located on the north side of the perimeter access road surrounding the main operations complex. The site was originally a flammable liquids storage facility. The building, miscellaneous debris, 3 tons of stained soils, and an AST were removed in 2001.

Environmental sampling activities for Site 16 included the collection of soil and shallow groundwater samples. The primary contaminants of concern in soil were arsenic, antimony, lead, and PCBs. The detected arsenic and antimony levels were attributable to naturally occurring background levels. The maximum concentration of PCBs was 1.4 mg/kg in one surface soil sampling location adjacent to the building foundation in 1994; all 7 other sampling results were less than 1 mg/kg. The average PCB concentration is 0.78 mg/kg, which is less than the cleanup level.

Lead was detected above the residential cleanup level of 400 mg/kg at two locations. Three soil borings and 8 surface soil locations were sampled for lead in 1994. The concentrations of lead ranged from 18 to 822 mg/kg in surface soil; and from 18 to 157 mg/kg in subsurface soils. Two additional samples were collected in 2001, the concentration of lead ranged from 42 to 240 mg/kg. The lead exceedances are isolated in extent and may have been removed with the stained soils.

The primary contaminants of concern in shallow groundwater were cadmium and trichloroethene (TCE). The shallow groundwater at Site 16 was evaluated in the risk assessment as a potential future drinking water source, including the ingestion, dermal contact, or inhalation of volatile organics pathways. The risk assessment indicated potential carcinogenic risks ($1x10^{-4}$) for a future resident consuming the shallow groundwater due to a single detection of TCE at 0.0033 mg/L in 1994. Follow up groundwater sampling was conducted in 1998 and TCE was not detected. The presence of TCE was an isolated occurrence and did not exceed the USEPA maximum contaminant level (MCL), or the ADEC Table C groundwater cleanup level of 0.005 mg/L. The MCLs for groundwater are protective of human health.

Cadmium and lead were detected in 1994 above screening levels in the shallow groundwater. Cadmium contributed to potential noncancer risks (hazard index of 7). However, metals were not detected in the dissolved phase, after filtering of the water samples. The metals therefore, were due to suspended sediment particles in the water column.

Shallow groundwater at Site 16 is intermittent in nature. Additional groundwater sampling was attempted in 2004, but not completed due to insufficient water in the monitoring wells. Given the intermittent nature of the shallow groundwater at Site 16, it is very unlikely a future drinking water supply could be established and utilized over an entire year.

No further action is recommended for Site 16. The risk assessment results are within the risk management range set by the USEPA. The concentration of TCE in shallow groundwater is below MCLs, was not confirmed in subsequent sampling, and the detections of cadmium and lead were isolated and due to suspended sediments in the water column.

Site 17 - General Supply and Mess Hall Warehouses

This site included Buildings 107 and 111 at the main complex. The warehouses were used to store miscellaneous materials required for general base operations.

The buildings were demolished and removed during the 2001 and 2003 field seasons.

No sources of contamination were identified during the remedial investigation.

No further action is proposed for Site 17.

Site 18 - Building 99 prior to demolition (2003)

Site 18 - Housing Facilities and Squad Headquarters

This site included Buildings 99, 100, 101, 102, 104, 105, 106, 125 and 130, as well as the connecting utilidors and immediate surrounding area. The buildings were investigated for the presence of hazardous substances such as lead-based paint and asbestos-containing materials (ACM).

All structures were demolished and disposed off-site during 2001 and 2003.

No contamination was identified during the remedial investigation.

No further action is proposed for Site 18.

Site 18 - Building 99 under demolition (2003)

Site 20 - Aircraft Control and Warning Building

Site 20 included Building 103 at the housing and operations complex. The building was inspected for ACM, demolished, and disposed offsite during the 2003 removal action.

No contamination was identified in the immediate vicinity of this structure.

No further action is proposed for Site 20.

Site 21 - Wastewater Treatment Tank System

Site 21 included the wastewater treatment system for the Main Housing and Operations complex. The facility was located west of the perimeter road and consisted of a concrete septic settling tank which discharged via an 8" insulated cast iron pipe to the wetland area approximately 450 feet to the west.

The septic tank compartments were cleaned and decommissioned during the 2003 removal action. The utilidor corridor from the main complex to the septic tank and the wooden utilidor outfall line were also removed in 2003. Soil confirmation samples were collected from underneath the inlet and outfall lines, adjacent to and below the lowest level of the septic tank, and from beneath the wooden utilidor corridor. The concrete sidewalls and floor of the tank were also sampled prior to demolition. All PCB sampling results from the concrete were equal to or less than 1 mg/kg. The concrete tank was broken up and buried in place.

Soil, sediment, surface water, and shallow groundwater samples were collected at Site 21 throughout the various phases of remedial investigation. Arsenic and PCBs were identified as primary contaminants of concern during the investigations.

During the 1994 investigation, PCBs were detected in surface soils at one location due west of the septic tank. The sample was analyzed in triplicate and the results ranged from 0.93 to 4.2 mg/kg. PCBs were not detected in the other soil or sediment samples. Sludge from within the septic tank was sampled in 1999 and contained total PCBs at a concentration of 120 mg/kg. Additional samples were collected from soils surrounding the tank and outfall pipe in 2001 and PCB were detected at a maximum concentration of 0.18 mg/kg.

Confirmation samples were collected in 2003 after decontamination and decommissioning of the septic tank. The sampling results demonstrated that PCBs had not migrated through the concrete. A total

Site 21 wastewater tank prior to demolition (2001)

Proposed Plan

Site 21 - Wastewater Treatment Tank (continued)

Outfall pipe and collapsed utilidor at Site 21 (2002)

of 17 samples were collected from beneath the concrete tank, beneath the outfall pipe adjacent to the tank, and from the bottom of the wooden utilidor corridor. PCBs were not detected in the samples collected from beneath the concrete tank and the wooden utilidor. PCBs were detected at 1.7 mg/kg in only one sample, collected immediately beneath the outfall piping adjacent to the septic tank.

Arsenic was detected at a single location at an anomalous concentration of 170 mg/kg in surface soil downgradient of the septic tank outfall during the 1994 investigation. Other surface soil and subsurface soil samples collected in 1994 at Site 21 contained arsenic at levels ranging from 2.8 to 39 mg/kg. Additional surface soil and sediment samples were collected from the surrounding tundra near the septic tank outfall in 2001 and arsenic concentrations ranged from 4.5 to 14.7 mg/kg and were within the range of ambient levels for the Northeast Cape site. During the 2003 removal action, arsenic was detected in tundra soil samples collected from immediately beneath the demolished utilidor corridor and concentrations ranged from 11.4 to 35.2 mg/kg.

The arsenic detections are likely attributable to naturally occurring minerals in the tundra soils. There is no other known source for the detected arsenic.

Chromium was identified as a potential contaminant of concern during the remedial investigation, but did not exceed ambient levels established for Northeast Cape. The maximum detected concentration of chromium in soil was 42 mg/kg, compared to the ambient level of 48 mg/kg for the site. Soil confirmation samples collected in 2003 along the utilidor corridor and adjacent to the septic tank bottom contained chromium at concentrations ranging from 21.3 to 109 mg/kg. Chromium in soil exists predominantly in the trivalent state, and the levels do not pose a potential risk to residents.

The primary contaminant of concern in shallow groundwater is arsenic. Arsenic was detected above cleanup levels during the 1994 investigation at one location. Surface water samples collected downgradient of the monitoring wells did not contain arsenic above action levels. The arsenic detected in the shallow groundwater was due to sediments in the water column.

No further action is proposed for the Site 21 wastewater treatment tank area. The extent of PCBs and arsenic detected at concentrations above cleanup levels is spatially limited and does not pose a threat to human health or the environment.

Site 22 - Water Wells and Water Supply Storage Building

Demolition in progress at Main Complex (2003)

This site included the water storage building, the pumphouse, and four water wells. The water storage building held four 20-foot diameter and 26-foot high water storage tanks. An underground storage tank (UST) was located adjacent to the pumphouse.

The buildings were demolished, the UST was removed, and the water wells were decommissioned during the 2001 field season. Approximately 18 cubic yards of soil were removed from the tank excavation. A small area of stained soil from within the water supply storage building was also excavated. All containerized wastes were removed from the buildings prior to demolition.

The water wells were sampled prior to decommissioning; residual range organics were detected in one water sample above the cleanup level. Diesel range organics were also detected in subsurface soils from the bottom of the tank excavation, but did not exceed the risk-based cleanup levels.

Sampling data demonstrates that source removal of the UST successfully reduced the potential for migration of contamination to the groundwater. In 2004, two monitoring wells were installed downgradient of the former pumphouse and water storage building. The sampling results confirmed that the shallow groundwater is not impacted by fuel contamination. Soil borings surrounding the UST excavation also demonstrated that contamination has not migrated laterally or vertically.

No further action is proposed for Site 22.

Site 23 - Power and Communications Line Corridor

The power and communications line corridors extended from the main complex to the outlying facilities west along the access road.

During the 2003 and 2005 field seasons, debris was removed from the corridors in conjunction with the removal action at Sites 24 and 25. Two discrete areas along the corridor were investigated during 1994 based on field observations of potential contaminant sources. Soil samples were collected and analyzed for fuels and PCBs. Some DRO and low level PCBs were detected, but the concentrations were below cleanup levels. All potential sources of contamination have been removed.

No further action is proposed for Site 23.

Antenna poles prior to demolition (2001)

Site 24 - Receiver Building

The receiver building area was located approximately 1.5 miles west of the main operations complex. It consisted of a reinforced concrete building on concrete pillars. The equipment associated with the building was removed during deactivation of the installation. The gravel pad is suspected to consist of empty drums covered with gravel.

The concrete building was demolished (49 tons) and used as backfill in low areas at the main operations complex during the 2003 removal action. Miscellaneous debris (i.e., inert waste and scrap metal) was also removed from Site 24 and the connecting corridor, extending back to the main operations complex and Site 25, during the 2003 field season. A total of 15 tons of solid waste and 4 tons of scrap metal debris were removed near Site 24 in addition to the building itself.

During the 1994 remedial investigation, soil, water, and sediment samples were collected and analyzed for petroleum compounds, volatile organics, PAHs, and metals. The primary contaminant of concern was diesel range organics. The maximum detected concentration of DRO was 4,250 mg/kg in tundra soils. Surface water and shallow groundwater samples did not exceed 1.5 mg/L DRO.

In 2001, two additional sediment samples and one surface water sample were collected. The surface water sample did not contain any contaminants of concern. One sediment sample contained DRO at 4,600 mg/kg, which does not exceed the risk-based soil cleanup level of 9,200 mg/kg. Antimony was also detected in the sediment at a maximum concentration of 70 mg/kg, compared to the ADEC soil cleanup of 41 mg/kg. The soil, sediment, and water samples collected in 1994 were analyzed for antimony; all results were non detect. Since the 2001 detection was isolated, and potential sources of contamination (e.g., debris) have been removed, the antimony does not pose a significant risk to human health and the environment.

The primary human exposure pathway is ingestion or dermal contact with soil or sediment. The observed shallow groundwater at this location is not a reasonably expected potential drinking water source. Sampling data has demonstrated that contaminants were not detected above ADEC drinking water standards in the groundwater or surface water. The concentrations of petroleum hydrocarbons in soil/sediment do not exceed the risk-based cleanup levels.

No further action is proposed for Site 24.

Receiver building prior to demolition (2001)

Site 25 prior to demolition (2001)

Site 25 - Direction Finder Area

This site originally contained a small building with radio equipment. The building had been burned and the debris pushed to the sides of the gravel pad when the installation was deactivated.

Scattered drums on or near the gravel pad, as well as an estimated 5 tons of incidental stained soils were removed during the 2000 removal action. Miscellaneous debris (13 tons) was also removed from

Site 25 after removal action activities (2004)

Proposed Plan

Site 25 - Direction Finder Area (continued)

Tramway tower during demolition (2005)

Site 25 and the connecting corridor extending back to the main operations complex during the 2003 field season.

Soil, sediment, surface, and groundwater were sampled during the Phase I remedial investigation. DRO concentrations ranged from 190 to 1,100 mg/kg. Stained surface soils were excavated and removed during the 2001 field season. Groundwater and surface water samples did not contain DRO above 1.5 mg/L.

This site does not pose a risk to human health and the environment and meets all cleanup levels.

No further action is proposed for Site 25.

Site 26 - Former Construction Camp

The former Construction Camp area was located adjacent to and upgradient of the Main Operations complex, southeast of the perimeter access road. The site consisted of a flat gravel pad area and a pumphouse shed. There were no other existing structures or debris at this location.

The pumphouse shed was demolished and removed in 2001. A water supply well at this site was also decommissioned in 2001. The former water supply well was sampled before being decommissioned. The groundwater sample was analyzed for fuels, metals, and volatile organic compounds (VOCs). No contaminants of potential concern were detected. In 2004, a new monitoring well was installed at Site 26 to further evaluate the groundwater and provide an upgradient monitoring well for the Main Operations Complex. A second monitoring well was installed downgradient of the site, northeast of the main complex along the beach access road south of the Suqitughneq River bridge. No contaminants of concern were identified in the groundwater samples.

