US Army Corps
of Engineers

Decision Document
GAMBELL FORMERLY USED DEFENSE SITE
F10AK0696
St. Lawrence Island, Alaska

June 2005

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Declaration Statement
for
Decision Document
Gambell Site F10AK0696
St. Lawrence Island, Alaska

Site Name and Location

The Gambell Formerly Used Defense Site (FUDS), project numbers F10AK069601 and F10AK069603, is located on St. Lawrence Island in the western portion of the Bering Sea, approximately 200 air miles southwest of Nome, Alaska. The Alaska Department of Environmental Conservation (ADEC) contaminated sites record key (reckey) number for the overall Gambell site is 198532X917919, individual areas of concern are also tracked with separate reckeys (198532X917920-32 and 198532X117901-13). One area of concern, Site 5 Tramway (reckey #198532X917923) will be addressed under a future decision document. The Environmental Protection Agency (EPA) identification number is AKD981765894. The Gambell site is not listed on the National Priorities List (NPL).

Statement of Basis and Purpose

This decision document presents the selected remedy for the Gambell site on St. Lawrence Island, Alaska, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, 42 United States Code §9601 et seq., and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations Part 300 et seq. The State of Alaska, through the Department of Environmental Conservation (ADEC) concurs with the selected remedy.

This decision is based on the results of a phased remedial investigation and subsequent removal action activities which were conducted from 1994 to 2003. The accompanying decision document summarizes these activities. Detailed information supporting the selected remedial action is also contained in the Administrative Record for this site, located at the U.S. Army Corps of Engineers (USACE) Alaska District Office on Elmendorf Air Force Base, AK, and the Information Repositories located at the Alaska Resource Library and Information Services (ARLIS) in Anchorage, the Sivuqaq Lodge in Gambell, the Savoonga IRA Building in Savoonga, and the University of Alaska Fairbanks Northwest Campus Library in Nome.

Assessment of Site

The Gambell site was used by the military from 1948 until the late 1950's. Various facilities were constructed near the village of Gambell to provide housing and operations, aircraft radar, communications, and other functions. Two discrete areas of contaminated soil are present at Sites 7 and 12. The identified contaminants of concern (COCs) are arsenic, chromium and lead. The response action selected in this Decision Document is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants, which may present an imminent and substantial endangerment. The response action will also address the physical hazards posed by one area containing inherently hazardous military debris, which poses a clear danger, likely to cause death or serious injury to

persons exercising ordinary and reasonable care. These unsafe conditions include exposed metal Marston matting debris adjacent to the local airstrip at Site 8A.

The Marston matting was abandoned in place when the military demobilized from the area in the late 1950s. The exposed Marston matting debris is located in an area heavily traveled by local residents using all terrain vehicles and snowmobiles. The debris poses a clear danger to local residents due to the sharp and jagged edges which protrude above the ground surface and large piles which create a navigation hazard during the winter when partially covered by snow.

Description of Selected Remedy

The selected remedy was chosen from many alternatives as the best method of addressing the arsenic contaminated soil at Site 7 and the lead and chromium-contaminated soil at Site 12. It addresses the risks to health and the environment caused by the current or future exposure of a resident to contaminated soils. The selected remedy addresses this risk by reducing soil contamination to below risk-based cleanup levels established for these sites. The selected remedy at Site 7 is excavation and off-Island disposal of an estimated 4 tons of soil containing greater than the cleanup level of 11 mg/kg arsenic. The selected remedy at Site 12 is excavation and off-Island disposal of an estimated 4 tons of soil containing greater than the cleanup levels of 400 mg/kg lead and 26 mg/kg chromium. Inherently hazardous debris will also be removed from Site 8A. The specific components of the selected remedy consist of the following:

- Approximately 4 tons of soil at Site 7 with arsenic concentrations in excess of 11 ppm will be excavated and shipped off-Island to a permitted disposal facility;
- Approximately 4 tons of soil at Site 12 with lead concentrations in excess of 400 ppm and chromium concentrations greater than 26 mg/kg will be excavated and shipped off-Island to a permitted disposal facility;
- Confirmation soil sampling will be conducted to ensure cleanup goals are met;
- Approximately 50 tons of exposed metallic debris (i.e., Marston matting) at Site 8A will be gathered and shipped off-Island to a permitted disposal or recycling facility;
- Sites 1A, 1B, 1C, 2, 3, 4A, 4B, 4C, 4D, 4E, 6, 8B, 8C, 8D, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25A, 25B, 26, 27, and 28 were investigated and previous response actions removed debris and/or contaminated soils. Under the FUDS Program, no further action is planned.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to remedial actions, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because treatment of the contaminants at the site was not found to be practicable, alternative treatment technologies were not selected. Because the selected remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a five-year review will not be required.

In accordance with CERCLA and the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS), the U.S. Army Corps of Engineers, Alaska District, has

completed all activities required for selection of a response action and determination of no further action at the Gambell Site located on St. Lawrence Island, Alaska. The accompanying Decision Document supports the conclusions that all known sources of contamination have been investigated. Contaminated soil will be removed from Sites 7 and 12, and inherently hazardous debris consisting of exposed metal Marston matting will be removed from Site 8A. Following these remedial actions, no sites in Gambell will have contaminants at levels determined by the ADEC to be harmful to human health and the environment.

The Proposed Plan was presented to the Gambell community on 21 July 2004 and copies of the Proposed Plan were provided to the Native Village of Gambell, the Information Repositories, and other interested parties. Comments were received from community members, Restoration Advisory Board members, and the Technical Assistance for Public Participation (TAPP) provider.

Authorizing Signatures

This Decision Document presents the selected remedial action of debris removal and excavation of contaminated soil with offsite landfill disposal for the Gambell Site, St. Lawrence Island, Alaska. The U.S. Army Corps of Engineers is the lead agency under the Defense Environmental Restoration Program (DERP) at the Gambell Formerly Used Defense Site (F10AK0969), and has developed this Decision Document consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document will be incorporated into the Administrative Record file for the Gambell Site, which is available for public view at the U.S. Army Corps of Engineers Alaska District Office on Elmendorf AFB, AK; and the Information Repositories located at the Alaska Resource Library and Information Services (ARLIS) in Anchorage, the Sivuqaq Lodge in Gambell, the Savoonga IRA Building in Savoonga, and the University of Alaska Fairbanks Northwest Campus Library in Nome. This document, presenting a selected remedy with a present worth cost estimate of less than $2 million, is approved by the undersigned, pursuant to Memorandum, DAIM-ZA, September 9, 2003, Subject: Policies for Staffing and Approving Decision Documents (DDs), and to Engineer Regulation 200-3-1, Formerly Used Defense Sites (FUDS) Program Policy.

5 July 2005

Colonel Timothy Gallagher
Commander
U.S. Army Corps of Engineers, Alaska District

Date

This signature sheet documents the decision made for the Gambell Formerly Used Defense Site, St. Lawrence Island, Alaska. The Alaska Department of Environmental Conservation concurs with the Corps of Engineers' selected remedy. The decision may be reviewed and modified in the future if new information becomes available that indicates the presence of previously undiscovered contamination or exposures that may cause unacceptable risk to human health or the environment.

6/27/05

John Halverson
DoD Cleanup Unit Manager
Alaska Department of Environmental Conservation

Date

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Appendix A – Responsiveness Summary

Glossary of Terms and Acronyms

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ARARs	Applicable or Relevant and Appropriate Requirements
BNAs	Base, neutral, and acid compounds (includes PAHs)
BTEX	Benzene, toluene, ethylbenzene, and xylene
BGS	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of concern
DOD	Department of Defense
DRO	Diesel-range organics
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FUDS	Formerly Used Defense Site
GRO	Gasoline-range organics
IC	Institutional Controls
mg/kg	milligram per kilogram
mg/L	milligram per liter
MWH	Montgomery Watson Harza
NALEMP	Native American Land Environmental Mitigation Program
NCP	National Contingency Plan
NFA	No Further Action
OSCI	Oil Spill Consultants, Inc.
pg/g	picogram per gram
POL	Petroleum, oil, and lubricants
ppm	Parts per million
PAHs	Polyaromatic (or Polycyclic) Hydrocarbons
PCBs	Polychlorinated biphenyls
Priority Pollutant Metals	Antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.
RCRA	Resource, Conservation and Recovery Act
RCRA metals	arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver
RRO	Residual Range Organics
RAB	Restoration Advisory Board

RI	Remedial Investigation
RA	Removal/Remedial Actions
SVOCs	Semi volatile organic compounds
TAL metals	Target Analyte List metals, includes aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
TCLP	Toxicity characteristic leaching procedure
TRPH	Total recoverable petroleum hydrocarbons
USACE	United States Army Corps of Engineers
UCL	Upper Confidence Level
VOCs	Volatile organic compounds

1. Decision Summary

This Decision Summary provides an overview of the contaminants at the Gambell Site. It identifies the areas evaluated for remedial response, describes the remedial alternatives considered, and analyzes those alternatives compared to the criteria set forth in the National Contingency Plan (NCP). The Decision Summary explains the rationale for selecting the remedy, and how the remedy satisfies the statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.1 Site Name, Location, and Brief Description

The Gambell Site, FUDS project #s F10AK069601 and F10AK069603, is located on St. Lawrence Island, Alaska, about 200 air miles southwest of Nome in the Bering Sea (see Figure 1). The State of Alaska, Department of Environmental Conservation (ADEC) tracks the entire site with reckey # 198532X917919, and also lists individual areas of concern by separate reckeys (198532X917920-32 and 198532X117901-13). One area of concern, Site 5 Tramway (reckey #198532X917923) will be addressed under a future decision document. The EPA identification number for Gambell is AKD981765894. The site is situated on a gravel spit at the northwest point of the island. Gambell is located at latitude 63° 46’ 49” North and longitude 171° 43’ 46” West. The military leased approximately 2,500 acres in Gambell. Thirty-eight (38) separate sites of concern were identified during the remedial investigation process (see Figure 2). The selected remedy for each site, except Site 5, is listed in Table 1.

Figure 1 – Site Vicinity Map

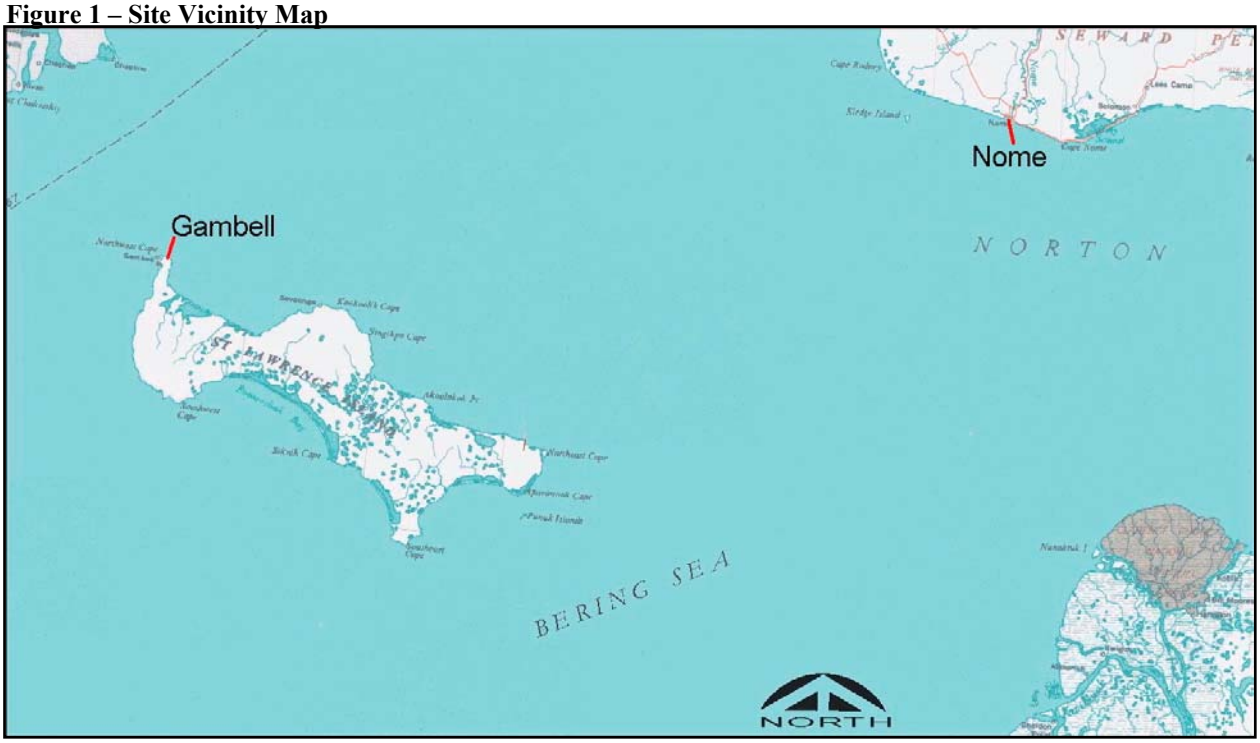
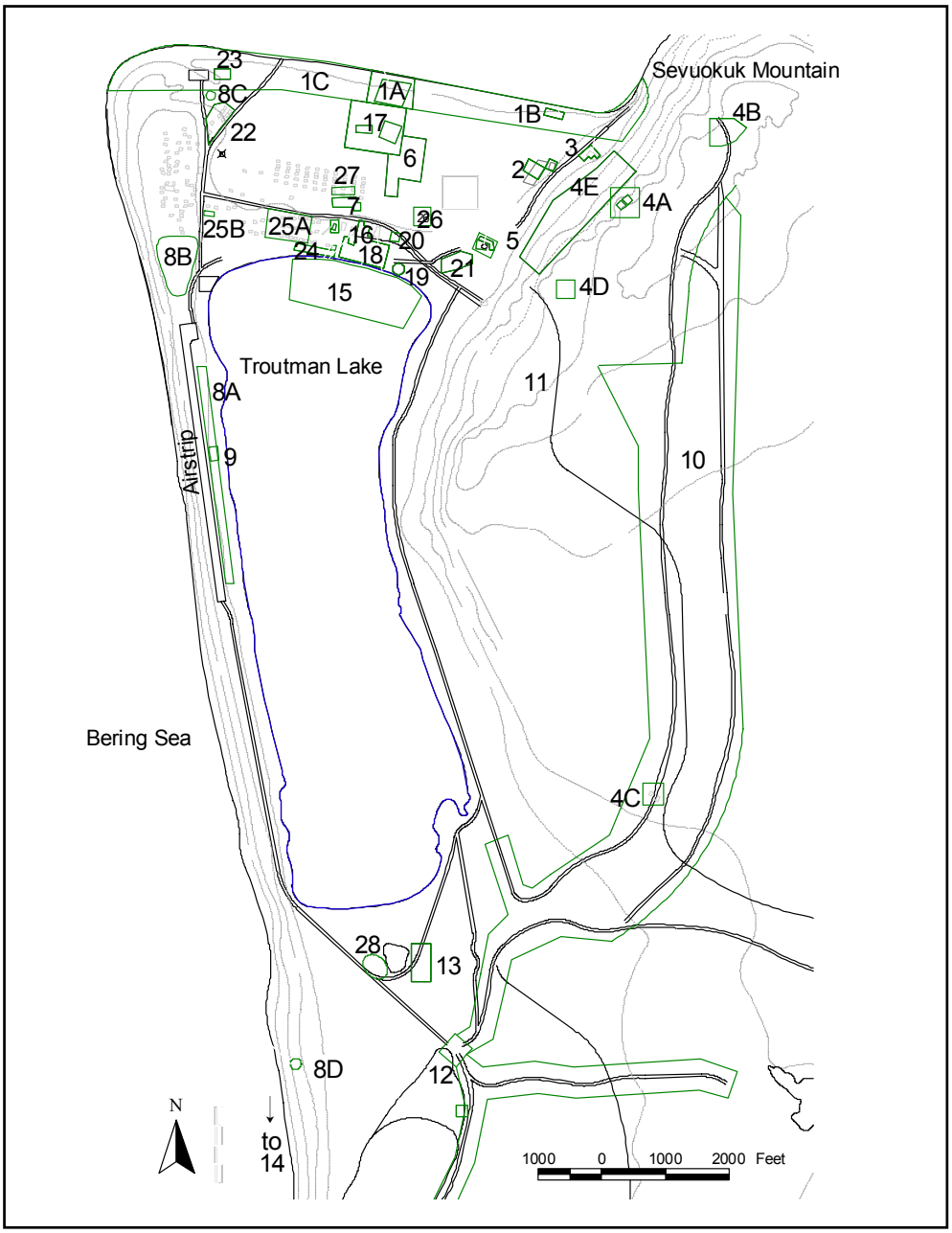


Table 1 – Remedial Responses by Site Location

Site	Selected Remedial Response
1A North Beach	No Further Action
1B Army Landing Area	No Further Action
1C Air Force Landing Area	No Further Action
2 Military Burial Site	No Further Action
3 Communications Facility	No Further Action
4A Air Force Radar Site	No Further Action
4B Former Quonset Huts	No Further Action
4C Discarded Drums	No Further Action
4D Former Transformers	No Further Action
4E Western Face of Sevuokuk Mtn	No Further Action
6 Military Landfill	No Further Action
7 Military Power Facility	Excavation and off-site disposal of arsenic-contaminated soil
8A Marston Matting	Removal and off-site recycling/disposal of exposed metal debris
8B Buried Debris	No Further Action
8C Navy Landfill	No Further Action
8D Beach Ammunition	No Further Action under FUDS *
9 Asphalt Drums	No Further Action
10 Army/Air Force Trails	No Further Action
11 Communication Cable Route	No Further Action
12 Nayvaghat Lakes Disposal Site	Excavation and off-site disposal of lead-contaminated soil
13 Radar Power Station	No Further Action
14 Navy Plane Crash Site	No Further Action
15 Troutman Lake Disposal Site	No Further Action
16 Municipal Building Site	No Further Action
17 Army Landfills	No Further Action
18 Main Camp	No Further Action
19 Diatomaceous Earth	No Further Action
20 Schoolyard	No Further Action
21 Toe of Sevuokuk Mountain	No Further Action
22 Former CAA Housing	No Further Action
23 Debris from High School	No Further Action
24 South of Municipal Building	No Further Action
25A Gambell South Housing Units	No Further Action
25B Low Drainage Area	No Further Action
26 Possible Debris Burial Site	No Further Action
27 Drum Storage Area	No Further Action
28 Disturbed Ground	No Further Action

* Site 8D is planned for future debris removal under NALEMP, pending the availability of funding.

Figure 2 – Site Location Map



1.2 Site History

The military established the Gambell site in the 1950's as part of a surveillance and intelligence-gathering network. Various units of the U.S. Army and U.S. Air Force utilized the area. The Air Force built a base camp in 1950 at the foot of Sevuokuk Mountain and a radar site directly above on the mountain top (both abandoned in 1956). The Army occupied several sites during the late 1950s, with a main base camp located just north of Troutman Lake. The Navy also laid communications cables from the village of Gambell, up Sevuokuk Mountain, and south to Brunnell Cape.

Environmental investigations and cleanup activities at Gambell began in the mid 1980's. The goals of the investigations were to locate and identify areas of contamination and to gather enough information to develop a cleanup plan. The first major environmental study, the remedial investigation, was performed at Gambell in 1994. The study divided the concerns among 18 separate sites. The results of the remedial investigation showed that contaminants were present at some but not all sites. Some sites were subdivided into sub sites and new sites were also added in subsequent investigations.

In 1996, the second phase of remedial investigation was performed. In this study, additional soil and groundwater samples were collected from Sites 1A, 1B, 2, 3, 4B, 4D, and 5. The study objectives were to further delineate the extent of contamination, estimate amounts of debris, and conduct a geophysical survey.

In 1997, a USACE contractor, Montgomery Watson, removed visible surface debris from various sites around Gambell. During the 1999 field season, Oil Spill Consultants, Inc. (OSCI) performed further cleanup activities in Gambell, including the removal of additional debris exposed by frost jacking after the 1997 cleanup activity. OSCI removed a total of 26.8 tons of hazardous and non-hazardous containerized wastes such as asphalt drums, paint, generators, batteries, empty drums, and transformer carcasses. OSCI also removed 71 tons of exposed metal debris such as runway Martson matting, cable, fuel tanks and equipment parts; and excavated 72 tons of contaminated soil. However, OSCI was unable to complete the removal of Martson matting adjacent to the runway due to safety concerns over its proximity to airstrip utilities.

In 2000 and 2001, the Army Engineering and Support Center (Huntsville, AL) conducted extensive research and investigations to locate possible ordnance and explosives materials left behind by the military. During the field surveys, small amounts of ordnance waste were found, consisting primarily of highly weathered 30-caliber small arms ammunition at a beach burial pit southwest of Troutman Lake. An Engineering Evaluation/Cost Analysis (EECA) dated November 2002 recommended institutional controls as the appropriate response action for military munitions and explosives of concern (MEC) at the Gambell Site. An Action Memorandum, dated June 2003, documented the selected response action of institutional controls.

The institutional controls were implemented during the summer of 2004 and consisted of distributing informational pamphlets and posters about ordnance risks to local residents and businesses and holding a community meeting. An initial review to evaluate the continued effectiveness and reliability of the ordnance response action will be conducted in 3 years. After

the initial review has been conducted, recurring reviews will be performed at 5-year intervals. The need for recurring reviews will be coordinated with regulators and stakeholders and justified in each recurring review report.

A supplemental remedial investigation was conducted by Montgomery Watson Harza during the 2001 field season, to verify previously collected confirmation data and investigate the nature and extent of contamination at four newly identified sites. These sites were identified as potential areas of concern based on community concerns and a review of a historical photographic analysis completed by the USACE Topographic Engineering Center in September 2000. The summary report recommended no further action for most sites. Further action was recommended at Sites 4A, 4B, 6, 7, and 12 based on a comparison to screening levels. The ADEC Ingestion pathway cleanup levels were later determined to be the applicable cleanup levels for Sites 4A, 4B and 6. Since Sites 4A, 4B and 6 meet the specified regulatory cleanup levels, only Sites 7 and 12 require further action.

The Corps of Engineers completed a Feasibility Study (FS) in February 2004. A Proposed Plan was distributed to the public in July 2004 which summarized site conditions, investigation results, and described the remedial alternatives evaluated in the FS. A public meeting to discuss the plan was held in Gambell on July 21, 2004. The supporting documents can be found in the Administrative Record located at the USACE Office on Elmendorf Air Force Base or at the Information Repositories located in Gambell, Savoonga, Nome, and Anchorage.

Remedial investigation and removal work at Gambell was carried out under the Defense Environmental Restoration Program (DERP) FUDS program. There have been no enforcement activities or notices of violation pertaining to the Department of Defense activities at the Gambell site.

