ENVIRONMENTAL RESTORATION PROGRAM

FINAL FIRST FIVE-YEAR REVIEW

CAPE ROMANZOF SITES

LANDFILL NO. 2 (LF003), DIESEL SEEP AREA (SS013), AND UST SPILL AREA (SS015)

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ABBREVIATIONS AND ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFCEE	Air Force Center for Engineering and the Environment
ARARs	Applicable or Relevant and Appropriate Requirements
AST	Above Ground Storage Tank
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
DO	Dissolved oxygen
DQO	Data Quality Objectives
DRO	Diesel-Range Organics
ERP	Environmental Restoration Program
GRO	Gasoline-Range organics
LTM	Long-Term Monitoring
LUC	Land-Use Control
ND	Not Detected
NM	Not Measured
ORP	Oxidation-Reduction Potential
PAH	Polynuclear Aromatic Hydrocarbon
PDC	Paug-Vik Development Corporation
POL	Petroleum, Oil, and Lubricants
PVC	Polyvinylchloride
RAO	Remedial Action Objectives
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compounds

UNITS OF MEASURE

ft	feet
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
µg/L	micrograms per liter
ppm	parts per million
°C	degrees Celsius

1 INTRODUCTION

1.1 PURPOSE

The purpose of this five-year review is to independently evaluate whether current site conditions and remedial measures are and will continue to be protective of human health and the environment. This five-year review is the first conducted at Cape Romanzof LRRS and covers the sites Landfill No. 2 (LF003), Diesel Seep Area (SS013), and UST Spill Area (SS015). This five-year review has been prepared in accordance with existing United State Environmental Protection Agency (US EPA) five-year review guidance (US EPA, 2001).

1.2 AUTHORITY STATEMENT

The United Stated Air Force (USAF) has conducted this review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9621(c), the National Contingency Plan (NCP) – 40 CFR 300.430 (f) (4) (ii), and Executive Order 12580 (January 23, 1987). This document is consistent with these guidance documents: Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-02 (May 23, 1991), as supplemented by OSWER Directives 9355.7-02A (July 26, 1994) and 9355.7-03A (December 21, 1995).

The USAF is the lead agent for this Cape Romanzof LRRS five-year review along with participation of project managers for the US EPA and the State of Alaska Department of Environmental Conservation (ADEC). This review is limited to only the sites specified that are being remediated under CERCLA and/or State of Alaska authority.

1.3 REVIEW PROCEDURE

In conducting this five-year review, the project team reviewed and evaluated record of decision requirements, work that has been done to satisfy those requirements, current and past monitoring data, current status of the remedies, and physical condition of the sites. Review activities included site inspections by remedial project managers, public meetings, and interviews with key stakeholders. Table 1-1 present the individuals that served on the five-year review team.

Table 1-1 Cape Romanzof Five-Year Review Team

Team Member	Organization	Phone	Contact E-mail
Keith Barnack	USAF 611 CES	907-552-5160	keith.barnack@elmendorf.af.mil
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2 INSTALLATION BACKGROUND

Cape Romanzof LRRS was one of the ten original aircraft control and warning sites in the Alaska Air Defense System. Construction of the installation was completed in 1952 and operations began in 1953. The White Alice Communication Station (WACS) became operational in 1958, and replaced the initial communication and warning system. As technologies improved, the communications systems were upgraded, eventually allowing the station to become a Minimally Attended Radar Station. By 1977, technological advances and significant reduction in site personnel allowed the Air Force to turn over operational support of the installation to independent contractors. The current site operations contractor is ARCTEC.

2.1 PHYSICAL CHARACTERISTICS

Cape Romanzof LRRS is located in coastal western Alaska, on a small peninsula of land that extends into the Bering Sea. The site is approximately 560 miles west of Anchorage, 165 miles northwest of Bethel, and 170 miles southeast of Nome (Figure 1). Air Force property at the installation entails about 4,900 acres of land situated within the boundaries of the Yukon-Kuskokwim Delta National Wildlife Refuge, a federally protected habitat area.

The installation is comprised of two main areas: the Lower Camp where the main camp facilities (i.e. housing, power plant, and bulk fuel storage area) are located, and the Upper Camp where the Long Range Radar equipment is located (Figure 2-1). The Upper Camp is situated at the top of Towak Mountain (elevation 2,250 feet above mean sea level), with the two areas connected by a gravel road and tramway service. Almost all of the original installation facilities have been demolished. A new composite facility, consisting of two dome type structures, was constructed at the Lower Camp in 1984 and provides working and living facilities for installation personnel.

A one-mile-long gravel runway serving the installation is located near the beach at Kokechik Bay, approximately 4 miles southwest of the Lower Camp by road.

2.2 LAND AND RESOURCE USE

Independent contractors have operated the Cape Romonzof LRRS since 1977. The current site operations contractor is ARCTEC. Approximately six contractor personnel currently live at the installation year-round. In the summer, the number of people living at the site can significantly increase (up to 30 people) when contractors and government

agencies (e.g., Alaska Department of Fish and Game and U.S. Department of the Interior Fish and Wildlife Service) are conducting studies and performing work at the site.

The nearest local communities are Scammon Bay (population 520) and Hooper Bay (population 1,157), each located about 15 miles east and south of the installation, respectively. Although the communities are not connected to Cape Romonzof by road, the community members use off-road vehicles, boats, snow machines, and walking to travel all around the Cape Romanzof area. The populations of Scammon Bay and Hooper Bay are 95-97 percent Native Alaskan. Employment is seasonal, with peak economic activity in the summer months. Major sources of employment are the Bureau of Land Management firefighting programs, commercial fishing, and the associated canneries.

Cape Romanzof LRRS is located within the limits of the Yukon Delta National Wildlife Refuge, a federally protected environment. Dolly varden inhabit Fowler (Nilumat) Creek, and pink salmon spawn in Fowler Creek. Beaver have constructed several ponds in the creek. Fowler Creek is used by Cape Romanzof workers for recreational fishing. Kokechik Bay and Scammon Bay are important subsistence resources for members of nearby communities.

2.3 GEOLOGY AND HYDROLOGY

2.3.1 Geology

Cape Romanzof LRRS is located at the western end of the Askinuk Mountain range that rises several hundred feet to 2,300 feet above the flat, low-lying delta plain of the Yukon and Kuskokwim Rivers. The main rock type at this end is granitoid intrusive. Bedrock crops out extensively along the ridges surrounding Fowler Creek Valley. Deep weathering, jointing, exfoliation, and frost wedging have produced extensive talus slopes and boulder fields. The Upper Camp consists of sand, gravel, and boulders overlying the granitic bedrock, while the Lower Camp consists of moderately thick talus (57 to 74 feet thick) and alluvial sequences, consisting of rock fragments, sand, and minor amounts of silt and clay.

Soils at the Upper Camp are characterized as a thin, granular, unconsolidated, non-cohesive layer of sand and gravel that is overlain by a spongy layer of mosses and organic matter of varying thicknesses. Soils at the Lower Camp are commonly sand and silt with gravel/talus horizons near the bedrock interface.

2.3.2 Surface Water

Fowler (Nilumat) Creek, a perennial stream, drains the main Cape Romanzof valley. It flows four miles from a constructed reservoir at the head of the valley to Kokechik Bay. Recharge of the stream is primarily from the reservoir, sheet run-off, and small tributaries from near-by valleys. Numerous ponds and surface water bodies exist for short periods of time (one to five days) after precipitation events. Fowler Creek, the reservoir, and a small pond approximately 300 feet north of the reservoir are the only perennial bodies of water close to the installation. The Fowler Creek watershed has an approximate area of 8.5 square miles.

2.3.3 Groundwater

The depth to groundwater in the vicinity of Cape Romanzof LRRS is reportedly 8 to 70 feet bgs. The unconfined aquifer occurs both in the glacial till and the fractured bedrock. No boundary is believed to exist between the colluvial/alluvial and the bedrock aquifers.

The installation receives its drinking water from a deep well located near the Lower Camp. Stratographic and water level relationships in Well No. 1 indicate that clayey materials encountered at around 43 feet in depth are acting as an aquitard between the overlying water bearing glacial deposits and the underlying bedrock aquifer (USAF, 1992).

Recharge of groundwater is from infiltration of precipitation within the drainage basin. Little or no regional flow exists across drainage boundaries. Surface runoff and groundwater flow directions follow the downward slopes of the valley and exit the main valley to the west. Previous documents have noted groundwater flow to the north; however, this is not consistent with the site topography or 1997 well survey results (USAF, 1998a and 1998b). Contour maps based on the 1997 well survey data indicate that the groundwater flow direction is in a westerly direction and downslope; following drainage and topography patterns.

2.3.4 Groundwater Use

Unless classified otherwise, all groundwater in the state of Alaska is considered drinking water (per 18 AAC 75.350). Cape Romanzof LRRS currently obtains its water supply from groundwater, which is present in fractured bedrock and overlying alluvial sediments along Fowler Creek. The installation originally obtained its drinking water supply from two wells drilled into bedrock. Only Water Supply Well No. 1 is now being

used. Well No. 1 was constructed in 1957 to a depth of 154 feet and cased with 8-inch diameter casing to a depth of 98 feet. Well No. 1 produces groundwater from confined water-bearing zones at 82 to 102 feet deep and 146 to 148 feet deep. It is reportedly capable of producing 60 gallons per minute.

In 1962, a second well (Well No. 2) was installed to a depth of 96 feet and equipped with 6-inch diameter casing. This second well, which is now inactive, served only the Weather Station Building and reportedly became contaminated with petroleum, oil, and lubricant (POL) products in 1964. In 1972, a second well was constructed approximately 200 feet northeast of the Weather Station Building. This well, Well No. 3, is enclosed in a wooden pump house and provides non-potable water to the Weather Station Building.

2.4 INSTALLATION COMMUNITY RELATIONS

A **Community Relations Plan (CRP)** was prepared for Cape Romanzof LRRS in September 1996 (USAF, 1996). The CRP was prepared to promote communication between the USAF and the general public during environmental restoration activities at Cape Romanzof. The objective of the CRP is to provide accurate, straightforward, and up-to-date information about all phases of cleanup activities to public officials, commercial interests, the community, and other interested parties.

A **restoration advisory board (RAB)** was formed on September 1, 2000, to serve as a forum for discussion and exchange of information between federal/state agencies and the community regarding the cleanup program at Cape Romanzof LRRS. The RAB provides an opportunity for stakeholders to review cleanup progress, provide input, and participate in dialogue with decision-makers. The RAB is comprised of representatives from the local communities and federal, state, and local governments. RAB meetings have been scheduled at the convenience of the communities since the first official meeting on September 1, 2000.

As required by CERCLA, an **Administrative Record** has been established for Cape Romanzof LRRS environmental restoration. The Administrative Record contains the information used to support USAF decision making (e.g., historical site investigation and remediation reports). It has been established at the 611 CES Environmental Restoration Section located at Elmendorf Air Force Base and is open to the public. The Administrative Record contents are also available at the following internet address: http://www.adminrec.com, although there may be a delay between a document's availability in the physical Administrative Record and its availability on the internet.

A mailing list of interested parties in the community is maintained and updated regularly by the USAF Remedial Project Manager or the Community Relations Coordinator. The mailing list is used to provide interested parties copies of the newsletters, fact sheets, and public meeting notices pertaining to the environmental issues at Cape Romanzof LRRS.

Fact sheets and newsletters are distributed as changes occur in the restoration program or when proposed plans require public comment and to keep interested parties informed on the restoration program for Cape Romanzof LRRS.

2.5 INSTALLATION LAND USE CONTROL AND REMEDY IMPLEMENTATION

The Air Force has a process to incorporate the requirements of records of decision (ROD) decision documents into their base operations. Facility design, construction, maintenance, environmental restoration, and environmental compliance are controlled by the 611 CES.

Land use controls (LUCs) have been established to implement remedies selected in the ROD for Interim Remedial Action at Spill Site SS013, Spill Site SS015, and Landfill Site LF003 (USAF, 2002). The purpose of these land use controls is to prevent accidental exposure to contaminated media. The specific land use controls include specific land use restrictions and the prohibition of the use of groundwater at selected sites.

The USAF has adopted standard language for the utilization of LUCs. This standard language is designed to make LUCs more reliable. The USAF has and will implement, monitor, maintain, and enforce the LUCs identified below in accordance with CERCLA and the NCP. The LUCs have been and will be implemented as follows:

- The USAF surveyed the site boundary;
- The USAF dig permit and construction review system is utilized to restrict incompatible activities;
- The USAF documents the LUCs in Appendix C of the General Plan (USAF, 2006). The General Plan contains a map indicating the LUC locations for Cape Romanzof Sites LF003, SS013, and SS015; and a one-page description of the LUC for each of these sites.
- The USAF notifies ADEC prior to making any major changes to the General Plan that could affects the LUCs. USAF will seek prior concurrence from ADEC to terminate the LUCs, modify current land use or allow anticipated actions that may disrupt effectiveness of the LUCs.

The LUCs have been and will be enforced by annual visual inspections performed to verify effectiveness of the LUCs, and where results of the inspection will be reported to ADEC. Annual inspection reports will evaluate the status of the LUCs and how any LUC deficiencies or inconsistent land uses have been addressed. The inspection reports will be used in preparation of the five-year review to evaluate effectiveness of the remedy.