There are no contaminants of concern in the groundwater at this location. The existing well may serve as an upgradient monitoring well for the Main Operations Complex.

No further action is proposed for Site 26.

Site 33 - Upper Tram Terminal

Tram Towers prior to demolition (2005)

A tramway linked the lower tram terminal building with the radome area, located on top of Mt. Kangukhsam. The site consisted of a tram terminal building connected to the Upper Camp by an enclosed track man-lift.

The structures and tram towers were demolished and removed during the 2003 and 2005 field seasons.

During the 2001 remedial investigation, surface soil samples were collected from stained soil areas outside the upper tram bay. DRO concentrations ranged from ND to 660 mg/kg. RRO was below screening levels and PCBs were not detected.

No further action is proposed for Site 33.

Site 34 - Upper Camp

The Upper Camp is located at the top of Mt. Kangukhsam and consisted of a substation transformer pad, two ASTs, a radome building, and the upper quarters building.

Scattered drums were removed during a previous removal action. The site structures and ASTs were demolished and removed during the 2003 field season.

Historical soil sampling indicated the presence of PCBs at a maximum concentration of 1.4 mg/kg in soil adjacent to the concrete transformer pad. During the 2001 investigation, additional surface soil samples were collected from a grid around the former pad. PCBs were detected at a maximum concentration of 1.06 mg/kg.

Soil samples were also collected and analyzed for fuels and/or PCBs and PAHs from various locations near the ASTs, an outfall pipe, the former drum field, and background locations. DRO was detected at concentrations ranging from ND to 1,100 mg/kg. RRO was not detected above screening levels. PCBs and PAHs were not detected.

The DRO and PCBs detected do not pose a potential risk to human health or the environment.

No further action is proposed for Site 34.

Radome during site operations (1960's)

Radome post-demolition and cleanup (2003)

AOC A – Fuel Pumphouse and Pipeline
- 3 Fuel Line Corridor and Pumphouse
- 4 Subsistence Fishing and Hunting Camp

AOC B – Cargo Beach Road Drum Field
- 6 Cargo Beach Road Drum Field

AOC C – Housing and Operations Landfill
- 9 Housing and Operations Landfill

AOC D – Pipeline Break
- 8 Fuel Line Break POL Spill Site

AOC E - Main Operations Complex
- 10 Buried Drum Field
- 11 Fuel Storage Tank Area
- 13 Heat and Electrical Power Building
- 15 Buried Fuel Line Spill
- 19 Auto Maintenance and Storage Facilities
- 27 Diesel Fuel Pump Island

AOC F – Drainage Basin
- 28 Drainage Basin

AOC G – Suqitughneq River and Estuary
- 29 Suqitughneq River and Estuary

AOC H – White Alice Complex
- 31 White Alice Site
- 32 Lower Tramway

AOC I – PCB-contaminated Soils
- Site-wide

Area of Concern A - Fuel Pumphouse and Pipeline

The site is located just south of Cargo Beach on Kitnagak Bay. A 4-inch welded pipeline was used to transfer diesel fuel from the pumphouse to the bulk storage facilities at the housing and operations area (Main Complex). The former pumphouse was situated on a gravel pad, near the local subsistence hunting camp structures. The site topography generally slopes north-northeast towards the beach.

The area between the pumphouse and the beach consists of former dunes covered with tundra. The area south of the gravel pad contains unconsolidated deposits, likely of glacial origin, with a thick tundra mat cover. Permafrost and ice-rich soil underlie the tundra.

The fuel pumphouse, fuel and water ASTs, abandoned vehicles, drums, batteries, miscellaneous debris, stained soils, and the fuel pipeline were removed during the 2000, 2001, and 2003 field seasons.

Two areas of petroleum-stained soils were excavated and disposed off-site during 2001. A total of 14 tons of contaminated soil were removed from the former fuel pumphouse gravel pad and from a former AST located west of Cargo Beach Road.

Nature and Extent of Contamination

Soil, sediment and shallow groundwater sampling were conducted as part of the remedial investigations between 1994 and 2004. Petroleum hydrocarbons have been detected in soils near the former pumphouse, outlying sediments, and in shallow groundwater downgradient of the pumphouse along the former fuel pipeline (see Figure 4).

Stained soils were excavated from the gravel pad and AST area in 2001. Soil samples collected from the bottom of the gravel pad excavation had DRO levels ranging from non-detect to 2,280 mg/kg and RRO levels from 245 to 393 mg/kg. Soil confirmation results from the AST area indicated DRO at a maximum concentration of 1,400 mg/kg and RRO up to 14,000 mg/kg (see Table 6).

Additional sampling was conducted in 2004. Concentrations of DRO in gravel soil at the former pumphouse ranged from 126 to an estimated 20,500 mg/kg; RRO ranged from 1,150 to an estimated 6,120 mg/kg. DRO and RRO were also measured in tundra soil/sediment located near the former pumphouse in 2004. Estimated DRO levels ranged from 2,610 to 3,720 mg/kg in sediment; RRO was estimated at 17,300 to 28,500 mg/kg in sediment. Samples collected from media such as tundra soil/sediment often contain high levels of naturally occurring organic compounds which are reported as residual range petroleum hydrocarbons.

Petroleum hydrocarbons have also been detected in shallow groundwater, but do not exceed the proposed cleanup levels for a non-drinking water source (see Table 7). During the 2004 field season DRO concentrations ranged from 0.433 mg/L to 3.4 mg/L. RRO in shallow groundwater ranged from 0.641 mg/L to 3.4 mg/L. The higher concentrations of RRO were detected in well points placed in the tundra, not the gravel pad.

Table 6. Soil Sampling Results at AOC A Fuel Pumphouse and Pipeline

Sample Location	Year	Depth (feet bgs)	Maximum Result (mg/kg)	
			DRO	RRO
Site 3 Pumphouse Gravel Pad	2004	2.5	**20,500**	6,120
Site 3 Bottom of Excavation	2001	1.0	2,280	393
Site 3 Tundra Soils	2004	0.8	3,720	**28,500**
Site 4 Post Excavation of Stained Soils (triplicate results)	2001	1.0	773 (388 -1,400)	6,950 (2,380-14,000)
Cleanup Level	Ingestion Pathway		9,200	9,200

Notes: bgs = below ground surface.
mg/kg = milligrams per kilogram; equal to parts per million
Bold = Values in bold denotes clean-up level exceedance

Risk Evaluation Summary

The shallow groundwater in the vicinity of this site is not a reasonably expected potential future drinking water source, based on the criteria in 18 AAC 75.350. The risk assessment evaluated the potential for human exposures to contaminated soils under a future residential scenario. The soil does not pose a carcinogenic risk (8×10^{-11}). The potential non-cancer hazard index is 4, which exceeds the criterion of 1.

Fuel pumphouse prior to demolition (2002)

Remedial Action Objectives

Site-specific soil cleanup levels for the Fuel Pumphouse and Pipeline are based on future residential use; the primary exposure pathway is incidental ingestion or contact with contaminated soils. The migration to groundwater pathway is not applicable because the shallow groundwater is not a reasonably expected potential drinking water source. The proposed soil cleanup levels are shown in Table 2 (page 4).

Preferred Alternative

The preferred alternative for Area of Concern A Fuel Pump house and Pipeline is excavation and treatment/disposal of an estimated 60 cubic yards (cy) of diesel-contaminated soils at the gravel pad. The close proximity of this site to the subsistence hunting camp slightly increases the potential for human exposure to the contaminated soil. However, the potential for significant impacts to human or ecological receptors is limited due to the nature of the contamination.

Excavation and disposal was selected after consideration of the remedial actions being proposed for other areas of the entire installation. Excavation is more cost effective than the other soil remediation alternatives evaluated, including landfarming, phytoremediation, or thermal treatment if implemented simultaneously with the remedial actions proposed for the Main Complex. The small volume of contaminated soil can be effectively remediated in the short term.

Removal of the source of contamination is protective of human health and the environment and meets the cleanup goals in a shortened timeframe compared to the natural attenuation alternative. The tundra soils identified beyond the gravel pad with RRO contamination will not be excavated because the existing soil matrix promotes binding of the organic compounds and transport to surface waters is not likely. The FS also evaluated chemical oxidation, but it was not selected because the shallow groundwater meets the cleanup levels for a non drinking water source.

Land use controls will be implemented to inform the landowners and public that the shallow groundwater is not a reasonable potential future drinking water source; and that residual contaminated soils must be properly managed if excavated. A notation on the state of Alaska Contaminated Sites database will be made.

The preferred alternative will reduce risk by removing the contaminant source and providing safe management of remaining material. This approach reduces risk sooner and costs less than the other alternatives.

Subsistence hunting camp buildings, view west of Cargo Beach Road (2006)

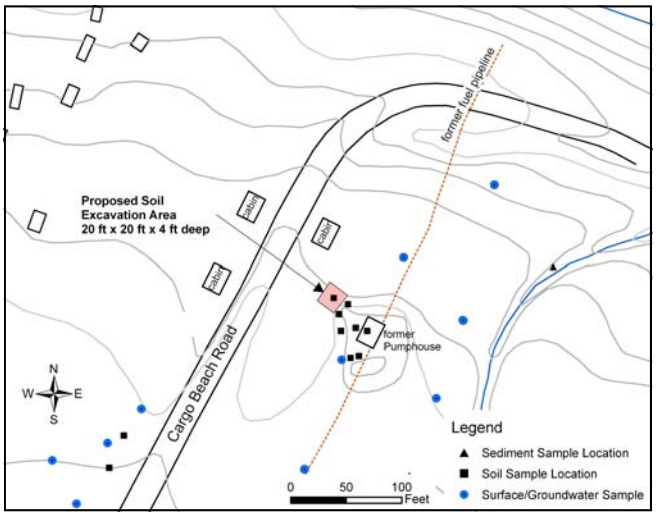


Figure 4. Fuel Pumphouse and Pipeline

Table 7. Shallow Groundwater Results at AOC A Fuel Pumphouse

Sample Location	Year	Maximum Result (mg/L)	
		DRO	RRO
Site 3 downgradient of gravel pad/tundra	2004	3.4	3.4
Site 3 downgradient of gravel pad	2001	3.3	8.1
Site 3 gravel pad	1998	14	--
Site 4 downgradient tundra	2001	2.0	6.5
Site 4 tundra	1998	3.7	6.5
Cleanup Level		15	11

Notes: mg/L = milligrams per liter; or parts per million

Area of Concern B - Cargo Beach Road Drum Field

Cargo Beach Road Drum Field, view west showing drums prior to cleanup (1994)

The Cargo Beach Road Drum Field site is located west of Cargo Beach Road, approximately 0.6 mile south of the former fuel pumphouse, and north of the Cargo Beach Road landfill. The site was used to dispose of empty drums which had contained petroleum-oil-liquid (POL) products used during operation of the installation. The site consists of relatively fine grained soils with exposed cobbles. The areas to the west-northwest and south contain boulders and large cobbles. Over 1,500 drums, an empty 500-gallon water storage tank, battery, and miscellaneous metal debris were removed during removal actions in 2000 and 2001.

Nature and Extent of Contamination

Excavation of test pit at Cargo Beach Road Drum Field (2001)

Soil, sediment, shallow groundwater, and surface water samples were collected during the 1994 remedial investigation. The results showed that diesel fuel compounds were present at the site. Additional soil sampling was conducted in 1998. In order to verify the extent of petroleum contamination detected in 1994 and 1998, additional soil, sediment, shallow groundwater, and surface water samples were collected in 2001 and analyzed for fuel-related compounds, benzene, toluene, ethylbenzene, xylenes (BTEX), metals, PCBs.

The primary contaminant of concern is DRO in soil. Metals were detected at low levels, but did not exceed cleanup levels. The maximum detected concentration of DRO in surface soils (0-2 feet) was 102,000 mg/kg; Subsurface soils contained DRO up to 3,000 mg/kg (2-5 feet); and up to 358 mg/kg (5-15 feet). The average concentration of DRO is 28,000 mg/kg.

Several metals (aluminum, arsenic, lead, nickel, and zinc) were detected in unfiltered samples of shallow groundwater to the west and northwest of the gravel pad area. It is common to detect metals in water samples that have not been filtered to remove suspended sediments. The concentration of aluminum ranged from not analyzed to 78.3 mg/L; arsenic ranged from non-detect to 0.068 mg/L; lead ranged from 0.005 to 0.23 mg/L; nickel ranged from non-detect to 1.68 mg/L; and zinc ranged from 0.1 to 17.1 mg/L. Aluminum, arsenic and zinc are not considered contaminants of concern because they did not exceed cleanup levels for a non drinking water source.

Metals have not been detected above cleanup levels in up-gradient shallow groundwater monitoring wells, or adjacent surface water. Metals were detected at low levels in soil samples collected during various phases of investigation, but did not exceed cleanup levels.

The source of the anomalous metals in shallow groundwater is either localized or due to suspended sediments in the water column and not the result of military impacts.

Two areas of contaminated soil exceed the proposed DRO cleanup level of 9,200 mg/kg. A small surface soil stain with a DRO concentration of 14,300 mg/kg was documented in 1994 at the eastern edge of the pad. More recent sampling did not detect fuels at depth (10-15 ft bgs). The stained area is about 400 square feet and 2 feet in depth.