1.3 Community Participation

Public participation has been an important component of the CERCLA process at the Gambell Site. A Community Relations Plan was developed for the project in March 1996 and updated in April 2002. The Community Relations Plan describes the measures used to meet the community relations goal of keeping Gambell residents and other interested people informed about project activities. It provided a means for local residents to share their knowledge about the Gambell area and its history with the project team. It further allowed the residents and other interested persons to provide their feedback and comments on project activities, and gave everyone an opportunity to become involved in the project. Activities aimed at informing and soliciting public input regarding the Gambell Site include:

- Restoration Advisory Board (RAB): A RAB comprised of community members and other interested parties was established in January 2000. RAB meetings are held approximately 3 times per year to keep the public informed of ongoing project activities. Many Gambell residents identified areas of concern on maps or photographs and relayed information on past activities or stories about certain areas from village elders.
- TAPP Advisor/Community Liaison: The RAB is served by a technical advisor, under the Technical Assistance for Public Participation (TAPP) program, to provide technical guidance on workplans, reports, proposed remedies, and potential environmental and human health impacts. In addition, a local resident was employed as a community liaison during the remedial investigation phase, to help community members access technical information, distribute meeting notices, and assist with agency communication.
- Meeting Notices: Meeting notices were published in the Nome Nugget newspaper and posted in prominent locations around town such as the Sivuqaq Lodge, City Hall, Post Office, and Washeteria. Radio announcements were broadcast on KNOM of Nome, AK.
- Informal Meetings and Site Visits: Informal meetings occurred whenever project staff visited with Gambell residents and other interested or knowledgeable parties. The project team gathered information on potential hazardous waste or debris locations, and gathered available documentation through interviews with village residents, Native Village of Gambell IRA Council members and staff, Sivuqaq Incorporated board members, and other interested parties. These persons contributed information regarding historical and current conditions at the Gambell site.
- Fact Sheets: Information about the project was published periodically through Fact Sheets distributed to RAB members and placed at the Information Repositories.
- Information Repositories: Project documentation, reports, and other materials are available at 4 locations including the Sivuqaq Lodge in Gambell, the Savoonga IRA Building in Savoonga, the University of Alaska Fairbanks Northwest Campus Library in Nome (formerly at the National Park Service) , and the Alaska Resource Library and Information Services in Anchorage.
- Mailing List: A mailing list was compiled and updated throughout the project.
- Proposed Plan: The Gambell Proposed Plan was distributed to the public in July 2004; a public meeting was held July 21, 2004; and the public review period was from July 21 to August 30, 2004. Comments from the public are contained in the Responsiveness Summary found in the Appendix of this document.

- Public Notices: Public notices have been issued prior to all significant decision points including RAB meetings. A public notice for the Proposed Plan and Public Meeting was published in the Nome Nugget newspaper on July 14, 2004.
- Responsiveness Summary: Public comments were received on the Gambell Proposed Plan. The USACE maintains a record of all comments and has published responses to the comments in this Decision Document. A Responsiveness Summary binder was also developed for the project to document implementation of the Community Relations Plan. It contains responses to all comments/concerns raised by the public during the project and will continue to be updated until the project is completed.

1.4 Scope and Role of Response Action

The CERCLA process is intended to identify solutions to contamination issues where they exist. The remedial action described in this Decision Document addresses threats to human health and the environment posed by contamination at the Gambell Site. The RI/FS Reports defined these threats as soil contaminants. Soil with contaminants that pose a potential threat to the public will be removed, transported, and disposed in an appropriate facility. In addition, exposed military debris which poses a clear danger, likely to cause death or serious injury to persons exercising ordinary and reasonable care will be removed and transported to a permitted landfill or approved recycling facility.

1.5 Site Characteristics

This section provides an overview of the Gambell Site, including geographical information, hydrology, ecological resources, and land use. Site locations are shown on Figures 2 and 3.

1.5.1 Geographical and topographic information

The Native Village of Gambell is located on St. Lawrence Island, in the western portion of the Bering Sea, approximately 200 air miles southwest of Nome, Alaska (see Figure 1). The village is situated on a gravel spit that projects north and westward from the island. Gambell is relatively flat, with an elevation range from sea level to approximately 30 feet above mean sea level. Sevuokuk Mountain forms the eastern boundary of the gravel spit, and rises steeply to a height of approximately 619 feet. The dominant soil lithologies underlying the Gambell area are unconsolidated, poorly to well-sorted gravels with sand and poorly to well-sorted sand with gravels. These soils are interpreted as washed beach gravels deposited on a wave cut platform. Sevuokuk Mountain is composed of Cretaceous quartz monzonite, a gray rock rich in quartz and feldspars.

The entire Gambell site encompasses approximately 2,500 acres. The majority of the areas of concern are located within or adjacent to the village of Gambell, a community of 649 persons (US Census 2000).

1.5.2 Hydrology and Groundwater Use

Groundwater was encountered at depths ranging from 2.5 feet below ground surface (bgs) south of Troutman Lake to 16.5 ft bgs along the North Beach area. The largest and most permanent surface water features in the vicinity of Gambell are Troutman Lake and North Nayvaghat Lakes. Small ephemeral ponds and bogs are also present on the tundra east of Troutman and North Nayvaghat Lakes.

Groundwater from the central gravel spit is not suitable as a source of drinking water. Groundwater in the gravels is often saline, difficult to recover in useable quantities, and located in an active lens over permafrost. A drinking water well in the old Village area was abandoned in the past because of poor water quality (salt water intrusion) or quantity. Groundwater encountered at the site has been limited in quantity, and only intermittently detected. Permafrost in Gambell is commonly encountered at depths ranging from 3 to 15 feet below the ground surface. The groundwater aquifer (10-14 ft depth) that currently supplies drinking water to the community is located at the base of Sevuokuk Mountain, approximately 1,500-2,000 feet east of the village on the far eastern edge of the gravel spit. The predominant surface water feature, Troutman Lake, is considered slightly brackish due to influences from the Bering Sea.

Continuous permafrost acts as a barrier for soil contaminant migration to a groundwater zone. However, migration of contaminants may occur with groundwater movement in the active lens above the permafrost layer (suprapermafrost groundwater). Suprapermafrost groundwater occurs sporadically within the village of Gambell (i.e., in the vicinity of Sites 6, 7, 16, 17, 18). The documented groundwater flow direction in this area is to the north, towards the Bering Sea, a distance of about 1,200 feet.

According to a State of Alaska hydrogeological investigation report (Ireland, 1994), the Gambell aquifer is canoe-shaped, originating along the front of the steep bluff of Sevuokuk Mountain, and continuing down the hydrological gradient across a highly permeable gravel bar towards the ocean. The aquifer appears to be a thaw bulb in the permafrost, and as the permafrost expands or recedes, the aquifer dimensions vary. Warm recharge water originating on Sevuokuk Mountain effectively melts the permafrost where the mountain front joins the gravel spit. Most of the water entering the aquifer comes from two springs that flow from the steep bluffs of the mountain into the gravel. Shallow groundwater across the gravel spit does not appear to be continuous because of the presence of shallow permafrost (Munter and Williams, 1992).

1.5.3 Ecological and Biological Resources

St. Lawrence Island supports habitats for the following endangered or threatened species: the spectacled eider (endangered), Steller's eider (threatened), and Steller sea ion. Walrus and polar are protected under the Marine Mammal Protection Act. The investigation areas of concern do not support sensitive habitats, and are predominantly comprised of gravel and sand within the city of Gambell, adjacent roads or the airport.

1.5.4 Current and Potential Future Land Uses

St. Lawrence Island is owned jointly by the two village native corporations: Sivuqaq, Inc., in Gambell, Alaska, and the Savoonga Native Corporation in Savoonga, Alaska. Non-Native land on St. Lawrence Island is limited to state land used for airstrips and related facilities in Gambell and Savoonga. A federally recognized tribe is located in the community -- the Native Village of Gambell. Gambell is inhabited primarily by Native St. Lawrence Island Yupik people, who lead a subsistence-based lifestyle. The Gambell area supports habitat for a variety of seabirds, waterfowl, and mammals that either breed in or visit the area. The area surrounding the top of Sevuokuk Mountain, above the Village of Gambell, supports a large bird rookery. The birds and bird eggs are a subsistence food source for local inhabitants. The ocean surrounding the Gambell area is used extensively for subsistence hunting of whales, walrus, seals, sea birds, and fish. Future land use is expected to remain residential with the surrounding area used for recreation and subsistence hunting or gathering.

1.6 Summary of Site Contamination

This section summarizes the sampling strategy for 37 of the 38 sites in Gambell, identifies contaminants of concern, and affected media. Two areas, Sites 7 and 12, were identified for a response action based on the presence of contaminants at levels which may pose a risk to human health and the environment. The basis of this analysis is the data collected during the Remedial Investigation (RI), which identified the nature and extent of contamination in Gambell. One additional area, Site 8A, was identified for a response action based on the presence of physical hazards consisting of exposed metal debris.

During the remedial investigation process, soil, sediment, and shallow-aquifer groundwater were sampled and analyzed for a wide range of organic and inorganic constituents. Contaminants detected in the soil and shallow-aquifer groundwater were primarily fuels and metals.

1.6.1 Site 1A – North Beach, Army Landing Area

Site 1A is located in the central portion of the North Beach, where two well-established all-terrain vehicle (ATV) trails intersect. The Army landing area was located east of an area that is currently used by local residents to land or launch whaling boats. The site consisted of exposed surface debris including engine pieces, Marston matting, weasel tracks, steel cables, a partially buried 100-foot crane, and other buried metallic debris which are periodically exposed and reclaimed by shifting gravels along the beach area.

In 1997, Montgomery Watson removed all visible surface debris from Site 1A (5,545 pounds) and the surrounding beach area (3,630 pounds), including corrugated roofing material, piping, Marston matting, weasel tracks, protruding parts of a buried crane, engines, cables, and other miscellaneous debris. No dangerous surface debris remains at this site. Buried debris is not eligible for further action under FUDS.

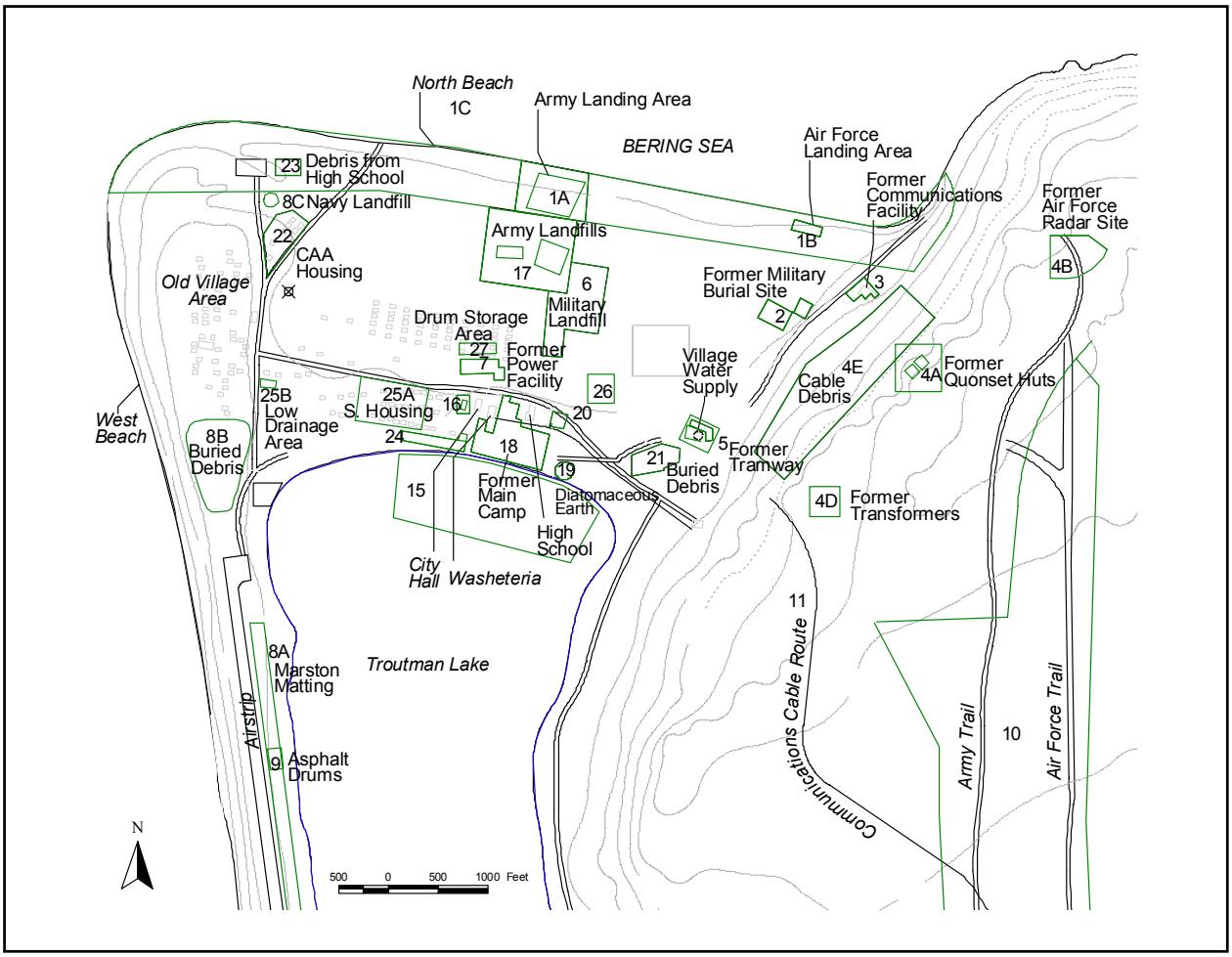
Soil

Surface and subsurface soil samples were collected in 1994. One surface soil sample was collected and analyzed for total recoverable petroleum hydrocarbons (TRPH), BNAs, PCBs, and priority pollutant metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc). Subsurface soil samples were collected from 5 borings and analyzed for petroleum hydrocarbons (DRO, GRO, TRPH), VOCs, PCBs, and priority pollutant metals. Arsenic concentrations in soil ranged from 1 to 9 mg/kg. The calculated 95% upper confidence level (95%UCL) of the mean concentration for arsenic at Site 1A is 5.0 mg/kg, which does not exceed the ADEC Table B ingestion cleanup level of 5.5 mg/kg. No other contaminants were detected in soil above screening levels based on the ADEC Table B migration to groundwater pathway cleanup levels in 18 AAC 75.341.

Groundwater

Five monitoring wells were installed during the 1994 Phase I remedial investigation. Groundwater samples from all 5 wells were analyzed for petroleum hydrocarbons (DRO, GRO, TRPH), VOCs, PCBs, and priority pollutant metals. No contaminants were detected in groundwater above screening levels based on the ADEC Table C groundwater cleanup levels in 18 AAC 75.345.

Figure 3 – Site Location Map, Northern Area



1.6.2 Site 1B – North Beach, Air Force Landing Area

Site 1B is located west of Sevuokuk Mountain, and approximately 1,900 feet east of the Army Landing Area on North Beach. The site contained exposed surface debris, rust-stained gravel, and a separate patch of tar-stained gravel (degraded asphalt). Additionally, buried debris may be periodically exposed as the gravel beach deposits shift or frost jacking occurs. This area receives a large amount of ATV traffic due to its proximity to the bird rookeries on Sevuokuk Mountain visited by local residents and tourists.

In 1997, Montgomery Watson removed all visible surface debris from Site 1B (105 pounds) and the surrounding beach area (2,865 pounds), including Marston matting, empty drums, sheet metal, steel cables, and other miscellaneous debris. All dangerous surface debris has been removed. Buried debris is not eligible for further action under FUDS.

Soil
During the 1994 remedial investigation, subsurface soil samples were collected from three borings and analyzed for petroleum hydrocarbons (GRO, DRO, TRPH), VOCs, PCBs, and priority pollutant metals. One surface soil sample was collected from the rust-stained soil and analyzed for TRPH, BNA, PCBs, and priority pollutant metals. Petroleum hydrocarbons and lead were detected in soil, but did not exceed screening levels based on ADEC Table B migration to groundwater pathway cleanup levels in 18 AAC 75.341. Arsenic was also detected in soil at concentrations ranging from 2 to 7 mg/kg. The calculated 95% UCL of the mean concentration for arsenic at Site 1B is 4.8 mg/kg, which does not exceed the ADEC Table B ingestion cleanup level of 5.5 mg/kg. No other chemicals were detected in soil above screening levels based on the ADEC Table B migration to groundwater cleanup levels in 18 AAC 75.341.

Groundwater
In 1994, three monitoring wells were installed at Site 1B, to a maximum depth of 20.5 feet. Groundwater was encountered between 10 and 14.5 feet below ground surface. Groundwater samples were collected from the three wells and analyzed for petroleum hydrocarbons (GRO, DRO, TRPH), VOCs, PCBs, and priority pollutant metals. No contaminants were detected in groundwater above screening levels based on the ADEC Table C groundwater cleanup levels in 18 AAC 75.345.

1.6.3 Site 1C – North Beach

Site 1C covers the entire length of North Beach and consists of underwater metallic debris located just offshore. The majority of the debris is thought to be Marston matting used to construct the two military landing areas. North Beach is the primary area used by local residents for launching and landing boats.

In 1997, Montgomery Watson removed all exposed surface debris (10,105 pounds) from the entire length of the North Beach, including corrugated roofing material, piping, Marston matting, empty drums, heavy machinery parts, metal cables, and other miscellaneous debris. The remaining underwater debris does not pose a physical hazard and is not eligible for further action under FUDS.

1.6.4 Site 2 – Former Military Housing/Operations Burial Site

Site 2 is located approximately 1,000 feet south of the former Air Force Landing Area on North Beach, and just west of the base of Sevuokuk Mountain. Facilities associated with military housing/operations, and a power plant, were reportedly demolished and buried at this site. Ordnance was potentially buried here as well, but investigations have not confirmed this possibility. Exposed debris was observed at the site, including remnants of a rock fireplace, partially buried concrete pad, burned wood, scattered metal debris/gear, and discolored gravel.

In 1997, Montgomery Watson removed 100 pounds of miscellaneous debris from Site 2. They also removed a large quantity (total of 1,740 pounds) of cable spools, wheel rims, corrugated metal, and Marston matting from the vicinity of Site 2 (between Sites 1A and 3). Oil Spill Consultants, Inc (OSCI) removed the remaining exposed debris in 1999, but attributed all

quantities of debris removed to Site 3. OSCI also removed 24,982 pounds (12.5 cubic yards) of petroleum-stained soils from near Site 2. The stained soil was located adjacent to a large rock at the base of Sevuokuk Mountain, approximately 450 feet south of the Bering Sea/North Beach. This location was identified by Montgomery Watson as between Site 1A and 3. The partially buried concrete pad is not eligible for further action under FUDS.

Soil

Surface and subsurface soil samples were collected during the 1994 remedial investigation. Nine subsurface soil samples were collected from three borings and analyzed for VOCs, GRO, DRO, TRPH, priority pollutant metals, PCBs, and explosives. Two surface soil samples were also collected at the areas of discolored gravel and analyzed for TRPH, BNA's, and priority pollutant metals. Fuels were detected in the soil below screening levels. Elevated levels of metals were also detected in one surface soil sample above screening levels. Sampling results are summarized in Table 2. No asbestos was detected in the fibrous material.

With the exception of arsenic, metals were detected above screening levels in only one sample out of 13. This single sample had anomalous concentrations of both lead (749 mg/kg) and chromium (391 mg/kg); the other samples demonstrated a mostly sympathetic relationship between lead and chromium suggesting where lead is low, chromium will also be low. The 12 other soil samples contained low levels of chromium (ND to 21 mg/kg) and lead (1 to 70 mg/kg). Chromium was not considered a contaminant of concern following the 1994 investigation because it did not exceed the 1994 screening levels (chromium screening levels have since changed). Further investigation was conducted in 1996 to determine the extent of lead contamination surrounding this particular sample, since the lead results were more highly anomalous. Eight surface soil samples were collected and analyzed for lead only. The sampling results indicated the lead concentrations (3.6 to 63 mg/kg) were well below screening levels (400 mg/kg). The 95% UCL of the mean lead concentration at the site does not exceed the ADEC cleanup levels. Since lead was not elevated during the 1996 investigation, it is logical to assume that the chromium contamination was similarly below levels of concern. Any remaining chromium is likely isolated and present in de-minimus quantities. The detected arsenic concentrations (3 to 11 mg/kg) do not exceed site background concentrations. Although the arsenic concentrations exceed the ADEC Table B ingestion pathway cleanup level (5.5 mg/kg), the levels are consistent across many sites in Gambell, and do not appear associated with past military activity.

Table 2. Sampling Results at Site 2

Chemical	Cleanup Level [a]	Screening Level (1994)	Range of Results (1994)	Range of Results (1996)	95% UCL of the mean
Soil (mg/kg)					
DRO	10,250	100 [b]	ND - 28	--	
TRPH	NA	2,000 [b]	ND - 710	--	
Arsenic	11 [i]	6.7 [c]	3 – 11	--	6.5 [f]
Chromium	300	390-78,000 [d]	3 – 391	--	82 – 165 [g]
Lead	400	500-1,000 [e]	1 – 749	3.6-63	206 [h]
Water (mg/L)					
TRPH	NA	sheen (0.5)	0.2 – 0.5	--	

Notes: NA - not available, ND - not detected, mg/kg - milligrams per kilogram (parts per million), mg/L - milligrams per liter (parts per million)
[a] 18AAC75, Table B, Under 40 Inch Zone, Ingestion (May 26, 2004)
[b] ADEC Interim Guidance Level A soil cleanup targets (July 17, 1991)
[c] USGS Element Concentrations in Soil and Other Surficial Materials of Alaska (1988)
[d] US EPA Region 3 Risk-Based Concentration Table (July 11, 1994), Cr III and Cr VI
[e] US EPA Region 5 Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (September 7, 1989)
[f] based on the gamma distribution
[g] range of values based on non-parametric methods
[h] calculated using all results from 1994 and 1996
[i] site background

In 1999, OSCI collected a pre-excavation sample to characterize the stained soils for disposal purposes; the sample contained gasoline and diesel range organics at 309 and 6,440 mg/kg, respectively. The concentration of petroleum hydrocarbons in the removed soils did not exceed ADEC Table B Ingestion pathway cleanup levels (1,400 mg/kg GRO and 10,250 mg/kg DRO). PCBs, VOCs, SVOCs, pesticide/ herbicides, and leachable metals were not detected. After OCSI removed a large quantity of stained soils, the Corps of Engineers stopped further excavation because the scope of the removal action was limited to stained soils associated with drums and other debris. The contamination was more extensive than anticipated. Comments from local workers revealed that the petroleum stain at this site probably resulted from oil that was drained from ATVs by Gambell residents. No post-excavation samples were collected, because the Corps decided the stained soil was outside the scope of work. The observed petroleum contamination may be the result of more recent oil spills that are not related to former DoD activities.