Any activity that is inconsistent with LUC requirements, objectives or controls, or any action that may interfere with the effectiveness of the LUC will be addressed by the USAF as soon as practicable after discovery, but in no case will the process be initiated later than 10 days after USAF becomes aware of the breach.

USAF will provide notice to ADEC as soon as practicable after discovery of any activity that is inconsistent with LUC requirements, objectives or controls, or any action that may interfere with the effectiveness of the LUC. In the event that the LUCs fail or are deficient and could imminently lead to actual risk to human health and the environment, USAF will address the situation promptly, including notification of ADEC.

In the event that the property is transferred, the property transfer document will describe the LUCs in place for protection against unacceptable exposure to contaminants left in place. If groundwater fails 18 AAC 75.345(b)(1) Table C cleanup levels, protective of drinking water, at the time of the transfer, the property transfer document will also describe LUCs in place for restricting the installation of drinking-water wells. USAF will provide notice to ADEC prior to any transfer, sale or lease of property, so that ADEC can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain the LUCs.

3 LANDFILL NO. 2 (LF003)

3.1 INTRODUCTION

Landfill No. 2 (LF003) was the installation landfill and was used until the mid-1970s for disposal of garbage, rubbish, wood, metal, plastic, construction and demolition debris, and incinerator ash. The landfill was capped in 1994 with an impermeable hypalon liner overlain by geotextile fabric, sandwiched between layers of sand and pit-run material (USAF, 1995).

LF003 is located approximately one mile west of the residential dome at the Lower Camp, on the south side the access road between the Lower Camp and the airstrip (Figure 2). The landfill area covers approximately 1 to 1 ½ acres. Fowler (Nilumat) Creek lies approximately 250 feet south of the landfill, with two small tributaries located between the landfill and the creek. One of these tributaries is directly adjacent to the landfill.

3.2 SITE CHRONOLOGY

1985: Eleven sites were identified as potentially containing hazardous contaminants at Cape Romanzof during the *Phase I Records Search, AAC-Southern Region (*USAF, 1985*)*.

1989 - 1991: Four monitoring wells were installed at the landfill area. Investigations conducted in 1989 and 1990 indicated that soil and surface water downgradient of the landfill were contaminated with petroleum hydrocarbons and PCBs. In 1989 and 1991, site investigations documented large amounts of exposed wood, metal and plastic debris in the areas around the landfill. Several areas of stained soil and several points of oily effluent were noted on top of and adjacent to the landfill, respectively. Two drainages adjacent to the landfill were receiving surface flow and effluent flow from the landfill. Several seeps were observed to emanate from the landfill surface, and appeared to flow for up to 100 feet before reentering the landfill.

1992: In 1989 and 1990, a remedial investigation (RI) of soil, surface water, and groundwater contamination was conducted at 10 sites at Cape Romanzof LRRS. A Feasibility Study (FS) was performed for the sites recommended for remedial action. This culminated in a Remedial Investigation/Feasibility Study (RI/FS) report (USAF, 1992) of which results relevant to LF03 are summarized in Section 3.3.4.

1993 – 1994: The 611 CES collected debris from the periphery of the landfill, diverted the drainage at the toe of the landfill, and covered the landfill with a protective surface cap (USAF, 1995). The landfill cap was constructed of an impermeable Hypalon® membrane overlain with geotextile fabric between layers of sand and pit-run material. The cap was designed to prevent the infiltration of surface water that could potentially create contaminated effluent due to contact with buried debris. Two monitoring wells installed in 1989 (#3, #4) were abandoned during the construction of the landfill cap.

1996 and 1997: In 1996 Harding Lawson installed 7 monitoring wells around LF003 as part of landfill closure actions (USAF, 1997). Soil, sediment, groundwater and surface water samples were collected and analyzed during this effort. Results indicated that surface water and sediment downgradient of the landfill contained levels of PCB and DRO above the U.S. Environmental Protection Agency's (EPA) risk-based concentration (RBC) screening criteria. Harding Lawson continued monitoring the site in 1997(USAF, 1998).

1998: 611 CES personnel collected 50 soil samples in order to ascertain the extent of PCB and petroleum hydrocarbon contamination adjacent to LF003 (USAF, 1999). Low level, widespread petroleum hydrocarbon contamination was documented from this sampling event. One sample location, SD-2, indicated a PCB concentration of 180 mg/Kg upon analyses. Long-Term groundwater and surface water sampling were also conducted during this sampling effort.

1999: Long-Term Monitoring at Landfill No. 2 (LF03), Spill Sites SS13 and SS15 along with landfill cap inspection at LF03 were initiated in October 1999 (USAF, 2000b).

2000: Long-Term Monitoring and landfill inspection efforts were continued in September 2000 (USAF, 2001b).

2001: Proposed Plan for Cleanup of Landfill (LF03), Spill Site SS13, and Spill Site SS15 at Cape Romanzof LRRS was submitted (USAF, 2001).

2002: Record of Decision for Interim Remedial Action at Spill Site SS013, Spill Site SS015, and Landfill Site LF003 was signed (USAF, 2002).

2003: The 611th Clean Sweep Program performed an assessment of PCB soil contamination downgradient of Landfill Site LF003 and inspected the landfill cap for integrity and serviceability.

2003 and 2004: Long-Term Monitoring of groundwater, surface water and sediment were continued in October 2003 (USAF, 2004b) and June 2004 (USAF, 2005b).

2004: A detailed surface soil sampling grid consisting of 29 field screening and 18 laboratory sample locations was performed to assess PCB contamination near the SD-2 sample location downgradient of Landfill Site LF003 (USAF, 2005a).

2006 and 2007: Long-Term Monitoring of groundwater, surface water and sediment were continued in August 2006 (USAF, 2007) and August 2007 (In Preparation).

3.3 BACKGROUND

3.3.1 Physical Characteristics

The installation is comprised of two main areas: the Lower Camp where the main camp facilities are located, and the Upper Camp where the Long Range Radar equipment is located. The Upper Camp is situated at the top of Towak Mountain (elevation 2,250 feet). The two camps are connected by a gravel road and tramway service. A mile long runway is located near the beach at Kokechik Bay approximately 4 miles southwest of the Lower Camp. There are no roads connecting the Cape Romanzof installation to nearby communities.

The Landfill No. 2 (LF003) site is south of the access road between Cape Romanzof's Lower Camp and the runway. The landfill covers approximately 43,800 square feet (about 1 acre) on a slope than descends to a lower plateau. The landfill received garbage, rubbish, wood, metal, plastic, construction and demolition debris, shop wastes, and incinerator ash, and was operated until the mid-1970s. Fowler (Nilumat) Creek lies approximately 250 feet south of the landfill, with two small tributaries located between the landfill and the creek. One of these tributaries is directly adjacent to the landfill and receives surface flow and effluent flow from the landfill.

3.3.2 Land and Resource Use

Independent contractors have operated the Cape Romonzof LRRS since 1977. The current site operations contractor is ARCTEC. Approximately six contractor personnel currently live at the installation year-round. In the summer, the number of people living at the site can significantly increase (up to 30 people) when contractors and government agencies (e.g., Alaska Department of Fish and Game and U.S. Department of the Interior Fish and Wildlife Service) are conducting studies and performing work at the site.

The nearest local communities are Scammon Bay (population 520) and Hooper Bay (population 1,157), each located about 15 miles east and south of the installation, respectively. Although the communities are not connected to Cape Romonzof by road, the community members use off-road vehicles, boats, snow machines, and walking to travel all around the Cape Romanzof area. The populations of Scammon Bay and Hooper Bay are 95-97 percent Native Alaskan. Employment is seasonal, with peak economic activity in the summer months. Major sources of employment are the Bureau of Land Management firefighting programs, commercial fishing, and the associated canneries.

Cape Romanzof LRRS is located within the limits of the Yukon Delta National Wildlife Refuge, a federally protected environment. Dolly varden inhabit Fowler (Nilumat) Creek, and pink salmon spawn in Fowler Creek. Beaver have constructed several ponds in the creek. Fowler Creek is used by Cape Romanzof workers for recreational fishing. The area surrounding Cape Romanzof LRRS is a prime subsistence food gathering area. Kokechik Bay and Scammon Bay are important subsistence resources for members of nearby communities. The possibility of contaminant migration is of extreme concern and importance to the health and well being of local residents.

3.3.3 Hydrology

The shallow subsurface geology consists of sand, gravel, and boulders overlying granitic bedrock of Towak Mountain. The depth to groundwater varies from ground surface to approximately 10 feet below ground surface at the LF003 site. The groundwater is unconfined and outcrops as springs in drainages at the toe of Landfill No. 2 and in Fowler Creek and a small unnamed creek on the north side of the main access road.

Groundwater flow is southwesterly towards Fowler Creek. Based on 1996 water level data, an approximate groundwater gradient of 0.125 ft/ft was calculated across the landfill site. Fowler Creek flows westerly and then southerly past the installation airstrip until it drains into Kokechick Bay.

3.3.4 History of Contamination

Numerous studies have been conducted at LF003 since 1989 to characterize the nature and extent of contamination. Four monitoring wells (MW-1 to MW-4) were installed at LF003 in 1989 and seven more (CMW-1 to CMW-7) were installed in 1996 (Figure 3). Monitoring wells MW-3 and MW-4 were abandoned during the installation of the landfill

cap in 1994. These wells have been sampled frequently since 1996 and routinely analyzed for DRO, GRO, BTEX, and PCBs. Since 1998 none of the groundwater monitoring results have been above their RAO (Table 3-1).

Surface water and sediment samples have been collected at three locations (SD/SW-1, SD/SW-2, and SD/SW-3) during each of the groundwater monitoring events. With the exception of occasional PCB detection in the surface water samples all other sample results have been below ADEC 18 AAC 70 Water Quality Criteria (Table 3-2).

PCBs have been consistently detected at SD-2 with concentrations ranging from 65.8 to 342 mg/kg and occasionally at SD-1 at concentrations of 0.045 to 0.0867 mg/kg. Careful observations performed during clean sweep operations at LF003 in 2003 indicated that sediment located at SD-2 was being deposited from the landfill via seep that surfaces at the toe of the landfill (USAF, 2004a). The subsurface stream was traced through the boulder field by visual and auditory observations until a sediment sample could be collected approximately 120 feet downstream of SD-2 that contained 395 mg/kg of PCB. During 2004 a detailed surface soil sampling grid consisting of 29 field screening and 18 laboratory sample locations was performed to further assess the PCB contamination near the SD-2 sample location downgradient of Landfill Site LF003 (USAF, 2005a). The results of this sampling effort are shown on Figure 4 and indicated the PCBs extend over 600 feet downgradient of the landfill towards Fowler Creek. One of four samples taken from surface soils along Fowler Creek had a detectable PCB concentration of 0.457 mg/kg (USAF, 2005a).

3.3.5 Initial Response

Response actions taken prior to the 2002 Record of Decision for Interim Remedial Action (USAF, 2002) are summarized below.

- In 1994, the 611 CES collected debris from the periphery of the landfill, diverted the drainage at the toe of the landfill, and covered the landfill with a protective surface cap (USAF, 1995). The landfill cap was constructed of an impermeable Hypalon® membrane overlain with geotextile fabric between layers of sand and pit-run material. The cap was designed to prevent the infiltration of surface water that could potentially create contaminated effluent due to contact with buried debris.

3.3.6 Basis for Taking Action

No known imminent or substantial danger to human health and the environment has

been observed at Landfill No. 2 due to subsurface contamination. Actions were taken under the Environmental Restoration Program (ERP) to meet the following provisions.

- Air Force ERP, a CERCLA-based approach where the Air Force is the implementing or lead agency;
- ADEC 18 AAC 75 – Oil and Other Hazardous Substances Pollution Control (ADEC, 2000a); and
- ADEC 18 AAC 70 – Water Quality Standards (ADEC, 1999).

3.4 REMEDIAL ACTIONS

The selection, implementation, and maintenance of the remedial actions selected in the 2002 Record of Decision for Interim Remedial Action (USAF, 2002) are described below.

3.4.1 Remedy Selected

As documented in the ROD for Interim Remedial Action issued in March 2002 (USAF, 2002), remedial alternative were evaluated in the 1992 Remedial Investigation/Feasibility Study (RI/FS) document (USAF, 1992). In the 1992 feasibility study Landfill No. 2 (LF003) also known as ROM-8 was grouped under Operable Unit C. The three remedies considered for Operable Unit C (LF003) included:

- No action/institutional controls (Long-Term Monitoring)
- Landfill closure (Capping and Hydraulic Controls)
- Landfill closure (Capping and Hydraulic Controls) with onsite treatment of surface water

Landfill Closure combined with PCB Hotspot removal is the selected remedy for LF003. The main elements of the landfill closure portion of the alternative are capping and long-term monitoring of groundwater and any effluent generated by the landfill. Approximately 0.5 cubic yards of PCB contaminated sediment will be excavated and shipped to an approved PCB disposal facility. Additionally, since this remedy will result in hazardous substances remaining onsite above levels that would otherwise allow for unlimited use and unrestricted exposure, a five-year review will be necessary to ensure the remedy continues to provide adequate protection of human health and the environment.

The Interim ROD prescribe cleanup levels are presented in Table 3-5.

3.4.2 Remedy Implementation

All of the remedial actions specified in the Interim ROD have been implemented at LF003 as summarized below.