A larger area of stained soil exists at the western portion of the pad, but sampling results have shown varying levels of contamination. Surface soil samples collected in 1994 from the edges of the gravel pad contained DRO ranging from 17,900 to 102,000 mg/kg. In 1998, a surface soil sample from the stained gravel pad area contained DRO at 9,200 mg/kg. Two test pits were excavated in 2001 and the maximum DRO concentration was 3,000 mg/kg at 5.3 ft.

The estimated volume of contaminated soil is 2,700 cubic yards, assuming excavation to a maximum depth of 5 feet.

AOC B, view northwest at former drum field (2006)

Risk Evaluation Summary

The shallow groundwater at AOC B is not a reasonably expected potential future drinking water source, based on the criteria in 18 AAC 75.350. The risk assessment also evaluated the potential for human exposures to contaminated soils under a future residential scenario. The soil does not pose a carcinogenic risk (6 x 10^{-9}). The potential non-cancer hazard index is 21, which exceeds the risk management criterion of 1.

Remedial Action Objectives

The remedial objective for the Cargo Beach Road Drum Field is to prevent exposure to contaminated soils or shallow groundwater which may pose a risk to human health and the environment. The only contaminant of concern in soil is diesel range organics.

Site-specific soil cleanup levels for AOC B are based on potential future residential use; the primary exposure pathway is incidental ingestion or contact with contaminated soils. The proposed soil cleanup level is 9,200 mg/kg DRO.

The shallow groundwater at the Cargo Beach Road Drum Field is not a current or reasonably expected potential future drinking water source. Proposed cleanup levels for the shallow groundwater are protective of a non-drinking water source. Lead and nickel are the only contaminants of concern in shallow groundwater at AOC B, and the detections may be due to suspended sediment in the water samples.

The proposed shallow groundwater cleanup levels, for a non-drinking water source are:

Lead 0.15 mg/L
Nickel 1.0 mg/L

Although the current risk posed by the fuel-related compounds in the soil is low, there is a significant volume of soil with DRO concentrations exceeding the risk-based future residential cleanup level.

Excavation of contaminated soils to a maximum depth of 5 feet bgs is protective of current subsistence users, potential future permanent residents, and potential future construction workers.

Barge departing Northeast Cape (2005)

Preferred Alternative

The preferred remedial action alternative is excavation and treatment/disposal of soil with DRO concentrations above the proposed cleanup level of 9,200 mg/kg. Excavation and disposal was selected after consideration of the remedial actions proposed for other areas of the entire installation.

Excavation is more cost effective than other remediation alternatives evaluated including landfarming, phytoremediation, and onsite thermal treatment, if implemented simultaneously with the remedial actions proposed for the Main Complex.

The other alternatives for treating the petroleum contaminated soil onsite do so at a greater cost, without providing additional protection of human health and the environment, or long-term effectiveness.

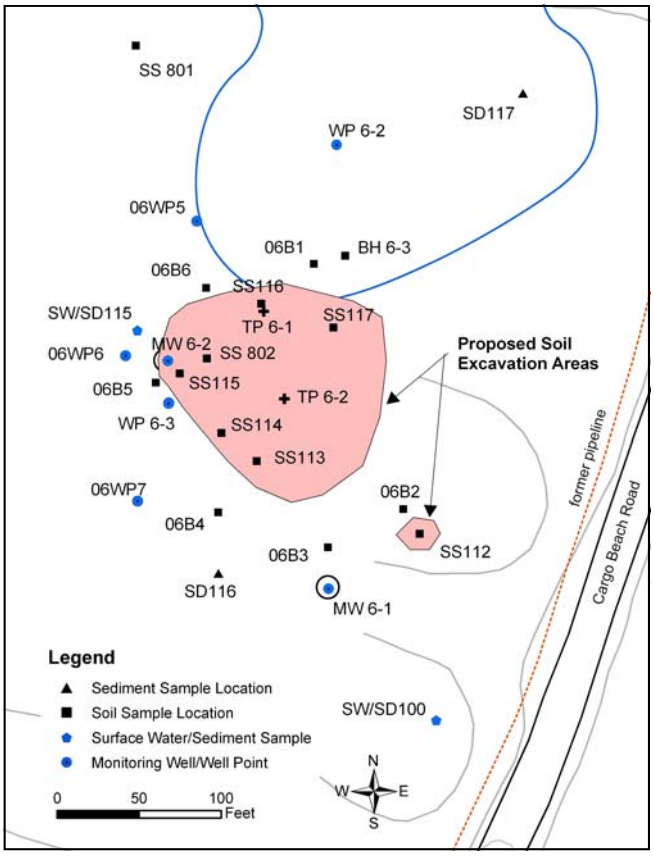
The volume of contaminated soil is estimated at 2,700 cubic yards and shown in Figure 5.

Land use controls will be implemented to inform the landowners and public that the shallow groundwater is not a reasonable potential future drinking water source; and that residual contaminated soils must be properly managed if excavated. A notation on the ADEC Contaminated Sites database will also be made.

The other alternatives evaluated consisted of no action, natural attenuation, and long term monitoring. Natural attenuation was not selected because of the uncertainty associated with achieving the proposed cleanup levels in a reasonable timeframe given the maximum concentrations of DRO, and the low probability of meeting the state of Alaska's maximum allowable levels.

The preferred remedial alternative is straightforward to implement and provides the best long-term effectiveness. Excavation and treatment/disposal of the contaminated soils meets the risk-based cleanup levels in the shortest timeframe, and is protective of current temporary or future permanent residents.

Figure 5. Cargo Beach Road Drum Field



Proposed Plan

Area of Concern C - Housing and Operations Landfill

Eastern edge of Site 7 Cargo Beach Road Landfill, before debris removal, view south (2005)

Eastern edge of Site 7 Cargo Beach Road Landfill, after debris removal, view north (2006)

Site 9 Housing and Operations Landfill area, after surface debris removal (2005)

Two landfills exist at Northeast Cape. The main solid waste dump for the installation was located 0.8 mile south of Cargo Beach, midway between the Main Operations Complex and the beach at Kitnagak Bay. This dump site is known as the Site 7 Cargo Beach Road Landfill. A second dump area was located 500 feet northeast of the Main Operations Complex in a marshy area east of Cargo Beach Road. This dump site is known as the Site 9 Housing and Operations Landfill.

The Proposed Plan does not include a proposed action for Site 7, which was evaluated in the Feasibility Study. A decision on remedial actions for the Site 7 Landfill will be made in the future under a separate document after additional geophysical information is obtained and evaluated.

Several drums of waste oil were discovered around the perimeter edges of the Site 7 Cargo Beach Road Landfill during the 2005 removal action. Liquid from one drum was drained and sent off-site for disposal. Several other drums with partial contents were left in place, but protected by placement of large rocks around them.

The Proposed Plan addresses the Housing and Operations Landfill only, which covers an estimated 3 acres. Several surface water drainages flow through the site and enter the Suqitughneq River about 1/4 mile to the north (Figure 6). This site served as a waste disposal area from 1952 until 1965 and contains miscellaneous metal debris, drums and other trash. All exposed drums, debris, and batteries were removed from the site and surrounding vicinity in 2001 and 2005.

Nature and Extent of Contamination

Environmental sampling activities at Site 9 have included the collection of soil, sediment, surface, and shallow groundwater samples (see Figure 6). The remedial investigation activities demonstrate that no significant contamination exists surrounding or migrating from the landfill.

The nature and extent of contamination at Site 7 is not discussed further in this Proposed Plan.

Metals and DRO were identified as contaminants of potential concern in soil. The maximum concentration of DRO in soil was 375 mg/kg and does not exceed the proposed cleanup level. Arsenic concentrations in soil ranged from 3.6 to 30 mg/kg, with a 95%UCL of 17 mg/kg. The arsenic detections are within the range of ambient arsenic concentrations in Alaska soils. Arsenic was eliminated as a contaminant of concern in soil.

The shallow groundwater surrounding the Site 9 landfill is not a current or reasonably expected potential drinking water source. Shallow groundwater samples were collected to evaluate the potential for contaminant migration away from the landfill.

DRO, RRO, and lead are the contaminants of concern in shallow groundwater at Site 9. Elevated levels of DRO were detected at one monitoring well (MW9-3) during the 1994 and 1998 investigations, ranging from 0.51 to 7.7 mg/L. Elevated levels of RRO were measured in one well point (WP102) during the 2001 investigation at a concentration of 4.2 mg/L. Subsequent sampling of MW9-3 in 2001 showed non-detectable level of fuels. The concentrations of DRO and RRO do not exceed the proposed cleanup levels for a non-drinking water source.

Lead was consistently detected above screening levels at all sampling locations, ranging from 0.019 mg/L to a maximum of 0.30 mg/L. During the 2001 investigation, lead exceeded the proposed cleanup level of 0.15 mg/L at only one location (MW9-3). Metals are commonly detected in poorly developed monitoring well samples. The observed lead concentrations may represent suspended sediments in the water column.

Surface water samples have also been collected from the ephemeral ponds surrounding the Site 9 landfill and lead has either not been detected or did not exceed the drinking water criteria.

No contaminants of concern were detected above cleanup levels in the surface water samples collected downgradient and within the landfill during the 2001 investigation.

Risk Evaluation Summary

The shallow groundwater in the vicinity of this site is not a reasonably expected potential future drinking water source based on the criteria in 18 AAC 75.350. The risk assessment also evaluated the potential for human exposures to contaminated soils under a future residential scenario. Arsenic was the only risk driver for soils. Even though arsenic was later eliminated as a contaminant of concern, the risk assessment results are still within the acceptable risk range (10^{-4} to 10^{-6}) specified by the USEPA.

Debris removal at Site 9 (2005)

Remedial Action Objectives

The remedial objectives for the Site 9 landfill are to limit access and exposure to the landfill contents, and prevent future impacts to the environment from migration of contamination to surface water or shallow groundwater.

The shallow groundwater surrounding the Site 9 landfill is not a current or reasonably expected potential future drinking water source. Therefore, the proposed cleanup levels for the shallow groundwater are protective of a non-drinking water source.

Lead, DRO and RRO are the contaminants of concern in shallow groundwater at Site 9. Surface water and soil at Site 9 are not impacted.

Debris removal at Site 9 (2005)

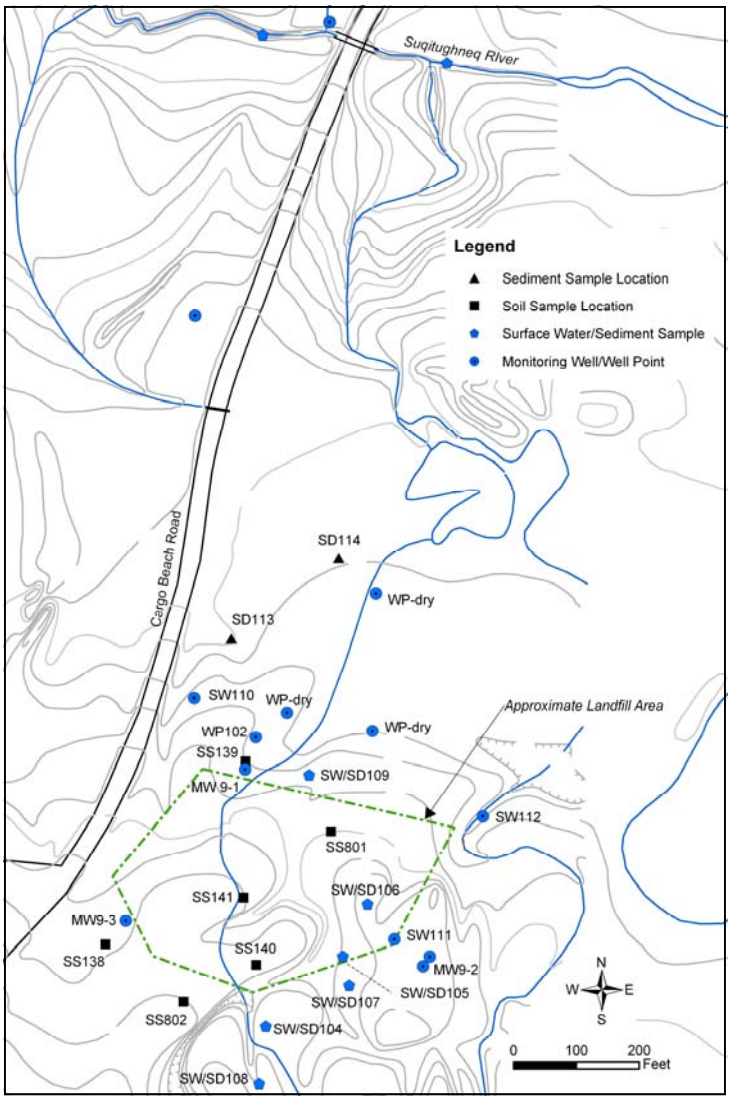


Figure 6. Site 9 Housing and Operations Landfill

The proposed shallow groundwater cleanup levels, for a non-drinking water source are:

Lead	0.15 mg/L
DRO	15 mg/L
RRO	11 mg/L

Site 9 before debris removal, view southwest (2005)

Site 9 after debris removal, view southwest (2005)

Proposed Plan

Preferred Alternative - Housing and Operations Landfill

Surface debris removal at Site 9 Landfill (2005)

The preferred alternative for Area of Concern C - Landfill is land use controls and long term monitoring. Exposed surface debris was removed from the Site 9 Housing and Operations Landfill during the 2005 field season, thus eliminating the primary hazards and potential sources of contamination. The overall surface area of the Site 9 landfill is approximately 3 acres, which includes many ponded areas and streams.