Groundwater
Three monitoring wells were installed at the site during the 1994 investigation. Groundwater samples were collected from the 3 wells and analyzed for VOCs, GRO, DRO, TRPH, priority pollutant metals, and explosives. Low levels of total hydrocarbons were detected in one groundwater sample (see Table 2), but did not exceed ADEC Table C cleanup levels in 18 AAC 75.345. No other analytes were detected in the groundwater.

Military Munitions
Earth Tech, Inc. conducted two geophysical surveys at Site 2 during July and September 2000, to determine the presence or absence of buried ordnance. First, the field team visually surveyed the area and removed metallic scrap and debris from the surface. Next, metal detectors were used to map the location of subsurface metal within three site grids. Mapped metallic anomalies were

then excavated to determine the source of the magnetic signature. No evidence of any ordnance was found during the investigation.

1.6.5 Site 3 – Former Communications Facility Burial Area

Site 3 is located approximately 700 feet south of the North Beach, near the base of Sevuokuk Mountain. The preliminary assessment indicated the possible burial of Jamesway huts, power plant generators, transformers, oils, batteries, and sulfuric acid. Exposed above-ground debris included weasel tracks, Marston matting, pipe, empty drums, and anchors for guy wire.

In 1997, Montgomery Watson removed 1,740 pounds of debris from the vicinity of Site 3, including cable spools, corrugated metal, Marston matting, and cable wires. In 1999, OSCI removed an additional 3,030 pounds of surface debris, including weasel tracks, 3 empty fuel storage tanks, Marston matting and drums. All dangerous surface debris has been removed. The buried debris is not eligible for further action under FUDS.

Soil
Surface and subsurface soil samples were collected during the Phase I investigation. A geophysical survey identified two discrete areas with suspected buried material. Subsurface soil samples were collected from two borings at depths of 2.5 and 5 feet, and analyzed for petroleum hydrocarbons, VOCs, priority pollutant metals, PCBs, sulfate/sulfur, and pH. No VOCs or PCBs were detected. The only petroleum hydrocarbon detected was DRO, but at concentrations below cleanup levels. Several metals were detected in the soil, including arsenic, beryllium, cadmium, mercury, selenium, and thallium. Beryllium and thallium exceeded initial screening levels, and further sampling was conducted during the 1996 Phase II investigation. Four surface soil samples were collected; the results were all below detection limits. The thallium results from 1994 were determined to be spatially limited. Table 3 summarizes the sampling results.

Groundwater
Two monitoring wells, MW09 and MW10, were installed during the 1994 investigation and encountered groundwater at depths of 8 to 9 feet below ground surface. Groundwater samples from the two wells were analyzed for VOCs, GRO, DRO, TRPH, PCBs, priority pollutant metals, and sulfates. Lead was detected in the groundwater from MW10 at a concentration which exceeded the ADEC Table C groundwater cleanup value. However, a filtered sample from this well did not contain any dissolved lead. A second monitoring well, MW09, located immediately downgradient of MW10 did not contain detectable levels of lead in the groundwater. Both monitoring wells are located downgradient of the village drinking water supply well, and the groundwater gradient in the vicinity flows north toward the Bering Sea. Lead was not identified as a contaminant of concern, and no further groundwater sampling was performed at Site 3 after the Phase I investigation.

Table 3. Sampling Results at Site 3

Chemical	Cleanup Level	Screening Level (1994)	Maximum Result (1994)	Maximum Result (1996)
Soil (mg/kg)				
DRO	10,250 [a]	100 [g]	522	
Arsenic	11 [h]	6.7 [f]	6	
Beryllium	200 [a]	1.5 [f]	6	ND (2.52)
Cadmium	100 [a]	39 [e]	7	
Mercury	18 [b]	23 [e]	11	
Selenium	510 [a]	390 [e]	13	
Thallium	5.5 [d]	7.0 [e]	15	ND (0.28)
Water (mg/L)				
Lead Lead, dissolved	0.015 [c]	0.015	0.045 ND (0.002)	

Notes: mg/kg – milligrams per kilogram (parts per million)
mg/L – milligrams per liter (parts per million)
[a] 18AAC75, Table B, Under 40 Inch Zone, Ingestion (May 26, 2004)
[b] 18AAC75, Table B, Under 40 Inch Zone, Inhalation (May 26, 2004)
[c] 18AAC75, Table C (May 26, 2004)
[d] US EPA Region 3, Risk-Based Concentration Table (April 4, 2004)
[e] US EPA Region 3, Risk-Based Concentration Table (July 11, 1994)
[f] USGS Element Concentrations in Soil and Other Surficial Materials of Alaska (1988)
[g] ADEC Interim Guidance, Level A soil cleanup targets (July 17, 1991)
[h] site background

1.6.6 Site 4A – Former Quonset Huts near USAF Radar Station

Site 4A consisted of collapsed Quonset Huts frames and transformer casings located on the top of Sevuokuk Mountain. In 1997, Montgomery Watson removed three empty transformer carcasses. In 1999, OSCI removed 14,772 pounds (7.4 tons) of unsafe debris, including two collapsed Quonset hut frames, metal siding, drums, and petroleum-stained soil (1,877 pounds) associated with the drums and debris.

Soil
During the remedial investigation, three surface soil samples were collected adjacent to the fallen transformers and analyzed for PCBs. Asbestos samples were also taken around the fallen Quonset huts. No PCBs or asbestos-containing material (ACM) were detected in the soils.

OSCI collected four confirmation soil samples from within and outside of the two Quonset hut footprints following the 1999 removal action. The samples were analyzed for petroleum hydrocarbons (DRO/RRO/GRO), VOCs, SVOCs, PCBs, pesticides, and Resource Conservation and Recovery Act (RCRA) metals.

The 1999 confirmation samples contained concentrations of diesel range organics and metals which exceeded screening levels, including arsenic, chromium, and lead. A supplemental investigation was conducted in 2001 at Site 4A to verify the previous confirmation sampling results. Four samples were collected based on field screening results and analyzed for petroleum hydrocarbons and RCRA metals. Two of the samples were also analyzed for hexavalent chromium. The 2001 sampling results indicated that all chemicals of concern were below the ADEC Table B ingestion pathway cleanup levels (18 AAC 75.341) or site background. In

addition, hexavalent chromium was not detected in the soil samples. Table 4 summarizes the confirmation soil sampling results from Site 4A. The chromium detected in 1999 does not pose a potential risk to human health or the environment because further investigation demonstrated that the chromium exists the less toxic form (Cr III), and is not present in a significant quantity. No significant volume of contaminated soil remains at the site. The area consists of large boulders on top of bedrock with small amounts of soil. Site 4A has been cleaned up to the extent feasible, as there is minimal soil above bedrock.

Table 4. Confirmation Sampling Results at Site 4A

Chemical	Cleanup Level [a]	Screening Level [b] (1999)	Maximum Concentration (1999)	Maximum Concentration (2001)
Soil (mg/kg)				
Arsenic	11 [c]	2	8.3	3.9
Chromium	300	26	422	12.1
Lead	400	400	311	44
DRO	10,250	250	1,310	970

Notes: mg/kg – milligrams per kilogram (parts per million)
[a] 18AAC75, Table B, Under 40 Inch Zone, Ingestion (May 26, 2004)
[b] 18AAC75, Table B, Under 40 Inch Zone, Migration to Groundwater (May 26, 2004)
[c] site background

1.6.7 Site 4B – Former USAF Radar Station

Site 4B was a US Air Force (USAF) radar station, located on top of Sevuokuk Mountain. The site covered an area approximately 375 feet by 500 feet. The radar station consisted of buildings that burned and caused ordnance to explode and scatter debris. In 1999, OSCI excavated 52 tons of contaminated soil to a depth of 24 inches. The excavation area was approximately 29 by 37 feet and was partly covered by boulders. The removal included soil with localized heavy staining and an oily substance. OSCI also removed 1.4 tons of miscellaneous metal debris from Site 4B.

Soil
During the 1994 Phase I investigation, five surface soil samples were collected and analyzed for petroleum hydrocarbons (TRPH), PCBs, priority pollutant metals, BNAs, and dioxin/furans. The sampling results identified elevated concentrations of metals and dioxins.

During the 1996 Phase II investigation, four additional surface soil samples were collected from the edges of the stained soil area to delineate the extent of metals contamination. Samples were analyzed for antimony, arsenic, cadmium, copper, and lead. The results were significantly lower than those detected during the Phase I. See Table 5 for a comparison of results.

One pre-excavation soil sample and six post-excavation confirmation samples were collected during the 1999 removal action. The samples were analyzed for DRO, RRO, GRO, VOCs, SVOCs, PCBs, pesticides, metals (antimony, arsenic, cadmium, copper and lead), and dioxin/furans. Sampling results are shown in Table 5. The concentration of dioxins decreased significantly as a result of removing the soils. The USEPA and ADEC have not established cleanup levels for dioxins. The USEPA Region 9 has established a screening level of 3.9 ppt for dioxins in residential soil. The State of Alaska adjusts the EPA screening level by one order of

magnitude to derive a preliminary remediation goal for residential soil of 39 ppt dioxin. The Agency for Toxic Substance and Disease Registry (ATSDR) uses a screening level of 50 ppt and an action level of 1,000 ppt for dioxins in soil.

In 2001, supplemental RI fieldwork was done at Site 4B to verify the 1999 confirmation sampling results because the latitude and longitude coordinates were not documented. Four soil samples were collected and analyzed for petroleum hydrocarbons (DRO/RRO/ GRO) and RCRA metals. As shown in Table 5, these confirmation samples contained no analytes which exceeded cleanup levels. Antimony and copper were not analyzed in 2001 because they are not part of the standard set of 8 RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver).

Copper exceeded the ADEC Table B cleanup level of 4,060 mg/kg, based on the ingestion pathway, in 1 out of 6 samples collected in 1999. The highest concentration of copper in the remaining samples was 65.7 mg/kg. However, the maximum concentration of copper (6,940 mg/kg) does not exceed the ADEC Table B cleanup level of 7,000 mg/kg based on the migration to groundwater pathway. The 1999 sample with elevated copper also contained lead. Further sampling in 2001 indicated lead at much lower levels, but copper was not included in the analytical suite.

Table 5. Comparison of Maximum Concentrations of Contaminants of Concern in Soil at Site 4B

Chemical	Units	1994 maximum results	1996 maximum results	1999 pre-excavation result	1999 post-excavation max results	2001 post-excavation max results	Cleanup level [a]
Antimony	mg/kg	130	ND (15)	--	3.3	--	41 [a]
Arsenic	mg/kg	38	17	--	1.6	4.3	5.5 [a] 11 [e]
Cadmium	mg/kg	52	6	--	1.8	0.4	100 [a]
Copper	mg/kg	26,600	1,900	--	6,940	--	4,060 [b] 7,000 [c]
Lead	mg/kg	3,249	840	11.7 mg/L (TCLP)	396	96	400 [a]
Total Dioxins (TEQ)	pg/g	51.2	--	262	29	--	NA [d]
DRO	mg/kg	--	--	469	13,900	10,000	10,250 [a]
RRO	mg/kg	--	--	2,110	984	200	10,000 [a]
TRPH	mg/kg	690	--	--	--	--	NA

Notes: ND – non detect, TEQ – total dioxin/furan equivalent, TCLP – toxicity characterization leaching procedure, NA – not available, -- not analyzed for, mg/kg – milligrams per kilogram (parts per million), pg/g – picograms per gram (parts per trillion), mg/L – milligrams per liter
[a] 18AAC75, Table B, Under 40 Inch Zone, ingestion pathway (May 26, 2004)
[b] Additional Cleanup Levels, ADEC Technical Memo 01-007 (November 24, 2003), ingestion pathway or [c] migration to groundwater
[d] The ATSDR screening level for dioxin is 50 ppt, the ATSDR action level for dioxins is 1,000 ppt. USEPA Region 9, Preliminary Remediation Goal, residential soil (October 2004) for dioxin is 3.9 ppt. The State of Alaska uses a preliminary remediation goal of 39 ppt.
[e] site background

No contaminants of concern remain above ADEC Table B ingestion pathway soil cleanup levels, with the exception of copper. Site 4B is located at the top of Sevuokuk Mountain. The site is dominantly boulders and bedrock, and very little soil is present. It is unlikely that water from Site 4B impacts the drinking water supply at Site 5 at the base of the mountain since Site 5 is significantly south of Site 4B and the mountain slopes due west at Site 4B. Surface runoff would

likely travel west off of the mountain or enter bedrock fractures. The steep open slope likely channels many fractures to the west. At the base of Sevuokuk Mountain, west of Site 4B, groundwater in the gravel spit migrates slowly to the north, away from the drinking water supply.

The elevated copper at Site 4B is an isolated occurrence, confined to de-minimus quantities of soil. The contamination is an unlikely threat to the public drinking water supply located southwest of the Site at the base of Sevuokuk Mountain. It is impractical to remove additional quantities of soil.

1.6.8 Site 4C – Sevuokuk Mountain

Site 4C is located at the south end of Sevuokuk Mountain, and contained discarded drums along an ATV trail. Scattered drums were collected from along ATV trails and the surrounding tundra at the southern end of Sevuokuk Mountain by OSCI during the 1999 field season. OSCI removed a total of 12,516 pounds of drums and drum parts from the Army Trails (Site 10), which included the drums identified at Site 4C. All unsafe debris was removed during the 1999 field season.

Soil
Five soil/sediment samples were collected and analyzed for PCBs during the Phase I remedial investigation. PCBs were not detected.

1.6.9 Site 4D – Sevuokuk Mountain

Site 4D is located near the top of Sevuokuk Mountain. Three empty transformer casings and miscellaneous debris were observed in the mountainside drainage above the pump house.

In 1999, OSCI removed the three empty transformers from Site 4D. Wipe samples collected from inside each transformer carcass did not contain any PCBs. All unsafe debris was removed during the 1999 field season.

Soil/Sediment/Water
During the 1994 investigation, one soil and four sediment samples were collected and analyzed for PCBs. No PCBs were detected in the samples collected adjacent to the empty transformers. A background sample collected upgradient contained 0.194 mg/kg PCBs, which is well below the ADEC Table B Ingestion pathway cleanup level of 1 mg/kg. In 1996, groundwater from a former infiltration gallery just downslope of Site 4D was also sampled and analyzed for BTEX and PCBs. No contaminants were detected in the groundwater.

1.6.10 Site 4E – Western Face of Sevuokuk Mountain

Various types of cable and wire are present on the ground surface along the sloped western face of Sevuokuk Mountain. The Native Village of Gambell identified this area as an impacted site during preparation of a strategic project implementation plan for the Native American Lands

Environmental Mitigation Program (NALEMP). The debris is not eligible for further action under FUDS.

1.6.11 Site 6 – Military Landfill

Site 6 is located north of the Gambell High School and east of the new housing area. This landfill was used to dispose of building materials, vehicles, machinery, drums of latrine waste, and miscellaneous debris. A geophysical survey to delineate the extent of buried debris was completed in 1994.

In 1999, OSCI removed exposed drums (7,897 pounds) and other metal debris (1,748 pounds). In 2003, NALEMP funded a removal action at Site 6. Montgomery Watson Harza (MWH) excavated and removed buried debris at the site, including empty 55-gallon drums used to containerize latrine waste, engine parts, vehicle parts, Marston matting, metal spikes, piping, tin cans, miscellaneous household garbage, and used oil filters. MWH removed approximately 1,000 drums and other debris, and excavated 2.5 tons of fuel-contaminated soils. There was no notable evidence of fuel contamination associated with the buried debris.

Soil
One soil sample was collected after removing surface debris from the site in 1999. OSCI collected the confirmation soil sample from beneath the removed drum stockpile. The soil contained no metals (except arsenic), fuels, solvents, PCBs, or pesticides above ADEC Table B cleanup levels based on the migration to groundwater pathway in 18 AAC 75.341.

In 2001, a supplemental investigation was conducted to verify the OSCI sampling results and to further define the nature and extent of soil and groundwater contamination. Two surface soil samples were collected from the approximate location of the 1999 confirmation sample, and analyzed for GRO, DRO, RRO, and RCRA metals. As shown in Table 6, no analytes exceeded cleanup levels or site background.

Five soil borings were also advanced to frozen soil during the 2001 field effort. Groundwater was not encountered in any of the soil borings. Soil samples were collected and analyzed for GRO, DRO, RRO, VOCs, and target analyte list (TAL) metals. Sampling results are summarized in Table 6. The detected arsenic concentrations exceeded the ADEC Table B ingestion cleanup level of 5.5 mg/kg. The calculated 95% UCL of the mean concentration for arsenic at Site 6 is 7.2 mg/kg. The observed arsenic concentrations in soil are consistent with site background levels, are not associated with a point source of contamination, and do not appear associated with past military activity. No other analytes were detected in the soil samples at concentrations exceeding the ADEC Table B soil cleanup levels based on the ingestion pathway.

Table 6. Sampling Results at Site 6					
Chemical	Cleanup Level [a]	Screening Level [b]	Confirmation Sample (1999)	Range of Results Confirmation Samples (2001)	Range of Results Soil Borings (2001)
Soil (mg/kg)					
Arsenic	11[c]	2	5.3	6 – 7.7	3.7 – 13.2
Antimony	41	3.6			ND(0.2) – 7.3
Chromium	300	26	1.33	3 – 6.3	1.1 – 59
Nickel	2,000	87			1.3 – 120
DRO	10,250	250	ND(9.35)	ND(5) – 21	ND(5) – 1,200

Notes: ND - non detect, mg/kg – milligrams per kilogram (parts per million)
[a] 18 AAC 75, Table B, Under 40 Inch Zone, Ingestion (May 26, 2004)
[b] 18 AAC 75, Table B, Under 40 Inch Zone, Migration to Groundwater (May 26, 2004)
[c] site background

Groundwater

Groundwater was evaluated during the initial remedial investigation of 1994. Five borings were drilled at Site 6. No water was found in three of the borings, but two borings encountered melted porewater which was sampled through the auger. The groundwater samples were analyzed for petroleum hydrocarbons (DRO, GRO, TRPH), VOCs, metals, sulfate, biological oxygen demand (BOD), coliform, and total suspended solids/total dissolved solids (TSS/TDS). Low levels of diesel range organics and several metals were detected in the samples. Table 7 summarizes the sampling results. Although several metal concentrations did exceed screening levels, the metals were primarily detected in unfiltered water samples. Exceedances were attributed to soil particles suspended in the water column. Groundwater has not always been present at Site 6 and the suprapermafrost groundwater is not considered a likely source of drinking water. The major source of potential contamination has been removed from the site and no significant residual contamination was found in the soil or groundwater.

Table 7. Sampling Results at Site 6		
Chemical	Range of Results (1994)	Screening Level [a]
Groundwater (mg/L)		
DRO	0.46 – 0.75	1.5
Arsenic	0.03 – 0.05	0.05
Beryllium	0.007	0.004
Cadmium	0.007 – 0.008	0.005
Chromium Chromium, dissolved	0.107 – 0.364 0.006	0.1
Lead Lead, dissolved	0.12 – 0.172 0.008	0.015
Nickel	0.08 – 0.153	0.1

Notes: mg/L – milligrams per liter (parts per million)
[a] 18 AAC 75, Table C (May 26, 2004)

1.6.12 Site 7 – Former Military Power Facility

Site 7 is located north of the Gambell Municipal Building, and west of the Gambell School. A military power facility was reportedly demolished and buried in this location. A military motor pool building was also believed to be located in this vicinity. The site contained a concrete pad

and surface debris. A geophysical survey to locate buried debris was completed in 1994. The survey revealed no major anomalies indicative of large amounts of buried metal. Montgomery Watson removed all exposed surface debris in 1996. In 1999, OCSI verified that no measurable quantities of surface debris remained at the site.

During 2003, MWH removed the concrete pad, underlying support timbers, a buried 55-gallon drum, and 1 cubic yard of incidental contaminated soils under NALEMP.

Soil

During the 1994 investigation, five soil borings were drilled to permafrost (6.5 to 15.0 feet below ground surface) and four were completed as monitoring wells. Two surface soil samples and 17 subsurface soil samples were collected and analyzed for VOCs, GRO, DRO, TRPH, and priority pollutant metals. The subsurface soil samples were also analyzed for PCBs.

The investigation results indicated DRO and TRPH were present in surface and subsurface soil. The DRO concentrations did not exceed the ADEC Table B soil cleanup levels based on the Ingestion pathway. There are no ADEC cleanup levels for TRPH. Table 8 summarizes the results. No other analytes were present at concentrations exceeding the ADEC cleanup levels.

Additional soil borings were drilled in 2001 to further investigate the potential for soil contamination, and to address continuing community concerns regarding Site 7. Three soil borings (SB7-18, SB7-19, SB7-20) were drilled to permafrost (6.2, 7.2 and 10.0 feet bgs). The 2001 investigation results showed DRO in one soil sample at a maximum concentration of 710 mg/kg, which does not exceed the ADEC Table B ingestion cleanup level of 10,200 mg/kg. Arsenic was detected at concentrations ranging from 4.5 to 10.2 mg/kg, with a calculated 95% UCL of the mean concentration of 7.8 mg/kg at Site 7. Six of the eleven arsenic results exceeded the ADEC Table B ingestion cleanup level of 5.5 mg/kg arsenic. However, the observed arsenic concentrations in soil are consistent with site background levels, are not associated with a point source of contamination, and do not appear associated with past military activity. PCBs were not detected in any Site 7 samples. No other analytes were detected in the soil samples at concentrations exceeding the cleanup levels.

After the 2003 removal action, MWH collected five confirmation soil samples from the edges of the concrete pad excavation and one sample from beneath the excavated drum (see Figure 4). The soil samples were analyzed for DRO, RRO, PCBs, and TAL metals. One sample contained DRO at 570 mg/kg, which does not exceed the ADEC Table B ingestion cleanup level of 10,200 mg/kg. This detection may correspond to leakage from a community fuel pipeline present at the edge of the pad. The five samples near the concrete pad contained arsenic levels ranging from 4.2 to 34.9 mg/kg, which exceeds the ADEC Table B ingestion cleanup level of 5.5 mg/kg, and may correspond to leached preservative from the treated timbers used as a form surrounding the concrete pad. The arsenic concentrations are also significantly higher than site background concentrations and may pose a risk to human health and the environment.