- PCB sampling efforts conducted in 2003 and 2004 indicate that the extent of PCB contamination exceeds the 0.5 cubic yards as estimated in the Interim ROD. Because cleanup efforts will be complicated due to the presence of large onsite boulders additional sampling was recommended so that accurate estimates of the PCB contaminant extent can be made.
- Capping of the landfill was completed in 1994 as previously described in Section 3.3.5. Inspection of the landfill cap has occurred during each of the long-term monitoring events conducted from 1996 through 2007.
- Land use controls are in place to prohibit the disturbance of the landfill cap and landfill contents by any excavation activities. Land use controls are in place that prohibit digging, excavation, or trespassing on the PCB hot spot area downgradient of the landfill site (USAF, 2006).
- Long-term monitoring of groundwater, surface water, and sediments at LF003 was performed in 1996, 1997, 1998, 1999, 2000, 2003, 2004, 2006, and 2007. The groundwater monitoring results are summarized in Table 3-1 and the surface water and sediment monitoring results are summarized in Table 3-2.
- Long-term groundwater monitoring results indicate that from 1998 through 2007 there have been no exceedances of the remedial action objectives defined in the Interim ROD. This also applies to the current ADEC regulatory cleanup levels defined in Table C of 18 AAC 75 (ADEC, 2006a).
- Long-term surface water monitoring results indicate that PCBs are the only parameter that has exceeded RAOs or ADEC 18 AAC 70 Water Quality Standards (Table 3-2). The PCB exceedances have all been at SW-2 except for the 1997 sampling event where SW-1 and SW-2 also exceeded the cleanup level.
- Long-term sediment monitoring results indicate that PCB concentrations at SD-2 have consistently exceeded the sediment screening level of 0.0341 mg/kg and the ADEC soil cleanup level of 1 mg/kg. The PCB concentrations at SD-1 and SD-3, while mostly below the reporting limit, have reporting limits above the sediment screening level of 0.0341 mg/kg.

3.4.3 System Operations/Operation and Maintenance

Landfill cap inspections – Landfill cap inspections have occurred during each of the long-term monitoring events. The cap has been found to be in serviceable condition

although there were several locations where the edges of the membrane have been visible around the margins of the landfill. In 2004, the liner was found to be exposed in several places around the top of the cap and was subsequently covered with additional soil by the 611th CES.

While the landfill liner appears to be intact and effective at preventing precipitation from infiltrating through the cap, there are three seeps at the toe of the landfill that may indicate water is entering and exiting the landfill area via subsurface routes. The entire area surrounding LF003 is composed of boulders and talus slopes that easily support migration of water. Water flowing through the talus may entering the landfill from under the road upgradient of the landfill site or during periods of higher groundwater regimes, water could also enter the landfill from below. One potential source of water entering the landfill is through infiltration of surface water from the drainage ditch located on the north side of the main access road.

Monitoring well replacement – The LF003 monitoring wells have remained serviceable during each of the long-term monitoring events with the following exceptions. In 1994, during landfill cap installation, two monitoring wells (MW-3 and MW-4) were abandoned and seven additional monitoring well installed. Over the years frost jacking has forced the MW-1 well casing out through the top of the monument and fractured the well casing. The MW-2 well casing and monument have been struck by a grader and damaged extensively. Occasionally some of the monitoring wells (e.g., CMW-2) have been dry due to groundwater elevations being below the screened interval.

Table 3-1: LF003 Selected Groundwater Analytical Data (1996-2007)

Well	Analyte	RAO [1] (mg/L)	1996 Sampling (HLA)	1997 Sampling (HLA)	1998 Sampling (USAF)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
CMW-1 LF03 1996	Benzene	0.005	**0.017**	ND	ND	ND	ND	ND	ND	ND	NS
	Total BTEX	None	0.029	ND	0.0022 J	ND	ND	ND	ND	ND	NS
	GRO	1.3	0.113	ND	ND	ND	ND	ND	NS	NS	NS
	DRO	1.5	0.89	0.179	ND	ND	ND	0.0863 F	ND	ND	NS
	PCB	0.0005	ND	ND	ND	ND	ND	ND	ND	ND	NS
CMW-2 LF03 1996	Benzene	0.005	ND	NS	NS	NS	NS	NS	ND	ND	NS
	Total BTEX	None	ND	NS	NS	NS	NS	NS	ND	0.00144 F	NS
	GRO	1.3	ND	NS	NS	NS	NS	NS	NS	NS	NS
	DRO	1.5	1.34	NS	NS	NS	NS	NS	0.226 F	0.326	NS
	PCB	0.0005	ND	NS	NS	NS	NS	NS	ND	ND	NS
CMW-3 LF03 1996	Benzene	0.005	ND	NS	ND	ND	ND	ND	0.000156 F	0.000301 F	ND
	Total BTEX	None	ND	NS	0.0019 J	ND	ND	ND	0.000156 F	0.000301 F	0.000744 F
	GRO	1.3	ND	NS	ND	ND	ND	ND	NS	NS	NS
	DRO	1.5	0.092 J	NS	ND	ND	ND	0.0949 F	ND	0.711	0.789
	PCB	0.0005	ND	NS	ND	ND	ND	ND	ND	ND	ND
CMW-4 LF03 1996	Benzene	0.005	ND	ND	ND	ND	ND	ND	0.000393 F	0.000202 F	0.000698
	Total BTEX	None	ND	ND	0.0015 J	ND	ND	0.00057 F	0.00245 F	0.0154	0.00417
	GRO	1.3	0.0332	ND	ND	ND	ND	0.0343 F	NS	NS	NS
	DRO	1.5	**1.62**	**2.13**	0.29	0.79	ND	0.436	0.355	0.722	1.26
	PCB	0.0005	ND	ND	ND	ND	ND	ND	ND	ND	ND
CMW-5 LF03 1996	Benzene	0.005	ND	ND	ND	ND	ND	ND	0.000195 F	ND	0.000324 F
	Total BTEX	None	ND	ND	0.0017 J	ND	ND	0.00040 F	0.00130 F	0.00336 F	0.00505
	GRO	1.3	ND	ND	ND	ND	ND	ND	NS	NS	NS
	DRO	1.5	0.318	0.399	0.22	0.41 J	ND	0.178 F	0.157	0.249 F	0.163 F
	PCB	0.0005	ND	ND	ND	ND	ND	ND	ND	ND	ND
CMW-6 LF03 1996	Benzene	0.005	ND	ND	ND	ND	ND	ND	0.00024 F	ND	NS
	Total BTEX	None	ND	ND	0.0019 J	ND	ND	0.00042 F	0.00232 F	0.00148 F	NS
	GRO	1.3	ND	ND	ND	ND	ND	ND	NS	NS	NS
	DRO	1.5	ND	ND	ND	ND	ND	0.104 F	0.0853	0.111 F	NS
	PCB	0.0005	ND	ND	ND	ND	ND	ND	ND	ND	NS

Table 3-1: LF003 Selected Groundwater Analytical Data (1996-2007)

Well	Analyte	RAO [1] (mg/L)	1996 Sampling (HLA)	1997 Sampling (HLA)	1998 Sampling (USAF)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
CMW-7 LF03 1996	Benzene	0.005	**0.0070**	ND	ND	ND	ND	ND	ND	0.000427 F	0.000504
	Total BTEX	None	0.0114	ND	0.0016 J	ND	ND	ND	ND	0.0263	0.00706
	GRO	1.3	0.0743	ND	ND	ND	ND	ND	NS	NS	NS
	DRO	1.5	1.21	0.125	0.23	ND	ND	ND	ND	0.113 F	ND
	PCB	0.0005	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1 LF03 1989	Benzene	0.005	NS	NS	ND	NS	ND	ND	ND	NS	NS
	Total BTEX	None	NS	NS	0.0015 J	NS	ND	0.00051 F	ND	NS	NS
	GRO	1.3	NS	NS	ND	NS	ND	ND	NS	NS	NS
	DRO	1.5	NS	NS	ND	NS	ND	ND	0.0713 F	NS	NS
	PCB	0.0005	NS	NS	ND	NS	ND	ND	ND	NS	NS

Notes: [1] 18 AAC 75.345(b)(1) = ADEC Method Two (Table C) groundwater cleanup levels, as amended through December 30, 2006.

ND = below method detection limits

NS = Not sampled

Values in **Bold** exceed current preliminary RAOs.

mg/L = milligrams per liter

BTEX = benzene, toluene, ethylbenzene and xylenes

DRO = diesel range organics

GRO = gasoline range organics

PCB = polychlorinated biphenyls

RAOs = Remedial Action Objectives (preliminary)

Table 3-2: LF003 Surface Water and Sediment Analytical Data (1996-2007)

Location ID	Analyte	RAO	1996 Sampling (HLA)	1997 Sampling (HLA)	1998 Sampling (USAF)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
SURFACE WATER RESULTS [1,2] (mg/L)											
SW-1	TAH	*0.01*	ND	ND	ND	ND	ND	ND	ND	NS	NS
	TAqH	*0.015*	ND	ND	ND	ND	ND	ND	ND	NS	NS
	GRO	*None*	ND	ND	ND	ND	ND	ND	NS	NS	NS
	DRO	*None*	ND	ND	ND	ND	ND	ND	0.0708 F	NS	NS
	PCB	*0.000014*	**ND**	**0.000147**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
SW-2	TAH	*0.01*	ND	ND	ND	ND	NS	ND	0.00263 F	NS	NS
	TAqH	*0.015*	ND	ND	ND	NS	NS	ND	0.00263 F	NS	NS
	GRO	*None*	ND	ND	ND	ND	NS	ND	NS	NS	NS
	DRO	*None*	0.142	0.205	ND	NS	NS	0.108 F	0.208 F	NS	NS
	PCB	*0.000014*	**0.00469**	**0.0459**	**ND**	NS	NS	**ND**	**0.0797**	**0.0019**	**0.00462**
SW-3	TAH	*0.01*	ND	ND	ND	ND	ND	0.00031 F	ND	NS	NS
	TAqH	*0.015*	ND	ND	ND	ND	0.0090 J	0.00031 F	0.000015 F	NS	NS
	GRO	*None*	ND	ND	ND	ND	ND	ND	NS	NS	NS
	DRO	*None*	0.0883 F	ND	ND	NS	ND	0.0733 F	0.117 F	NS	NS
	PCB	*0.000014*	**ND**	**0.000209**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
SEDIMENT RESULTS [2,3 4] (mg/Kg)											
SD-1	VOC	*Varies*	ND	ND	ND	ND	ND	ND	**X - 0.0918 F**	NS	NS
	SVOC	*Varies*	ND	ND	ND	ND	ND	ND	ND	NS	NS
	GRO	*None*	ND	ND	ND	ND	ND	ND	NS	NS	NS
	DRO	*None*	10.3	34.7	8.8	98.3	21	16.4 F	42.7 F	NS	NS
	PCB	*0.0341*	ND	ND	ND	**ND (0.075)**	**0.045**	**0.0867 F**	**ND (0.118)**	**ND (0.076)**	**ND (0.104)**
SD-2	VOC	*Varies*	ND	ND	ND	ND	ND	ND	**X - 0.0389 F**	NS	NS
	SVOC	*Varies*	ND	Table 3-2b	ND	ND	Table 3-2b	ND	Table 3-2b	NS	NS
	GRO	*None*	ND	ND	ND	ND	ND	1.02 F	NS	NS	NS
	DRO	*None*	754	181	180	112	310	156	154	NS	NS
	PCB	*0.0341*	**65.8**	**69.1 J**	**180**	**197**	**250 J**	**342**	**153**	**72.3**	**135**
SD-3	VOC	*Varies*	ND	ND	ND	ND	ND	ND	**X - 0.0469 F**	NS	NS
	SVOC	*Varies*	ND	ND	ND	ND	Table 3-2b	ND	ND	NS	NS
	GRO	*None*	ND	ND	ND	ND	ND	0.745 F	NS	NS	NS
	DRO	*None*	18.7	13.1	18.0	109	14	10.5 F	29.6 F	NS	NS
	PCB	*0.0341*	0.00754	ND	ND	**ND(0.149)**	ND	**ND (0.073)**	**ND (0.0815)**	**ND (0.0838)**	**ND (0.0657)**

Table 3-2: LF003 Surface Water and Sediment Analytical Data (1996-2007)

Notes: [1] 18 AAC 70.020 = ADEC Water Quality Standards; water quality criteria as amended through December 28, 2006 (ADEC, 2006b).

[2] There are no regulatory or screening criteria for DRO, RRO, or GRO in surface water and sediments; except that 18 AAC 70 requires that petroleum hydrocarbons, oils, and grease may not cause a visible sheen upon the surface of the water.

[3] Sediment screening was performed in accordance with ADEC Technical Memorandum *Sediment Quality Guidelines* , dated March 2004.

[4] NOAA SquiRT Lowest ARC Threshold Effects Level.

DRO = diesel range organics
GRO = gasoline range organics
PAH = polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyls
TAH = total aromatic hydrocarbons = sum of BTEX concentrations
TAqH = total aqueous hydrocarbons = sum of BTEX and PAH concentrations
X = Xylenes: preliminary RAO = 0.025 mg/Kg in sediment
RAOs = Remedial Action Objectives (preliminary)

ND = below method detection limits
NS = Not sampled
VOC=volatile organics compound
SVOC=semivolatile organic compounds
mg/L = milligrams per liter
mg/Kg = milligrams per kilogram

3.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for this site.

3.6 FIVE-YEAR REVIEW PROCESS

This five-year review was conducted in accordance with US EPA Guidance (EPA, 2001).