Land use controls will be implemented to inform the landowners and public that the shallow groundwater surrounding the Site 9 landfill is not a reasonable potential future drinking water source. The land use controls will also inform the landowners that future excavation or building construction is not recommended in the immediate vicinity of the buried debris. Site-specific information and future monitoring activities will be described in the State of Alaska Contaminated Sites database.

Land use controls was selected as the preferred alternative because it provides an effective means of limiting access and exposure to the buried landfill materials.

Western side of Cargo Beach Road Landfill, after debris removal (2005)

A deed notice will be prepared to document the landfill boundaries and provide information on the shallow groundwater properties.

The other alternatives evaluated included no action, natural attenuation, capping, and excavation/off-site disposal. The no action alternative was not selected because no measures would be taken to prevent exposure or provide information to the public.

Natural attenuation meets the remedial action objectives and would continue to reduce risks to human health and the environment over the long term. However, this alternative provides no assurance that contaminants are not migrating.

Long term monitoring will be implemented to verify that the contaminants of concern in shallow groundwater are not migrating downgradient or impacting surface waters. Over time, long term monitoring will demonstrate that the shallow groundwater meets the remedial action objectives for a non-drinking water source.

Capping was not selected because the remedial investigation results indicate contaminants are not migrating from the landfill to downgradient surface waters. Capping to reduce infiltration would not change near surface groundwater flow through the buried materials.

Capping is not necessary to prevent exposure to surface soils, because these soils have not been demonstrated to pose a potential ingestion risk. Surficial soils are vegetated and the existing topography and surface water features do not appear to be creating a potential erosion concern.

Off-site removal of the entire landfill was not selected because migration of contaminants from the landfill has not been demonstrated. Furthermore, excavation was not chosen given the greater possibility of adverse impacts to the wetland environment and tundra vegetation. The high costs and logistics associated with removal of buried materials off-island supported selection of the proposed remedy.

As part of the land use controls, a review of site conditions will also be conducted every 5 years, as necessary, to demonstrate the landfill contents are stable.

Area of Concern D - Pipeline Break

Example of pipeline removal near Main Operations Complex (2001)

The Pipeline Break Site is located southwest of the intersection of Cargo Beach Road and the Airport Access Road. A fuel pipeline extended from the pumphouse at Cargo Beach to the bulk storage tanks at the main operations complex. A reported break in the pipeline was located on the west side of the main road embankment and north of the Suqitughneq River. The fuel pipeline was drained and removed in 2000.

The site is a wetland with thick surface vegetation, typical of locations along roads and the airstrip where the tundra mat was removed before construction. The wetland slopes southward toward the Suqitughneq River. The wetland narrows as it approaches the river and a spring of flowing water is present. The vegetation does not appear stressed or petroleum stained according to field observations.

The wetland consists of dense, grassy vegetation and roots with little soil or peat development. Some sand is present between cobbles under the vegetation mat.

Nature and Extent of Contamination

Two sediment and one surface water sample were collected in 2004 to assess possible fuel impacts at the site. DRO was detected in the sediment at concentrations ranging from 6,700 to 19,500 mg/kg. No contaminants were detected in the surface water.

The two sediment samples were spaced 50 feet apart. The pipeline break was 50 feet upgradient of the first sample, based on field observations. The roughly 40-foot wide wetland slopes southward for approximately 300 feet toward the Suqitughneq River.

Risk Evaluation Summary

The primary exposure route for humans is via incidental ingestion or dermal contact with sediments or exposure through the food chain for ecological receptors. The primary contaminant of concern is DRO. Given the limited surface area affected by elevated levels of DRO, the potential for significant adverse effects to either human or ecological receptors is low.

The existing levels in sediment may pose a potential risk to future seasonal or permanent residents, because the DRO levels exceed the risk-based alternate soil cleanup levels.

However, there is a low probability that future seasonal or permanent residents could be exposed to the contaminated sediments for long enough duration to pose a potential risk. Furthermore, the petroleum hydrocarbons detected in the sediments are tightly bound with other naturally occurring organic carbons, and are not bioavailable to ecological receptors. The site does not pose a risk to current site visitors.

Remedial Action Objectives

The remedial action objectives for the Pipeline Break Site are to prevent exposure to contaminated sediments which may pose a future risk to human health or the environment.

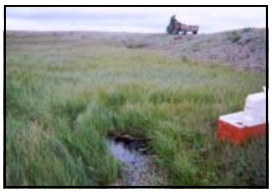
The proposed cleanup level for DRO at AOC D is 12,500 mg/kg, which is the ADEC's maximum allowable level for soils.

The high organic carbon content of the sediment promotes binding with the fuel components and minimizes the potential for contaminant migration. The abundant vegetation also helps naturally break down the diesel range organics.

Given the limited surface area potentially affected by DRO and the lack of stressed vegetation, the potential for significant adverse effects to either human or ecological receptors is low.

Proposed Plan

Preferred Alternative - Pipeline Break



Sampling at the Pipeline Break site (2004)

The preferred alternative for the Pipeline Break Site is natural attenuation and land use controls.

The abundance of vegetation indicates the site is naturally filtering the diesel range organics and hydrocarbon enrichment may be enhancing plant growth. Only a small area of wetland is affected at levels that could pose a potential future threat to human health.

There is a low probability that future seasonal or permanent residents could be exposed to the contaminated sediments for long enough duration to pose a potential risk. The site does not pose a risk to current site visitors.

Over the long term, the petroleum hydrocarbons will continue to naturally attenuate and break down in the environment. An initial sampling event will be conducted to verify site conditions. A deed notice will be implemented to provide information to current or future landowners about the presence of contaminated sediments at the site and the need for proper management of the sediments if excavated.

As part of the land use controls, a review of site conditions will also be conducted every 5 years as necessary, until the evaluation demonstrates the site meets the remedial action objectives.

The other alternatives evaluated included no action, phytoremediation, land farming, excavation and off-site disposal, and reactive matting. Both phytoremediation and landfarming involved excavation and onsite treatment. Excavation of the limited area of contaminated sediments was considered more destructive and harmful to the environment than natural attenuation of the contamination.

Cargo Beach area (2006)

Area of Concern E - Main Operations Complex

Aerial view of Main Operations Complex (2001)

The Main Operations Complex at the Northeast Cape installation included the majority of the site infrastructure including buildings, heat and power supply, fuel storage tanks, maintenance, and housing quarters. Individual sites were grouped together to evaluate an overall response action for the known contamination. These sites are located on the northeast portion of the main complex gravel pad and include Sites 10, 11, 13, 15, 19, and 27.

All of the main complex structures have been demolished. Tanks and piping have been removed. Contaminated concrete, PCB-contaminated soils, and fuel stained soils were also excavated and transported offsite during removal actions from 2000 to 2005.

Site 10 is a wide gravel area that is level with the road. The gravel extends westward and drops off approximately 8 feet to a shallow wetland basin at the base of an embankment. The embankment on the northwest side has a few pieces of decomposing drums exposed. The site was reportedly used as a drum storage area for a variety of petroleum products.

Site 11 included three large above ground fuel storage tanks (400,000 gallons each) located between the perimeter access road and Site 10. The tanks were situated on a constructed gravel pad, and the gravel embankment drops to a shallow tundra drainage basin to the northeast. The center tank was punctured during snow removal activities in the late 1960's and released a large amount of fuel. The tanks were dismantled in 2000 and the area was reseeded with grass in 2005.

Site 13 consisted of the Heat and Electrical Power Building (Building 110). Several ASTs, USTs, diesel generators, and power transformers were formerly located at this site. PCB-contaminated soils (141 tons) were excavated and removed from Site 13.

Site 15 is adjacent to the eastside of Building 110 and included the pipeline corridor connecting to the diesel fuel pump island at Site 27. A break in this fuel line resulted in a diesel fuel spill. The pipeline and surrounding stained soil were removed in 2001.

Site 19 consisted of the Auto Maintenance (Bldg 109) and Auto Storage (Bldg 108) buildings, which were constructed with concrete floors and floor drains.

Site 27 included the diesel fuel pump island that was originally used to refuel heavy equipment and vehicles. The site consisted of a small shed and concrete valve box, and a buried pipeline from the bulk fuel storage tanks at Site 11. The pipeline and surrounding stained soils were removed during the 2001 field season.

Nature and Extent of Contamination

The primary contaminant of concern in soil at the Main Operations Complex is DRO. Surface and subsurface soils are contaminated with petroleum at depths up to 16 feet below ground surface. The fuel contamination is assumed to have created a smear zone along the shallow groundwater interface.

Shallow groundwater is also contaminated throughout the northeast portion of the site. The primary contaminants of concern in groundwater are DRO, GRO, RRO, benzene, and naphthalene. The depth to groundwater across the northeast portion of the main complex varies from 10 to 25 feet below ground surface.

Remedial investigations were conducted in 1994, 1996, 1998, 2001, 2002, and 2004. The sampling results demonstrate that soils and groundwater contain petroleum compounds at elevated levels. Surface and subsurface soil sampling results at each site are summarized in Table 8.

Site 10: An area of surface soil contamination was documented in 1994 along the western edge of the gravel pad. The maximum concentration of DRO was 26,500 mg/kg. Additional surface soil samples were collected in 1996 and the maximum DRO was 17,000 mg/kg. Soil borings were completed in 2004 and demonstrated that subsurface soils are not significantly impacted; the maximum DRO result was 619 mg/kg.

Site investigation activities, Main Complex (2004)

Proposed Plan

Nature and Extent of Contamination (continued)

Groundwater sampling at Main Complex (2004)

Site 11: Visibly stained soil exists within the footprint of each of the dismantled fuel storage tanks. The circular pads measure approximately 50 feet in diameter. The total depth of contamination is unknown. Adjacent soil borings outside the tank footprints contained DRO ranging from 358 mg/kg at 4 ft depth to 22,000 mg/kg at 11.5 ft depth. Immediately downgradient of the tank footprints, DRO was detected in surface soils up to 69,100 mg/kg.

Site 13 and 15: Surface and subsurface soil samples were collected during the 1994 investigation. Surface soils contained DRO ranging from 398 to 7,610 mg/kg. Additional soil borings were completed in 2002 and 2004. The maximum DRO concentration in subsurface soils was 16,000 mg/kg (6-8 ft). The maximum GRO concentration was 513 mg/kg (6-8 ft); the maximum RRO concentration was 3,400 mg/kg (1-3 ft). Benzene in soil ranged from non-detect to 0.062 mg/kg; naphthalene in soil ranged from non-detect to 28 mg/kg.

Site 19: During the 1994 investigation, DRO was detected at a maximum concentration of 1,240 mg/kg in surface soils (0-0.5 ft) and 13,300 mg/kg in subsurface soils (9.5-11.5 ft). One soil boring also contained GRO at a maximum concentration of 6,650 mg/kg (4-6 ft). Subsequent soil borings completed in 2002 indicated the maximum concentration of DRO was 5,000 mg/kg (15.5-17.5 ft); and GRO was 51 mg/kg (16-18 ft). One additional soil boring was completed in 2004; the maximum concentration of DRO was 3,590 mg/kg and GRO was 91.6 mg/kg at 12-13.5 ft.

Site 27: Surface soil sampling in 1994 indicated DRO at a maximum concentration of 37,900 mg/kg. In 2001, soil samples were collected from the bottom of the UST and piping excavations and indicated fuel-contaminated soil remains in subsurface soils at depths between 4-7 feet bgs. The concentrations of DRO and naphthalene in the subsurface soils exceeded the risk-based cleanup levels, RRO and benzene were also detected. DRO concentrations ranged from 144 to 36,500 mg/kg; RRO ranged from 313 to 9,100 mg/kg; benzene ranged from non-detect to 0.79 mg/kg; naphthalene ranged from non-detect to 191 mg/kg.

Five soil borings were completed around Site 27 in 2002. The subsurface soil sample results indicated DRO concentrations ranged from 20 to 51,000 mg/kg (7-9 ft), RRO ranged from 16 to 6,000 mg/kg; benzene ranged from non-detect to 0.37 mg/kg; and naphthalene ranged from 0.0011 to 81 mg/kg.

Groundwater: Ten groundwater monitoring wells were installed in 1994. The wells were sampled again in 1998. An additional 10 monitoring wells were installed in 2002, and sampled a second time in 2004. Petroleum hydrocarbons have been detected throughout the northeast corner of the Main Complex area. DRO concentrations ranged from 0.71 to 960 mg/L in the monitoring wells. GRO concentrations ranged from 0.42 to 6.1 mg/L. RRO concentrations ranged from 0.22 to 190 mg/L. Benzene was detected above the proposed cleanup level (0.005 mg/L) in six MWs at concentrations ranging from 0.01 to 0.12 mg/L. Lead also exceeded the cleanup level of 0.015 mg/L at eight locations. Table 9 summarizes the maximum shallow groundwater sampling results.