Table 8. Sampling Results at Site 7 during 1994 investigation

Soil (mg/kg)	SS40, SS41	SB17	MW24	MW25	MW26	MW27	Cleanup Level	Screening Level
Arsenic	3.0 – 4.0	2.0 – 5.4	2.0 – 4.0	1.0 – 2.0	2.0	2.0 – 5.4	11 [d]	2.0 [b]
DRO	1,950–2,090	ND	20–941	20–271	18–1,840	ND	10,250 [a]	100 [c]
GRO	ND	ND	ND	ND	ND	ND	1,400 [a]	100 [c]
TRPH	1,800–4,300	ND–47	13–180	400–1,300	115–13,000	ND–162	NA	2,000 [c]
Benzene	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	ND(0.005)	150 [a]	0.5 [c]

Notes: NA - not available, ND - not detected. mg/kg – milligrams per kilogram (parts per million)
[a] 18 AAC 75 Table B, Under 40 Inch Zone, Ingestion (May 26, 2004)
[b] 18 AAC 75 Table B, Under 40 Inch Zone, Migration to Groundwater (May 26, 2004)
[c] ADEC Interim Guidance, Level A soil cleanup targets (July 17, 1991)
[d] site background

Table 9. Sampling Results at Site 7 (2001 and 2003)

Soil (mg/kg)	SB118	SB119	SB120	SL001	SL002	SL003	SL004	SL005	Cleanup Level [a]	Screening Level [b]
Arsenic	6.3 – 7.3	4.5 – 10.2	4.9 – 9.8	34.9	9.6	4.2	27.9	3.2	11 [c]	2.0
DRO	ND	45 - 67	160 - 710	570	100	120	99	11 VJ	10,250 [a]	250
GRO	ND	ND	ND	ND	ND	ND	ND	ND	1,400 [a]	300
RRO	ND	120 - 310	ND	1,300	480	370	430	38 VJ	10,000 [a]	11,000
Benzene	ND (0.005)	ND (0.008)	ND (0.005)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	150 [a]	0.2

Notes: ND - not detected, mg/kg – milligrams per kilogram (parts per million), VJ – analyte positively identified, estimated value.
[a] 18 AAC 75 Table B, Under 40 Inch Zone, Ingestion (May 26, 2004)
[b] 18 AAC 75 Table B, Under 40 Inch Zone, Migration to Groundwater (May 26, 2004)
[c] site background

Groundwater

During the 1994 investigation, four monitoring wells were installed at Site 7 (see Figure 4). Three monitoring wells (MW24, MW25, MW27) encountered perched groundwater, but they were essentially dry wells. The monitoring wells were installed by drilling down into the ice to create a reservoir which would collect melted groundwater. A fourth well (MW26) was abandoned without collecting a groundwater sample due to lack of water. Suprapermafrost groundwater was collected from the three wells, but the lack of water in these wells prevented standard well development. The groundwater samples were analyzed for VOCs, GRO, DRO, TRPH, priority pollutant metals, and PCBs. A sufficient quantity of water could not be withdrawn from MW27, and the sample was only submitted for analysis of VOCs, DRO, and priority pollutant metals. DRO, GRO and TRPH were detected in the groundwater. Benzene was also detected in monitoring well MW24. The DRO and benzene results exceed the ADEC Table C groundwater cleanup levels. Water sample turbidity ranged from 9.3 to 82.5 Nephelometric Turbidity Units (NTUs). This suggests that the laboratory results included contributions from suspended solids. Table 10 summarizes the Site 7 groundwater results.

Table 10. Sampling Results at Site 7 during 1994 investigation

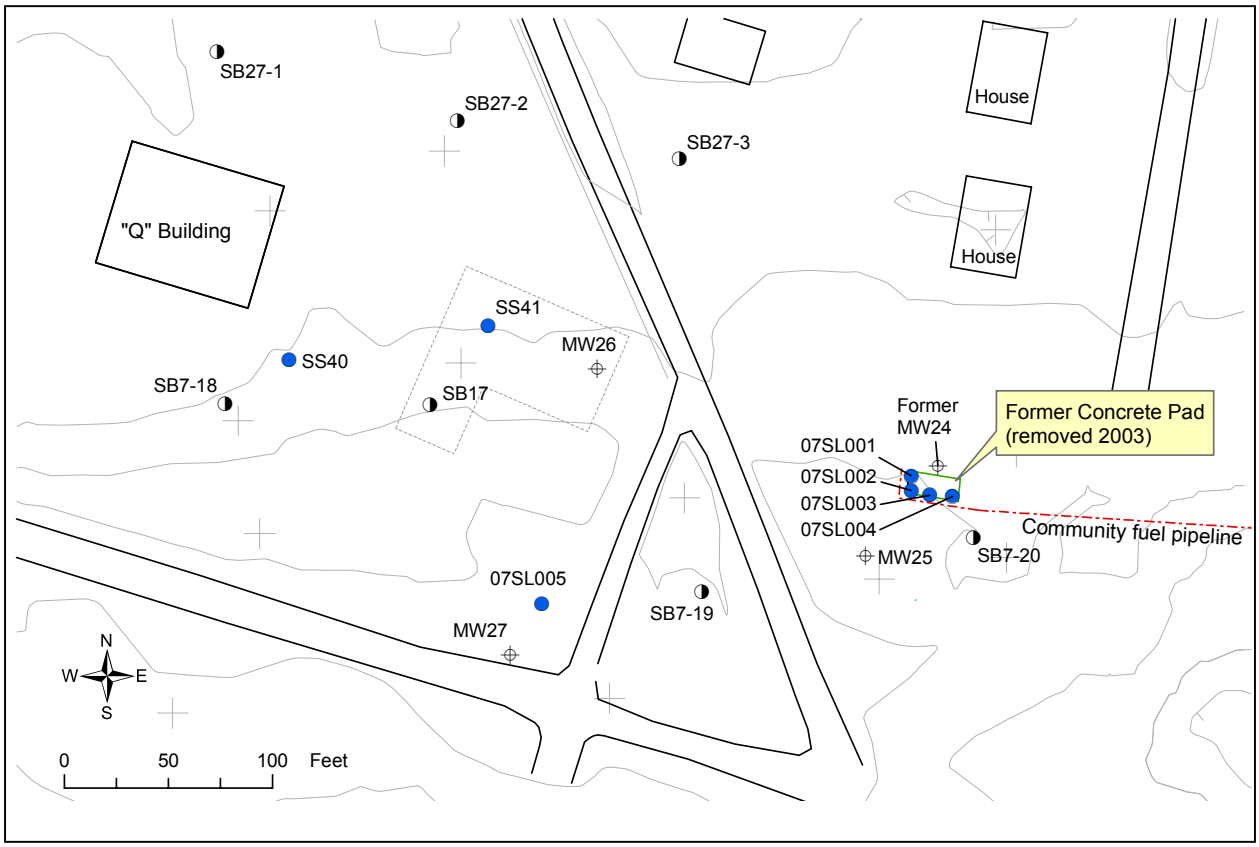
Chemical	MW24	MW25	MW26	MW27	ADEC Cleanup Level [a]
Groundwater (mg/L)					
DRO	18.4	19.4	--	1.18	1.5
GRO	0.844	--	--	0.103	1.3
TRPH	4.2	--	--	1.1	NA
Benzene	0.019	ND (0.0005)	--	ND (0.0005)	0.005
Turbidity (NTUs)	82.5	50.1	--	9.3	5 [b]

Notes: NA - not available, ND - not detected, NTU - nephelometric turbidity units, -- not analyzed for
mg/L – milligrams per liter (parts per million)
[a] 18AAC75 Table C cleanup levels (May 26, 2004)
[b] general standard for well sampling

Additional borings were drilled in 2001 to further investigate the potential for suprapermafrost groundwater contamination, and to address continuing community concerns regarding Site 7. Three borings were drilled to permafrost (6.2, 7.2 and 10.0 feet bgs); but groundwater was not encountered in any of the soil borings.

The supplemental investigation demonstrated that the groundwater at Site 7 is ephemeral, and soil contamination is below cleanup levels. The risk of contaminant migration east towards the aquifer located at the base of Sevuokuk Mountain is extremely low.

Figure 4 – Sampling Locations at Site 7



1.6.13 Sites 8A, 8B, 8C, 8D – West Beach Area

Site 8 includes the area surrounding the airstrip from west beach (north of the airfield), east to the western edge of Troutman Lake, and south to the northern shore of North Nayvaghat Lakes. Exposed Marston matting debris (8A) is located along the eastern side of the airstrip. Buried miscellaneous metallic debris (8B) has been reported south of the old village area, including numerous 55-gallon drums and a Jeep. A Navy Landfill (8C) is located northwest of the former Civil Aeronautics Administration (CAA) housing area and south of the village landfill. The Navy reportedly constructed this landfill during their utilization of the former CAA housing area. The Navy landfill may have asbestos-containing materials (ACM). An Army landfill was also reportedly located northwest of the Nayvaghat Lakes area. A geophysical survey to determine the extent of buried debris at the reported Army landfill was conducted in 1994. The survey results indicated no significant anomalies, confirming the reported Army landfill was not present.

Small-arms ammunition debris including intact 0.30 caliber rounds is also located along the beach (8D) southwest of Troutman Lake. The buried debris is not eligible for further action under FUDS. FUDS Program Policy (ER 200-3-1), Chapter 3 (3-2.4.5 *Building Demolition and Debris Removal Projects*.) states that "Inherently hazardous BD/DR must present a clear danger, likely to cause, or having already caused, death or serious injury to a person exercising ordinary and reasonable care." In the OE Response Action Memorandum for the Gambell Site, signed 16 October 2003, it states on page 1 "During the EE/CA field investigation, ordnance was found at only one of the Gambell sites (Area D), comprised solely of small arms ammunition. Small arms ammunition does not present a hazard to human safety, the environment, or public interest unless intentionally subjected to intense heat or other energetic activities." Intentionally subjecting these small rounds to intense heat is not exercising ordinary and reasonable care.

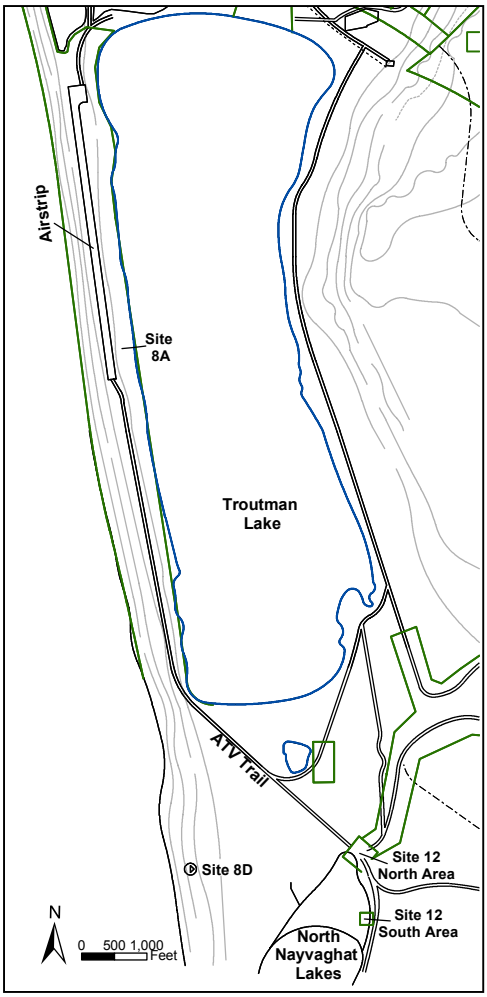


Figure 5 – Site 8 vicinity map

The Marston matting at Site 8A was abandoned in place when the military demobilized from the area in the late 1950s. The exposed Marston matting debris is located in an area heavily traveled by local residents using all terrain vehicles and snowmobiles. The debris poses a clear danger to local residents who frequently traverse the area on ATVs and snowmachines due to the sharp and jagged edges which protrude above the ground surface and large piles which create a navigation hazard during the winter when partially covered by snow.

In 1999, OSCI removed surface debris from Site 8A, including scattered metal, small quantities of wood and concrete, and an exposed layer of Marston matting

approximately 30 feet wide and 4,500 feet long along the eastern side of the airstrip. OSCI did not complete the planned removal of the Marston matting because buried electrical lines prevented safe implementation of the field activities. Approximately 1,820 feet of exposed metal Marston landing mat remains at Site 8A.

Earth Tech, Inc. recovered approximately 800 small arms ammunition rounds from Site 8D in July 2000, and shipped the material off-site to a facility in Colfax, Louisiana for disposal.

Soil/Groundwater
A remedial investigation was completed in 1994 and included collection of limited soil and groundwater samples at the reported Army landfill area located northwest of the Nayvaghat Lakes area. No samples were collected from other sub-areas of Site 8. The investigation results indicated that all detected analytes in soil/groundwater were below ADEC Table B cleanup levels, based on the migration to groundwater pathway.

Military Munitions
In 2000, Earth Tech, Inc. surveyed Site 8D using metal detectors to locate possible ordnance and explosive materials. Highly weathered small arms rounds were documented in a beach burial pit southwest of Troutman Lake. Approximately 800 small arms ammunition rounds were recovered from the surface of Site 8D and shipped off-site to a facility in Colfax, Louisiana for disposal. An OE Response Action Memorandum dated August 2003 documented the selected ordnance and explosives response actions for the Gambell site. Institutional controls were approved to manage any existing ordnance-related hazards and residual risks. The institutional controls were implemented during the summer of 2004 and consisted of distributing informational pamphlets and posters about ordnance risks to local residents and businesses and holding a community meeting. An initial review to evaluate the continued effectiveness and reliability of the ordnance response action will be conducted in 3 years. After the initial review has been conducted, recurring reviews will be performed at 5-year intervals. The need for recurring reviews will be coordinated with regulators and stakeholders and justified in each recurring review report.

1.6.14 Site 9 – Asphalt Barrel Cache

Site 9 is located on the east side of the local airport runway. Drums of leaking tar were observed in two areas. A debris inventory prepared by Montgomery Watson in 1997 indicated drums containing asphalt (6,200 estimated pounds) and empty drums (900 pounds) were located within Site 8, which includes the area referred to as Site 9.

OSCI overpacked and removed nine drums of asphalt (4,458 pounds) and associated stained soils (4,790 pounds) from east of the runway during the 1999 removal action. All empty drums were also removed. All unsafe debris and contaminated soil have been removed from the site.

Soil
OSCI collected one confirmation soil sample after removing the asphalt drums and stained soil. The sample was analyzed for petroleum hydrocarbons (DRO, GRO, RRO), VOCs, SVOCs,

PCBs, pesticides, and metals. The results indicated that all analytes were either not detected or below the ADEC Table B cleanup levels based on the migration to groundwater pathway.

In 2001, two additional soil samples were collected to verify the 1999 results. The samples were analyzed for petroleum hydrocarbons (DRO, GRO, RRO), and RCRA metals. Arsenic was detected at concentrations of 5.3 and 6.8 mg/kg, which exceeds the ADEC Table B ingestion cleanup level of 5.5 mg/kg. However, the levels are consistent with site background levels and do not appear associated with past military activity. All other analytes were either below the cleanup levels or not detected.

1.6.15 Site 10 – Sevuokuk Mountain Trail

Site 10 consists of a trail system that originates at the southeast end of Troutman Lake and separates into individual trails to the north, south, and east. Two trails lead to the top of Sevuokuk Mountain. Empty 55-gallon drums located approximately 250 feet apart marked the trails. Other debris at the site included Marston matting and weasel tracks. No staining or stressed vegetation was observed during the initial remedial investigation and the drums were either empty or contained gravel.

In 1999, OSCI removed all the scattered drums (12,516 pounds), miscellaneous metallic debris (1,388 pounds), and a small amount (540 pounds) of stained soils from beneath the drums. All unsafe debris has been removed from the site.

1.6.16 Site 11 – Communications Cable Route

Site 11 contained a sonar cable going up Sevuokuk Mountain, abandoned cable spools, and a remnant of braided metal cable on top of the mountain. The only evidence of sonar cables were some cable spools observed near Site 4D during the 1994 remedial investigation. OSCI removed the debris at Site 4D during the 1999 removal action. The remaining debris is not eligible for further action under FUDS.

1.6.17 Site 12 – North Nayvaghat Lakes Disposal Site

Site 12 is located north of Nayvaghat Lakes on the southwest side of an all-terrain vehicle (ATV) trail. The site is divided into a north and a south area. The north area contained approximately 120 drums, battery remnants, and miscellaneous metal debris. The south area contained approximately 50 drums. The area south of Troutman Lake is within the City of Gambell boundary. The area is currently used primarily for recreation, subsistence food gathering, and as a gravel borrow source. However, this site has the potential to be developed for residential use in the future, given the flat topography and close proximity to a new drinking water source.

In 1999, OSCI removed contaminated soil and debris from the site including drums, dried paint, and batteries from large vehicles consistent with former military use. OSCI removed 798 pounds of miscellaneous metal debris; 7,104 pounds of drums; 1,598 pounds of RCRA hazardous materials (lead contaminated soil, lead acid batteries, and lead paint); and 7,237 pounds of petroleum-stained soil associated with the drums.

Soil
A remedial investigation was conducted in 1994; soil confirmation samples were collected following the 1999 removal action. Additional investigation was performed in 2001.

Three surface and two subsurface soil samples were collected in 1994. The soil samples were analyzed for VOCs, GRO, DRO, TRPH, priority pollutant metals, and PCBs. Except for arsenic, the concentrations of metals detected in the soil samples were below screening levels. Arsenic concentrations ranged from 4 to 10 mg/kg, consistent with site background levels. No other analytes were detected in the soil samples. Three confirmation surface soil samples were also collected after completing the 1999 removal action. Arsenic, cadmium, lead, and DRO were detected in soil at concentrations exceeding screening levels based on the ADEC Table B cleanup levels, migration to groundwater pathway.

In 2001, supplemental RI fieldwork was completed at Site 12 to verify the previous confirmation sampling results. Five surface soil samples were collected and analyzed for petroleum hydrocarbons (GRO, DRO, RRO), and RCRA metals. Chromium and lead exceeded the ADEC cleanup levels. DRO and cadmium were not detected at concentrations exceeding the cleanup levels. The arsenic levels at Site 12 are consistent with site background levels and do not appear associated with past military activity. The sampling results are summarized in Table 11. No other analytes were detected at concentrations exceeding the ADEC cleanup levels.

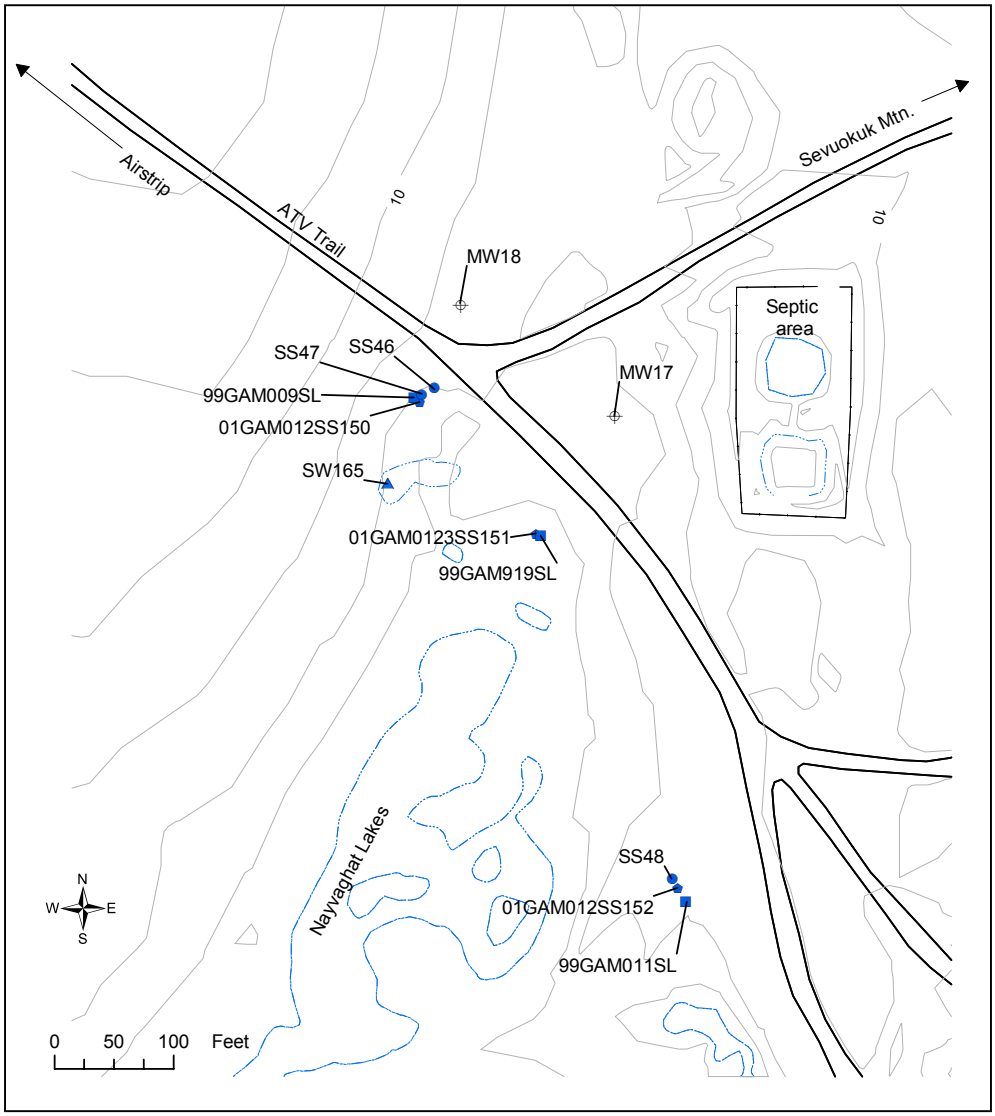
Table 11. Confirmation Sampling Results at Site 12

Chemical	Cleanup Level	Range of Results (1999)	Range of Results (2001)
Soil (mg/kg)			
Arsenic	11 [c]	3 – 6	6 – 9.4
Cadmium	5 [a]	0.18 - 142	ND(0.2) – 1.6
Chromium	26 [a]	2.6 - 20	5.7 – 162
Lead	400 [b]	12.4 - 562	7 – 1,530
DRO	250 [a]	463	ND(5) – 46

Notes: ND - non detect, mg/kg – milligrams per kilogram (parts per million)
[a] 18AAC75 Table B, Under 40 Inch Zone, migration to groundwater pathway (May 26, 2004)
[b] 18AAC75 Table B, Under 40 Inch Zone, ingestion pathway (May 26, 2004)
[c] site background

Water
During the 1994 remedial investigation, one surface water sample was collected from North Nayvaghat Lake, and two groundwater monitoring wells were installed. The three water samples were analyzed for VOCs, GRO, DRO, TRPH, PCBs, and priority pollutant metals. DRO and metals were detected at low levels in surface water and groundwater, but did not exceed the ADEC Table C cleanup levels.

Figure 6 – Site 12 vicinity map



1.6.18 Site 13 – Former Radar Power Station

Site 13 is located east of the pond between Troutman and North Nayvaghat Lakes. The radar power station consisted of two wooden Quonset huts, one long wooden building, and several 150 foot towers that were reportedly demolished and buried on-site. Stained soils and miscellaneous surface debris such as steel wire, pipes, and Marston matting were observed at the site.

A geophysical survey was conducted in 1994 to determine the extent of buried debris. The survey revealed strong anomalies around two mounds and scattered surface debris which are probably related to significant amounts of buried material. In 1999, OSCI removed 343 pounds of miscellaneous metal debris from surface areas at Site 13. The buried debris is not eligible for further action under FUDS.