3.6.1 Administrative Components

The request to complete a five-year review was issued by Mr. Keith Barnack of USAF 611th CES and Remedial Project Manager for Cape Romanzof. Mr. Louis Howard of ADEC cooperated with Mr. Barnack to complete a draft of this report, present the findings to the public, and finalize the report.

3.6.2 Community Involvement

All aspects of the environmental restoration program activities at Cape Romanzof have been made available to the public through public meetings, public announcements, administrative record repositories, and public comment periods. The USAF has been proactive in communicating findings and soliciting input from concerned citizens. This draft document will be sent to the USAF, ADEC, EPA, local communities, and placed in two local information repositories for the public to review and comment. The general public was notified of the opportunity through public announcement. The final document, public comments and responses, and meeting minutes describing the findings and resolution of the final review will be available to the public in the administrative record information repositories.

3.6.3 Document Review

This five-year review consisted of a review of all relevant documents and monitoring data. Interim groundwater, surface water, and sediment cleanup RAOs, as listed in the Interim ROD, were reviewed. Documents in the administrative record repositories (e.g., http://www.adminrec.com) were reviewed.

3.6.4 Data Review

Existing monitoring data were compiled and summarized on data summary tables. Data from 1996 though 2007 for multiple contractors were combined to produce historical

representations of site data for this five-year review.

3.6.5 Site Inspection

Periodic site inspections have occurred as part of systems operation, maintenance, and monitoring programs. Site inspections were conducted during each of the long-term monitoring events performed in 1996, 1997, 1998, 1999, 2000, 2003, 2004, 2006, and 2007. Site inspections consisted of landfill cap inspections and monitoring system inspections consistent with the applicable portions of the EPA Five-Year Review Site Inspection Checklist (EPA, 2001).

The only significant problem identified is that while the landfill liner appears to be intact, there are seeps at the toe of the landfill that indicate groundwater is still entering and exiting the landfill area. Furthermore, one of the seeps has been shown to be transporting PCBs downstream of the landfill towards Fowler Creek. Water is likely entering the landfill via subsurface routes either through periods of higher groundwater regimes and/or through subsurface flow of surface runoff (i.e., water from the drainage ditch located on the north side of the main access road on the north edge of the landfill).

3.6.6 Interviews

Interview forms were mailed to ADEC, ARTEC (on site manager), USAF, and Cape Romanzof contractor representatives. A list of interviewees and completed interview forms are presented in Appendix A. No major problems were reported by interviewees that would suggest that any unacceptable threat to human health or the environment exists. However, one potential issue was mentioned regarding the presence of large amounts of surface water drainage at LF003 during spring breakup.

3.7 TECHNICAL ASSESSMENT

3.7.1 Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the results of the site inspections indicate that the remedy is not functioning as intended by the Interim ROD. The landfill cap has not prevented groundwater from passing through the landfill contents and leachate exiting the landfill is contaminated with PCBs that are migrating downstream of the landfill towards Fowler Creek.

Removal of the PCB hotspot has not been performed as required by the decision document. Site investigation activities have shown that the PCB hot spot is larger than

originally estimated and additional investigation activities are needed to define the full extent of the PCB contamination.

One opportunity for system optimization observed during this review includes a reduction of the groundwater monitoring well network and/or monitoring frequency. With the exception of a couple of benzene and DRO results from 1996 and 1997, all the groundwater monitoring results have been below the ADEC groundwater cleanup levels (Table 3-1).

3.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No. The sediment/soil and surface water cleanup levels for PCBs and DRO have been revised from those provided in the Interim ROD (USAF, 2002). The ADEC cleanup level for PCBs in surface water has changed from 0.0005 mg/L to 0.000014 mg/L (ADEC, 2003). The ADEC cleanup level for PCBs in soil has changed from 10 mg/Kg to 1.0 mg/Kg (ADEC, 2006a). The ADEC does not provide cleanup level for sediment but ADEC guidance includes a PCB screening criteria of 0.0341 mg/Kg in sediments (NOAA, 1999).

There have been no substantial changes to the land use factors that were used at the time of remedy selection. The land use still represents a relatively low level of occupancy and activity. Land use controls are in place to prohibit the disturbance of the landfill cap and landfill contents by any excavation activities. Land use controls have also been established that prohibits digging, excavation, or trespassing on the PCB hot spot area downgradient of the landfill site (USAF, 2006).

3.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

A surface soil investigation conducted in 2004 (USAF, 2005a) shows that PCBs are present in a drainage exiting the landfill that flows into Fowler Creek and that PCBs are also present in soils adjacent to Fowler Creek (Figure 4). These data suggest that there is a potential for PCB impacts to Fowler Creek. Sediment and surface water sampling of Fowler Creek is recommended to assess the potential impacts to this water body.

3.7.4 Technical Assessment Summary

The primary contaminant of concern at LF003 is PCBs. The landfill cap has proven to

be ineffective in preventing the migration of PCBs from this landfill site. Additionally the volume of PCB contaminated media outside the landfill cap has proven to be larger than originally estimated and accurate estimates of its volume are still unknown. The absence of any land use controls (i.e., fencing) allows for direct exposure to the PCB contaminated soils and sediments.

Current conditions do not appear to be protective of human health and the environment. Future investigations and alternative remedial actions need to be developed to correct this deficiency.

3.8 ISSUES

Issues related to the Interim ROD and remedy selection are outlined in Table 3-3.

Table 3-3 Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
The2004 site investigation findings show that PCB contamination is more extensive than presumed in the ROD. Revisions to the long-term monitoring plan are needed to address these contaminants particularly near Fowler Creek	**N**	**N**
The removal of PCB contaminated sediments has not been completed thus allowing for direct exposure	**Y**	**Y**

3.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions for LF003 are presented in Table 3-4.

Table 3-4 Recommendations and Follow-up Actions

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
A new RI/FS will be done to determine extent and volume of PCB contaminated media and potential impacts to Fowler Creek	USAF – 611 CES/CEVR	ADEC	Summer 2008	**N**	**N**
A new ROD will be prepared to address any unacceptable PCB exposure(s) at the site	USAF – 611 CES/CEVR	ADEC	2013	**N**	**N**

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
Implement removal/treatment of PCB contaminated soil and sediment or other future selected remedy	USAF – 611 CES/CEVR	ADEC	After 2013	**Y**	**Y**
Revise long-term monitoring program to include PCB sampling of Fowler Creek and reduce/ eliminate groundwater monitoring	USAF – 611 CES/CEVR	ADEC	2008	**N**	**N**

3.10 PROTECTIVENESS STATEMENT(S)

The 2002 ROD for Interim Remedial Action at LF003 is not protective. The PCB affected area turned out to be larger than expected and consequently the prescribed removal action was not implemented based on technical and fiscal restraints at that time (2004). Surface soil and sediment PCB contamination at the affected area and down gradient were not removed and remain at this date. A new remedial investigation is currently under contract with fieldwork scheduled for the summer of 2008. A follow on feasibility study is scheduled for completion by 2010 to select a remedy that is protective of human health and the environment and to mitigate contaminant migration.

Land use controls are in place to prohibit the disturbance of the landfill cap and landfill contents by any excavation activities. Land use controls have been established that prohibit digging, excavation, or trespassing on the PCB hot spot area downgradient of the landfill site (USAF, 2006).

3.11 NEXT REVIEW

As described previously, the USAF has scheduled a new/revised RI/FS be completed for this site during 2008 to address the PCB contamination with a new ROD be completed by 2013. These revisions will reset the five-year review timeline depending on the actual dates completed.

If the items discussed above are not completed before 2013, five years from the date of this review, then the next five-year review for Landfill No. 2 (LF003) at Cape Romonzof will be performed as required.

Table 3-5 LF003 Interim RAOs and ADEC Cleanup Levels

Media	Contaminant of Concern	Site	Human Health/ADEC Criteria	Ecological Screening Criteria	Basis	Interim ROD RAO	Basis	Revised/ Current RAO
Groundwater (mg/L)	GRO	SS015	1.3	NA	18-AAC-75 Table C	1.3	18-AAC-75 Table C	1.3
	DRO	SS015	1.5	NA	18-AAC-75 Table C	1.5	18-AAC-75 Table C	1.5
	RRO	SS015	1.1	NA	18-AAC-75 Table C	1.1	18-AAC-75 Table C	1.1
	Benzene	SS015	0.005	NA	18-AAC-75 Table C	0.005	18-AAC-75 Table C	0.005
Surface Water (mg/L)	PCB	LF003	0.0005	0.000014	18-AAC-70	0.0005	18-AAC-70	0.000014
	TAH	LF003	NA	0.01			18-AAC-70	0.01
	TAqH	LF003	NA	0.015			18-AAC-70	0.015
Sediment (mg/Kg)	DRO	SS013	NA	NA	18-AAC-75.341	250 [1]		
	PCB	LF003		0.0341	18-AAC-75.341	10 [1]	NOAA	0.0341
Near-Surface Soil (mg/Kg)	DRO	SS013	250		18-AAC-75.341	250	18-AAC-75.341	250
	RRO	SS013	10,000		18-AAC-75.341	10,000	18-AAC-75.341	10,000
	PCB	LF003	1.0		18-AAC-75.341	10	18-AAC-75.341	1.0

Definitions
18 AAC 75 Oil and Hazardous Substances Pollution Control Regulations (ADEC, 2006a)
18 AAC 70 Alaska Water Quality Standards (ADEC, 2006b)
NOAA – NOAA Screening Quick Reference Tables, updated September 1999.
RAO – Remedial Action Objective
TAH – Total Aromatic Hydrocarbons (BTEX)
TAqH – Total Aqueous Hydrocarbons (BTEX + PAH)
mg/L – milligrams per liter
mg/Kg –milligrams per kilogram
1 – ADEC soil cleanup levels are being used for sediments that being reclassified as soils because these locations are predominantly dry

4 DIESEL SEEP AREA (SS013)

4.1 INTRODUCTION

Site SS013 is located 800 feet south of the Lower Camp composite facility and is accessible by road (Figure 2). SS013 is the result of a 14,000-gallon diesel fuel spill in 1979 caused by a fuel bladder rupture. Based upon recent studies, it appears that the spill ran over ground and contaminated near surface soil material over a wide area. The spill percolated down to the water table in some areas and left contamination that has been and may still be above remedial action objectives. An RI/FS was conducted in 1989 on several sites including SS013. Total Petroleum Hydrocarbons (TPH) were detected in soils and groundwater sampled from the wells. Based on the findings of the 1989 study, further investigation was recommended. In 1997, a second RI/FS was conducted at SS013 only. The Feasibility Study recommended intrinsic remediation and long term monitoring as the remedial alternative for this site (USAF, 1998).

4.2 SITE CHRONOLOGY

1979: SS013 is the result of a 14,000-gallon diesel fuel spill in 1979 caused by a fuel bladder rupture.

1985: Eleven sites were identified as potentially containing hazardous contaminants at Cape Romanzof during the *Phase I Records Search, AAC-Southern Region (*USAF, 1985*)*.

1989: A RI/FS was conducted on several sites including SS013. Total Petroleum Hydrocarbons were detected in soils and groundwater sampled. Based on the findings of this study, further investigation was recommended.

1990: Two abandoned and unsealed wells present on this site (Wells A & B) were sampled for BTEX and TPH and then abandoned.

1992: A RI/FS conducted by Woodward-Clyde Consultants resulted in a Long-Term Monitoring Plan. The main contaminants of concern identified were petroleum hydrocarbons in groundwater and soils.

1997: A second RI/FS was conducted at SS013, with the objective of delineating the nature and extent of soil, surface water, and groundwater contamination.

1998: A LTM plan was developed for the site, which included a determination of aquifer

characteristics and natural attenuation parameters in groundwater. The FS recommended intrinsic remediation and long term monitoring as the remedial alternative for this site (USAF, 1998).

1999-2000: Additional sampling occurred at the site and the three years of data were compiled in the ROD for IRA at this site (USAF, 2002). By 2000, all hydrocarbon levels in groundwater and surface water had decreased to below detection limits or maximum contaminant levels (MCLs) at all sampled areas. DRO was above cleanup levels in some sediment and near surface soil samples, while other hydrocarbon concentrations were below the cleanup levels or detection limits.

2001: Proposed Plan for Cleanup of Landfill (LF03), Spill Site SS13, and Spill Site SS15 at Cape Romanzof LRRS was submitted (USAF, 2001).

2002: Record of Decision for Interim Remedial Action at Spill Site SS013, Spill Site SS015, and Landfill Site LF003 was signed (USAF, 2002).

2003: DRO levels in groundwater and surface soil/sediment continued to exceed cleanup levels. Surface water samples were not collected due to frozen conditions. GRO some BTEX constituents showed an increase in one sediment sample to levels above cleanup criteria. RRO was also above cleanup levels in one surface soil sample (LB-08).

2004: In the 2004, Long-Term Monitoring samples collected from three wells at SS013 (MW-01, MW-02, and MW-03) indicated that there were no exceedances for RAOs in groundwater. A comprehensive evaluation of the 2004 data and previous historical results for these wells supported that previously detected groundwater contaminants were attenuating naturally over time, and were below RAOs during this most recent round of sampling.

2006: In the 2006, the Long-Term Monitoring program was reduced, as compared to previous years, to include only surface soil and sediment samples for DRO and RRO analysis per the Interim ROD (USAF, 2002). DRO was detected at both sediment-sampling locations. DRO and RRO levels exceeded preliminary RAOs at all three surface sampling locations.