Table 8. Main Complex Historic Soil Sampling Results, Maximum Concentration of Diesel Range Organics

Site	Depth	Result (mg/kg)	Year
Site 10	Surface (0 - 0.5 feet)	**26,500**	1994
	Subsurface (5 - 6.5 ft)	619	2004
Site 11	Surface (0 - 0.5 ft)	**69,100**	1994
	Subsurface (9.5 - 11.5 ft)	**22,000**	1994
Site 13	Surface (0 - 0.5 ft)	7,610	1994
	Subsurface (10 - 12 ft)	**13,000**	2002
Site 15	Surface (0 - 0.5 ft)	4,860	1994
	Subsurface (6 - 8 ft)	**16,000**	2002
Site 19	Surface (0 - 0.5 ft)	1,240	1994
	Subsurface (9.5 - 11.5 ft)	**13,300**	2002
Site 27	Surface (0 - 0.5 ft)	**37,900**	1994
	Subsurface (7 - 9 ft)	**51,000**	2002
	DRO Cleanup Level	9,200	

Risk Evaluation Summary

The risk assessment evaluated human health risks under a future permanent resident scenario that assumed long term (i.e., lifetime) exposure to soils and shallow groundwater. At each site, DRO concentrations in soil contributed to potential non-cancer risks for a future resident that exceeded a risk management threshold of 1. At Site 27, naphthalene also contributed to potential risks from contaminated soils. PCBs in soil were the primary risk driver at Site 13, but are addressed separately under AOC 1.

The risk assessment indicated under a future resident scenario, carcinogenic risks from soil (excluding PCBs) ranged from $6x10^{-8}$ to $4x10^{-9}$, and the non-cancer hazard index ranged from 3 to 14.

The gravel pad of the Main Complex is insufficient habitat for ecological receptors due to minimal vegetation. Potential ecological risks from migration of contaminants were considered at Site 28 Drainage Basin. Contaminants in shallow groundwater at the Main Complex also contribute to potential human health risks if the water is utilized as a permanent future drinking water supply. The concentrations of DRO, GRO, RRO, benzene, and arsenic were the primary risk drivers which contributed to the risks. The potential carcinogenic risks from consumption of shallow groundwater as a future permanent drinking water source ranged from $2x10^{-3}$ to $6x10^{-5}$ and the non-cancer hazard index ranged from 4 to 642.

Lead also exceeded drinking water standards. Arsenic is found naturally in the environment and the observed concentrations in groundwater are likely within background levels for Alaska.

The risk assessment did not distinguish between surface and subsurface soils in evaluating the potential risks to future seasonal or permanent residents. A future resident is most likely to be exposed to surface soil contamination through incidental ingestion or dermal contact. Exposure to subsurface soils, between 2 and 15 feet, is possible through digging or construction activities. However, a construction worker is the most likely receptor in these cases.

According to local construction design standards applied statewide in Alaska, building foundations must be excavated to a burial frost depth of 3.5 feet, assuming thaw stable permafrost, with 1 foot of gravel base. Buildings and utilities in areas with permafrost are more commonly constructed with driven pilings and above ground utilidors. The maximum anticipated excavation depth for future development at Northeast Cape is approximately 5 feet.

Under a construction worker scenario, there is a low probability of risk from exposure to hydrocarbons due to the shorter duration of potential exposure. Petroleum hydrocarbons do not pose an acute hazard and concentrations must be significantly higher than the ADEC's maximum allowable to pose a potential risk to workers. Furthermore, the risks to construction workers can be managed using appropriate personal protective clothing such as gloves and coveralls.

Stained soil, edge of Main Complex and Drainage Basin (2006)

Table 9. Main Complex Historic Shallow Groundwater Sampling Results

Contaminant of Concern	Maximum Results (mg/L)				Cleanup Level (mg/L)
	1994	1998	2002	2004	
DRO (exceeds) [a]	**34** (10/14)	**960** (7/12)	**72** (8/11)	**15.2** (7/12)	1.5
GRO (exceeds)	**6.1** (5/12)	ND	**1.5** (1/11)	**1.5** (1/12)	1.3
RRO (exceeds)	**190** (8/12)	**3.8** (1/12)	**2.3** (6/11)	**2.28** (3/12)	1.1
Benzene (exceeds)	**0.12** (4/12)	ND	**0.03** (4/11)	**0.033** (4/12)	0.005
Lead (exceeds)	**0.68** (9/10)	--	--	**0.0546** (2/12)	0.015

[a] the number of samples out of the total number of samples which exceed the cleanup level

Proposed Plan

Remedial Action Objectives

View south towards Main Complex, pre-demolition (2003)

The remedial objectives for the Main Operation Complex are to prevent exposure to contaminated soils or shallow groundwater which may pose a risk to human health and the environment. The Main Operations Complex is also a source area of contaminants that may impact downgradient areas of concern such as the Drainage Basin. A secondary remedial objective is prevention of downgradient migration of contamination.

Site-specific soil cleanup levels for the Main Operations Complex are based on potential future residential use; the primary exposure pathway is incidental ingestion or contact with contaminated soils. Proposed soil cleanup levels are shown in Table 2 (page 4).

The shallow groundwater at the Main Operations Complex is a potential future drinking water source, but is not currently utilized as a water source. The applicable cleanup levels for the shallow groundwater are protective of a drinking water source. The shallow groundwater cleanup levels are shown in Table 3 (page 5).

Although the current risk posed by the fuel-related compounds in the soil is low, there is a significant volume of soils with DRO concentrations exceeding the risk-based future residential cleanup level.

Preferred Alternative - Main Operations Complex

The preferred alternative for the Main Operations Complex is limited excavation of contaminated surface and near-surface soils above the risk-based ingestion cleanup levels (see Table 2, page 4), natural attenuation of subsurface soils and shallow groundwater, and land use controls. Long term monitoring of the shallow groundwater will also be conducted to measure progress towards meeting the drinking water cleanup goals (see Table 3, page 5).

View east towards Site 11 Former Fuel Tanks, stained soil footprints (2006)

Visibly stained surface soils and historic surface or near-surface sampling locations above the proposed cleanup level of 9,200 mg/kg (DRO) will be removed to a maximum depth of 5 feet below ground surface. Excavation of contaminated soils to a depth of 5 feet bgs is protective of current subsistence users, potential future permanent residents, and potential future construction workers.

Contaminated subsurface soils below 5 feet do not pose a potential risk to residents or potential future construction workers based on incomplete exposure pathways and the nature of the contamination. Petroleum hydrocarbons do not pose a health hazard, at the documented levels, over a short duration such as during construction activities. Furthermore, construction workers can be protected by using adequate personal protective clothing.

Natural attenuation of petroleum hydrocarbons in the subsurface soils will continue over time and be protective of potential future residents and construction workers in the long term.

Shallow groundwater monitoring will be conducted once every 5 years to document natural attenuation processes and fulfill the long term objective of meeting drinking water criteria. Potential exposures in the short term to contaminated shallow groundwater can be adequately managed using land use controls. The shallow groundwater is not currently utilized for drinking water.

As part of the land use controls, five-year reviews will be conducted, as necessary, to ensure that the remedial actions remain protective of human health, safety, and the environment.

Soils and sediments downgradient of the Main Operations Complex will be addressed as part of the remedial measures for the Drainage Basin (AOC F), see the next section.

An estimated 6,000 cubic yards of contaminated soils will be excavated and treated or disposed under this alternative. Previous estimates of the volume of contaminated soil did not distinguish between sur-

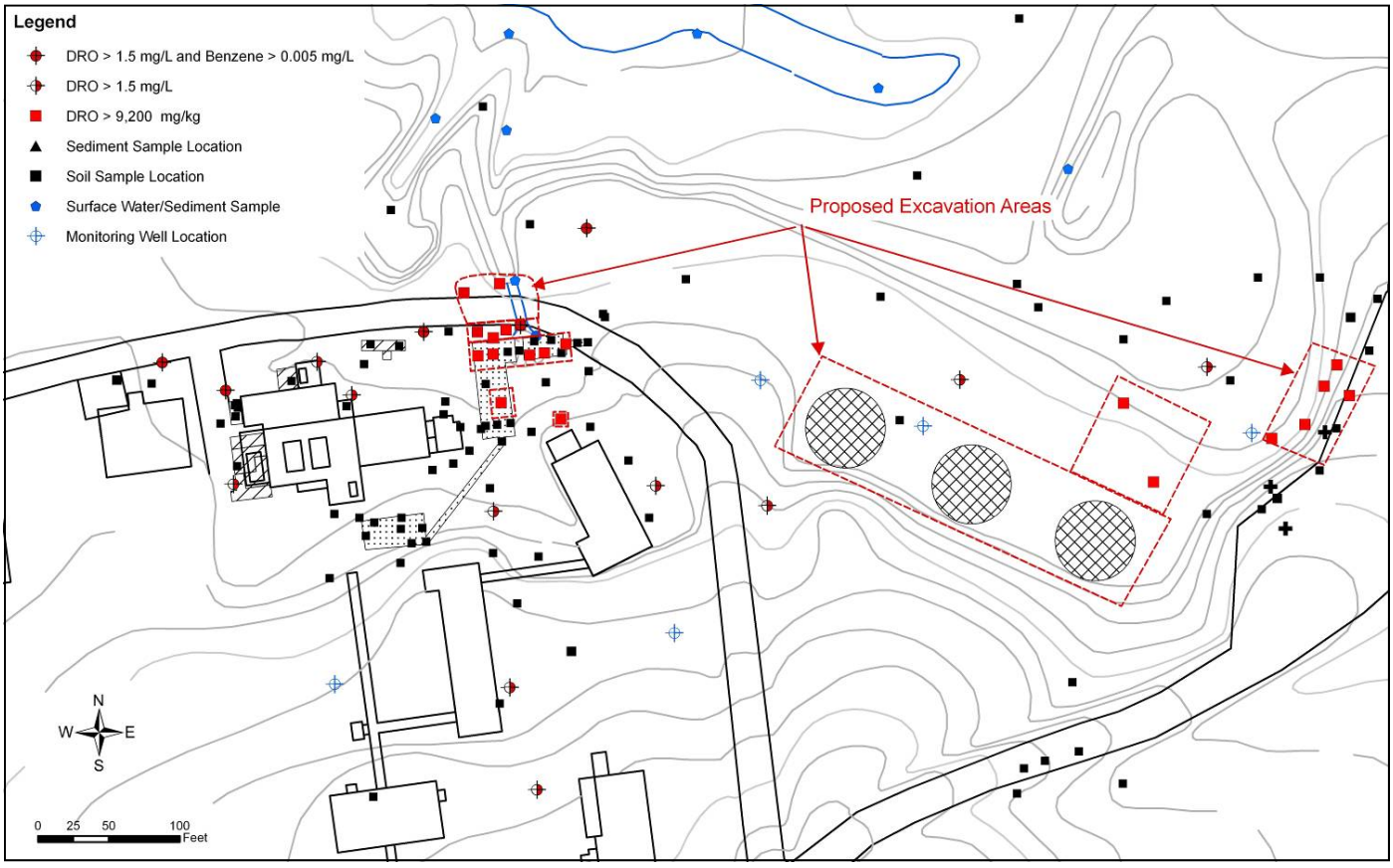
Preferred Alternative (continued)

face and subsurface contamination. The original volume estimates (13,000 CY - 28,000 CY) in the Feasibility Study assumed excavation to an average total depth of contamination (up to 12 feet) and continuous distribution of the petroleum hydrocarbons. The proposed soil excavation areas are shown in Figure 7.

A range of remedial alternatives were evaluated for the Main Operations Complex area. The alternatives consisted of no action; land use controls; natural attenuation; long term monitoring; and excavation with onsite phytoremediation, onsite landfarming, onsite thermal treatment, or off-site treatment and disposal. Limited excavation was selected over the original excavation and treatment or disposal alternatives evaluated in the feasibility study because the costs are significantly less, and excavation of contaminated soils to a maximum depth of 5 feet is still protective of human and ecological receptors. Excavation of a larger volume of contaminated soil will not significantly reduce risk to human health.

The no action alternative was considered the least protective and did not meet the proposed cleanup objectives.

Figure 7. Main Operations Complex, DRO levels in soil



Proposed Plan

Area of Concern F - Drainage Basin

Site 28 Drainage Basin, western culvert (2006)

Site 28 Drainage Basin, eastern drainage (2006)

The Drainage Basin lies north of the Main Operations Complex and flows north into the Suqitughneq River. This site has been impacted by fuel releases from the bulk fuel storage tanks, other spills and releases. Surface water run-off and subsurface water seeps from the Main Operations Complex gravel pad drain into this tundra/wetland area.

Three discrete drainages originate from the Main Operations Complex gravel pad and contribute flow to the Drainage Basin. The eastern drainage flows from the area adjacent to Sites 10/11, the middle drainage originates from a culvert which directs flow from the Site 27 former diesel fuel pump island, and the western drainage is adjacent to Site 13. The eastern drainage is a vegetated area north of the former fuel tanks. Soil staining has been observed near the head of this drainage and downgradient of the tank footprints.