Soil
Two surface and five subsurface soil samples were collected during the 1994 remedial investigation. The subsurface soil samples were analyzed for VOCs, petroleum hydrocarbons (GRO, DRO, TRPH), priority pollutant metals, and PCBs. Surface soil samples were analyzed for TRPH, PCBs, and priority pollutant metals. No analytes, except arsenic, were detected at concentrations exceeding ADEC Table B cleanup levels based on the migration to groundwater pathway. Arsenic concentrations ranged from 2 to 6 mg/kg, with a calculated 95% UCL of the mean concentration at Site 13 of 4.5 mg/kg, compared to the ADEC Table B ingestion cleanup level of 5.5 mg/kg.

Water
Three monitoring wells were installed during the 1994 remedial investigation. Groundwater was encountered from 2 to 4 feet bgs and samples from all 3 wells were analyzed for VOCs, GRO, DRO, TRPH, PCBs, and priority pollutant metals. DRO (0.053 to 0.159 mg/L) and TRPH (0.2 to 0.4 mg/L) were detected at low levels, but did not exceed ADEC Table C cleanup levels.

1.6.19 Site 14 – Navy Plane Crash Site

Site 14 is located approximately 7 miles south of the Village of Gambell. A Navy P2V-5 Neptune reconnaissance plane crash landed at this location in June 1955 after being attacked by Russian aircraft. The aircraft's gasoline tank exploded and most of the fuels burned leaving no apparent stains or any stressed vegetation at the site. Debris remains on the tundra, in the area immediately surrounding the crash site.

The plane crash location is outside the military property boundary identified for the Gambell site, and is therefore not eligible for action under the FUDS program. There is no reason to believe hazardous materials are/were present.

1.6.20 Site 15 – Troutman Lake Disposal Site

Site 15 was reported to contain submerged ordnance and other debris at the north end of Troutman Lake. The underwater debris (miscellaneous metal debris) is not eligible for further action under FUDS.

Military Munitions
During 2000 and 2001, Troutman Lake was investigated using geophysical surveying techniques. The entire lake bottom was mapped along a series of transect lines, to detect underwater anomalies representative of piles of steel ammunition boxes. Metallic anomalies detected by the equipment were then further investigated using ice augers, depth sounding equipment, poles, and an underwater video camera to determine the source of the metal signal. An open water investigation was also conducted to verify the anomaly source using dredging anchors, depth-sounding leads, and an underwater camera. Anomaly locations within 20 feet of the lakeshore were verified by visual inspection. The source of the magnetic anomalies ranged from runway matting and 55-gallon drums, to geologic features such as iron and fault features. No evidence of ordnance or large piles of ammunition boxes was discovered in Troutman Lake.

Additional details regarding the ordnance investigation can be found in the report Final Engineering Evaluation/Cost Analysis (Earth Tech Inc., 2002).

1.6.21 Site 16 – Gambell Municipal Building Site

Site 16 consisted of a 35 by 55-foot area of stained gravel, located immediately west of the Municipal Building. The origin of the stain is unknown, and staining is most visible after a rainfall event. A geophysical survey was conducted in 1994. The survey results revealed four small anomalies which may be related to buried materials. The buried debris is not eligible for further action under FUDS.

Soil
Surface and subsurface soil samples were collected during the 1994 remedial investigation. Four surface soil samples were analyzed for petroleum hydrocarbons (DRO, GRO, TRPH), and priority pollutant metals. Three subsurface soil samples from one soil boring were analyzed for VOCs, GRO, DRO, TRPH, PCBs, and priority pollutant metals. Groundwater was not encountered in the soil boring. Arsenic results ranged from 2 to 7 mg/kg, with a calculated 95% UCL of the mean concentration at Site 16 of 5.4 mg/kg. Only 1 out of 7 samples exceeded the ADEC Table B ingestion cleanup level of 5.5 mg/kg. No other contaminants were identified at Site 16 above the ADEC Table B migration to groundwater pathway soil cleanup levels.

In 2001, four additional soil borings were drilled at the site based on community concerns. The soil samples were analyzed for petroleum hydrocarbons (DRO, GRO, RRO), VOCs or BTEX, and TAL metals. No analytes (except arsenic) were detected in any sample above ADEC Table B cleanup levels based on the migration to groundwater pathway. Arsenic concentrations ranged from 3.6 to 9.8 mg/kg. Only 1 sample exceeded the ADEC Table B ingestion cleanup level of 5.5 mg/kg. The arsenic levels are consistent with site background levels and do not appear associated with past military activity.

1.6.22 Site 17 – Army Landfills

The Army Landfills are located between the North Beach and Site 6 Military Landfill, which is north of the Gambell School and Municipal Building. The two landfills reportedly contained buried debris and/or trash, as well as exposed surface debris such as drums, Marston matting, and scrap metal. A geophysical survey of the area was conducted in 1994. The survey results indicated the potential for buried debris associated with the reported landfills. The remaining buried debris is not eligible for further action under FUDS.

Exposed miscellaneous surface debris, including nodwell tracks, Marston matting, steel cable and scrap metal, was removed by OSCI during the 1999 removal action. The actual tonnage of debris removed was combined with Site 6 for a total of 1,748 pounds.

Soil
Soil samples were collected during the 1994 remedial investigation. Five soil borings were completed to permafrost (7.5 to 10.5 feet). Samples were analyzed for petroleum hydrocarbons (GRO, DRO, TRPH), VOCs, PCBs, and priority pollutant metals. Arsenic ranged from 2 to 6

mg/kg in soil, compared to the ADEC Table B ingestion cleanup level of 5.5 mg/kg. Only 1 sample out of 13 exceeded the ADEC cleanup level. The arsenic levels are consistent with site background levels and do not appear associated with past military activity. No other analytes were detected in soil above ADEC Table B migration to groundwater cleanup levels.

Water
Monitoring wells were not installed at the site because well completion was impractical. Melted porewater samples were collected through the auger and submitted for analysis of VOCs, PCBs, petroleum hydrocarbons (GRO, DRO, TRPH), and priority pollutant metals. No groundwater contaminants exceeded the ADEC Table C cleanup levels.

1.6.23 Site 18 – Former Main Camp

Site 18 is located at the northeast end of Troutman Lake, between the current Municipal Building and the Gambell School. A geophysical survey was conducted in 1994 to determine the presence of buried debris. The survey showed a linear anomaly in the center of the survey grid, between the high school and the washeteria. This feature was thought to represent water delivery lines for the existing Power Plant. The buried debris is not eligible for further action under FUDS.

Soil
Soil samples were collected during the 1994 remedial investigation. One soil boring was drilled south of the anomaly due to the reported burial of discarded underground storage tanks in the vicinity. Subsurface soil samples and melted porewater were collected and analyzed for VOCs, petroleum hydrocarbons (DRO, GRO, TRPH), priority pollutant metals, and PCBs. No analytes were detected above screening levels based on the ADEC Table B migration to groundwater pathway cleanup levels. Arsenic concentrations in soil ranged from 2 to 5 mg/kg, and did not exceed the ADEC Table B ingestion cleanup level.

During the 2001 investigation, further sampling was conducted at Site 18 based on community concerns. One soil boring was placed adjacent to the north fence of the Municipal Water Treatment/Washeteria Complex. The soil boring, 18A-1, was advanced to 17.5 feet below ground surface, and two soil samples were collected near the bottom of the boring at 12 and 14 ft bgs. The samples were analyzed for petroleum hydrocarbons (DRO, GRO, RRO), VOCs, and TAL metals. DRO was detected at concentrations ranging from 54 to 640 mg/kg in subsurface soil, which does not exceed the ADEC Table B ingestion cleanup level of 10,250 mg/kg. Arsenic was detected at concentrations ranging from 5.6 to 5.9 mg/kg, which slightly exceeds the ADEC Table B ingestion cleanup level of 5.5 mg/kg. Arsenic levels are consistent with site background levels and do not appear associated with past military activity. No other analytes were detected above screening levels based on the ADEC Table B migration to groundwater cleanup levels.

Groundwater
In 2001, one well point was also installed at the location of soil boring 18A-1 and free product was observed. The free product recovered from the well point appeared clear and clean, and had the strong odor of fresh fuel, features not typical of degraded fuels from previous military activities. The free product was not sampled because the origin of the fuel was believed to be

non-military. In 1997, the City of Gambell lost a reported 10,000 gallons of fuel while pumping fuel from the north beach (via pipelines) to Site 18, the missing fuel was never located.

Further investigation of the reported free product was conducted in July 2004. A well point was installed in the same location as the previous well point. A groundwater sample was collected and analyzed for total petroleum hydrocarbons (TPH) as diesel. A complete fuel characterization analysis (fingerprint) was not possible because enough free product could not be extracted from the water sample. The water sample had a sheen, but no obvious free product layer. The sample contained 22 mg/L TPH, and the peak distribution was characteristic of a light diesel such as arctic diesel. The laboratory narrative report indicated the sample from Site 18 was characteristic of other fresh fuels dispensed in the United States and had experienced, at most, mild degradation from environmental exposure, based on interpretation of the chromatogram.

1.6.24 Site 19 – Diatomaceous Earth

Site 19 was identified as a separate area of concern by the Native Village of Gambell under the NALEMP program. This area coincides with the description of Site 18 presented above. A white powdery material was observed in a berm which borders Troutman Lake, and was determined to be inert, diatomaceous earth previously used for water filtration by the military. Diatomaceous earth is an inert material which does not pose a chemical hazard, and thus cannot be addressed further under the FUDS program.

1.6.25 Site 20 – Schoolyard

Site 20 is located north of the former Main Camp (Site 18) near the current Gambell School. The schoolyard contained two rubble piles that consisted primarily of concrete and rebar, plus a partially exposed concrete slab. The piles presented a physical hazard to local residents such as children attending school, ATV and snowmachine traffic. The rubble piles and concrete pad were removed in August 2003 under the NALEMP program.

1.6.26 Site 21 – Toe of Sevuokuk Mountain

Site 21 is located at the base of Sevuokuk Mountain and southwest of Site 5, and is thought to contain buried miscellaneous wire and metallic debris from military activities. The buried debris is not eligible for further action under FUDS.

1.6.27 Site 22 – Former CAA Housing

Former Civil Aeronautical Administration (CAA) Housing units are located near the northeast edge of the Old Gambell section of the village. The CAA housing area consists of six homes and one lodge originally built as a weather data collection facility to help guide Russian pilots during World War II. The Navy and Army also reportedly used the housing area in the Cold War era during their efforts to lay submarine detection cables off the coast of St. Lawrence Island. This site was identified as a concern under the NALEMP program due to the possibility that asbestos-containing materials may be present in the structures.

The buildings are presently occupied and/or owned by local residents, thus they do not qualify for further action under FUDS due to beneficial reuse.

1.6.28 Site 23 – Debris from High School Construction

Site 23 was identified by local residents as a concern in the Strategic Project Implementation Plan (SPIP) produced for the NALEMP program. The area is located due east of the Gambell landfill and consists of metallic debris that was originally unearthed during the construction of the Gambell High School. The City of Gambell moved the excavated debris to the local landfill for reburial.

Removal actions undertaken by current landowners are not eligible for reimbursement or further action under FUDS. The buried debris is not eligible for further action under FUDS.

1.6.29 Site 24 – South of Municipal Building

Site 24 is located south of the Municipal Building along the northern shore of Troutman Lake. A geophysical survey of the site was conducted in 2000, and subsurface anomalies consistent with metallic debris were found. The buried debris is not eligible for further action under FUDS.

Soil
During the 2001 supplemental remedial investigation, one soil boring was drilled to frozen soil. Two soil samples were collected and analyzed for petroleum hydrocarbons (DRO, GRO, RRO), VOCs, and TAL metals. The soil samples contained arsenic at concentrations of 5.7 and 6.3 mg/kg. The arsenic levels are consistent with site background levels and do not appear associated with past military activity. Fuels were not detected in the soil samples. No other analytes were detected at concentrations exceeding the ADEC Table B migration to groundwater cleanup levels.

1.6.30 Site 25A – Village of Gambell South Housing Units

Local residents identified the south housing units, Site 25A, during the 2001 investigation as an area that may be contaminated by fuel-related products of military origin. During construction work performed in 1997 by Alaska Village Safe Water, oily soils were encountered at the permafrost interface. Residents are concerned that the military may have dumped barrels of oil directly on the ground in this area.

Soil
During the 2001 supplemental investigation, six soil borings were drilled to permafrost. Soil borings were selected based on the location of depressions and trenches identified on historical aerial photographs, and disturbed ground identified by local residents. The field crew carefully avoided buried utility corridors.

Eighteen subsurface soil samples were collected and analyzed for petroleum hydrocarbons (DRO, GRO, RRO), and BTEX. A subset of five samples was also analyzed for VOCs and TAL metals. The results were compared to the ADEC Table B cleanup levels based on the migration

to groundwater pathway. Fuels, BTEX and VOCs were not detected above ADEC Table B migration to groundwater cleanup levels in any sample. Arsenic was detected at concentrations from 2.2 to 19.2 mg/kg. Three of the five samples exceeded the ADEC Table B ingestion cleanup level of 5.5 mg/kg. The arsenic levels are consistent with site background levels, are not associated with a point source of contamination, and do not appear associated with past military activity.

1.6.31 Site 25B – Low Drainage Area Southwest of Armory

Local residents identified Site 25B during the 2001 supplemental investigation as an area where contaminants may migrate and accumulate. The site is located west of the Sivuqaq Lodge, southeast of the Gambell store and fuel storage tanks, and near a local church and Army Guard building.

Soil
Two soil borings were drilled to frozen soil (depth of 11 and 12 feet) to identify potential contamination. Six subsurface soil samples were collected and analyzed for petroleum hydrocarbons (DRO, GRO, RRO) and BTEX. One sample was also analyzed for PCBs. The soil sampling results were compared with the ADEC Table B cleanup levels, based on the migration to groundwater pathway. No analytes were detected at concentrations exceeding the Table B cleanup levels.

1.6.32 Site 26 – Possible Debris Burial Site

Site 26 was identified from a 1953 aerial photograph as a possible debris burial feature. The site is located east of the Gambell School near the Former Main Camp (Site 18). Local residents reported finding metal debris, machinery, oily debris, and transformers in this vicinity.

Soil
During the 2001 supplemental remedial investigation, two soil borings were drilled to frozen soil. Four subsurface soil samples were collected and analyzed for petroleum hydrocarbons (DRO, GRO, RRO), VOCs, and TAL metals. Arsenic was detected at concentrations ranging from 3.6 to 7.7 mg/kg in surface and subsurface soils. One out of four samples exceeded the ADEC Table B ingestion cleanup level of 5.5 mg/kg. The arsenic levels are consistent with site background levels and do not appear associated with past military activity. No other analytes were detected above the ADEC Table B migration to groundwater cleanup levels.

1.6.33 Site 27 – Drum Storage Area

Analysis of an aerial photograph from 1955 indicated this location was a historical drum storage area. The community was also concerned about an area of rust-stained soil at this site. The site is located north of the former military power facility (Site 7), within the new housing area. The drums stored at this site have been removed.

Soil
During the 2001 supplemental remedial investigation, four soil borings were drilled to frozen soil to determine if contamination was present. Eight subsurface soil samples were collected and analyzed for petroleum hydrocarbons (DRO, GRO, RRO), VOCs, PCBs, and TAL metals. The soil sampling results were compared with the ADEC Table B cleanup levels, based on the migration to groundwater pathway. Arsenic concentrations ranged from 5.4 to 16.9 mg/kg. The observed arsenic concentrations are consistent with site background levels, are not associated with a point source of contamination, and do not appear associated with past military activity. No other analytes were detected in the soil samples at concentrations above the ADEC Table B cleanup levels based on the migration to groundwater pathway.

1.6.34 Site 28 – Disturbed Ground

Site 28 was identified from a 1972 aerial photograph as a disturbed area. This site is located south of Troutman Lake and west of an unnamed pond. The U.S. Army leased this area from January 1955 to May 1958 and utilized the area for communications.

Soil
During the 2001 supplemental investigation, two soil borings were advanced to frozen soil to determine if contamination was present. Six subsurface soil samples were collected and analyzed for petroleum hydrocarbons (DRO, GRO, RRO), VOCs, and TAL metals

The sampling results were compared with the ADEC Table B cleanup levels, based on the migration to groundwater pathway. Arsenic concentrations ranged from 5.5 to 10 mg/kg. The arsenic levels are consistent with site background levels and do not appear associated with past military activity. No other analytes in the soil samples exceeded the ADEC Table B migration to groundwater pathway levels.

1.7 Summary of Site Risks

Contaminants of concern were identified during the Remedial Investigation by comparison to risk-based screening levels and cleanup criteria. Screening levels were based on the most stringent Alaska Department of Environmental Conservation (ADEC) soil and groundwater cleanup levels promulgated in 18 Alaska Administrative Code (AAC) 75.341 and 345. The ADEC regulates cleanup of contaminated sites in Alaska. The cleanup levels established by the ADEC are based on an estimate of the reasonable maximum exposure expected to occur under current and future site conditions and are designed to be protective of human health and the environment. The cleanup level from Table B1 or B2 that applies at a site depends on the applicable exposure pathway based on ingestion, inhalation, or the migration to groundwater pathway.

The soil cleanup standards regulations in Tables B1 and B2 of 18 AAC 75.341 set out three different sets of soil cleanup standards based on climate variations ("zones") throughout the state. These zones were developed based on a sensitivity analysis of the factors affecting the migration of contaminants through the soil into groundwater. The resulting three climate zones were: "Arctic" (continuous permafrost), "Under 40 Inch Zone" (that area of the state receiving less than 40 inches of annual precipitation), and "Over 40 Inch Zone" (that area of the state receiving more than 40 inches of annual precipitation). The Gambell Site is located in area which receives less than 40 inches of rainfall per year.

Each zone was also assigned a conservative estimate of the reasonable exposure frequency to contaminated soil for an individual within that geographic area. This analysis looked at temperature, snowfall, and ADEC's past risk assessment data within each zone. This analysis showed that average temperature and snowfall uniquely affect potential exposure in Alaska. The resulting exposure frequency values used to develop the soil cleanup standards for the Under 40 Inch Zone was 270 days (90 days non-exposure time). Standardized default exposure parameters developed by the United States Environmental Protection Agency were used except for exposure frequency as outlined above. The target hazard quotient for non-carcinogenic compounds was set a 1, and the target cancer risk was set at 1×10^{-5} for carcinogens. Cleanup levels were calculated based on a 30-year exposure duration consisting of 6-years as a child and 24-years as an adult.

The ADEC regulations consider three scenarios – ingestion (potential pathway of exposure to hazardous substances in soil through direct consumption of the soil), inhalation (potential pathway of exposure to volatile organic hazardous substances in the soil through volatilization), or migration to groundwater (potential exposure to hazardous substances in soil through direct ingestion of groundwater contaminated with concentrations of hazardous substances at levels listed in Table C at 18 AAC 75.345(b)(1) as a result of movement of hazardous substances through soil to the groundwater). In general, the most stringent pathway is selected as the cleanup level, however, if a particular pathway is not applicable to a site, then the selected cleanup level is based on the remaining exposure pathways contained in Table B.

The selected soil cleanup levels for all sites in Gambell, with the exception of Site 12, are based on the Table B, Under 40 Inch Zone, Ingestion soil cleanup levels. Site 12 is located in close

proximity to the local aquifer, and the Table B, Under 40 Inch Zone, Migration to Groundwater Pathway soil cleanup levels are applicable at these sites. The groundwater cleanup levels promulgated by the State of Alaska in 18 AAC 75.345 Table C are based on drinking water criteria, and utilize standard US EPA exposure assumptions (70 kg body weight, 30 years averaging time – noncarcinogen, 70 years averaging time – carcinogen, 2 liters/day ingestion rate, 350 days/year exposure frequency, 30 years exposure duration, target hazard quotient of 1, and target cancer risk of $1x10^{-5}$).

A comparison of the concentrations of contaminants of concern was presented in Section 1.6. The only sites with contamination remaining above soil cleanup levels are Site 7 and Site 12.

Based upon the relatively small size of the contaminated source areas in comparison to the habitats of ecological receptors, there is little potential for significant exposure of wildlife to the contaminants. The potential for significant ecological impacts appears small. No threatened or endangered species commonly occur at the Gambell Sites.

1.8 Remedial Action Objectives

Specific remediation alternatives were developed and evaluated for contaminants of concern (COCs) at the Gambell site. The remedial action objectives are:

- At Site 7, protect human health and the environment by reducing the risk from potential exposure to arsenic. Eliminate exposure via incidental ingestion of soils by removing soils which exceed the site background level of 11 mg/kg arsenic.
- At Site 12, protect human health and the environment by reducing the risk from potential exposure to chromium and lead. Eliminate exposure via incidental ingestion of soils or migration to groundwater by removing soils which exceed the cleanup levels of 400 mg/kg lead and 26 mg/kg chromium;
- Restore contaminated soils for future residential land use; and
- Remove exposed military debris which poses a clear danger, likely to cause death or serious injury to persons exercising ordinary and reasonable care.

As part of the remedial investigation process, contaminants of concern were identified through a comparison of contaminant levels to risk-based screening levels and applicable regulatory cleanup levels. The primary COCs for soil at Gambell are arsenic at Site 7 and lead and chromium at Site 12. Contaminants at the other Gambell sites either do not exceed established cleanup levels, or exist in de-minimus quantities. The risks are below the target threshold of 1×10^{-5} and result in no further action decisions for the remaining sites. These sites are available for unrestricted use.

The Alaska Department of Environmental Conservation (ADEC) regulates cleanup of contaminated sites, and has established soil and groundwater cleanup levels in 18 Alaska Administrative Code (AAC) 75.340 and 345. Cleanup levels established following ADEC regulations are based on an estimate of the reasonable maximum exposure expected to occur under current and future site conditions. The cleanup levels are based on the most relevant exposure pathways at each site. The ADEC regulations consider three scenarios – migration to groundwater, ingestion, and inhalation. In general, the most stringent pathway is selected as the cleanup level, however, if a particular pathway is not applicable to a site, then the selected cleanup level is based on the remaining cleanup levels contained in Table B. The selected soil and groundwater cleanup levels for all sites are risk-based and designed to be protective of human health and the environment.

The soil cleanup goals for Site 7 (Table 12) are based on the ADEC Table B2 ingestion pathway soil cleanup levels. The migration to groundwater pathway is not applicable at Site 7 due to the presence of continuous permafrost which acts as a barrier to contaminant migration, and the sporadic presence of suprapermafrost groundwater at this site. The arsenic cleanup level of 11 mg/kg represents the site background concentration.