2007: In the 2007, Long-Term Monitoring program was performed for surface soil and sediment samples for DRO and RRO analysis. DRO was detected at both sediment-sampling locations. DRO levels exceeded preliminary RAOs at all three surface

sampling locations. RRO levels exceeded preliminary RAOs at one surface sampling location.

4.3 BACKGROUND

4.3.1 Physical Characteristics

The installation is comprised of two main areas: the Lower Camp where the main camp facilities are located, and the Upper Camp where the Long Range Radar equipment is located. The Upper Camp is situated at the top of Towak Mountain (elevation 2,250 feet). The two camps are connected by a gravel road and tramway service. A mile long runway is located near the beach at Kokechik Bay approximately 4 miles southwest of the Lower Camp. There are no roads connecting the Cape Romanzof installation to nearby communities.

Site SS013 is located approximately 1,000 feet south of the lower camp and can be accessed by foot or vehicle by the north-south road from the lower camp. Fowler Creek runs through the site, which may be hydraulically connected to the lower camp's drinking water supply (Well-1). Well-1 is located south of the lower camp and east of Site SS013.

4.3.2 Land and Resource Use

Independent contractors have operated the Cape Romonzof LRRS since 1977. The current site operations contractor is ARCTEC. Approximately six contractor personnel currently live at the installation year-round. In the summer, the number of people living at the site can significantly increase (up to 30 people) when contractors and government agencies (e.g., Alaska Department of Fish and Game and U.S. Department of the Interior Fish and Wildlife Service) are conducting studies and performing work at the site.

The nearest local communities are Scammon Bay (population 520) and Hooper Bay (population 1,157) located about 15 miles east and south of the installation, respectively. Although the communities are not connected to Cape Romonzof by road, the community members use off-road vehicles, boats, snow machines, and walking to travel all around the Cape Romanzof area. The populations of Scammon Bay and Hooper Bay are 95-97 percent Native Alaskan. Employment is seasonal, with peak economic activity in the summer months. Major sources of employment are the Bureau of Land Management firefighting programs, commercial fishing, and the associated

canneries.

Cape Romanzof LRRS is located within the limits of the Yukon Delta National Wildlife Refuge, a federally protected environment. Dolly varden inhabit Fowler (Nilumat) Creek, and pink salmon spawn in Fowler Creek. Beaver have constructed several ponds in the creek. Fowler Creek is used by Cape Romanzof workers for recreational fishing. The area surrounding Cape Romanzof LRRS is a prime subsistence food gathering area. Kokechik Bay and Scammon Bay are important subsistence resources for members of nearby communities. The possibility of contaminant migration is of extreme concern and importance to the health and well being of local residents.

4.3.3 Hydrology

Surface flow tends to follow incised paths in the nearly flat ground surface at this site. Flow direction is mostly to the southwest towards Fowler Creek and then northwest along Fowler Creek (Figure 5).

Based on the results of the geophysical surveys and the known geologic and hydrogeologic data, it is concluded that the top of the phreatic zone occurs at approximately 60 feet (±18 feet) below ground surface at SS013. Above that general level, water is believed to occur under perched conditions within lenticular and laterally discontinuous bodies of permeable material (sand/gravel) enclosed within relatively impermeable materials (clay, bouldery clay). Such complex stratigraphic conditions are typical in continental glacial deposits, and are to be expected in this area.

4.3.4 History of Contamination

SS013 is the result of a 14,000-gallon diesel fuel spill in 1979 caused by a fuel bladder rupture. Contaminants and media of concern for Site SS013 are DRO in groundwater, DRO and residual-range organics (RRO) in surface soil/sediment. Historically, DRO and RRO levels in surface soil have generally been above ADEC soil cleanup action levels at SS013. Petroleum hydrocarbons in surface water at SS013 have been quite low since monitoring began at this site and have never exceeded preliminary RAOs.

Numerous studies have been conducted at SS013 since 1979 to characterize the nature and extent of contamination. Two monitoring wells (MW-01 and MW-02) were installed at SS013 in 1997 and a third monitoring well (MW-03) was installed in 2004 (Figure 5). An initial RI/FS was conducted in 1992 (USAF, 1992) was followed by a second RI/FS conducted in 1997 (USAF, 1998c). Additional sampling events occurred

in 1999, 2000, 2003, 2004, 2006, and 2007.

In the 2004, groundwater samples collected from three monitoring wells at SS013 (MW-01, MW-02, and MW-03) indicated that there were no exceedances for RAOs in groundwater. A comprehensive evaluation of the 2004 data and previous historical results for these wells supported that previously detected groundwater contaminants were attenuating naturally over time, and were below RAOs during the most recent round of sampling in 2004 (Table 4-1). Groundwater was not sampled at this site in 2006 or 2007.

Surface water sampling included the collection of samples from SW-01, SW-02, and SW-03 from 1997 through 2000. Petroleum hydrocarbons in surface water at SS013 have been quite low since monitoring began, and have never exceeded preliminary RAOs (USAF, 2001b).

Surface soil sampling has been conducted at three locations (LB-03, LB-07, and LB-08) from 1997 through 2007. DRO and RRO are the only contaminants detected in soils at SS013 at levels in excess of preliminary RAOs (see Table 4-3). DRO levels exceeded RAOs at LB-03 in 1997, 1999, 2004, 2006, and 2007. All of the DRO detections at LB-07 and LB-08 between 1997 and 2007 were above RAOs, with the peak concentration of 110,000 mg/kg (Table 4-3). BTEX and GRO detected at these three sample locations have always been below ADEC cleanup requirements and have not been sample for since 2004.

Sediment sampling has been conducted at two locations (SS-01 and SS-06) from 1997 through 2007. With the exception of 2003 DRO is the only contaminant detected at SS013 at levels in excess of preliminary RAOs (Table 4-4). In 2003 the SS-01 sample concentrations for benzene, ethylbenzene, and GRO were above the preliminary RAOs (Table 4-4).

4.3.5 Initial Response

No response actions were taken prior to the 2002 Record of Decision for Interim Remedial Action (USAF, 2002).

4.3.6 Basis for Taking Action

No known imminent or substantial danger to human health and the environment has been observed at Spill Site SS013 due to the surface and subsurface contamination. Actions were taken under the Environmental Restoration Program (ERP) to meet the

following provisions.

- Air Force ERP, a CERCLA-based approach where the Air Force is the implementing or lead agency;
- ADEC 18 AAC 75 – Oil and Other Hazardous Substances Pollution Control (ADEC, 2000a);
- ADEC 18 AAC 70 – Water Quality Standards (ADEC, 1999); and
- ADEC 18 AAC 80 – Drinking Water (ADEC, 2000b).

4.4 REMEDIAL ACTIONS

The selection, implementation, and maintenance of the remedial actions selected in the 2002 Record of Decision for Interim Remedial Action (USAF, 2002) are described below.

4.4.1 Remedy Selected

As documented in the ROD for Interim Remedial Action issued in March 2002 (USAF, 2002), remedial alternative were evaluated in the 1992 RI/FS document (USAF, 1992) and 1997 SS013 RI/FS document (USAF, 1998c). In the 1992 feasibility study Spill Site SS013 also known as ROM-1S was grouped under Operable Unit B. The three remedies considered for Operable Unit B (SS013) included:

- No Further Action (Long-Term Monitoring)
- Monitored Natural Attenuation (Institutional Controls and Monitoring)
- Monitored Natural Attenuation with Hot Spot Removal

Monitored Natural Attenuation is the selected remedy for soil, sediment, groundwater, and surface water at SS013. This alternative will effectively reduce risk to human health and the environment utilizing all natural technologies. The elements of the selected remedy include implementation of institutional controls restricting access, sampling of soil, sediment, and surface water, and long-term groundwater monitoring. Additionally, since this alternative will result in hazardous substances remaining onsite above levels that would otherwise allow for unlimited use and unrestricted exposure, a five-year review will be necessary to ensure that the remedy continues to provide adequate protection of human health and the environment.

The Interim ROD prescribe cleanup levels are presented in Table 4-7.

4.4.2 Remedy Implementation

All of the remedial actions specified in the Interim ROD have been implemented at SS013 as summarized below.

- Land use controls have been established that prohibit any digging or excavation within the Site SS013 area (USAF, 2006).
- Long-term monitoring of groundwater and surface water at SS013 was performed in 1997, 1999, 2000, 2003, and 2004 for groundwater and 1997, 1999, and 2000 for surface water. The groundwater monitoring results are summarized in Table 4-1 and the polynuclear aromatic hydrocarbon (PAH) results being summarized in Table 4-2. The surface water monitoring results were all below the RAOs (USAF, 2001b).
- Long-term monitoring of surface soil and sediments at SS013 was performed in 1997, 1999, 2000, 2003, 2004, 2006, and 2007. The surface soil monitoring results are summarized in Table 4-3 and the sediment monitoring results are summarized in Table 4-4.
- Long-term groundwater monitoring results indicate that from 1997 through 2004 the only exceedance was DRO in MW-01 from 1997 to 2003 (Table 4-1). The 2004 monitoring event showed no exceedances of the remedial action objectives defined in the Interim ROD or current ADEC groundwater cleanup levels (ADEC, 2006a). Groundwater monitoring was discontinued after 2004.
- Long-term monitoring results indicate DRO levels in surface soil have generally been above preliminary RAOs at SS013. RRO levels are also elevated and generally above preliminary RAOs at LB-08, but generally below RAOs at LB-03 and LB-07 (Table 4-3).
- DRO concentrations in sediment at SS-01 have declined over time; while results at SS-06 located downstream have been more variable over time with no apparent trend (Table 4-4).

4.4.3 System Operations/Operation and Maintenance

Well abandonment – Two water supply wells (Wells A and B on Figure 5), located in the path of the spill, were discovered during the initial survey of the site in 1989. Well B may have served as a base water supply well at one time. The other well appeared to have been abandoned at the time of installation. In 1990, both wells were grouted and abandoned (USAF, 1992).

The SS013 monitoring wells have remained serviceable during each of the long-term monitoring events. However, in 2007 groundwater monitoring wells MW-01 and MW-02 were decommissioned, as they were no longer being used.

Table 4-1: SS013 Selected Groundwater Analytical Data (1997-2004)

Well	Analyte	RAOs [1] (mg/L)	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)
MW-01 1997	Benzene (mg/L)	0.005	0.0003 J	ND	ND	ND	ND
	Total BTEX (mg/L)	None	0.0078	ND	0.0029	0.00268 F	ND
	GRO (mg/L)	1.3	0.091	ND	ND	ND	NA
	DRO (mg/L)	1.5	**2.47**	**2.7**	**1.9**	**2.22**	0.175 F
	RRO (mg/L)	1.1	0.628	ND	ND	0.245 F	0.393 F
MW-02 1997	Benzene (mg/L)	0.005	0.0002 J	ND	ND	ND	ND
	Total BTEX (mg/L)	None	0.0005 J	ND	ND	00.000727 F	ND
	GRO (mg/L)	1.3	ND	ND	ND	ND	0.0239 F
	DRO (mg/L)	1.5	0.213	0.385	ND	0.114 F	0.142 F
	RRO (mg/L)	1.1	0.202	ND	ND	0.123 F	0.106 F
MW-03 2004	Benzene (mg/L)	0.005	NS	NS	NS	NS	ND
	Total BTEX (mg/L)	None	NS	NS	NS	NS	0.000842 F
	GRO (mg/L)	1.3	NS	NS	NS	NS	0.142
	DRO (mg/L)	1.5	NS	NS	NS	NS	0.233 F
	RRO (mg/L)	1.1	NS	NS	NS	NS	NA

Notes:

Total BTEX is the sum of benzene, toluene, ethylbenzene, and xylene concentrations.

Results shown in **BOLD** exceed the ADEC 18 AAC 75 Method 2 (Table C) cleanup levels.