The middle drainage originates as a small swale south of the perimeter access road. Surface water runoff from the Main Operations Complex is routed under the road via a culvert to this swale. An area of ponded water periodically exists immediately north of the culvert outlet. Stained soils exist on the banks of this drainage swale. The area is generally heavily vegetated with grasses.

The western drainage originates from a manhole and small concrete supporting structure just north of the perimeter access road, which emptied into an artificially created swale. The manhole likely served as the drain for Building 110 Heat and Electric Power. The drainage swale is approximately 10 feet wide and 40 feet long. The presence of standing surface water is intermittent, depending on seasonal rainfall. Sediments in this area have been noted as stained dark brown and black, and produce a sheen when disturbed. Stained soils have also been observed along the drainage embankment. Grassy vegetation currently grows throughout the drainage.

Nature and Extent of Contamination

The drainage basin has been investigated since 1994. Sediment, soil, surface water, and shallow groundwater samples have been collected and analyzed for various constituents. Sampling activities occurred in 1994, 1996, 1998, and 2001.

The primary contaminants of potential concern in sediment are chromium, lead, zinc, PCBs, PAHs, DRO, and RRO. The highest concentrations of these compounds are predominantly located upgradient and closest to the edge of the main complex. Figure 9 highlights the sampling locations with concentrations of DRO above the proposed cleanup level of 9,200 mg/kg. A summary of the maximum detected concentrations of all contaminants of concern is shown in Table 10. The extent of metal-contaminated sediments is limited to 2 discrete locations. The maximum concentrations of chromium, lead, and zinc were detected in 2001 in a single sample from the head of the western drainage, near the culvert. Zinc was also elevated at one location approximately 1,450 feet downstream.

Surface water samples were collected in the drainage basin in 1994, 1996, and 2001. Concentrations of DRO, TRPH (total recoverable petroleum hydrocarbons), PCBs, and lead were elevated in 1994. Surface water samples were collected in 2001 and analyzed for DRO, RRO, and PCBs. The samples were not analyzed for lead. DRO was detected at concentrations ranging from 0.39 to 2.3 mg/L. PCBs and RRO were not detected.

The shallow groundwater was also investigated during the 1994 investigation. Two monitoring wells were installed

Table 10. Sediment Sampling Results - AOC F Drainage Basin

Contaminant of Concern	Exceeds Cleanup Level	Maximum Result	Cleanup Level
	# per total *	mg/kg	mg/kg
Chromium	1/85	649	270
Lead	1/85	4,590	530
Zinc	2/86	4,810	960
PCBs	7/95	5.4	0.7
Methylnaphthalene, 2	52/88	500	0.6
Acenaphthene	32/87	14	0.5
Fluoranthene	5/88	14	2
Fluorene	33/88	20	0.8
Naphthalene	36/88	220	1.7
Phenanthrene	9/88	21	4.8
DRO	45/98	150,000	9,200
RRO	5/83	14,000	9,200

* total samples collected includes QA/QC samples

Nature and Extent of Contamination (continued)

within the eastern drainage of the drainage basin. The 1994 sampling results indicated the potential for DRO and lead contamination. Subsequent sampling in 2001 demonstrated the levels of DRO and lead were below groundwater cleanup levels. No contaminants of concern were retained for the shallow groundwater.

Drainage Basin, middle drainage (2002)

Risk Evaluation Summary

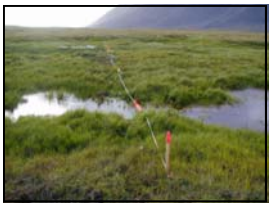
The primary contaminants of concern in sediments of the Drainage Basin are DRO, lead, chromium, zinc, and PCBs. The only chemical which contributes to potential human health risks from contact with the sediment is DRO. The risk assessment assumed potential future subsistence use of the drainage basin area, including contact with contaminated soil, sediment, and surface water. The wetland environment is not suitable for residential development.

The chemical data also indicates the potential for adverse ecological or environmental impacts based on maximum PAH concentrations. Field observations have also noted black-stained soils and a sheen on the water nearest to the main operations complex, which provides another line of evidence supporting the conclusion that the contaminated sediments in the Drainage Basin may pose a risk to the environment if disturbed or transported downgradient.

The potential for ecological risks from petroleum hydrocarbon fractions is more difficult to quantify. Overall, the data indicate a low potential for adverse ecological effects to higher trophic level receptors based on the maximum sediment concentrations. Higher trophic level receptors do not spend as much time in one particular location, have a larger home range relative to the impacted area, and thus are not exposed for a long enough duration to predict potential impacts.

The sediments in the Drainage Basin are likely a continuing source of contaminants to the Suqitughneq River and Estuary, especially during periods of high runoff when sediment transport is more likely to occur.

The contaminants of potential concern in surface water are chromium, copper, lead, zinc, PCBs, DRO and GRO. Only two chemicals contributed to potential risks, PCBs and DRO. Unusually high concentrations of DRO and PCBs were reported in one surface water sample during the 1996 investigation. PCBs (method detection limit of 0.0003 mg/L) were not detected in subsequent surface water sampling events. PCBs were thus eliminated as a contaminant of concern in surface water.



Sampling transect in Drainage Basin (2001)

Remedial Action Objectives

The primary remedial action objective for the Drainage Basin is to prevent future migration of contamination to the Suqitughneq River via suspended sediments or dissolved phase surface water transport. The potential for significant impacts to human or ecological receptors is limited due to the nature of the contamination (petroleum). However, a secondary remedial action objective is to prevent future exposure of human receptors to contamination above risk-based cleanup levels and be protective of ecological receptors. The sediment cleanup levels are shown in Table 4 (page 6).

Preferred Alternative

The Drainage Basin site is a wetland that consists of vegetated grassy areas, with intermittent flowing streams and ponds of standing water that primarily occur during significant rain or seasonal run off events. The grassy vegetation is underlain by organic materials such as tundra peat. Thick vegetation occurs throughout the site and function as a natural filter to adsorb and break down contaminants moving through the system.

Proposed Plan

Preferred Alternative - Drainage Basin (continued)

Drainage Basin, western culvert (2002)

The preferred alternative for the drainage basin site involves a combination of actions, including source control, enhanced natural attenuation, and land use controls. Active remedial measures were selected over other alternatives evaluated in the Feasibility Study based in part on two modifying criteria, community and agency acceptance. Land use controls and natural attenuation were considered cost effective, but did not meet the remedial objectives in a reasonable timeframe.

A limited area of highly contaminated sediments and two culverts will be removed as shown in Figure 8. Down-gradient migration of contaminants via suspended sediment transport will be minimized by maintaining the majority of the existing vegetation and construction of two weirs.

The most heavily contaminated areas of the drainage basin are found immediately below two culverts, located in the western and middle drainages. The highest concentrations of most contaminants of concern are located within this zone. The proposed approach includes excavation of an estimated 2,200 cubic yards of sediments to a depth of 2 feet. The ends of the culverts would also be cleaned out and may be removed or plugged to prevent direct outflows of upgradient residual sources of contamination. The most heavily contaminated soils at the Main Complex will be addressed by excavation and disposal (see description under AOC E).

Excavation permanently removes the contaminated sediments, minimizes the potential for continued down-gradient migration of contamination, and is protective of potential future residents. The proposed excavation areas are located in the most accessible portion of the drainage basin, based on proximity to the main complex. Excavation may temporarily damage a small portion of the existing wetlands, but will result in long term benefits to the system.

The downgradient portions of the system will be enhanced to reduce future migration of contaminants as suspended sediment load to the Suqitughneq River. Wetlands naturally filter and retain suspended particles, while existing grasses break down petroleum.

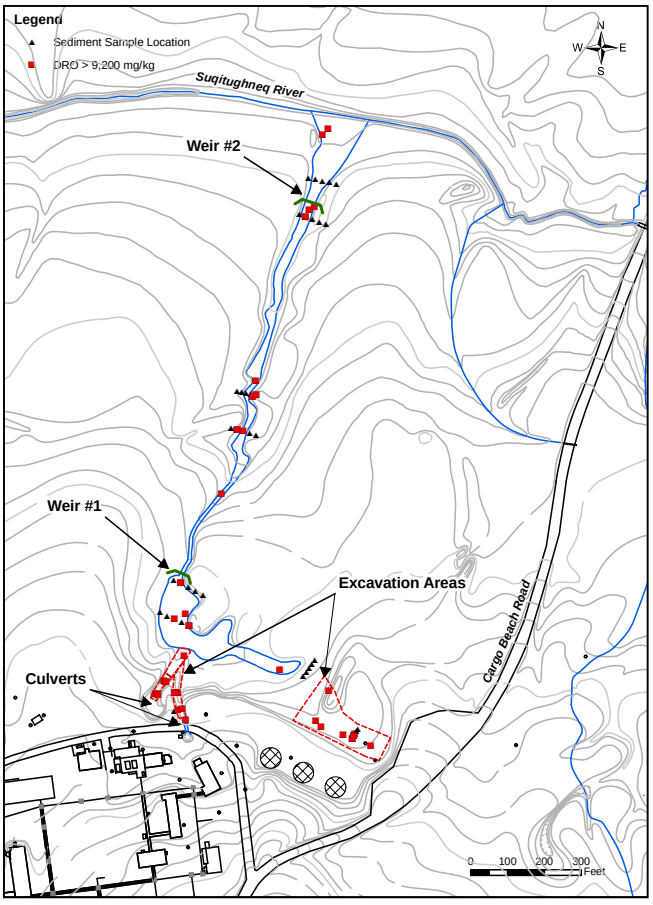
The preferred alternative includes construction of two weirs (i.e., water flow structures) in the main channel of the drainage basin to reduce water energy during periods of high flow, allowing suspended sediments to drop out prior to entering the Suqitughneq River. Construction of the weirs would involve developing an access trail for heavy equipment and future monitoring.

Land use controls are also necessary to prevent installation of a drinking water well, and harvesting of plants in the actual drainage basin area. Information will also be provided to the community and landowners regarding proper management of soil or sediments if future development were to occur at the site.

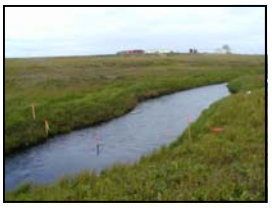
As part of the land use controls, five-year reviews will be conducted, as necessary, to ensure that the remedial actions remain protective of human health, safety, and the environment.

The Feasibility Study evaluated a range of other alternatives for AOC F, including no further action, phytoremediation, landfarming, excavation/disposal, constructed wetlands, and reactive matting. The study considered two different volumes of contaminated sediments, which ranged from 3,400 to 15,000 cy. Excavation in a large area of sensitive wetlands was considered more harmful and destructive to the environment than the more focused source control measures. Reactive matting was not selected due to the uncertainties associated with its use in wetlands with intermittent standing water.

Figure 8. AOC F Drainage Basin Proposed Excavations and Weirs



Area of Concern G - Suqitughneq River and Estuary



Suqitughneq River near the airstrip (2001)

The Suqitughneq River flows north from the Kinipaghulghat Mountains, originating south of the main complex. The Suqitughneq River flows through tundra to a lagoon and estuary located east of the Northeast Cape airstrip where it drains into the Bering Sea. The lagoon and estuary are separated from the Bering Sea by a sand berm that forms at the beach and occasionally breaches. Several smaller tributaries, including AOC F Drainage Basin, contribute flow to the Suqitughneq River.

Nature and Extent of Contamination

Remedial investigations of the Suqitughneq River were conducted between 1996 and 2004. The primary contaminant of concern is DRO. In 1996, five sediment samples were collected; DRO concentrations ranged from non-detect to a maximum of 25,000 mg/kg at one location about 850 feet downgradient of the drainage basin. Subsequent sampling events could not duplicate or substantiate the anomalous hit of diesel. In 1998, four sediment samples were collected; DRO ranged from 11 to 2,200 mg/kg. In 2001, sediment samples were collected from 4 cross sections, as well as two locations upstream of the drainage basin, and two within the estuary. DRO concentrations ranged from 15 to 1,400 mg/kg. During the 2004 investigation, six sediment samples were collected from the estuary. The concentration of DRO ranged from 157 to 988 mg/kg, which does not exceed the proposed sediment cleanup level of 3,500 mg/kg.

PAHs were detected at low levels during the 2004 investigation, but do not exceed ecological screening levels based on consensus-based probable effects concentrations.

PCBs have not been detected in the Suqitughneq River sediments, with the exception of one sample collected downstream of the airport road bridge in 2004. PCBs were analyzed for but not detected in sediment samples collected in 1996, 1998, and 2001. In 2004, PCBs were detected at 0.452 mg/kg, which does not exceed the proposed sediment cleanup level of 0.7 mg/kg.

All surface water sampling results from the Suqitughneq River have been within drinking water standards. Early PCB sampling data, with its high detection limits, served only to indicate that the water was not grossly contaminated. The most recent sampling results from 2004 confirm that PCBs are not present in the Suqitughneq River above detection limits ranging from 0.105 to 0.115 ug/L (primary lab) and 0.5 ug/L (QA lab), compared to the ADEC Table C cleanup level of 0.5 ug/L.