Table 12

Site 7 Soil Cleanup Levels		
Arsenic [a]	11	mg/kg
DRO [b]	10,250	mg/kg
RRO [b]	10,000	mg/kg

Sources:
[a] site background
[b] 18 AAC 75, Table B, Under 40 Inch Zone, Ingestion Pathway (May 26, 2004)

The soil cleanup goals for Site 12 (Table 13) are based on the ADEC Table B1 and B2 migration to groundwater and ingestion pathway soil cleanup levels. Site 12 is located due south of Troutman Lake, and the groundwater table is in close connection to surface waters.

Table 13

Site 12 Soil Cleanup Levels		
Arsenic [a]	11	mg/kg
Cadmium [b]	5	mg/kg
Chromium [b]	26	mg/kg
Lead [b]	400	mg/kg
DRO [b]	250	mg/kg
RRO [c]	10,000	mg/kg

Sources:
[a] site background
[b] 18 AAC 75, Table B, Under 40 Inch Zone, Migration to Groundwater Pathway (May 26, 2004)
[c] 18 AAC 75, Table B, Under 40 Inch Zone, Ingestion Pathway (May 26, 2004)

The soil cleanup levels for Sites requiring No Further Action (Table 14) are based on the on the ADEC Table B ingestion pathway soil cleanup levels. The migration to groundwater pathway was determined to be not applicable due to the presence of continuous permafrost which acts as a barrier to contaminant migration, and the sporadic presence of suprapermafrost groundwater across the Gambell sites.

Table 14

Soil Cleanup Levels for Sites Requiring NFA					
DRO [b]	10,250	mg/kg	Chromium [b]	300	mg/kg
RRO [b]	10,000	mg/kg	Copper [b]	4,060	mg/kg
Antimony [b]	41	mg/kg	Lead [b]	400	mg/kg
Arsenic [a]	11	mg/kg	Mercury [b]	18	mg/kg
Beryllium [b]	200	mg/kg	Nickel [b]	2,000	mg/kg
Cadmium [b]	100	mg/kg	Selenium [b]	510	mg/kg

Sources: [a] site background
[b] 18 AAC 75, Table B, Under 40 Inch Zone, Ingestion Pathway (May 26, 2004)

The site background concentration for arsenic was determined based on an analysis of area-wide arsenic concentrations, established background levels at other sites on St. Lawrence Island, and state-wide arsenic background levels. Of all the samples collected in Gambell with detections of arsenic, 96.6% of the results were below 11 mg/kg, the established background concentration of arsenic at Northeast Cape on St. Lawrence Island for gravel soils is 11 mg/kg, and the average arsenic concentration in Alaska ranges from 6.7 to 9.6 mg/kg (USGS 1988). At Site 12,

previously detected arsenic concentrations ranged from 3 to 10 mg/kg. At Site 7, previously detected arsenic concentrations ranged from 1 to 10.2 mg/kg, with the exception of the 2 data points identified as highly anomalous in the 2003 confirmation sampling results.

The soil cleanup levels for all other sites in Gambell are based on the ADEC Table B cleanup levels, under 40 inch zone, ingestion pathway, as promulgated in 18 AAC 75.341. These sites require no further remedial action, based on an evaluation of current site conditions and sampling data results, as presented in Section 2.7. In general, continuous permafrost acts as a barrier for soil contaminant migration. However, migration of contaminants can occur as groundwater travels in the active lens above the permafrost layer (suprapermafrost groundwater). Suprapermafrost groundwater occurs sporadically within the village of Gambell (i.e. in the vicinity of Sites 6, 7, 16, 17, 18). The groundwater flow direction from these areas is to the north, towards the Bering Sea. The groundwater aquifer that supplies drinking water to the community is located at the base of Sevuokuk Mountain, approximately 1,500-2,000 feet east of the village.

Sites 4A and 4B, located at the top of Sevuokuk Mountain, are beyond the likely recharge area for the village water supply. These sites are situated on bedrock. Very little soil is found at the top of Sevuokuk Mountain and groundwater is expected to run off the side of the mountain or enter bedrock fractures. It is unlikely that groundwater from Sites 4A and 4B could impact the drinking water aquifer at the base of the mountain.

1.9 Description of Alternatives

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

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

Institutional Controls. Institutional 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 installation of new wells in a particular area.

Site-specific Actions. A feasibility study (FS) evaluated alternatives for Sites 4A, 4B, 6, 7, 8, and 12. These sites were recommended for potential remedial action based on the remedial investigation completed in 2002 which identified areas with petroleum and/or metals-contaminated soils. An evaluation of the site-specific exposure pathways indicated that ingestion of soils was the most relevant exposure pathway for Sites 4A, 4B, 6, 7, and 8. The level of petroleum contamination in soils at these sites do not exceed ADEC Table B cleanup levels based on the ingestion pathway. Therefore, the FS provided a detailed analysis of four alternatives for the two remaining areas of concern, Sites 8 and 12.

In 2003, a concrete pad was removed from Site 7. Confirmation samples collected from underneath the removed concrete pad indicated residual levels of arsenic which were significantly higher than site background and exceeded the ADEC risk-based cleanup level. The FS was not updated to evaluate remedial alternatives for the arsenic-contaminated soil at Site 7. The No Further Action alternative was rejected for Site 7 because the chemical risk posed to human health and the environment would not be addressed since no actions would be taken to reduce the volume of arsenic contaminated soil. The alternative that is protective of human health and the environment, complies with ARARs, and is cost effective, is excavation and off-site disposal in a permitted landfill, based on the small estimated quantity of contaminated soils.

- Alternative 1 - No Action
- Alternative 2 - Debris Removal at Site 8
- Alternative 3 - Debris Removal at Site 8 and Soil Removal at Sites 7 and 12
- Alternative 4 - Debris Removal at Site 8, Soil Removal at Site 7, and In-situ Treatment of Contaminated Soil at Site 12

1.10 Comparative Analysis of Alternatives

The Corps of Engineers evaluated the remedial alternatives based on the nine evaluation criteria established under CERCLA. The comparative analysis describes how each of the alternatives meets the CERCLA evaluation criteria relative to each other.

1.10.1 Threshold Criteria

The remedial alternatives were first evaluated by comparison with the threshold criteria: overall protection of human health and the environment and compliance with ARARs. The threshold criteria must be fully satisfied by candidate alternatives before the alternatives can be given further consideration in the remedy selection process.

Protection of Human Health and the Environment
Alternative 1 is protective of human health and the environment and complies with ARARs for Sites 1A, 1B, 1C, 2, 3, 4A, 4B, 4C, 4D, 4E, 6, 8B, 8C, 8D, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25A, 25B, 26, 27, and 28.

Alternatives 1 and 2 would not reduce the chemical risk posed to human health and the environment since no actions would be taken to address the lead and chromium contaminated soil at Site 12 or the arsenic contaminated soil at Site 7. Alternative 3 would be protective because the lead and chromium contaminated soil at Site 12 and the arsenic contaminated soil at Site 7 would be permanently removed and disposed off-site. Alternative 4 would be protective, because the lead contamination would be chemically bound with a reagent to reduce the leachability of the lead.

Compliance With ARARs
This criterion addresses whether each alternative will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver. All alternatives, except the no action alternative, had common ARARs associated with the excavation of contaminated soil. The applicable requirements include those cleanup standards promulgated by the State of Alaska in 18 Alaska Administrative Code 75.341 and 345.

Alternatives 1 and 2 would not reduce or remove lead and chromium in soil at Site 12, would not reduce or remove arsenic in soil at Site 7, would not meet state cleanup levels, and would therefore not meet ARARs. Alternative 3 would comply with ARARs since the lead and chromium contaminated soil at Site 12 and the arsenic contaminated soil at Site 7 would be removed and disposed off-island. Alternative 4 would also comply with ARARs, but additional tests would have to be performed on the solidified soil following treatment to document the reduced leachability of the lead. Institutional controls would also be needed to verify the integrity of the solidified material over time, and to control future landuse in the immediate vicinity.

1.10.2 Balancing Criteria

For those alternatives satisfying the threshold criteria, five primary balancing criteria are used to evaluate other aspects of the potential remedies. No single alternative will necessarily receive

the highest evaluation for every balancing criterion. This phase of the comparative analysis is useful in refining the relative merits of candidate alternatives for site clean up. The five primary balancing criteria are: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

Long-Term Effectiveness
This criterion addressed the results of each alternative with respect to the risk remaining at the site after the conclusion of the remedial action. Evaluation of this criterion includes an assessment of the magnitude of the residual risk from untreated waste or treatment residuals. It also includes an assessment of the adequacy, reliability, and useful life of any controls that are to be used to manage hazardous substances that remain on site after the remediation.

Alternative 3 has the greatest long-term effectiveness because this alternative has the highest potential to permanently remove the lead and chromium contaminated soil at Site 12 and the arsenic contaminated soil at Site 7. Alternatives 1 and 2 provide the least long-term effectiveness since neither includes action to reduce the amount of lead and chromium contaminated soil or the arsenic contaminated soil. Alternative 4 is less effective than Alternative 3 over the long-term because it leaves the treated soil on-site. The solidified material has the potential to degrade over time in the harsh arctic climate due to continuous freeze thaw cycles. Alternative 4 has a long-term effectiveness that is greater than Alternatives 1 and 2, because Alternative 4 treats the lead contaminated soil in-situ and reduces its leachability.

Reduction of Toxicity, Mobility, and Volume Through Treatment
Evaluation of this criterion included: an assessment of the treatment processes to be employed by each remedial action and the types of wastes they would treat; the amount of waste that would be destroyed or treated; and the projected amount of reduction in toxicity, mobility, or volume. Also considered in this assessment is whether the alternative would satisfy the expressed preference of the Superfund Amendments and Reauthorization Act (SARA), Section 121, for remedial actions that reduce toxicity, mobility, or volume of hazardous waste.

Alternatives 1 and 2 do not reduce the toxicity, mobility, or volume of the lead and chromium contaminated soil or the arsenic contaminated soil. Alternative 3 reduces the volume of contaminants left on site through removal. Alternative 4 reduces the mobility and toxicity of the lead through chemical treatment.

Short-Term Effectiveness
The potential health effects and environmental impacts of each alternative action during construction and implementation were evaluated by this criterion. The factors assessed in this evaluation include the protection of the community and site workers during implementation and construction, environmental impacts during implementation, and the estimated time required to meet cleanup standards. None of the alternatives represent an unacceptable risk to the community, workers or the environment during implementation and can be effectively managed by following a health and safety plan and using appropriate personal protective equipment to minimize exposure of site workers to contaminants. Additional measures such as use of safety fencing/flagging would be taken to prevent residents from entering the areas during implementation of the alternative. Excavation of the contaminated soil at Sites 7 and 12 under Alternative 3 would involve about 4 days of field work. Under Alternative 4, treatment of the

contaminated soils at Site 12 would require about 5 days of field work, plus 2 days to excavate soil at Site 7.

Implementability
All of the alternatives can be implemented using commercially available services. Alternative 1 and 2 could be easily implemented and few technical challenges would be expected. Alternative 3 is more challenging. This alternative includes excavation and off-Island disposal of the metals contaminated soil, and coordinating remote site logistics. Alternative 4 would be the most challenging to implement. Alternative 4 would require the application and mixing of a reagent with the lead contaminated soil, utilization of additional equipment, additional laboratory testing, and increased time in the field. Alternative 4 would also require long term monitoring to ensure the solidified material remains intact into the future and institutional controls which limit future development at the site.

Disposal sites are not available within Alaska but are available outside of Alaska in the lower 48 United States. However, alternatives involving off-Island disposal could be implemented in one field season. The in-situ treatment alternative cannot be effectively implemented at this site.

Costs
Alternative 1 has the lowest cost ($46,400) and Alternative 2 has the second lowest cost ($460,900). Alternative 4 has the highest costs ($555,600) and Alternative 3 has the second highest cost ($538,200). Overall, the additional cost to remove and dispose of the lead and chromium contaminated soil is not significantly higher than Alternative 2 (Remove of Exposed Debris Only) and is less than Alternative 4 (Treat Contaminated Soil In-situ).

The costs shown in Table 15 are based on the best available information regarding the anticipated scope of the remedial alternatives. The cost estimates were prepared to guide project evaluation and implementation. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project costs.

Table 15. Comparative Analysis of Alternatives

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	No Action	*Remove Exposed Debris Only (Site 8A)*	*Remove Exposed Debris (Site 8A), Remove Arsenic-Contaminated Soil (Site 7), Remove Lead and Chromium Contaminated Soil (Site 12)*	*Remove Exposed Debris (Site 8A), Remove Arsenic Contaminated Soil (Site 7), and In-Situ Treatment of Lead and Chromium Contaminated Soil (Site 12)*
Overall Protectiveness	No risk reduction	No risk reduction. Reduces physical hazard posed by debris.	Reduces human health risk posed by contaminated soil.	Reduces human health risk posed by contaminated soil.
Compliance with ARARs	No	No	Yes	Yes
Short-term effectiveness	Not applicable	No short-term risks.	Manageable with health and safety workplan.	Manageable with health and safety workplan.
Long-term effectiveness	None	Does not eliminate human health risk posed by contaminated soil.	Eliminates human health risks posed by contaminated soil.	Reduces leachability of lead and eliminates human health risks due to arsenic. Increased potential for degradation of the solidified material given the harsh arctic climate.
Reduction of Toxicity, Mobility, or Volume	None	None.	No treatment of contaminated soils, but volume left on-site is reduced by landfill disposal.	Reduces mobility of lead in contaminated soil area.
Implementability	No technical or administrative issues	No technical issues, some coordination with Dept. of Transportation required for debris removal near runway.	No technical issues, some coordination with Dept. of Transportation required for debris removal near runway.	More complex to implement soil treatment at a remote site with no readily available services or equipment. Treatment technique requires monitoring, institutional controls, and additional trips to the site, thus increasing cost and risk of alternative not meeting risk reduction objectives.
Cost	$46,400	$460,900	$538,200	$555,600

1.10.3 Modifying Criteria

State Acceptance
The State of Alaska, through the Department of Environmental Conservation, concurs with the selected remedial responses of soil excavation at Sites 7 and 12, debris removal at Site 8A, and a determination of no further action at the remaining sites. However, the ADEC has requested the remaining small arms ammunition debris at Site 8D be removed. The decision may be reviewed and modified in the future if new information becomes available that indicates the presence of previously undiscovered contamination or exposures that may cause unacceptable risk to human health or the environment.

Community Acceptance
Based on written and oral comments received from RAB members, local residents, local Native corporation representatives, nonprofit environmental groups, and the RAB's technical advisor during the public comment period on the Proposed Plan, there appears to be support from the local community for the Preferred Alternative at Sites 7, 8A, and 12. However, there is some disagreement with the selected alternative of no further action for all remaining sites, due to concerns that inadequate site characterization was conducted at the Gambell site, inadequate site-specific background metal concentrations were defined, and a desire for additional assurances that sites won't pose a threat in the future due to changing climate conditions, melting of permafrost, undetected contaminants, and contaminant migration. The community also requested additional yearly groundwater monitoring events into the future at Site 5 and throughout the Gambell area, for a broader list of analytes. The Corps of Engineers will conduct additional investigation of the groundwater quality at Site 5, to demonstrate compliance with ADEC groundwater cleanup criteria in 18 AAC 75.345 Table C or establish a concentration trend for petroleum hydrocarbons. A final decision on any appropriate remedial action at Site 5 will be made in the future. The community is also concerned that buried military debris may become exposed in the future through erosion, frost heaving, or changing permafrost conditions and impact construction activities or resident's safety.

The FUDS program cannot address these concerns directly, since the buried debris has not been associated with soil contamination or migration. The debris impacts are documented in the Native American Environmental Tracking System (NAETS) database and will be addressed by the Native American Lands Environmental Mitigation Program (NALEMP), subject to eligibility and funding constraints. The Gambell NALEMP project is scoped to address surface/subsurface debris removal at the following sites: 1A, 1B, 1C, 2, 3A, 4E, 6, 8B, 8C, 13, 15, 17, 18, 19, 21, 23, and 24.

In addition, USACE will develop a map for use by the community during construction activities which depicts the general location of known buried military debris based on historic geophysical surveys and soil sampling results which exceed the Table B migration to groundwater pathway cleanup levels.

Detailed responses to each comment submitted on the Proposed Plan are contained in the Responsiveness Summary in the Appendix. The remedial alternatives were presented to the public at a Public Meeting held on July 21, 2004. The preferred alternatives presented at the public meeting were:

- excavation and removal of arsenic contaminated soil at Site 7,
- excavation and removal of lead and chromium contaminated soil at Site 12,
- one groundwater monitoring event at Site 5,
- removal of exposed debris at Sites 8A and 8D, and
- no further action for the remaining sites.

1.11 Principal Threat Waste

Principal threat wastes are those sources materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The primary contaminant source areas at the Gambell site (e.g., military debris, contaminated soil) have already been removed through previous removal actions. The remaining wastes do not constitute principal threat wastes based on the relatively low toxicity and mobility of the contaminants in the surface soils.

1.12 Selected Remedy

The selected remedy is the final remedial action for 37 areas of concern at the Gambell FUDS site. One area of concern will be considered under a future decision document. The remedy consists of: no further action at 34 locations, removal of inherently hazardous military debris at one location, and excavation of contaminated soils at two locations. All debris and contaminated soils will be shipped off-Island for recycling or disposal at a permitted landfill. The selected remedial alternatives for the 37 sites are:

- No Further Action at Sites 1A, 1B, 1C, 2, 3, 4A, 4B, 4C, 4D, 4E, 6, 8B, 8C, 8D, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25A, 25B, 26, 27, 28
- Excavate and off-Island disposal of approximately 4 tons of arsenic-contaminated soil which exceeds 11 mg/kg at Site 7
- Removal and off-Island disposal of approximately 50 tons of exposed Marston matting at Site 8A
- Excavate and off-Island disposal of approximately 4 tons of lead and chromium contaminated soil which exceeds 400 mg/kg and 26 mg/kg, respectively at Site 12

No Further Action Sites

The selected remedy of no further action for Sites 1A, 1B, 1C, 2, 3, 4A, 4B, 4C, 4D, 4E, 6, 8B, 8C, 8D, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25A, 25B, 26, 27, 28 is protective of human health and the environment and satisfies all applicable or relevant and appropriate requirements.

Site 7

Excavate approximately 4 tons of arsenic-contaminated soil, which exceeds the cleanup level of 11 mg/kg, from around the edges of the former concrete pad location. Dispose of soil at an off-site landfill. Collect confirmation samples and analyze for arsenic. This alternative is protective of human health and the environment because it permanently reduces the risk posed by the soil containing elevated arsenic. The no further action alternative was rejected because it would not meet established regulatory criteria, or reduce the toxicity, mobility, or volume of contaminated soil. Implementation of institutional controls or access restrictions is infeasible for the site because it is located in a high-traffic, residential area of town.

Site 8A

Remove approximately 50 tons of exposed Marston matting along the east side of the runway. Transport the debris to an off-site landfill or recycling facility. This alternative will involve picking up and consolidating the Marston matting. The Alaska District will coordinate with the Alaska Department of Transportation and Public Facilities and/or the Federal Aviation Administration during removal of the exposed debris to ensure airport operations are not disrupted. This alternative effectively reduces the long-term physical hazard posed by the debris.

Other alternatives were considered and rejected during the feasibility study phase. The exposed debris would continue to pose a physical hazard to local residents if no further action is taken. Site controls such as installation of fencing near the runway at Site 8A would require coordination with and approval from the landowner, the Alaska Department of Transportation

and Public Facilities and/or the Federal Aviation Administration. Construction of fencing may adversely affect maintenance of airport lighting/navigation aids or snow removal activities. Access restrictions were not retained for further evaluation.

Site 12
Excavate approximately 4 tons of lead and chromium contaminated soil, which exceeds the cleanup level of 400 mg/kg for lead and 26 mg/kg for chromium, and transport it off-site for disposal at a permitted landfill. Collect confirmation samples and analyze for arsenic, lead, cadmium, chromium, DRO, and RRO. Excavation and off-site disposal of soil will permanently reduce the potential risk posed by contaminated soils at Site 12.

The no further action alternative was rejected because it would not reduce the risk associated with the lead-contaminated soil. There would be no reduction in the toxicity, mobility, or volume of contaminated soil. This alternative would not meet established regulatory criteria. Implementation of institutional controls or access restrictions was determined to be infeasible for the site. In-situ treatment of the contaminated soils was also considered, but ultimately rejected due to challenges in implementation at a remote site and additional testing requirements.

Cost Estimate for the Selected Remedy
The information in the cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record. This is an order-of magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost. The costs shown in this summary table have been updated to include supervision and administration costs.

Table 16. Cost Estimate Summary for the Selected Remedy

Remedial Action	
Description	*Cost*
Workplans	$38,200
Mobilization	$127,100
Field Work	$98,400
Demobilization	$220,300
Laboratory Samples	$10,700
Project Reporting	$27,700
Project Management	$15,800
SUB TOTAL	**$538,200**
Supervision and Administration (13%)	$70,000
TOTAL	**$608,200**

1.13 Statutory Determinations

The selected remedy satisfies the requirements under Section 121 of CERCLA and the NCP. The following section discusses how the selected remedy meets these requirements.

The selected remedy is protective of human health and the environment, complies with applicable or relevant and appropriate requirements and is cost-effective. The remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

1.13.1 Protective of Human Health and the Environment

The selected remedy is protective of human health and the environment. The current and future exposure pathways are incidental ingestion of contaminated soil by local residents. The selected remedy, by excavation and off-site disposal of soil, will eliminate the risk posed by the contaminants of concern and achieve the risk-based cleanup levels promulgated by the State of Alaska. Based on previous sampling results, the groundwater pathway does not pose a current risk to human health or the environment.

1.13.2 Applicable or Relevant and Appropriate Requirements

The action-specific, chemical-specific, and location-specific applicable or relevant and appropriate requirements (ARARs) for the selected remedies are regulations promulgated by the State of Alaska in Alaska Administrative Code (AAC), Title 18, Chapter 75, Sections 340 and 341, as updated through May 26, 2004.

The chemical-specific requirements for Site 7 are cleanup of contaminated soils to:

- 10,250 mg/kg Diesel Range Organics
- 10,000 mg/kg Residual Range Organics
    - Source: 18 AAC 75.341, Table B2
- 11 mg/kg Arsenic
    - Source: 18AAC 75.340 (h)(1), site background

The chemical-specific requirements for Site 12 are cleanup of contaminated soils to:

- 5 mg/kg Cadmium
- 26 mg/kg Chromium
- 400 mg/kg Lead
- 250 mg/kg Diesel Range Organics
- 10,000 mg/kg Residual Range Organics
    - Source: 18 AAC 75.341, Tables B1 and B2
- 11 mg/kg Arsenic
    - Source: 18AAC 75.340 (h)(1), site background

1.13.3 Cost Effectiveness

The selected remedy represents the most cost-effective of the alternatives in comparison to their overall effectiveness proportional to their costs. The selected remedy provides the best long-term permanence and risk protection by removing contaminated soil which poses a risk to local residents.