GRO- Gasoline Range Organics; DRO - Diesel Range Organics; RRO - Residual Range Organics

NS- Well Not sampled; NA - Analyte Not analyzed; ND - Analyte Not detected

[1] 18 AAC 75.345(b)(1) ADEC Oil and Hazardous Substances Pollution Control Regulations, as amended through December 30, 2006; Method Two (Table C) groundwater cleanup levels

Table 4-2: SS013 Groundwater PAH Analytical Data (1997-2004)

Well	Analyte	RAOs (µg/L)[1]	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)
MW-01 1997	Acenaphthene	2,200	0.1	NA	ND(5.3)	ND(15)	ND(0.05)
	Acenaphthylene	2,200	ND(0.06)	NA	ND(5.3)	ND(15)	ND(0.05)
	Anthracene	11,000	ND(0.03)	NA	ND(5.3)	ND(15)	ND(0.05)
	Benzo(a)anthracene	1	ND(0.03)	NA	**ND(5.3)**	**ND(15)**	ND(0.05)
	Benzo(a)pyrene	0.2	ND(0.01)	NA	**ND(5.3)**	**ND(15)**	ND(0.05)
	Benzo(b)fluoranthene	1	ND(0.03)	NA	**ND(5.3)**	**ND(15)**	ND(0.05)
	Benzo(g,h,i)perylene	1,100	ND(0.04)	NA	ND(5.3)	ND(15)	ND(0.05)
	Benzo(k)fluoranthene	10	ND(0.03)	NA	ND(5.3)	**ND(15)**	ND(0.05)
	Chrysene	100	ND(0.02)	NA	ND(5.3)	ND(15)	ND(0.05)
	Dibenzo(a,h)anthracene	0.1	ND(0.05)	NA	**ND(5.3)**	**ND(15)**	ND(0.05)
	Fluoranthene	1,460	ND(0.03)	NA	ND(5.3)	ND(15)	ND(0.1)
	Fluorene	1,460	0.2	NA	ND(5.3)	ND(15)	ND(0.05)
	Indeno(1,2,3-cd)pyrene	1	ND(0.04)	NA	**ND(5.3)**	**ND(15)**	ND(0.05)
	Naphthalene	700	7.3	NA	ND(11)	ND(15)	0.0706
	Phenanthrene	11,000	0.1	NA	ND(5.3)	ND(15)	ND(0.1)
	Pyrene	1,100	ND(0.03)	NA	ND(5.3)	ND(15)	ND(0.05)
	1-Methylnaphthalene	1,500	NA	NA	NA	NA	NA
	2-Methylnaphthalene	780	8.7	NA	ND(5.3)	ND(15)	NA
MW-02 1997	Acenaphthene	2,200	ND(0.02)	NA	ND(5.1)	ND(16)	ND(0.05)
	Acenaphthylene	2,200	ND(0.06)	NA	ND(5.1)	ND(16)	ND(0.05)
	Anthracene	11,000	ND(0.03)	NA	ND(5.1)	ND(16)	ND(0.05)
	Benzo(a)anthracene	1	ND(0.03)	NA	**ND(5.1)**	**ND(16)**	ND(0.05)
	Benzo(a)pyrene	0.2	ND(0.01)	NA	**ND(5.1)**	**ND(16)**	ND(0.05)
	Benzo(b)fluoranthene	1	ND(0.03)	NA	**ND(5.1)**	**ND(16)**	ND(0.05)
	Benzo(g,h,i)perylene	1,100	ND(0.04)	NA	ND(5.1)	ND(16)	ND(0.05)
	Benzo(k)fluoranthene	10	ND(0.03)	NA	ND(5.1)	**ND(16)**	ND(0.05)
	Chrysene	100	ND(0.02)	NA	ND(5.1)	ND(16)	ND(0.05)
	Dibenzo(a,h)anthracene	0.1	ND(0.05)	NA	**ND(5.1)**	**ND(16)**	ND(0.05)
	Fluoranthene	1,460	ND(0.03)	NA	ND(5.1)	ND(16)	ND(0.1)
	Fluorene	1,460	ND(0.06)	NA	ND(5.1)	ND(16)	ND(0.05)
	Indeno(1,2,3-cd)pyrene	1	ND(0.04)	NA	**ND(5.3)**	**ND(16)**	ND(0.05)
	Naphthalene	700	ND(0.02)	NA	ND(10)	ND(16)	ND(0.05)
	Phenanthrene	11,000	ND(0.02)	NA	ND(5.1)	ND(16)	ND(0.1)
	Pyrene	1,100	ND(0.03)	NA	ND(5.1)	ND(16)	ND(0.05)
	1-Methylnaphthalene	1,500	NA	NA	NA	NA	NA
	2-Methylnaphthalene	780	ND(0.02)	NA	ND(5.1)	ND(16)	NA
MW-03 2004	Acenaphthene	2,200	NS	NS	NS	NS	ND(10)
	Acenaphthylene	2,200	NS	NS	NS	NS	ND(10)
	Anthracene	11,000	NS	NS	NS	NS	ND(10)
	Benzo(a)anthracene	1	NS	NS	NS	NS	**ND(10)**
	Benzo(a)pyrene	0.2	NS	NS	NS	NS	**ND(10)**
	Benzo(b)fluoranthene	1	NS	NS	NS	NS	**ND(10)**
	Benzo(g,h,i)perylene	1,100	NS	NS	NS	NS	ND(10)
	Benzo(k)fluoranthene	10	NS	NS	NS	NS	ND(10)
	Chrysene	100	NS	NS	NS	NS	ND(10)
	Dibenzo(a,h)anthracene	0.1	NS	NS	NS	NS	**ND(10)**
	Fluoranthene	1,460	NS	NS	NS	NS	ND(10)
	Fluorene	1,460	NS	NS	NS	NS	ND(10)
	Indeno(1,2,3-cd)pyrene	1	NS	NS	NS	NS	**ND(10)**
	Naphthalene	700	NS	NS	NS	NS	ND(10)
	Phenanthrene	11,000	NS	NS	NS	NS	ND(10)
	Pyrene	1,100	NS	NS	NS	NS	ND(10)
	1-Methylnaphthalene	1,500	NS	NS	NS	NS	NA
	2-Methylnaphthalene	780	NS	NS	NS	NS	ND(10)

Table 4-3: SS013 Selected Surface Soil Analytical Data (1997-2007)

Location ID	Analyte	RAOs [1] (mg/Kg)	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
LB-03	Benzene	0.02	**ND(0.1)**	**ND(0.056)**	ND	**ND(0.028)**	**ND(0.0574)**	NA	NA
	Ethylbenzene	5.5	0.46	ND	ND	0.0819 F	ND	NA	NA
	Toluene	5.4	ND	ND	ND	0.0809 F	ND	NA	NA
	Xylenes	78	1.14	ND	ND	0.1834 F	ND	NA	NA
	Total BTEX	None	1.60	ND	ND	0.3462 F	ND	NA	NA
	GRO	300	119	ND	ND	8.75	NA	NA	NA
	DRO	250	**16,800**	**466**	48	158	**411**	**49,700**	**275**
	RRO	10,000	1,610	469	140	83.2	1,140	**35,300**	2,210
LB-07	Benzene	0.02	**ND(0.1)**	**ND(0.06)**	**ND(0.037)**	**ND(0.0375)**	**ND(0.0371)**	NA	NA
	Ethylbenzene	5.5	ND	ND	ND	0.128 F	ND	NA	NA
	Toluene	5.4	ND	ND	ND	ND	ND	NA	NA
	Xylenes	78	ND	ND	ND	0.1686 F	ND	NA	NA
	Total BTEX	None	ND	ND	ND	0.297 F	ND	NA	NA
	GRO	300	ND	ND	ND	9.02	NA	NA	NA
	DRO	250	**7,050**	**5,870**	**8,900**	**31,000**	**4,390**	**32,000**	**48,700**
	RRO	10,000	2,560	3,440	6,800	7,640	5,160	**16,500**	**39,300**
LB-08	Benzene	0.02	**ND(0.1)**	**ND(0.055)**	ND	**ND(0.0481)**	**ND(0.0457)**	NA	NA
	Ethylbenzene	5.5	0.03 J	ND	ND	ND	ND	NA	NA
	Toluene	5.4	ND	ND	ND	ND	ND	NA	NA
	Xylenes	78	ND	ND	ND	ND	ND	NA	NA
	Total BTEX	None	0.03 J	ND	ND	ND	ND	NA	NA
	GRO	300	13	ND	ND	5.21 F	NA	NA	NA
	DRO	250	**110,000**	**2,680**	**620**	**59,400**	**48,500**	**27,600**	**555**
	RRO	10,000	**35,000**	1,880	810	**19,400**	**51,600**	**26,800**	2,970

Notes:

Total BTEX is the sum of benzene, toluene, ethylbenzene, and xylene concentrations. mg/Kg = milligrams per kilogram

Results shown in **BOLD** exceed cleanup levels.

GRO- Gasoline Range Organics; DRO - Diesel Range Organics; RRO - Residual Range Organics

NA - Analyte not analyzed; ND - Analyte not detected

[1] 18 AAC 75.341(c) and (d) - ADEC Oil and Hazardous Substances Pollution Control Regulations, December 30, 2006; Method Two (under 40-inch precipitation)

Table 4-3b: SS013 Selected Soil PAH Data (1997-2007)

Location ID	Analyte	RAOs (mg/Kg)[1]	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)
LB-03	Acenaphthene	210	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Acenaphthylene	210	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Anthracene	4,300	ND(0.05)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Benzo(a)anthracene	6	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Benzo(a)pyrene	3	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Benzo(b)fluoranthene	20	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Benzo(g,h,i)perylene	1,500	ND(0.05)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Benzo(k)fluoranthene	200	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Chrysene	620	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Dibenzo(a,h)anthracene	6	ND(0.05)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Fluoranthene	2,100	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Fluorene	270	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Indeno(1,2,3-cd)pyrene	54	ND(0.05)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Naphthalene	21	ND(0.05)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Phenanthrene	4,300	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	Pyrene	1,500	ND(0.1)	ND(1.3)	ND(0.19)	ND(0.98)	ND(0.0567)
	1-Methylnaphthalene	43	NA	NA	NA	NA	NA
	2-Methylnaphthalene	60.9	ND(0.05)	ND(1.3)	ND(0.19)	ND(0.98)	NA
LB-07	Acenaphthene	210	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Acenaphthylene	210	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Anthracene	4,300	ND(0.005)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Benzo(a)anthracene	6	ND(0.01)	**ND(8.6)**	ND(2.8)	**ND(31.5)**	ND(0.0386)
	Benzo(a)pyrene	3	ND(0.01)	**ND(8.6)**	ND(2.8)	**ND(31.5)**	ND(0.0386)
	Benzo(b)fluoranthene	20	ND(0.01)	ND(8.6)	ND(2.8)	**ND(31.5)**	ND(0.0386)
	Benzo(g,h,i)perylene	1,500	ND(0.005)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Benzo(k)fluoranthene	200	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Chrysene	620	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	0.0292 F
	Dibenzo(a,h)anthracene	6	ND(0.005)	**ND(8.6)**	ND(2.8)	**ND(31.5)**	ND(0.0386)
	Fluoranthene	2,100	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Fluorene	270	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Indeno(1,2,3-cd)pyrene	54	ND(0.005)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Naphthalene	21	ND(0.005)	ND(8.6)	ND(2.8)	**ND(31.5)**	0.0128 F
	Phenanthrene	4,300	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	ND(0.0386)
	Pyrene	1,500	ND(0.01)	ND(8.6)	ND(2.8)	ND(31.5)	0.0376 F
	1-Methylnaphthalene	43	NA	NA	NA	NA	NA
	2-Methylnaphthalene	60.9	2 J	ND(8.6)	ND(2.8)	ND(31.5)	NA
LB-08	Acenaphthene	210	2 J	ND(7)	ND(0.22)	ND(42.3)	ND(0.434)
	Acenaphthylene	210	ND(4)	ND(7)	ND(0.22)	ND(42.3)	ND(0.434)
	Anthracene	4,300	ND(2)	ND(7)	ND(0.22)	ND(42.3)	ND(0.434)
	Benzo(a)anthracene	6	0.1 J	**ND(7)**	ND(0.22)	**ND(423)**	0.149 F
	Benzo(a)pyrene	3	0.2 J	**ND(7)**	ND(0.22)	**ND(423)**	ND(0.434)
	Benzo(b)fluoranthene	20	0.4 J	ND(7)	ND(0.22)	**ND(423)**	ND(0.434)
	Benzo(g,h,i)perylene	1,500	0.4 J	ND(7)	ND(0.22)	ND(423)	ND(0.434)
	Benzo(k)fluoranthene	200	0.2 J	ND(7)	ND(0.22)	**ND(423)**	ND(0.434)
	Chrysene	620	0.4 J	ND(7)	ND(0.22)	ND(423)	0.532
	Dibenzo(a,h)anthracene	6	0.3 J	**ND(7)**	ND(0.22)	**ND(423)**	ND(0.434)
	Fluoranthene	2,100	ND(4)	ND(7)	ND(0.22)	ND(42.3)	0.457
	Fluorene	270	ND(4)	ND(7)	ND(0.22)	ND(42.3)	ND(0.434)
	Indeno(1,2,3-cd)pyrene	54	0.5 J	ND(7)	ND(0.22)	**ND(423)**	ND(0.434)
	Naphthalene	21	ND(2)	ND(7)	ND(0.22)	**ND(42.3)**	ND(0.434)
	Phenanthrene	4,300	ND(4)	ND(7)	ND(0.22)	ND(42.3)	ND(0.434)
	Pyrene	1,500	ND(4)	ND(7)	ND(0.22)	ND(42.3)	0.584
	1-Methylnaphthalene	43	NA	NA	NA	NA	NA
	2-Methylnaphthalene	60.9	2 J	ND(7)	ND(0.22)	ND(42.3)	NA

Notes:

Detection limits shown in **BOLD** exceed cleanup levels.