Risk Evaluation Summary

The concentrations of petroleum hydrocarbons and PAHs in sediment do not exceed human health risk-based standards or ecological risk-based screening levels. The risk assessment also evaluated the consumption of fish from the vicinity of Suqi River and indicated potential future carcinogenic risks due arsenic, PCBs, and PAHs. Further evaluation by the Agency for Toxic Substances and Disease Registry in a health consultation concluded that consumption of fish from the waters of NE Cape is not likely to result in adverse health effects.

Measuring streamflow in the Suqitughneq River (2002)

Preferred Alternative

The weight of evidence for the Suqitughneq River and Estuary indicates the system is not adversely affected by contaminants of potential concern. However, there are significant community concerns regarding the overall health of the ecosystem and the potential for unknown areas of contamination. Visual observations have indicated the presence of a sheen in the estuary at various times. Laboratory samples have not identified heavily contaminated sediments.

Although no further remedial action is recommended, the Suqiqtughneq River is proposed for inclusion in the 5 year review process. Any additional data or observations will be evaluated at that time to verify the selected remedy is protective of human health and the environment.

Area of Concern H - White Alice Complex

Demolition of White Alice antennas (2003)

The White Alice Complex is located southeast and uphill from the main operations complex in a glacial valley at the base of Mt. Kangukhsam. The site included four large billboard antennas, a central main electronics building, other supporting structures, and seven ASTs.

The antennas, buildings, and ASTs were demolished and removed during the 2003 field season. A total of 118 tons of PCB-contaminated soil was excavated south and west of the former Main Electronics Building (Bldg 1001) adjacent to a former transformer pad, and at the septic tank outfall during the 2005 field season. PCB-contaminated concrete (79 tons) was also removed from portions of the Building 1001 foundation.

The lower tram terminal (Site 32) was located south of the White Alice Site at the northern base of Mt. Kangukhsam. The site consisted of a tram terminal building, substation transformer bank, two ASTs, a water well and anchor pit for the aerial tram line.

The buildings, ASTs, and tram structures were demolished and removed during the 2003 and 2005 field seasons.

Nature and Extent of Contamination

Surface and subsurface soil samples have been collected to evaluate the extent of petroleum hydrocarbon contamination associated with former fuel tanks and piping, and the extent of PCB contamination near transformer pads and a septic outfall.

At the White Alice Complex, soil samples were collected in 2001, 2003, and 2004. Surface water samples were collected in 2001 and no contaminants of concern were identified. Soil samples were collected from beneath fuel pipelines, fuel tanks, and tank impoundments.

White Alice Site (2003)

After final building demolition and debris removal activities, including removal of contaminated concrete and excavation of PCB-contaminated soils, additional soil confirmation samples were collected in 2005.

DRO was initially detected at concentrations ranging from 310 to 3,400 mg/kg near the ASTs and fuel tank impoundment during the 2001 field season.

During the 2003 removal action, soil samples were collected along the former fuel pipeline corridors. The sampling results indicated DRO at concentrations ranging from 42.9 to 5,400 mg/kg. RRO concentrations ranged from ND to 11,000 mg/kg at one location beneath a fuel tank valve.

Additional soil samples were collected in 2004. The sampling results indicated the maximum concentration of DRO was 1,280 mg/kg, and RRO was an estimated 474 mg/kg.

At the Lower Tram area, soil samples were collected during the 2001 investigation. The primary contaminant of concern is DRO. DRO concentrations ranged from 230 to 13,000 mg/kg. The highest results were associated with an area of heavy soil staining beneath the valve of the exterior AST. The anchor pit also contained DRO at a concentration of 11,000 mg/kg. RRO concentrations ranged from non-detect to 3,600 mg/kg.

Soil confirmation samples were collected in 2003 following the building demolition activities and removal of the AST outside the tram terminal building. DRO concentrations ranged from 1,150 to 10,400 mg/kg surrounding the former AST. DRO was also detected from 374 to 2,350 mg/kg in soils surrounding concrete transformer pad CTP-2. No other contaminants (BTEX, lead, PCBs, PAHs) were detected above screening levels.

Risk Evaluation Summary

The White Alice Complex does not pose a risk to current site visitors or future seasonal residents. The risk assessment concluded the existing DRO levels in soil may pose a potential non-cancer risk (hazard index of 2) to future permanent residents. A small quantity of soil exceeds the proposed risk-based cleanup level of 9,200 mg/kg DRO.

PCBs in soil were the primary cancer risk driver at Site 31, but are addressed separately under AOC I. No other contaminants of concern were identified based on the sampling results and screening risk assessment.

Site 32 Lower Tramway, after demolition and revegetation (2006)

Remedial Action Objectives

The remedial action objectives for the White Alice Complex are to prevent future resident ingestion, inhalation, and dermal contact with soils containing DRO greater than 9,200 mg/kg.

Preferred Alternative

The preferred alternative is excavation and treatment or disposal of stained soils which exceed the proposed DRO cleanup level. The other alternatives evaluated included no action, land use controls, natural attenuation, phytoremediation, landfarming, and thermal treatment. Excavation and disposal was selected after consideration of the remedial actions being proposed for other areas of the entire installation.

Excavation is more cost-effective than the other alternatives evaluated if implemented simultaneously with remedial actions proposed for Area of Concern E, Main Operations Complex. Assuming the mobilization/demobilization costs are fixed, the incremental cost of excavating and disposing of the small volume of contaminated soils was less than natural attenuation with long term monitoring, or the on-site treatment alternatives such as phytoremediation or landfarming.

Removal of the limited sources of contamination is protective of human health and the environment and meets the cleanup goals in a shortened timeframe.

Area of Concern 1 - PCB Contaminated Soils

Excavation of PCB-contaminated soils at Site 31 White Alice (2005)

Two areas with residual PCB - contaminated soils exist at the Northeast Cape site, Sites 13 and 31. Site 13 is located in the northeast portion of the main operations complex and consisted of the Heat and Electrical Power Building 110. Site 31 is the former White Alice Communications Station.

The Heat and Power Building 110 contained three transformer banks and diesel generators. The building and contaminated concrete were removed under previous removal actions. A total of 141 tons of PCB-contaminated soils at Building 110 were also excavated and disposed offsite during the 2001 and 2005 field seasons. Additional PCB-contaminated soil remains in subsurface soils at Site 13.

The White Alice site is located southeast and uphill from the main operations complex in a glacial valley at the base of Mt. Kangukhsam. The site consisted of four large billboard antennas, a central main electronics building, other supporting structures, and seven ASTs. The antennas, buildings, and ASTs were demolished and removed during the 2003 field season. A total of 118 tons of PCB-contaminated soil was excavated south and west of the former Main Electronics Building (Bldg 1001) adjacent to a former transformer pad, and at the septic tank outfall during the 2005 field season. PCB-contaminated concrete (79 tons) was also removed from portions of the Building 1001 foundation.

Nature and Extent of Contamination

Excavation of PCB-contaminated soils near Site 13 Building 110 (2005)

Surface and subsurface soil samples were collected over several years to evaluate the extent of PCB contamination surrounding Building 110 and the transformer pads. Soil screening and laboratory confirmation samples following the 2005 removal action indicate residual PCB concentrations up to 37.1 mg/kg at one location (excavation 13B-2). Figure 10 shows the previous soil excavation and sampling locations at Site 13. An estimated 150 cubic yards of soil remain with PCBs above the cleanup level of 1 mg/kg.

Soil samples collected during the 2003 demolition of the wooden utilidor corridor south of Building 110 indicated two discrete hits of PCBs ranging from 2.4 to 16.9 mg/kg, at depths of 4 to 5 feet below ground surface. The utilidor trenches were backfilled with clean fill.

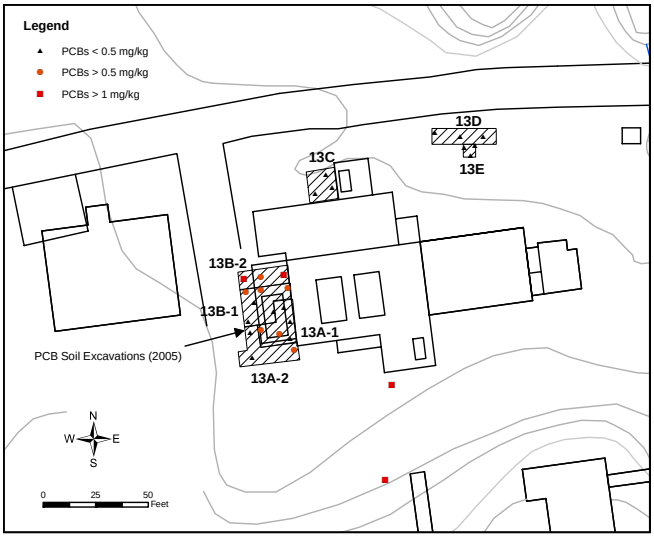
The three excavations conducted north of Building 110 (13C, 13D, and 13E) during the 2005 field season successfully removed PCB contamination to below 1 mg/kg at these locations.

At Site 31, surface and subsurface soil samples were collected over several years to evaluate the extent of PCB contamination near transformer pads and a septic outfall. Additional soil confirmation samples were collected in 2005 after the removal of PCB-contaminated concrete and soils. Figure 11 shows the soil excavation and sampling locations at Site 31.

PCBs were identified at a possible sewage outfall and adjacent to the main electronics building transformer pad. In 2005, PCB-contaminated soils were excavated from three locations, the septic tank outfall (31C, 13 tons), west of the main electronics building (31B, 50 tons), and adjacent to the former transformer pad (31A-1,31A-2, 55 tons).

Soil confirmation samples from one of the three excavations indicate PCBs still remain at concentrations above 1 mg/kg adjacent to the former transformer pad only. PCBs remain in soils at concentrations ranging from 1.53 to 7.09 mg/kg. The two excavations at the septic tank outfall and west of the building successfully removed all PCB contamination to below 1 mg/kg.

Figure 10. PCB soil excavations and sampling at Site 13



Risk Evaluation Summary

PCB-contaminated soils were evaluated in the human health and ecological risk assessment under two scenarios, current seasonal use and future residential use. The future residential scenario assumed residents would occupy the site year-round. The current or future seasonal use scenario (subsistence, recreational) assumed site use for 6 months per year.

Under a future residential use scenario, PCBs above 1 mg/kg exceed the ADEC risk management thresholds of $1x10^{-5}$ (cancer risk) and 1 (non-cancer hazard index). The potential future risks due to PCB-contaminated soils at Site 13 are $1x10^{-4}$, and 29; at Site 31 are $3x10^{-5}$, and 6.

However, if current seasonal use continues, PCBs below 10 mg/kg do not pose a risk to human health or the environment above the risk management criteria.

Federal rules (40 CFR 761) specify default PCB cleanup levels based on occupancy scenarios (high/low). Future residential land use is considered high occupancy. Seasonal land use may be considered low occupancy. Cleanup to the 1 mg/kg criteria results in no further conditions placed on the property. Cleanup to the 10 mg/kg criteria under the high occupancy scenario requires capping of residual contaminated soils and placement of a deed notice/restriction on the property. The deed notice informs landowners about the PCBs left onsite, use restrictions that apply, and the landowner's obligation to maintain the cap integrity.

Excavation of PCB-contaminated soils at White Alice site (2005)

Remedial Action Objectives

The remedial action objective for the PCB-contaminated soils at Area of Concern 1 is to prevent exposure to contaminated soils which may pose a risk to human health and the environment.

The proposed cleanup level for PCBs is 1 mg/Kg. The proposed cleanup level is protective of human health under a future residential exposure scenario and meets ADEC risk management standards.

Soil confirmation sampling will be conducted at the conclusion of the remedial action to verify cleanup levels were attained for the impacted areas. The cleanup will be considered complete when the mean concentration of samples at the upper 95% confidence limit (UCL) is below the site specific cleanup level.

Preferred Alternative

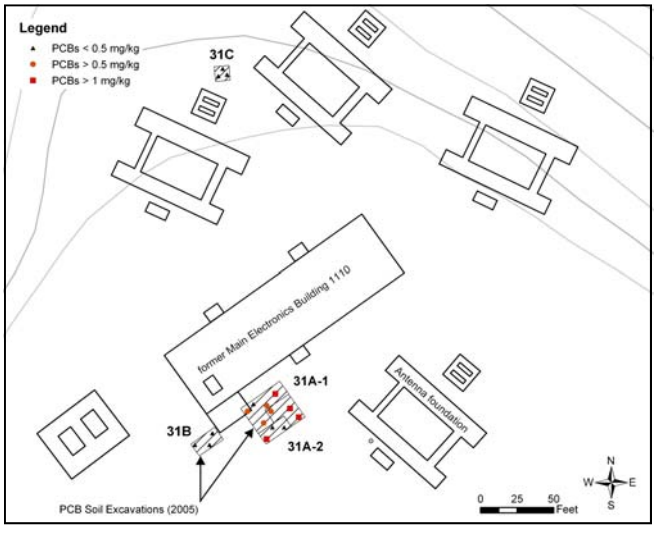
The preferred alternative for the PCB-contaminated soils is excavation and off-site treatment/disposal.