Disposal sites are not available in Alaska but are available outside of Alaska in the lower 48 Unites States. Debris removal activities could be completed in one field season, reducing the need for additional site visits and mobilization costs. The in-situ treatment alternative cannot be effectively implemented at this site given the complex remote site logistics.

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

The USACE and the State of Alaska have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost effective manner at the Gambell site. The on-site treatment alternative would be the most challenging to execute given the remote site conditions and requires additional testing, landowners' consent, and implementation of institutional controls.

1.13.5 Preference for Treatment as a Principal Element

Although the selected alternative for the contaminated soil relies upon off-site disposal instead of on-site treatment; the USACE and the State of Alaska have determined that this remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost effective manner at the Gambell site.

1.13.6 Five-Year Review Requirement

The selected remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. Therefore, a five-year review is not required.

1.14 Documentation of Significant Changes

There were no significant changes between the Preferred Alternative that was submitted for public comment in the Proposed Plan and the Selected Remedy. The Corps of Engineers will conduct additional investigation of the groundwater quality at Site 5, to demonstrate compliance with ADEC groundwater cleanup criteria in 18 AAC 75.345 Table C or establish a concentration trend for petroleum hydrocarbons. A final decision on any appropriate remedial actions at Site 5 will be made after evaluating the investigation results.

The proposed removal of small arms ammunition at Site 8D has been determined ineligible for the FUDS program under the BDDR category, because the material does not meet the definition of inherently hazardous debris, which presents a clear danger, likely to cause or having already caused, death or serious injury to a person exercising ordinary and reasonable care. An ordnance and explosives response decision, approved in August 2003, documented the appropriate response to be institutional controls focusing on providing community awareness and education, including ordnance information pamphlets and posters. The Corps of Engineers will recommend that the Native American Lands Environmental Mitigation Program (NALEMP) provide funding to remove the remaining small arms ammunition at Site 8D to fully address the remaining community and state concerns regarding the beach burial pit. The impacts at Site 8D are identified in the Native Village of Gambell's Strategic Project Implementation Plan (SPIP), updated February 2005.

2. Responsiveness Summary

The primary avenues of public input have been through the Proposed Plan and public comment period. The Proposed Plan for Gambell was issued to the pubic on July 21, 2004. The public comment period was from July 21 through August 30, 2004. To encourage public comment, the USACE inserted a pre-addressed form in distributed copies of the Proposed Plan. The comment forms were also distributed at the public meeting, held at City Hall in Gambell. The public meeting was attended by 14 people, including representatives from the Restoration Advisory Board (RAB), the ADEC, and local residents. Oral comments were received at the meeting. Prior to the conclusion of the public comment period, 4 individuals submitted written comments. All comments received are documented in the administrative record file for the site. Detailed meeting minutes from the public meeting are available to the public at the 4 information repositories. The repositories are located at the Sivuqaq Lodge in Gambell, the Savoonga IRA Building in Savoonga, the University of Alaska Fairbanks Northwest Campus Library in Nome, and the Alaska Resource Library and Information Services (ARLIS) in Anchorage. A complete response to public comments is contained in Appendix A.

Appendix A

Responsiveness Summary

Proposed Plan for Remedial Action, Gambell FUDS, St. Lawrence Island, Alaska
July 2004

Responses to Public Comments

1) Comment (P. Miller):
I remain concerned that residents of St. Lawrence Island (SLI) have not had sufficient opportunity or time to review and formally comment on this document. It is especially critical that people of SLI be given ample opportunity to comment, as this is a critical phase of the CERCLA process. I suggest that the Corps of Engineers provide time at the September 9 RAB meeting for additional public comments from RAB members and other residents on the proposed plan.

Response:
The comment period was initially extended from August 23, 2004 to August 30, 2004. During a Restoration Advisory Board meeting in Savoonga, AK on September 9, 2004, the Corps Project Manager stated that additional comments were always welcome, and may be included in the Responsiveness Summary if received by the week of September 20, 2004.

2) Comment (P. Miller):
The proposed plan for remedial action does not sufficiently respond to community concerns and some suggested courses of action. Particularly, the proposed plan does not provide measures to ensure proper monitoring and protection of the community drinking water source. At least once yearly, water from monitoring wells in and around the vicinity of the community drinking water source should be sampled and analyzed for heavy metals, VOCs, pesticides, and PCBs.

Response:
The Corps will conduct additional investigation of the groundwater quality at Site 5. A minimum of two monitoring events should provide the necessary information to assure that the village water supply is not being affected by contaminants left by the military. If significant fuel contamination is found, further action may be warranted. A final decision on Site 5 will not be made until after the additional groundwater monitoring is completed. The State of Alaska typically requires three or four sampling events to establish a concentration trend. The FUDS program is not authorized to conduct prospective groundwater monitoring into the indefinite future. Long-term monitoring is typically conducted as part of a natural attenuation scenario whereby known contaminants are left in place to degrade over time.

3) Comment (P. Miller):
During the public meeting, a Gambell resident raised a significant point about the vulnerability of the drinking water source because of the permeability of the gravel substrate and susceptibility to contamination from storm surges and flooding. Contamination can readily migrate in this environment. The sites cannot be viewed as

isolated from one another because the potential for cross contamination is high given the permeability of the substrate.

Response:

We agree that the gravel substrate in Gambell is highly porous and the groundwater gradient is low. The predominant flow direction, however, is north towards the Bering Sea. Salt-water intrusion is another likely impact from storm surge events, when flow directions are periodically reversed. However, these events are rare and occur over short periods of time. There is no evidence of cross-contamination impacting the village drinking water supply.

4) Comment (P. Miller):

The proposed plan does not include adequate data to justify no further action determinations for all but 4 of the 38 sites. Many of the sites warrant further investigation and cleanup.

Response:

The State of Alaska Department of Environmental Conservation (ADEC) provided regulatory oversight during the remedial investigation and all subsequent phases of the cleanup activities. The ADEC concurs that additional investigation is not warranted at these sites. Also, the Department of Defense's NALEMP Program has included 25 of these sites for buried debris removal.

5) Comment (P. Miller):

The document must identify sources of contamination, including thallium, beryllium, arsenic, lead, chromium, VOCs, benzene, fuels, and PCBs. Pesticides should be included among the potential contaminants of concern (including DDT metabolites, mirex, endosulfan, lindane, and other pesticides known to be used during the time of the military occupation) especially since we have reason to assume that DDT and possibly other pesticides were used at the site.

Response:

The contamination identified in the Proposed Plan is primarily fuels and metals. Fuels would have been used throughout the military installation, as a source of power for generators, heating, and vehicles. Metals such as lead and chromium are common constituents of batteries. Other metals are common components of alloys used in building materials or equipment parts. PCBs are a known component of some old lubricating and transformer oils but have not been documented at significant concentrations in Gambell. Metals are also natural elements found in the earth's crust and rock formations. Through the remedial investigation process, pesticides have not been identified as a potential contaminant of concern and would not be reasonably expected at the Gambell site.

6) Comment (P. Miller):

Analysis of historical records and interviews with former military personnel should be thoroughly conducted to determine other possible sources of contamination and contaminants of concern.

Response:
The initial site inventory and planning phase of the project consisted of background research, site reconnaissance, and interviews with local residents. In addition, a Historical Time Sequence Aerial Photograph Analysis was conducted by the Topographic Engineering Center, this study included archival search of military records. As part of the ordnance investigation, an Archive Records Search was also conducted.

7) Comment (P. Miller):
The perception of most community members is that the Corps of Engineers has not adequately investigated reports of buried hazardous materials, including reports of munitions (including grenades and larger caliber UXO). Contamination may pose a hazard to health and safety, yet the concerns of the community have been too easily dismissed.

Response: The Corps of Engineers has strived to be responsive to community concerns regarding buried hazardous materials or munitions. We have performed geophysical surveys and used heavy equipment to find such buried items, even re-checking areas. The Corps has also assigned QARs (Quality Assurance Representatives) to be on hand during removal actions to assure that a thorough debris removal job was accomplished. The Corps is greatly concerned about the public's perception of our cleanup activities. We disagree that community members' claims have been unreasonably dismissed, and we continuously request input and feedback on site activities. We also have hired a geologist as a TAPP (Technical Assistance for Public Participation) advisor who can provide additional technical assistance and interpretations to the community. We have offered suggestions on how to bring items to our attention, and we remain open to new evidence of buried debris or ordnance. We understand the community frustration that the military abandoned or buried its waste instead of removing it, and we diligently work through the FUDS program to evaluate the many leads we receive related to site cleanup. This includes investigating potential threats to human health and safety and the environment. In some areas, such as Troutman Lake, the potential for health or safety hazards resulting from "undiscovered" ordnance remains so small that further investigations are just not warranted.

8) Comment (P. Miller):
In addition, although the Corps states that buried debris is not subject to remedial action under the FUDS program, the proposed plan must make provisions to remediate debris and other hazardous material should it surface through erosion or frost heaving.

Response:
Program policy guidance for the FUDS program (ER 200-3-1) states that for eligible BDDR projects, the conditions must have been hazardous as a result of prior DoD use and must have been inherently hazardous when the property was transferred or disposed of by GSA before 17 October 1986. The Proposed Plan cannot contain provisions for "what if" scenarios. In the future, if new evidence of military debris or hazardous materials becomes available, the data will be reviewed by the FUDS program to determine if additional actions are necessary.

9) Comment (P. Miller):
The proposed plan for remedial action must include provisions for sampling of indoor air for volatile organics in the Gambell High School, other community buildings, and homes in the vicinity of the landfill and power facility sites (including sites 6, 7, and 17).

Response:
Volatile organic compounds have not been detected above cleanup levels in groundwater or soil samples collected at Sites 6, 7, and 17. There is no evidence to support indoor air sampling. The detected concentrations of volatile compounds in Gambell could not result in significant indoor air pollution.

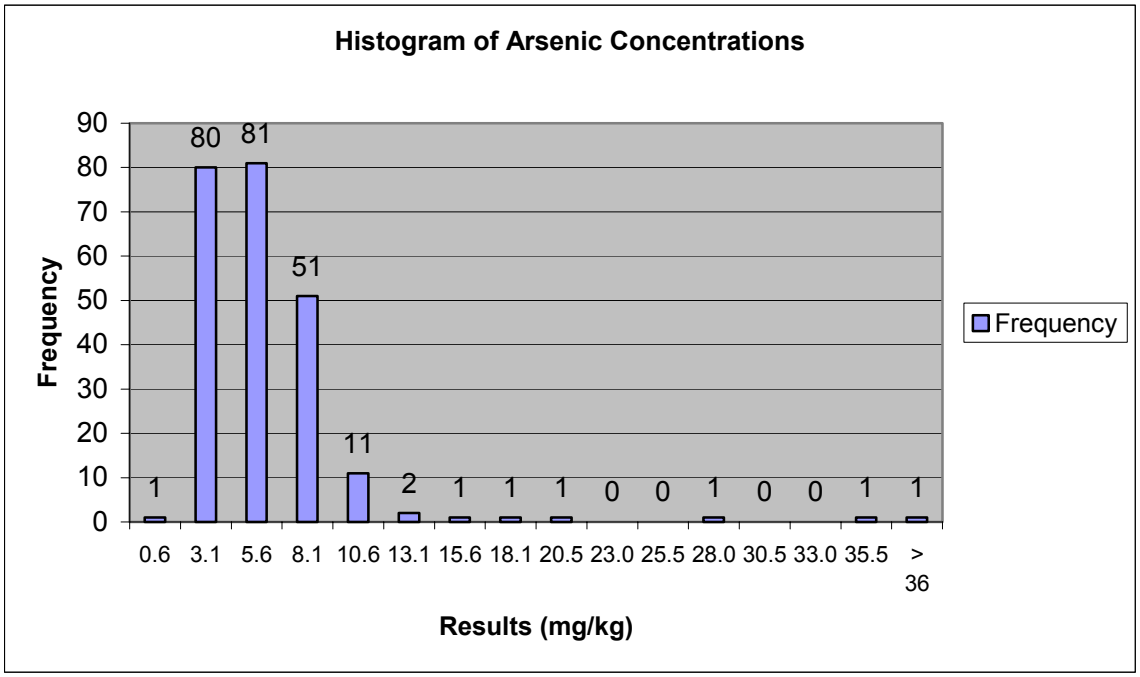
10) Comment (P. Miller):
Throughout the document, arsenic levels are considered "attributable to background" and not of military source. In some cases, arsenic levels are averaged and no further action is justified based on an average concentration. This is inappropriate and unjustified. True background levels are not provided. Often arsenic levels exceed ADEC cleanup standards. These sites should be remediated so that arsenic levels are below ADEC cleanup standards.

Response:
It is appropriate to use average concentrations of arsenic on a site-specific basis. The U.S. Environmental Protection Agency (US EPA) recommends calculating a reasonable maximum exposure (RME) for residential scenarios. Thus, the RME for chronic exposure on a site-specific basis is estimated using an average concentration of a chemical of concern. Average concentrations are typically derived by statistical methods by calculating the 95% Upper Confidence Level on the arithmetic mean of a dataset. U.S. EPA's Soil Screening Guidance Fact Sheet (July 1996) states that "For data sets of lesser quality, the 95% upper confidence level on the arithmetic mean of contaminant soil concentrations can be compared directly to the SSLs [soil screening levels]. The TBD [Soil Screening Guidance: Technical Background Document (U.S. EPA 1996)] discusses strengths and weaknesses of different calculations of the mean and when they are appropriate for making screening decisions."

Furthermore, according to Risk Assessment Handbook, Volume 1 Human Health Evaluation, U.S. Army Corps of Engineers, Engineer Manual EM 200-1-4 (January 1999), background values should be expressed as the 95% upper confidence level on the mean.

Arsenic has been documented at levels above ADEC cleanup standards throughout the state of Alaska. The ADEC recognizes that in some areas, naturally occurring levels of arsenic are higher than the most stringent ADEC cleanup levels. The ADEC has concurred that arsenic below 10-15 ppm is not a concern. According to the USGS Report "Element Concentrations in Soil and Other Surficial Materials of Alaska (1988), the average arsenic concentrations in the state ranged from 6.7 to 9.6 mg/kg (geometric and arithmetic mean). The calculated ambient concentration of arsenic at Northeast Cape on St. Lawrence Island is 7.8 to 11 mg/kg (tundra and gravel soil).

A statistical evaluation of the entire dataset (232 data points) of arsenic concentrations (excluding all non-detects) in Gambell demonstrates that 96.6% of the data falls below 10.6 ppm and 97.4% of the data fall below 13.1 ppm. This dataset includes locations which have been subsequently removed during remedial actions at the site (e.g., the sample result of 38 ppm at Site 4B from 1994), or are planned for removal (e.g., confirmation sampling results from Site 7 in 2003 of 27.9 and 34.9 ppm). A histogram of the data distribution is shown below, with the number of samples in each evenly spaced "bin" (i.e., an equally spaced interval) shown. The average arsenic concentration is 5.0 mg/kg, with a standard deviation of 4.2, and a 95% upper confidence level of 6.2 mg/kg (Chebyshev, non-parametric method).



11) Comment (P. Miller):
The document should cite screening levels for all contaminants of concern. Further, it is incorrect to make the assumption that certain data points are simply outliers. For example, the Site 2 sampling in 1994 indicated that levels for lead and chromium exceeded screening levels. 1996 samples were tested for lead only and do not provide a basis for assuming that levels for other contaminants are below the ADEC cleanup threshold. Site 2 requires further investigation and cleanup. The NFA determination is unjustified.

Response:
Screening levels are provided throughout the document. In some cases, sampling results are compared to proposed cleanup levels only and the screening step is not shown. Environmental data is inherently variable and an assessment of data distribution is a reasonable rationale for identifying certain constituents as anomalous (i.e., outliers). At Site 2 in 1994, only one sample out of 13 contained metals, besides arsenic, above

screening levels. This single sample had anomalous concentrations of both lead and chromium; other samples demonstrated a mostly sympathetic relationship between lead and chromium suggesting that where lead is low, chromium will be low. Further investigation was conducted to determine the extent of lead contamination surrounding this particular sample, since lead was more highly anomalous. The sampling results indicated lead was well below screening levels. Since lead was not elevated during the 1996 investigation, it is logical to assume that the chromium contamination was similarly below levels of concern. Any remaining chromium is likely isolated and present in de-minimus quantities. A surface debris cleanup was also completed at this location in 1999. No further sampling is recommended for Site 2, and the ADEC concurs with the NFA determination.

12) Comment (P. Miller):
Site 3, p 12. Thallium and beryllium exceeded screening levels and other metals (including mercury and others) have been detected. Results cannot be dismissed as anomalies. This site warrants further investigation and cleanup.

Response:
The additional investigation performed in 1996 confirmed that thallium and beryllium were not present above method detection limits. The ADEC concurs with the NFA determination for Site 3.

13) Comment (P. Miller):
Site 4 A, p 14. Although the document states that no significant volume of contaminated soil remains at the site, elevated levels of contaminants are present. Remedial action should include complete removal of all contaminated soil and coverage/reclamation of the area with clean soils and re-vegetation.

Response:
This area is a rocky outcropping of bedrock at the top of Sevuokuk Mountain. Vegetation is not present and reclamation with clean soils and re-vegetation is neither practical nor in harmony with the natural landscape.

14) Comment (P. Miller):
Site 4 B, p 14. The document states that "The concentration of dioxins decreased significantly as a result of removing the soils." However, dioxins and additional contaminants remain at levels of concern. Further removal actions are warranted here because of the potential for downgradient contamination. Dioxin contamination warrants special remedial actions due to the extreme health hazards posed by even low concentrations.

Response:
The USEPA and ADEC have not established cleanup levels for dioxins. The USEPA Region 9 has established a screening level of 3.9 pg/g (parts per trillion, ppt) for dioxins in residential soil. The State of Alaska adjusts the EPA screening level by one order of magnitude to derive a preliminary remediation goal for residential soil of 39 ppt dioxin.

The Agency for Toxic Substance and Disease Registry (ATSDR) uses a screening level of 50 ppt and an action level of 1,000 ppt for dioxins in soil. The residual dioxin contamination of 29 pg/g does not exceed the ADEC's preliminary remediation goal of 39 ppt. Furthermore, the dioxin contaminated soil has been removed to the maximum extent practicable. Dioxins are generally not very mobile except through the air; downgradient movement is unlikely given the setting. The ADEC concurs with the NFA determination for Site 4B.

15) Comment (P. Miller):
Site 5, p 18. Further action to identify and remove the source of DRO contamination must be taken. Monitoring of water for PAHs, DRO, solvents/VOCs, and PCBs from a close series of monitoring wells in the vicinity of the drinking water source is mandatory.

Response:
Further actions were completed in 1996, 1997, and 1998. The ADEC does not require additional groundwater monitoring. However, since several years have elapsed since the initial groundwater sampling was conducted, additional groundwater monitoring will be conducted to determine the groundwater quality in the vicinity of Site 5. There is no reason to suspect PCBs, PAHs, solvents, or VOCs are present. Earlier sampling events tested for DRO/RRO/GRO, BTEX, PAHs, PCBs, and/or VOCs. The only detected contaminant was fuel. The additional round of groundwater sampling will include sampling for DRO/RRO/GRO only. Should significant fuel contamination be discovered, additional actions will be considered. A final decision on any necessary remedial actions at Site 5 will be made after evaluating the additional groundwater data collected.

16) Comment (P. Miller):
Site 7, p 21. Benzene sources and other contamination must be remediated at this site, and not just arsenic.

Response:
Debris removals have already occurred at this site. The detected benzene concentration is not representative of groundwater across the site, and the groundwater is not considered a drinking water source. Benzene was not detected (DL 0.005 mg/kg) in the soil samples collected from Site 7 during the initial phase of remedial investigation (1994). During a subsequent phase of investigation (2001), three soil borings were advanced to permafrost and soil samples were analyzed for BTEX, DRO/RRO/GRO, VOCs, PCBs, and metals. Benzene was not detected (DL 0.003 – 0.007 mg/kg). The only analytes detected above the ADEC Table B migration to groundwater cleanup levels were arsenic and DRO. Arsenic concentrations ranged from 4.5 to 10.2 mg/kg. DRO concentrations ranged from ND(5) to 710 mg/kg. The DRO concentrations do not exceed the ingestion pathway ADEC cleanup level of 10,250 mg/kg.

17) Comment (P. Miller):
Site 12, p 26. I support the proposed alternative to remove sources of heavy metal contamination. Additional sampling should be done to delineate the full extent of contamination.

Response:
Confirmation samples will be collected after the soil is excavated, to verify the contamination was adequately removed.

18) Comment (P. Miller):
Site 14, p 28. Further investigation is necessary to determine whether the plane was carrying hazardous and/or radioactive material.

Response:
According to E&E (1992), a Navy reconnaissance plane crash landed south of Gambell, the belly gasoline tank exploded and most of the fuels burned leaving no apparent stains or any stressed vegetation surrounding the crash site.

According to Navy documentation, on June 22, 1955, a P2V-5 Neptune of VP-9, while on patrol, was attacked by two MiG-15s, which set fire to the starboard engine and forced the Neptune to crash on St. Lawrence Island, near Gambell. There were no fatalities. The plane burned almost completely.

The plane crash location is outside the military property boundary identified for the Gambell site. This is not a FUDS site, and is not eligible for action under the FUDS program. Furthermore, there is no reason to believe hazardous and/or radioactive materials are/were present.

19) Comment (V. Waghiyi):
Pg. 5, Table 1. Soil and Groundwater Cleanup Levels for All Sites and Sites 5 & 12: Why are the Cleanup Levels different for DRO, RRO, Arsenic, Cadmium and Chromium different as noted in Table 1 for All Sites and Sites 5 & 12?

Response:
According to ADEC regulations (18 AAC 75), cleanup levels are based upon an estimate of the reasonable maximum exposure expected to occur under current and future site conditions. The cleanup levels are based on the most relevant exposure pathways at each site. The regulations promulgated by the State of Alaska consider three scenarios – migration to groundwater, ingestion, and inhalation. In general, the most stringent pathway is selected as the cleanup level, however if a particular pathway is not applicable to a site, then the selected cleanup level is based on the remaining cleanup levels contained in Table B of 18 Alaska Administrative Code (AAC) 75.345. The migration to groundwater pathway is not relevant for sites on the main gravel spit because continuous permafrost acts as a barrier for soil contaminant migration to a groundwater zone. The flow direction of the groundwater above the permafrost is typically north, towards the Bering Sea, whereas the groundwater aquifer that supplies drinking water is located

approximately 1,500 to 2,000 feet east of the village. South of Troutman Lake near Site 12, the groundwater may be in close connection with surface waters, and the more conservative migration to groundwater pathway cleanup levels were selected.

20) Comment (V. Waghiyi):
Pg. 9, Site 1A-North Beach, Army Land Area, Investigation Summary: It does not disclose how many soil and groundwater samples were collected in 1994. The one surface soil sample does not seem enough, the geophysical survey boundaries for the landfill are not noted, does this one surface soil sample denotes that is sufficient for the Army landfill?