NA - Analyte not analyzed; ND - Analyte not detected

[1] 18 AAC 75.341(c) and (d)-ADEC Oil and Hazardous Substances Pollution Control Regulations, December 30, 2006; Method Two (under 40-inch precipitation)

Table 4-4: SS013 Selected Sediment Analytical Data (1997-2007)

Location ID	Analyte	RAOs (mg/Kg)[1]	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
SS-01	Benzene	0.02	ND	**ND(0.13)**	**ND(0.083)**	**0.409**	ND	NA	NA
	Ethylbenzene	5.5	0.02 J	ND(0.13)	ND	**19.7**	ND	NA	NA
	Toluene	5.4	ND	ND(0.13)	ND(0.083)	3.40	ND(0.0659)	NA	NA
	Xylenes	78	0.08	ND(0.26)	ND(0.083)	37.8	0.0569 F	NA	NA
	Total BTEX	None	0.10	ND	ND	61.3	0.0569 F	NA	NA
	GRO	300	9	16.4 J	13	**1,730**	NA	NA	NA
	DRO	250	**416**	**55,800**	**52,000**	**1,150**	**998**	**435**	**491**
	RRO	10,000	83	7,250	3,800	561	1,060	NA	NA
SS-06	Benzene	0.02	**ND(0.1)**	ND	ND	**ND(0.0923)**	ND	NA	NA
	Ethylbenzene	5.5	ND(0.1)	ND	ND	0.127 F	ND	NA	NA
	Toluene	5.4	ND(0.1)	ND	ND(0.054)	0.366 F	ND(0.0654)	NA	NA
	Xylenes	78	ND(0.1)	ND(0.076)	ND(0.11)	ND(0.778)	ND(0.109)	NA	NA
	Total BTEX	None	ND	ND	ND	0.493 F	ND	NA	NA
	GRO	300	ND	ND	ND	10.6 F	NA	NA	NA
	DRO	250	**1,710**	154	**4,300**	75.0	**1,680**	83.5	**12,500**
	RRO	10,000	1,230	421	4,300	547	743	NA	NA

Notes: Total BTEX is the sum of benzene, toluene, ethylbenzene, and xylene concentrations.

Results shown in **BOLD** exceed cleanup levels.

GRO- Gasoline Range Organics; DRO - Diesel Range Organics; RRO - Residual Range Organics

NA - Analyte not analyzed; ND - Analyte not detected

[1] 18 AAC 75.341 Soil Cleanup Levels are used because these sample locations are only temporarily submerged and thus are more repesentative of soil samples.

Table 4-4b: SS013 Selected Sediment PAH Data (1997-2004)

Location ID	Analyte	RAOs (mg/Kg)[1]	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)
SS-01	Acenaphthene	210	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Acenaphthylene	210	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Anthracene	4,300	ND(0.05)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Benzo(a)anthracene	6	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Benzo(a)pyrene	3	ND(0.1)	**ND(4.3)**	**ND(5.2)**	**ND(3.54)**	ND(0.0359)
	Benzo(b)fluoranthene	20	ND(100)	ND(4.3)	ND(5.2)	ND(3.54)	ND(0.0359)
	Benzo(g,h,i)perylene	1,500	ND(0.05)	ND(4.3)	ND(5.2)	ND(3.54)	ND(0.0359)
	Benzo(k)fluoranthene	200	ND(0.1)	ND(4.3)	ND(5.2)	ND(3.54)	ND(0.0359)
	Chrysene	620	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Dibenzo(a,h)anthracene	6	ND(0.05)	ND(4.3)	ND(5.2)	ND(3.54)	ND(0.0359)
	Fluoranthene	2,100	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Fluorene	270	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	0.0323 F
	Indeno(1,2,3-cd)pyrene	54	ND(0.05)	ND(4.3)	ND(5.2)	ND(3.54)	ND(0.0359)
	Naphthalene	21	ND(0.05)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Phenanthrene	4,300	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	Pyrene	1,500	ND(0.1)	ND(4.3)	ND(5.2)	ND(0.708)	ND(0.0359)
	1-Methylnaphthalene	43	NA	NA	NA	NA	NA
	2-Methylnaphthalene	60.9	0.005 J	ND(4.3)	ND(5.2)	ND(0.708)	NA
SS-06	Acenaphthene	210	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Acenaphthylene	210	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Anthracene	4,300	ND(0.05)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Benzo(a)anthracene	6	ND(0.1)	ND(0.55)	ND(0.68)	**ND(7.1)**	ND(0.00762)
	Benzo(a)pyrene	3	ND(0.1)	ND(0.55)	ND(0.68)	**ND(7.1)**	ND(0.00762)
	Benzo(b)fluoranthene	20	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Benzo(g,h,i)perylene	1,500	0.007 J	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Benzo(k)fluoranthene	200	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Chrysene	620	0.009 J	ND(0.55)	ND(0.68)	ND(7.1)	0.00372 F
	Dibenzo(a,h)anthracene	6	0.006 J	ND(0.55)	ND(0.68)	**ND(7.1)**	ND(0.00762)
	Fluoranthene	2,100	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Fluorene	270	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Indeno(1,2,3-cd)pyrene	54	0.010 J	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Naphthalene	21	0.004 J	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Phenanthrene	4,300	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	ND(0.00762)
	Pyrene	1,500	ND(0.1)	ND(0.55)	ND(0.68)	ND(7.1)	0.00442 F
	1-Methylnaphthalene	43	NA	NA	NA	NA	NA
	2-Methylnaphthalene	60.9	0.005 J	ND(0.55)	ND(0.68)	ND(7.1)	NA

Notes:

Results shown in **BOLD** exceed cleanup levels.

NA - Analyte not analyzed; ND - Analyte not detected

[1] 18 AAC 75.341(c) - ADEC Oil and Hazardous Substances Pollution Control Regulations, December 30, 2006; Method Two (under 40-inch precipitation)

ADEC Soil Cleanup Levels are used because these sample locations are only temporarily submerged and thus are more repesentative of soil samples.

4.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This five-year review was conducted in accordance with US EPA Guidance (EPA, 2001).

4.6 FIVE-YEAR REVIEW PROCESS

4.6.1 Administrative Components

The request to complete a five-year review was issued by Mr. Keith Barnack of USAF 611th CES and Remedial Project Manager for Cape Romanzof. Mr. Louis Howard of ADEC cooperated with Mr. Barnack to complete a draft of this report, present the findings to the public, and finalize the report.

4.6.2 Community Involvement

All aspects of the environmental restoration program activities at Cape Romanzof have been made available to the public through public meetings, public announcements, administrative record repositories, and public comment periods. The USAF has been proactive in communicating findings and soliciting input from concerned citizens. This draft document will be sent to the USAF, ADEC, EPA, local communities, and placed in two local information repositories for the public to review and comment. The general public was notified of the opportunity through public announcement. The final document, public comments and responses, and meeting minutes describing the findings and resolution of the final review will be available to the public in the administrative record information repositories.

4.6.3 Document Review

This five-year review consisted of a review of all relevant documents and monitoring data. Interim groundwater, surface water, sediment, and soil cleanup RAOs, as listed in the Interim ROD, were reviewed. Documents in the administrative record repositories e.g., http://www.adminrec.com) were reviewed.

4.6.4 Data Review

Existing monitoring data were compiled and summarized on data summary tables. Data from 1997 through 2007 for multiple contractors were combined to produce historical representations of site data for this five-year review.

4.6.5 Site Inspection

Periodic site inspections have occurred as part of systems operation, maintenance, and monitoring programs. Site inspections were conducted during each of the long-term monitoring events performed in 1997, 1999, 2000, 2003, 2004, 2006, and 2007. No major deficiencies or unresolved problems were reported.

4.6.6 Interviews

Interview forms were mailed to ADEC, ARTEC (on site manager), USAF, and Cape Romanzof contractor representatives. A list of interviewees and completed interview forms are presented in Appendix A. No major problems were reported by interviewees that suggest there exists any unacceptable threat to human health or the environment.

4.7 TECHNICAL ASSESSMENT

4.7.1 Question A: Is the remedy functioning as intended by the decision documents?

Contaminants of concern at SS013 were identified as petroleum hydrocarbons in surface soil/sediment and groundwater. Petroleum hydrocarbons in surface water have never exceeded preliminary RAOs. An evaluation of monitoring well data collected until 2004 indicated that previously detected groundwater contaminants were attenuating naturally over time, and were below action levels during the most recent round of sampling in 2004.

DRO and RRO levels in surface soil have generally been above ADEC soil cleanup levels at SS013. DRO concentrations in sediment at SS-01 have declined over time, while results at SS-06 located downstream have been more variable over time with no apparent trend.

Overall the monitoring data indicate that the hydrocarbon impacts are primarily limited to the spill site area with no evidence of impact to surface water from Fowler Creek, and that natural attenuation may be occurring.

4.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The near-surface soil cleanup levels for DRO and RRO have not changed from those provided in the Interim ROD (USAF, 2002). The sediment cleanup levels used in the Interim ROD are based on ADEC 18 AAC 75 Method Two soil cleanup levels.

Because these sediment sample locations (SS-01 and SS-06) are located in a predominantly dry streambed that only occasionally carries water the use of soil cleanup levels are appropriate for this site.

There have been no substantial changes to the land use factors that were used at the time of remedy selection. The land use still represents a relatively low level of occupancy and activity.

4.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. The land use is industrial, ROD provisions have been followed and the probability that unacceptable exposure to site contaminants could occur is negligible.

4.7.4 Technical Assessment Summary

The remaining contamination at SS013 is petroleum hydrocarbons contained in the soils and sediments. The surface water and groundwater have not been significantly affected by this contamination. The groundwater is not used for any purpose. Petroleum hydrocarbons are present in the surface soil and sediment, but since the land use is industrial the probability that unacceptable exposure to site contaminants could occur is negligible. Additionally, land use controls are in affect that prohibits digging or excavation of soils at this site. Long-term monitoring data confirms that no unexpected or unacceptable changes in contaminant concentration or distribution will occur. The intent of the SS013 Interim ROD is being met.

4.8 ISSUES

Issues related to the Interim ROD and remedy selection are outlined in Table 4-5.

Table 4-5 Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Petroleum hydrocarbons continue to be present is the surface soil and sediments at SS013 but since land use is industrial the probability that unacceptable exposure to site contaminant could occur is negligible.	**N**	**N**
Groundwater monitoring was discontinued in 2004 because the Interim ROD did not require it and all 2004 groundwater monitoring results were below ADEC cleanup levels.	**N**	**N**

4.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions for SS013 are presented in Table 4-6.

Table 4-6 Recommendations and Follow-up Actions

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
Long-term monitoring activities prescribed by Interim ROD shall be performed at least once every five years. LUC that prohibits excavation activities is protective.	USAF – 611 CES/CEVR	ADEC	2013	**N**	**N**

4.10 PROTECTIVENESS STATEMENT(S)

The remedy at SS013 is expected to be protective of human health and the environment when completed, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

4.11 NEXT REVIEW

The next five-year review for SS013 at Cape Romonzof is required by 2013, five years from the date of this review.

Table 4-7 SS013 Interim RAOs and ADEC Cleanup Levels

Media	Contaminant of Concern	Site	Human Health/ADEC Criteria	Ecological Screening Criteria	Basis	Interim ROD RAO	Basis	Revised/ Current RAO
Groundwater (mg/L)	GRO	SS015	1.3	NA	18-AAC-75 Table C	1.3	18-AAC-75 Table C	1.3
	DRO	SS015	1.5	NA	18-AAC-75 Table C	1.5	18-AAC-75 Table C	1.5
	RRO	SS015	1.1	NA	18-AAC-75 Table C	1.1	18-AAC-75 Table C	1.1
	Benzene	SS015	0.005	NA	18-AAC-75 Table C	0.005	18-AAC-75 Table C	0.005
Surface Water (mg/L)	PCB	LF003	0.0005	0.000014	18-AAC-70	0.0005	18-AAC-70	0.000014
	TAH	LF003	NA	0.01			18-AAC-70	0.01
	TAqH	LF003	NA	0.015			18-AAC-70	0.015
Sediment (mg/Kg)	DRO	SS013	NA	NA	18-AAC-75.341	250 [1]		
	PCB	LF003		0.0341	18-AAC-75.341	10 [1]	NOAA	0.0341
Near-Surface Soil (mg/Kg)	DRO	SS013	250		18-AAC-75.341	250	18-AAC-75.341	250
	RRO	SS013	10,000		18-AAC-75.341	10,000	18-AAC-75.341	10,000
	PCB	LF003	1.0		18-AAC-75.341	10	18-AAC-75.341	1.0

Definitions
18 AAC 75 Oil and Hazardous Substances Pollution Control Regulations (ADEC, 2006a)
18 AAC 70 Alaska Water Quality Standards (ADEC, 2006b)
NOAA – NOAA Screening Quick Reference Tables, updated September 1999.
RAO – Remedial Action Objective
TAH – Total Aromatic Hydrocarbons (BTEX)
TAqH – Total Aqueous Hydrocarbons (BTEX + PAH)
mg/L – milligrams per liter
mg/Kg –milligrams per kilogram
1 – ADEC soil cleanup levels are being used for sediments that being reclassified as soils because these locations are predominantly dry

5 UST SPILL AREA (SS015)

5.1 INTRODUCTION

Site SS015 is located 200 feet south of the lower camp facilities (see Figure 2). Site SS015 is the result of a diesel fuel spill that occurred from two underground storage tanks (USTs). The two tanks were discovered in 1991 as part of an excavation of fuel contaminated soils and a buried fuel line. The 5,000 and 15,000-gallon tanks were removed from the site along with approximately 900 cubic yards of contaminated soil (USAF, 1991). In 1993, an RI/FS was conducted at SS015 (USAF, 1993). Neither investigation delineated the extent of the soil contamination. In 1997, an investigation of SS015 was conducted to collect sufficient data to determine if intrinsic remediation would be effective in reducing contaminant concentrations to levels protective of human health and the environment (USAF, 1998b). Based on the 1997 study, it was recommended that long term monitoring be conducted at SS015.

5.2 SITE CHRONOLOGY

1985: Eleven sites were identified as potentially containing hazardous contaminants at Cape Romanzof during the *Phase I Records Search, AAC-Southern Region* (USAF, 1985).