The alternatives evaluated consisted of no action, land use controls, capping, and excavation with offsite disposal. The preferred remedial alternative is cost-effective if implemented simultaneously with other proposed remedial actions at the overall site and provides the best long-term effectiveness.

The feasibility study considered the potential future risks to be manageable using land use controls. Current landuse is considered recreational, and it is unlikely that human receptors would be exposed for a long enough duration to be adversely affected. However, based on the potential for future residential landuse, federal regulations require removal of PCBs at concentrations above 25 mg/kg.

Excavation is considered the most effective remedy, which provides the greatest long-term effectiveness. The slightly less expensive remedy utilizing capping was not selected due to permanence of the excavation alternative.

Figure 11. PCB soil excavations and sampling at Site 31



Proposed Plan

Summary

View from Kangukhsam mountain north towards Bering Sea (2003)

The Northeast Cape installation consists of 34 individual sites. A summary of the preferred alternatives selected for each site at Northeast Cape is shown below.

Sites 1, 2, 5, 12, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 33, and 34. No further action.

AOC A Fuel Pumphouse and Pipeline. Excavation of petroleum contaminated soils above risk-based cleanup levels.

AOC B Cargo Beach Road Drum Field. Excavation of petroleum contaminated soils above risk-based cleanup levels.

AOC C Housing and Operations Landfill. Land use controls and long term monitoring.

AOC D Pipeline Break. Land use controls and natural attenuation.

AOC E Main Operations Complex
Excavation of petroleum contaminated soils above risk-based cleanup levels in upper 5 feet, natural attenuation of deeper subsurface soils and shallow groundwater, long term groundwater monitoring.

AOC F Drainage Basin
Limited excavation of source area contaminated sediments, natural attenuation, construct two weirs to reduce sediment transport.

AOC G Suqitughneq River
Five-year reviews.

AOC H White Alice Complex
Excavation of petroleum contaminated soils above risk-based cleanup levels.

AOC I PCB-contaminated soils
Excavation and disposal of PCB contaminated soils above 1 mg/kg at Sites 13 and 31.

Land use controls will be implemented for portions of the site. A deed notice informing the landowners that certain areas of the site are not potential drinking water sources will be applied, including a restriction on installation of a drinking water well at the northeast portion of the main complex. Site conditions and requirements for conditional closure will be noted in the ADEC Contaminated Sites Database. Five-year reviews will be conducted, as necessary, for those sites where unlimited use and unrestricted exposure are not achieved.

The estimated cost is $14.6 million, as shown in Table 11. The cost estimate assumes field work over several seasons due to limited available funds per fiscal year. The actual scheduling of field work shown is conceptual and will be determined by the remediation contractor.

Table 11. Estimated Costs of Preferred Alternatives	
Mobilization/Demobilization (Year 1)	$4,700,000
Mobilization/Demobilization (Year 2)	$1,500,000
Field Work (Year 1 and 2)	
AOC A - Excavate/Dispose 60 CY POL soil at Fuel Pumphouse and Pipeline	$100,000
AOC B - Excavate/Dispose 2,700 CY POL soil at Cargo Beach Road Drum Field	$750,000
AOC D - Natural Attenuation of Pipeline Break	$160,000
AOC E - Excavate/Dispose 6,000 CY POL soil at Main Operations Complex	$3,600,000
AOC F - Excavate/Dispose 2,200 CY POL soil and Construct 2 Weirs at Drainage Basin	$2,140,000
AOC H - Excavate/Dispose 15 CY POL soil at White Alice Site	$80,000
AOC I - Excavate/Dispose 260 CY PCB soil at Sites 13 and 31	$200,000
Land Use Controls Set-Up and Implementation	$270,000
Subtotal - YEAR 1	**$8,700,000**
Subtotal - YEAR 2	**$4,800,000**
Long Term Monitoring & 5 Year Reviews	**$1,100,000**
TOTAL	**$14,600,000**

Sunset at Cargo Beach (2003)

Community Participation

You are encouraged to provide comments on the alternatives presented in this Proposed Plan for the Northeast Cape FUDS. A final decision on the alternatives for each of these sites will not be made until public comments are considered.

Your comments can be provided to USACE by any of the following methods.

- **Mailing** in the included Comment Form
- **Discussing** your comments or questions over the phone with the Project Manager, Carey Cossaboom
- **Presenting** your comments verbally at the scheduled public meetings

The USACE will prepare a written response to all significant comments and any new data submitted in reference to this Proposed Plan.

A summary of these responses will accompany the Decision Document and will be made available in the Administrative Record and Information Repositories.

PUBLIC MEETINGS

July 24, 2007
2 PM
New IRA Building
Savoonga, Alaska

July 25, 2007
7 pm
City Hall Building
Gambell, Alaska

The public comment period will end on **August 31, 2007**.

A pre-addressed comment form is also available.

Prepared by:
Environmental Engineering
Attn: CEPOA-EN-EE
P.O. Box 6898
Elmendorf AFB, AK 99506

For more information, please contact:

Mr. Carey Cossaboom
USACE Project Manager
P.O. Box 6898 (PM-C-FUDS)
Elmendorf AFB, AK 99506

Phone: (907) 753-2689
Fax: (907) 753-5626
Email: Carey.C.Cossaboom@poa02.usace.army.mil

Local Information Repositories		
Savoonga City Hall	**Sivuqaq Lodge**	**UAF Northwest Campus Library**
Savoonga, Alaska 99769	Gambell, Alaska 99742	Nome, Alaska 99762
Phone: (907) 984-6614	Phone: (907) 985-5826	Phone: (907) 443-2201
Alaska Resource Library and Information Services (ARLIS)		
UAA Consortium Library, Anchorage, Alaska 99508		
Phone: (907) 272-7547		

View south towards the Kinipaghulghat Mountains (2005)

TABLE 12 Comparative Analysis of Remedial Action Alternatives

Alternative	Overall Protection of HH and Envt.	Compliance with ARARs	Short term Effectiveness	Long term Effectiveness	Reduce Toxicity, Mobility, Volume	Implementability	Cost
1 - No Action	Low Protective of current visitors. Limited protection for potential future receptors.	Partial Generally does not comply with ARARs. Does not comply with PCB cleanup level.	Low Depends on rate of natural attenuation. Not effective to control potential risk from PCBs.	Low Some potential for natural attenuation processes to reduce concentrations of petroleum.	Low Some reduction in contamination is expected to occur through natural attenuation processes.	Easy No active measures taken.	None
2 - Institutional Controls	Medium/High Protective of current and potential future use.	Partial Generally complies with ARARs. Does not comply with PCB cleanup level.	Medium/High Signs, fencing, education are effective means to prevent human exposure.	Medium Ability of landowner to maintain controls is unknown.	Low Some reduction in contamination is expected to occur through natural attenuation processes.	More difficult Depends on ability and willingness of landowners to accept and implement controls.	Low
3 - Natural Attenuation	Medium Protective of current visitors. Limited risk to future receptors from petroleum hydrocarbons. Not protective of future receptors exposed to PCBs.	Partial Over time, concentrations of petroleum hydrocarbons in soil will decrease and may meet cleanup levels. Will not meet cleanup level for PCBs.	Medium Depends on rate of natural attenuation. Metals in shallow GW less likely to degrade in short term. Monitoring to establish contaminant trends.	Med/High Potential for natural attenuation processes to reduce concentrations of fuels. Does not apply to PCBs in soils, or other contaminants in shallow GW.	Low Some reduction in contamination is expected to occur through natural attenuation processes.	Average/Easy Site access is somewhat complicated logistically due to remote location and lack of permanent facilities. Only one site visit required.	Low
3 - LTM	Medium Protective of current visitors. Limited risk to future receptors from petroleum hydrocarbons. Not protective of future receptors exposed to PCBs.	Partial Over time, concentrations of fuels in soil will decrease and may meet cleanup levels. Will not meet cleanup levels for PCBs.	Medium Depends on rate of natural attenuation processes. Monitoring to establish contaminant trends.	Medium/High Will detect trends in concentrations over time, establish rates of natural attenuation.	Low Some reduction in contamination is expected to occur through natural attenuation processes.	Average/Easy Site access and logistics complicated due to remote location, lack of facilities. Several site visits required. Involves some contracting.	Med/ Low
4 - Landfarming	Medium/High Protective of current and future receptors exposed to petroleum hydrocarbons. Does not address potential risk from PCBs.	Yes Will meet ARARs for petroleum hydrocarbons over time.	Medium/High Several field seasons will be necessary to achieve cleanup levels	Medium/High Soil should eventually meet cleanup levels for petroleum hydrocarbons.	Medium/High Excavated soil will be processed onsite to more quickly reduce concentrations of petroleum in the soil matrix.	Average Straightforward Remote site logistics, barge arrangements necessary. Also need periodic maintenance by onsite worker. More potential weather delays.	Med/ High
5 – Phyto-remediation	Medium/High Protective of current and future receptors exposed to petroleum hydrocarbons. Does not address potential risk from PCBs.	Yes Will meet ARARs for petroleum hydrocarbons over time.	Medium/High Several field seasons will be necessary to achieve cleanup levels	Medium/High Soil should eventually meet cleanup levels for petroleum hydrocarbons. Depends on optimum growing conditions.	Medium/High Soil will be seeded to reduce concentrations of petroleum in the soil matrix using grasses/plants.	Average Straightforward Remote site logistics, barge arrangements necessary. Less maintenance once soils are excavated and seeded.	Med/ High

Alternative	Overall Protection of HH and Envt.	Compliance with ARARs	Short term Effectiveness	Long term Effectiveness	Reduce Toxicity, Mobility, Volume	Implement-ability	Cost
6 - Thermal Treatment	Medium/High Protective of current and future receptors exposed to petroleum hydrocarbons. Does not directly address potential risk from PCBs.	Yes Meets ARARs for petroleum hydrocarbons.	High Soil will be treated to achieve cleanup levels during initial field season.	High Contaminated soil permanently treated and can be used as fill at the site	High Excavated soil will be treated onsite to quickly reduce concentrations of petroleum in the soil matrix.	Difficult/Avg Slightly more difficult, but standard technology. More equip't to be mobilized, time onsite, cold temps may affect perf., also need power source,	Med/ High
7 - Off-site Treatment/ Disposal	High Protective of current and future receptors exposed to petroleum hydrocarbons. Also reduces potential risk from PCBs.	Yes Meets ARARs for fuel + other contaminants. Source removal means GW more likely to attenuate and meet cleanup levels in time.	High Soil will be immediately removed from the site.	High Contaminated soil permanently removed from the site.	High Excavated soil will be transported offsite, reducing volume of contamination left onsite.	More difficult Excavation activities will likely require dewatering or other measure. Challenging site logistics, must arrange barge transport well in advance.	High
8 - Chemical Oxidation	Medium Limited risk to current receptors, protective of potential future receptors who may utilize shallow GW as drinking water source. Prevents contaminant migration.	Yes Meets ARARs for GW cleanup levels. Does not apply to contaminated soils.	Medium/High Shallow GW treated to reduce contaminants in shortened timeframe. Doesn't address soil contamination directly.	Medium/High Treated will be verified by confirmation sampling. Long-term monitoring may not be required.	Medium/High Contaminants altered/ bound by treatment with oxidizing agents.	Difficult/Avg Requires several field seasons and mobilizations to treat GW. Shallow depth of GW, tundra, cold temps are problematic.	Med
9 - Reactive Walls	Medium Limited risk to current receptors, protective of potential future receptors who may utilize shallow GW as drinking water source. Prevents migration of contaminants.	Yes Meets ARARs for down-gradient GW. Does not meet for contaminated soils.	Medium/High Off site migration of shallow GW controlled and contaminants treated to meet cleanup levels. Not applicable to soil contamination.	Medium Unknown in arctic environment.	Medium/High Shallow groundwater treated as passes through the system. Passively addresses the source.	More difficult Installation between gravel pad sloping towards tundra matrix could be problematic, cold temps could adversely affect materials.	Med/ High
10 - Capping	Yes Protective of human health and the environment.	Partial. Prevents exposure to contaminated soils and landfill contents.	High Remedial activities can be completed in shorter time frame. Remedial objectives met in short term. LTM also required.	High Long term monitoring of cap integrity and five year reviews required. Arctic env't could adversely affect cap stability or effectiveness.	Medium/High Mobility of contaminants within landfill will be reduced by a cap which covers the soil and prevents precipitation from leaching contaminants into the water table.	Average Standard practice for landfills. Remote site logistics challenges still apply to transport materials and equipment.	Med/ High
11 - Reactive Matting	High Protective of potential future risk.	Yes Meets surface water quality criteria of no sheen.	High Capping prevents exposure to contaminated sediments and prevents potential migration through surface water column.	Medium/High Uncertain if environmental conditions may cause degradation of the matting.	Medium/High Although contaminated sediments are capped in place, components in the matting treats the water flowing through the sediments.	Slightly Difficult Technology unproven in Alaska. Unknown how matting can be placed in wetland environment with abundant vegetation.	Med/ High

References

Staged steel debris at Cargo Beach (2003)

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