Response:
Site 1A refers to a beach area where Air Force landing activities occurred, i.e., the loading and unloading of barges bringing supplies to the installation. The geophysical survey was conducted to determine the extent of possible buried debris and covered a grid measuring 400 by 200 feet. A cluster of anomalous areas was present in the eastern half of the surveyed area. Two significant anomalous locations represented both surface materials and ferrous material at shallow depths. The predominant debris visible at the surface included Marston matting, metal, and asphalt. The one surface soil sample collected was sufficient to characterize the nature of the stained soils. The survey did not indicate a large landfill was present. The single surface soil sample was collected at a rust-stained soil patch approximately four feet south of degraded asphalt along an ATV trail. Three monitoring wells (MW6, MW7, and MW8) were also installed at Site 1B in 1994. Three subsurface soil samples were collected for chemical analysis from the 2.5, 5.0, and 10.0-foot depths in all three borings (a total of 9 samples). The only detection of petroleum hydrocarbons at Site 1B was 3.3 mg/kg of DRO at MW7 and 20 mg/kg of TRPH in MW7 at 5 foot depth. Lead was detected at concentrations of 35 mg/kg in the surface soil sample and at 117 mg/kg in MW8 at 15 feet depth. These concentrations are significantly below cleanup levels.

21) Comment (V. Waghiyi):
Pg. 9, Site 1B-North Beach, Air Force Landing Area: Do empty drums/barrels have to be tested to see what they contained?

Response:
No. Empty drums are considered debris and are typically crushed for metal recycling or landfill disposal.

22) Comment (V. Waghiyi):
Pg. 10, Former Military Housing/Operations Burial Site: The discolored gravel, was it sampled?

Response:
Yes. According to the site description, exposed debris observed during the 1994 investigation included remnants of an apparent fireplace, concrete pad, pieces of burned wood, scattered metal debris and two locations of discolored gravel. Two surface soil

samples were collected from these gravel areas, at 50 feet west and 30 feet east of the concrete slab at Site 2. The physical description of the samples (SS27 and SS28) states "fine gravel, coarse sand, silt/stained red". The samples were analyzed for fuels (TRPH), BNA (base/neutral/acid compound), and priority pollutant metals. The figure showing the sample locations also labels nearby debris as "red brick and concrete building remains". Laboratory results showed high concentrations of metals in one of the two surface soil samples for chromium (391 mg/kg), and lead (749 mg/kg). The detected metals were most likely caused by the debris contained in the area. The debris was removed during the 1999 removal action. See also the discussion under Response to Comment #11.

23) Comment (V. Waghiyi):
Pg. 11, Former Military Housing/Operations Burial Site: Investigation Summary: 2nd paragraph, the sample from 1994 that exceeded the screening levels for chromium and lead. Which form of chromium is it? Form VI is a dangerous form of chromium and is very mobile in groundwater and is almost always the result of human releases.

Response:
The sample was analyzed for total chromium. Speciation of chromium is not typically conducted during initial rounds of environmental sampling. However, during the 2001 supplemental remediation investigation at Gambell, in a different site location (Site 4A), due to concerns over previously detected high levels of total chromium, two soil samples were collected and analyzed for both total chromium and hexavalent chromium (Cr^{+6}/Cr VI). Hexavalent chromium was not detected. Chromium is a very reactive element, and typically gets reduced to the Cr^{+3} (III) form when it reacts with soil. In general, chromium is rarely found in the +6 (VI) form in soil.

24) Comment (V. Waghiyi):
The arsenic levels that exceed the ADEC cleanup level, and that are determined "consistent across sites in Gambell, and do not appear associated w/past military activity" The many sites that are referred to, the "consistent across sites in Gambell", are they military sites in question? And has samples of arsenic ever been taken for background levels outside of the boundaries of the military bases in Gambell?

Response:
The sites referred to include all areas sampled under the various investigations. Since our investigations are confined to the FUDS property, all sampling could be considered military sites. Only a few "outside" or "background" samples have been collected. Nonetheless, the statistical evaluation of arsenic, as described in the Response to Comment #10 above, has been considered appropriate in Gambell.

25) Comment (V. Waghiyi):
Pg. 12, Preferred Alternative: Chromium VI is dangerous, the single chromium exceedance that is considered an outlier, what form is it and have background levels of chromium been sampled outside of military boundaries to determine if the single chromium exceedance is an outlier indeed?

Response:
The sample was analyzed for total chromium, therefore, the valence state of the chromium is not known. However, as discussed in the Response to Comment 23 above, hexavalent chromium is rare in soils, and has not been detected in Gambell.

26) Comment (V. Waghiyi):
Pg. 12, Preferred Alternative: NFA, The village drinking water source is down gradient of site 2 & 3, warrants further sampling and monitoring.

Response:
According to groundwater level measurements taken at different times of the year, the village drinking water supply well is up gradient of Sites 2 and 3. Local residents did raise the issue of storm surges that might temporarily overwhelm the predominant water flow directions during high water events. The short duration of these events would not be expected to impact the drinking water aquifer.

27) Comment (V. Waghiyi):
Pg. 12, Investigation Summary, 3rd paragraph: Are beryllium and thallium (site 3 levels) dangerous?

Response:
The level of beryllium documented at Site 3 (6 mg/kg) is significantly less than the most conservative ADEC cleanup level, which is 42 mg/kg, based on the migration to groundwater pathway, as well as the ingestion cleanup level of 200 mg/kg. The beryllium concentration is also well below the risk-based screening levels of 150 and 160 mg/kg for residential soil calculated by two U.S. EPA regional offices (Region 3's risk-based concentrations and Region 9's preliminary remediation goals). The U.S. EPA does not publish national soil cleanup levels, and other EPA regional offices have not calculated screening levels. The level of thallium initially detected at Site 3 during the 1994 investigation (15 mg/kg) did exceed screening levels published by U.S. EPA Regions 3 and 9 (5.5 mg/kg). However, screening levels are meant to be conservative numbers and are not equivalent to cleanup levels. Further investigation was conducted to determine the full extent of potential contamination. The more detailed investigation in 1996 documented that thallium was at non-detectable levels (less than 0.28 mg/kg) at Site 3, which is well below the EPA screening levels of 5.2 and 5.5 mg/kg. It is thus very unlikely that thallium poses a risk to local residents. The ADEC has not promulgated a cleanup level for thallium.

28) Comment (V. Waghiyi):
Pg. 15 Site 4B-Former USAF Radar Station, Investigation Summary: 2nd Paragraph, Do EPA regions have different "risk-based concentrations"? Since we are in Region 10, does this US EPA, Region 3 risk-based concentration apply?

Response:
Only two U.S. EPA regional offices have calculated risk-based concentrations, based on national guidance documents. U.S. EPA Region 3 and Region 9 both have tables of screening values for use in site investigations. The values are typically quite similar. Region 10 does not publish its own list of risk-based concentrations, thus either table would apply.

29) Comment (V. Waghiyi):
Pg. 16, Site 4B-Former USAF Radar Station, Preferred Alternative: Were off military boundary background samples taken to see if the elevated copper is an isolated occurrence?

Response:
Two background surface soil samples were collected from north of the Radar Station (Site 4B), at the edge of the cliffs on the northern point of Sevuokuk Mountain. Copper was analyzed for but not detected (detection limit of 2 mg/kg) in the two samples.

Very little copper-impacted soil remains, and it is not practical to attempt removal.

30) Comment (V. Waghiyi):
Pg. 18, Site 5-Former Tramway Site, Investigation Summary: Since the only evident activity is from the military, and this site is by the Village water supply, the exceeded level of DRO needs to be monitored and addressed.

Response:
The concentration of DRO detected in 1994 at MW16 was further investigated during a second phase of study (1998) and could not be duplicated, therefore, the contamination discovered at depth while drilling MW16 appears isolated (no large area of contamination was present). The 1998 replacement soil boring/monitoring well (MW32) was installed immediately adjacent to the initial location of MW16 and the soil sampling results verified that the DRO contamination was not widespread. Four soil borings were also completed at Site 5 during the 1998 investigation (SB33, SB34, SB35, and SB36) and no contaminants of concern were detected. The DRO detected in groundwater from monitoring well MW31 in 1998 remains a curiosity. Additional groundwater sampling will be conducted to evaluate current site conditions. A final decision on any necessary remedial actions at Site 5 will be made after evaluating the additional groundwater data.

31) Comment (V. Waghiyi):
Pg. 20, Site 6-Military Landfill, Investigation Summary: Have off military boundary background samples of metals been taken to determine that the levels of metals are naturally occurring?

Response:
Two background samples were collected from a remote area in Gambell. A comprehensive background study, with a statistically robust number of samples, has not been scoped because, with the exception of arsenic, elemental concentrations have

largely been below cleanup levels. Arsenic background levels have been computed statistically as described above in Response to Comment #10.

32) Comment (V. Waghiyi):
Pg. 21, Site 7-Former Military Power Facility, Investigation Summary, 4th paragraph: Since this site is by the Gambell School and the DRO and benzene results exceed the ADEC Table C groundwater cleanup levels, this site needs to be addressed. Benzene is a long term contaminant in groundwater, it cannot readily evaporate underground and since little microbial activity occurs in underground water, it is not degraded.

Response:
Groundwater has not been consistently detected at Site 7 and is not considered a likely source of drinking water for the community. The monitoring wells were installed by drilling down into the ice to create a reservoir that would collect groundwater. Furthermore, the samples from the monitoring wells were poor groundwater samples – the lack of water in these wells prevented standard well development, thus "dirty" water samples were submitted. Water sample turbidity ranged from 82.5 Nephelometric Turbidity Units (NTUs) at MW24, to 50.1 NTUs at MW25, to 9.3 NTUs at MW27. Ideally, turbidity should be less than 5 NTUs for well samples. This suggests that the laboratory results included contributions from suspended solids (soil). Additional investigation conducted in 2001 demonstrated that the suprapermafrost groundwater at Site 7 was not present. Soil sampling results from 2001 indicated that the maximum concentration of DRO was 710 mg/kg, which does not exceed the ADEC ingestion cleanup levels of 10,200 mg/kg. Benzene was not detected in the soil samples (detection limit of 0.005 mg/kg). These contaminant levels do not pose a tangible threat to the school (which is not in the immediate area) or the community.

33) Comment (V. Waghiyi):
Pg. 27, Site 12, North Nayvaghat Lakes Disposal Site, Investigation Summary, 2nd paragraph: The background levels for groundwater and surface water taken from MW-14 located at the base of Sevoukuk Mt. are from Site 5, so therefore NOT BACKGROUND.

Response:
At the time of the Phase I Remedial Investigation in 1994, MW14 was designated a background monitoring well. This site was selected because it was adjacent to the fresh water recharge area at the base of Sevuokuk Mountain and presumed to be upgradient from any potential contaminant sources, such as the Former Military Housing/Operations Site (Site 2) and Former Communications Site (Site 3). No metals were detected in the groundwater at this location; the comparison levels designated as background were actually the method detection limits for this sample from the 1994 investigation.

The only detectable analytes found in groundwater from 2 monitoring wells (MW17 and MW18) installed at Site 12 were the metals barium, lead and zinc. The concentrations of these elements were significantly below the ADEC Table C groundwater cleanup levels. Barium ranged from ND to 0.03 mg/L, compared to a cleanup level of 2.0 mg/L. Lead

ranged from ND to 0.004 mg/L, compared to a cleanup level of 0.015 mg/L. Zinc ranged from ND to 0.018 mg/L, compared to a cleanup level of 11.0 mg/L.

One surface water sample (SW165) was also collected at a small pond situated in the northeast corner of North Nayvaghat Lake. DRO was detected at a concentration of 0.06 mg/L, compared to a cleanup level of 1.5 mg/L. Chromium and zinc were also detected, but at concentrations well below the ADEC Table C groundwater cleanup levels. Chromium ranged from ND to 0.007 mg/L, compared to a cleanup level of 0.1 mg/L. Zinc ranged from 0.048 to 0.049 mg/L, compared to a cleanup level of 11.0 mg/L.

34) Comment (V. Waghiyi):
Pg. 32, Site 22-Former CAA Housing, Preferred Alternative: Since the housing has the possibility that asbestos-containing materials may be present in the structures, this site needs to be addressed to determine if the buildings do indeed pose a risk to the occupants or local resident owners, they have a right to know!!

Response:
The FUDS program is not authorized to conduct remedial actions for structures that have been occupied and beneficially used since military use. Furthermore, FUDS program policy (ER 200-3-1) specifically states that the abatement of asbestos-containing materials (ACM) is an <u>ineligible</u> project, unless the abatement is incidental to completing an approved building demolition project.

35) Comment (V. Waghiyi):
Pg. 34, Site 26-Possible Debris Burial Site: Since this site is by the Gambell School, it warrants cleanup since Local residents reported finding metal debris, machinery, oily debris, and TRANSFORMERS in the vicinity, NFA is not an option due to the risk associated with the site.

Response:
The 2001 remedial investigation demonstrated that soil contamination is not present at this location. Therefore there is no risk from contaminants associated with this site. The FUDS program is not authorized to excavate buried debris, unless hazardous constituents are present and demonstrated to be migrating off-site.

36) Comment (V. Waghiyi):
Pg. 35, Site 28-Disturbed Ground, Site Description: The Army's use of the land leased January 1955 to May 1958 needs to be determined, the community has a right to know if it poses a risk!

Response:
According to the Findings and Determination of Eligibility (1985), 16.07 acres located immediately south of Troutman Lake were obtained by Special Land Use Permit from the Bureau of Land Management (BLM) for the Army in January 1955 and called "Gambell Army Site No. 2", a defense site. This area was relinquished to BLM in February 1958. A small portion of this area, 0.23 acres, was obtained by notation of land records for the

Gambell National Guard in March 1962 and relinquished to BLM in February 1973. According to the Archives Search Report prepared by USACE (March 1998), the area south of Troutman Lake was used by the Army for communications.

37) Comment (V. Waghiyi):
Until credible samples of background arsenic levels are collected outside of the military boundaries in Gambell, Sites 1A, 1B, 2, 6, 7, 9, 12, 13, 16, 17, 18, 25A, 26 and 28 need to be taken off of "Preferred remedial alternatives NFA" proposed plans until if indeed the arsenic levels are not associated w/past military activity.

Response:
A comprehensive study of background metals values has not been conducted in the vicinity of Gambell. Such study has not been scoped because, with the exception of arsenic, elemental concentrations have largely been below cleanup levels. Arsenic background levels have been computed statistically as described above in Response to Comment #10. Arsenic is a naturally occurring element that has been well documented throughout the state of Alaska at concentrations higher than the default ADEC cleanup levels. Site 7 is the only site with a clear indication of elevated levels of arsenic. The gravel soil at this site is proposed for excavation and removal in the Proposed Plan.

38) Comment (V. Waghiyi):
Are the following sites with buried debris scoped under NALEMP and will be removed?
Sites 1A, 1B, 1C, 2, 3, 11, 13, 14, 15, 16, 17, 18, 21, 23 & 24.

Response:
The Native Village of Gambell (NVG) successfully removed debris at Site 18 during the 2004 field season under a Fiscal Year (FY) 03 Cooperative Agreement with the Department of Defense. The NVG also planned to remove debris at Sites 17 and 19 during the 2004 field season, but encountered more debris than anticipated at Site 18 and may not have completed those sites. These sites would then be addressed during the 2004 field season. The NVG was awarded a FY04 NALEMP Cooperative Agreement for additional work to be performed during the 2005 field season. The FY04 CA anticipates cleanup at Sites 3A, 5, 1A, 6, 1B, 2, 8C, 8B, 4E, 13, 23, 15, and 1C. Sites 21 and 24 are included in the Strategic Project Implementation Plan (SPIP) prepared by the Native Village of Gambell, but have not yet been funded for cleanup by NALEMP. Sites 11 and 14 are not identified as impacts by the Native Village of Gambell in their SPIP.

39) Comment (V.Waghiyi):
Sites 3, 4A, 4B, 5, and any other site that had samples that initially had elevated levels and are a risk to human health and the environment, and after additional samples were taken a year or years later, the results showed decreased levels, goes to show that the communities knowledge that the groundwater migrates and as a result the differences in the contaminant levels needs to addressed and long term monitoring are warranted and must remediate and cleanup the contaminants when concentration levels are above risk to human health and the environment

Response:
Sampling events are conducted over time and space to delineate the extent of contamination at a particular site. Sampling results that show a decrease in contamination can indicate several things. Natural attenuation for contaminants occurs over time, or perhaps the samples just reflect inherent variation in contaminant concentrations. Perhaps the subsequent sampling reached beyond the extent of contamination. In each of the areas mentioned, cleanup activities have already taken place, and decreased levels of contamination can logically be attributed to these cleanup efforts. The latest sampling results suggest that neither further cleanup actions nor long term monitoring is appropriate for these sites.

40) Comment (R. Scrudato):
One factor is clear from the data collected on the effects of the military occupancy is that it is very difficult to effectively characterize and assess the environmental impacts within the Gambell area due to the complex hydrology and geology of the area. The highly permeable and coarse grained nature of the cobble deposits are difficult to sample. The presence of permafrost, as well as the proximity of the impacted sites to the Bering Sea and the relative hydrologic influences of Troutman Lake, makes it difficult to effectively characterize impacts to the various sites known to have been impacted by the release of contaminants during the time the military occupied the area.

Response:
We agree that site characterization has been challenging at the Gambell site. Nonetheless, investigations have been thorough enough to demonstrate that gross, large-scale contamination is not a legacy of the Gambell FUDS. Whereas buried debris is a commonplace occurrence, contamination associated with that debris appears limited. The ADEC has concurred that site characterization is adequate to proceed with a remedial decision.

41) Comment (R. Scrudato):
Additional complications are imposed by the difficulties in gaining an understanding of the relationships of the Gambell cobble deposits (the spit) to the bedrock especially the transition at the base of the elevated mountainous area, including the interrelationship of the fractured bedrock, the talus and the on-lapping cobble deposits. This transition zone is particularly important to the source of the Gambell water supply since the infiltration gallery is charged by the groundwater deriving from this complex interrelationship. This interrelationship is also subject to seasonal changes and further complicated by the presence of contaminated cobble soils within the recharge gallery area. As I have mentioned in earlier correspondence, the hydrology of the infiltration gallery and relations to the contaminants identified in the sites located in proximity to the infiltration gallery are less than well defined.

Response:
We acknowledge that the complex hydrologic relationships between the aquifer and its recharge area in the vicinity of Gambell are not fully understood. To date, we do not recognize an imminent threat to the water supply and we remain cautiously optimistic

that the status quo will be maintained. The cobble soils within the recharge gallery area have been investigated during several phases of remedial investigation. A large source of contamination has not been identified which could impact the drinking water source. In the absence of water sampling results that indicate a definite problem, it is not an issue for the FUDS Program.

42) Comment (R. Scrudato):
As I mentioned in my comments on the Gambell Feasability Report, it is important to provide the Gambell residents with assurances that the environmental impacts deriving from the former military occupancy and release of contaminants at the various defined sites will not continue to affect their natural resources. The most effective way to provide this assurance is to establish a broad based monitoring program that will take into consideration the uncertainties inherent in effective site characterization due to the complex nature of the Gambell geology, hydrology, and relationship to permafrost, climatic changes and future land use to ensure that potential impacts will be identified and defined.

Response:
The purpose of site cleanups undertaken under FUDS is to remediate known sources of military contamination that pose a threat to human health or the environment. The Corps used the most stringent level of protection under state guidelines (residential) when considering the future land use in Gambell. It is not within the scope of the FUDS cleanup to set up monitoring programs to safeguard against potential future environmental concerns. Monitoring programs are established if recognized contaminants, above regulatory cleanup levels, are left in the ground and subject to natural or induced remediation, or if institutional controls such as fencing or deed restrictions are imposed. This does not appear to be the case in Gambell.

43) Comment (R. Scrudato):
I recommend a more comprehensive series of monitoring wells be established and monitored throughout the Gambell area to ensure detection of contaminants will not go undetected. The Gambell residents should be provide a measure of confidence that future potential impacts will be detected and once detected effectively eliminated.

Response:
Monitoring for potential contaminants, indefinitely into the future, is not within the scope of the FUDS Program. FUDS is a cleanup program, for known contamination.. If new information becomes available in the future regarding potential military impacts, the FUDS program will evaluate the data to determine the appropriate course of action.

44) Comment (M. Apatiki):
The overall concept of the Introduction and Description stated in this Document regarding the Geophysical Surveys, Remedial Investigations and Feasibility Studies (RI/FS) that were conducted and the proposed Work Plans to perform the Remedial Action (Cleanup) by the Independent Contractor were excessively unexplicit for several reasons stated in the following sections: The environmental impact on each of the Sites

do not seem to have a thorough examination and description regarding the analytical sampling and previous cleanup actions. Specifically, the sites that were proposed for the "No Further Action".

Response:
Please refer to the more detailed Remedial Investigation reports that are provided for public viewing at the Information Repository located at the Sivuqaq Lodge. The ADEC has provided regulatory oversight during the investigation and cleanup process for the Gambell Site. The ADEC has concurred that site characterization is adequate to proceed with a remedial decision.

45) Comment (M. Apatiki):
The analytical DATA Collections conducted by the Independent Contractor, that were started since the year of 1985 do not correspond with the other analytical comparison results conducted by the contractor that should have excessively exceeded the ADEC Cleanup Level Protocol.

Response:
The analytical data collected over time at the Gambell site has been verified for accuracy and usability. Data regarding analytical sampling should be expected to change over time, especially if cleanup activities occur between sampling events. Scientific analysis of the data requires an objective interpretation to best understand the meaning of the results.

46) Comment (M. Apatiki):
In accordance with the local eye-witness perspectives, regarding the sites that were proposed for the cleanup removal were recommended as the unfinished project performance because of the content of the debris sites were partially been removed and that still had the remains of the unidentified anomalies and contaminant that were still intact on sites.

Response:
The proposed cleanup action includes removal of debris at the airstrip (Site 8A) which was originally slated for removal during the 1999 debris removal action. The initial removal action encountered live electrical wires that prevented safe working conditions near this debris. A health and safety plan, and coordination with local airport officials will be conducted to ensure the remaining surface debris is completely removed.

47) Comment (M. Apatiki):
The overall condition of the 28 Sites indicated in this document were positively still remains on sites and some still needs to be addressed thoroughly on behalf of the communities of the St. Lawrence Island that were affected by the FUDS/HTRW.

Response:
Between the FUDS and NALEMP Programs, substantial cleanup activities are planned in the Gambell area. It is certain that these activities will result in a cleaner community, and

provide opportunities for the local citizens to be involved, and for employment. The ADEC has provided regulatory oversight during the investigation and cleanup process at the Gambell Site. The ADEC has concurred that site characterization is adequate to proceed with a remedial decision.