1991: Preliminary Assessment - Two USTs (5,000 and 15,000 gallon capacities) were discovered at SS015 during the summer of 1991 during excavation of fuel-contaminated soils and buried fuel lines adjacent to an aboveground storage tank (AST). Fuel was reportedly released through the vent pipe of the UST due to overfilling. Both tanks and approximately 900 cubic yards of fuel-contaminated soil were removed from the site.

1993: An RI/FS was performed during which six monitoring wells were drilled and installed at SS015. Three soil borings were drilled and five test pits were excavated in and around the site. Soil and groundwater were found contaminated by petroleum hydrocarbons, however the extent of diesel contamination was not effectively delineated (USAF, 1993).

1994: The USAF removed approximately 600 cubic yards of petroleum contaminated stockpiled soils from SS015 and placed it in a lined storage cell for storage and treatment (USAF, 1995).

1997: Data was collected to determine if intrinsic remediation would be effective in

reducing contaminant concentrations at SS15 to levels protective of human health and the environment. Long term monitoring was recommended for this site based on this investigation (USAF, 1998b).

1999: Long-Term Monitoring at Landfill No.2 (LF03), Spill Sites SS13 and SS15 along with a landfill cap inspection at LF03 were initiated in October 1999 (USAF, 2000b).

2000: Long-Term Monitoring and landfill inspection efforts were continued in September 2000 (USAF, 2001b).

2001: Proposed Plan for Cleanup of Landfill (LF03), Spill Site SS13, Spill Site SS15 at Cape Romanzof LRRS was submitted (USAF, 2001a).

2002: Record of Decision for Interim Remedial Action at Spill Site SS013, Spill Site SS015, and Landfill Site LF003 was signed (USAF, 2002).

2003 and 2004: Long-Term Monitoring of wells WW-02 and WW-08 was performed with results above RAOs both years at WW-02 for Benzene, GRO, and DRO.

2004: The 1994 POL contaminated soils were treated in Biocell #3 and a closure report was submitted in 2000 (USAF, 2000c). Upon receipt of concurrence from ADEC the treated soils were used as landfill capping material at Landfill No. 2.

2006 and 2007: Long-Term Monitoring of groundwater was continued in August 2006 (USAF, 2007) and August 2007 (In Preparation).

5.3 BACKGROUND

5.3.1 Physical Characteristics

The installation consists of 4,900 acres of land within the Yukon-Kuskokwim Delta National Wildlife Refuge and is comprised of two main areas: the Lower Camp where the main camp facilities are located, and the Upper Camp where the Long Range Radar equipment is located. The Lower Camp lies at the head of the valley next to tundra fields and ephemeral streams. The Upper Camp is situated on a steep bedrock ridge directly above the head of the valley and is adjacent to the peak of Towak Mountain (elevation 2,250 feet). The two camps are connected by a gravel road and tramway service. A mile long runway is located near the beach at Kokechik Bay approximately 4 miles southwest of the Lower Camp. There are no roads connecting the Cape Romanzof installation to nearby communities.

Site SS015 is located 200 feet south of the lower camp and is accessible by road.

5.3.2 Land and Resource Use

Cape Romanzof LRRS was one of the ten original aircraft control and warning sites in the Alaska Air Defense System. Construction of the installation was completed in 1952, and operations began in 1953. Independent contractors have operated the Cape Romonzof LRRS since 1977. The current site operations contractor is ARCTEC. Approximately six contractor personnel currently live at the installation year-round. In the summer, the number of people living at the site can significantly increase (up to 30 people) when contractors and government agencies (e.g., Alaska Department of Fish and Game and U.S. Department of the Interior Fish and Wildlife Service) are conducting studies and performing work at the site.

The nearest local communities are Scammon Bay (population 520) and Hooper Bay (population 1,157) located about 15 miles east and south of the installation, respectively. Although the communities are not connected to Cape Romonzof by road, the community members use off-road vehicles, boats, snow machines, and walking to travel all around the Cape Romanzof area. The populations of Scammon Bay and Hooper Bay are 95-97 percent Native Alaskan. Employment is seasonal, with peak economic activity in the summer months. Major sources of employment are the Bureau of Land Management firefighting programs, commercial fishing, and the associated canneries.

Cape Romanzof LRRS is located within the limits of the Yukon Delta National Wildlife Refuge, a federally protected environment. Dolly varden inhabit Fowler (Nilumat) Creek, and pink salmon spawn in Fowler Creek. Beaver have constructed several ponds in the creek. Fowler Creek is used by Cape Romanzof workers for recreational fishing. The area surrounding Cape Romanzof LRRS is a prime subsistence food gathering area. Kokechik Bay and Scammon Bay are important subsistence resources for members of nearby communities. The possibility of contaminant migration is of extreme concern and importance to the health and well being of local residents.

5.3.3 Hydrology

Surface water drainage of the valley is achieved by Fowler (Nilumat) Creek, a perennial stream that flows four miles from a constructed reservoir at the head of the valley to

Kokechik Bay. Recharge of the stream is primarily from the reservoir, sheet run-off, and small tributaries from nearby valleys. Numerous ponds and surface water bodies exist for short periods of time after precipitation events. Fowler reek, the reservoir, and a small pond approximately 300 feet north of the reservoir are the only perennial bodies of water close to the installation. The depth to groundwater at this site was approximately 25 feet bgs in September 1997. The unconfined aquifer below SS015 occurs within the glacial till as well as the fractured bedrock. No boundary is believed to exist between the colluvial/alluvial and bedrock aquifers; however, the hydraulic conductivity of the colluvial/alluvial aquifer is much less than that of the bedrock aquifer.

The installation receives its drinking water from a deep well located approximately 760 feet south of SS015. Well No.1 was installed in 1957 to a depth of 154 feet. The well is screened in two water-bearing zones: 82 to 102 feet bgs and 146 to 148 feet bgs.

Recharge of groundwater is from infiltration of precipitation within the drainage basin. Little or no regional flow exists across drainage boundaries. All Groundwater at the installation occurs within the Fowler Creek drainage basin. Surface run-off and groundwater flow directions follow the downward slopes of the valley and exit the site to the west.

5.3.4 History of Contamination

SS015 is the result of a diesel fuel spill that occurred from two underground storage tanks (USTs). The two tanks were discovered in 1991 as part of an excavation of fuel contaminated soils and a buried fuel line. The 5,000 and 15,000-gallon tanks were removed from the site along with approximately 900 cubic yards of contaminated soil (USAF, 1991). Contaminants and media of concern for Site SS015 are BTEX, GRO, DRO, and RRO in groundwater. Historically, DRO levels in soil have also been above ADEC soil cleanup action levels at SS015.

Numerous studies have been conducted at SS015 since 1991 to characterize the nature and extent of contamination. Six monitoring wells (WW-01 to WW-06) were installed at SS015 in 1993 and two additional monitoring wells (WW-07 and WW-08) were installed in 1997 (Figure 6). One additional monitoring well (WW-09) was installed in 2004 but has never been sampled. An initial RI/FS was conducted in 1993 (USAF, 1993) was followed by a second study conducted in 1997 (USAF, 1998b). Additional groundwater monitoring events occurred in 1999, 2000, 2003, 2004, 2006, and 2007.

From 1999 to 2007, groundwater samples have been collected from various monitoring

wells at SS015. An evaluation of the groundwater data shows that WW-02 has typically had the highest concentrations and has typically been above RAOs for benzene, GRO, and DRO (Table 5-1). Monitoring wells WW-01 and WW-04 have also had groundwater concentrations above RAOs for benzene, GRO, and DRO. Well WW-06 had one DRO results from 1993 that was above the RAO.

DRO was detected above the preliminary RAO of 250 mg/Kg in all soil samples collected from the soil boring installed to construct monitoring well WW-09 in 2004. The highest DRO soil result detected in 2004 was 8,010 mg/Kg, obtained from a sample collected between 5.2 and 7.2 feet bgs. Historically, SS015 DRO levels in subsurface soil samples were generally above the RAO at WW-01, WW-02, and one sample from WW-04.

5.3.5 Initial Response

On June 29, 1991, site personnel reported a fuel seep adjacent to the aboveground storage tank (AST) impoundment at the abandoned Lower Camp facility. Spill response activities commenced immediately, involving construction of a sump to collect fuel seeping from surficial soils, and excavation of buried fuel lines to determine the source of the release. Recovered fuel and fuel-affected soils were stored in 85-gallon overpack drums until construction of a line and bermed containment area was completed. Fuel-affected soils were then transferred to the containment area, and recovered fuel was pumped into an abandoned 25,000 gallon AST within the tank impoundment. Excavation of buried fuel lines within and north of the AST impoundment was completed by July 3, 1991. No leaks were found.

Continued excavation of fuel-affected soils adjacent to the AST impoundment revealed the presence of two underground storage tanks (UST) immediately north of the AST impoundment. Fuel and water were pumped from both UST's into the 25,000-gallon AST. The USTs were removed, along with approximately 900 cubic yards of fuel-affected soil. Additional fuel seepage was recovered from the UST excavation (USAF, 1991).

The recovered fuel is reported to be diesel. Measurements conducted during the site reconnaissance indicate that approximately 1,900 gallons of fuel, and 7,800 gallons of water were stored in the 25,000 gallon AST. No groundwater was encountered in the UST excavation. The depth to groundwater in the vicinity of the UST excavation is estimated at between 20 and 40 feet blow the original ground surface.

5.3.6 Basis for Taking Action

No known imminent or substantial danger to human health and the environment has been observed at Spill Site SS015 due to the surface and subsurface contamination. Actions were taken under the Environmental Restoration Program (ERP) to meet the following provisions.

- Air Force ERP, a CERCLA-based approach where the Air Force is the implementing or lead agency;
- ADEC 18 AAC 75 – Oil and Other Hazardous Substances Pollution Control (ADEC, 2000a);
- ADEC 18 AAC 70 – Water Quality Standards (ADEC, 1999); and
- ADEC 18 AAC 80 – Drinking Water (ADEC, 2000b).

5.4 REMEDIAL ACTIONS

The selection, implementation, and maintenance of the remedial actions selected in the 2002 Record of Decision for Interim Remedial Action (USAF, 2002) are described below.

5.4.1 Remedy Selected

As documented in the ROD for Interim Remedial Action issued in March 2002 (USAF, 2002), remedial alternative were evaluated in the 1993 RI/FS document (USAF, 1993) and 1997 SS015 Technical Report (USAF, 1998b). The three remedies considered for SS015 included:

- No Further Action (Long-Term Monitoring)
- Monitored Natural Attenuation (Institutional Controls and Monitoring)
- Monitored Natural Attenuation with Hot Spot Removal

Monitored Natural Attenuation is the selected remedy for groundwater at SS015. This alternative will effectively reduce risk to human health and the environment utilizing all natural technologies. The elements of the selected remedy include implementation of institutional controls restricting access, sampling of soil, sediment, and surface water, and long-term groundwater monitoring. Additionally, since this alternative will result in hazardous substances remaining onsite above levels that would otherwise allow for unlimited use and unrestricted exposure, a five-year review will be necessary to ensure

that the remedy continues to provide adequate protection of human health and the environment.

The Interim ROD prescribe cleanup levels are presented in Table 5-5.

5.4.2 Remedy Implementation

All of the remedial actions specified in the Interim ROD have been implemented at SS015 as summarized below.

- Land use controls have been established that prohibit any digging or excavation within the Site SS015 area (USAF, 2006).
- Long-term monitoring of groundwater at SS015 was performed in 1993, 1997, 1999, 2000, 20003, 2004, 2006, and 2007. The groundwater monitoring results are summarized in Table 5-1 and the polynuclear aromatic hydrocarbon (PAH) results being summarized in Table 5-2.
- GRO, DRO, and benzene are the analytes most commonly detected above their RAOs and are present in monitoring wells WW-01, WW-02, and WW-04 (Table 5-1). RRO was present above its RAO during the 1997 sampling of WW-02. DRO was present above it RAO in WW-06 at the time of installation in 1993.
- Long-term groundwater monitoring results indicate that from 1997 through 2007 the only PAH results to exceed their RAOs were benzo(a)pyrene at WW-02 in 1997 and 2004, and naphthalene at WW-02 in 2004 (Table 5-2).
- A soil boring was used to collect soil samples at SS015 in 2004 during the installation of monitoring well WW-09 adjacent to the former UST excavation (Figure 6). Three soil samples were collected at approximately 5, 7, and 10 feet bgs. The DRO concentrations were all above the RAO and ranged from 740 to 8,010 mg/Kg. The GRO, RRO, BTEX, and PAH results from these soil samples were all below the ADEC Method Two soil cleanup levels.
- Surface water and sediment sampling are not required at SS015 because there is no surface water present.

5.4.3 System Operations/Operation and Maintenance

Well maintenance – The SS015 monitoring wells have remained serviceable during each of the long-term monitoring events with the following exceptions. Monitoring well

WW-09 was constructed in 2004, but has not been sampled due to lack of water and a damaged surface casing. In 2007 monitoring wells WW-02, WW-04, WW-07, and WW-08 were found either destroyed or in a position/condition not conducive for sampling. The well monument and surface casing have been cut off at the ground surface for WW-02 and WW-04. Monitoring wells WW-07 and WW-08 appear to have the well screen silted in or the well screen broken as the total depth for both these wells has decreased from approximately 25 feet bgs to less than 10 feet bgs.

5.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This five-year review was conducted in accordance with US EPA Guidance (EPA, 2001).

Table 5-1: SS015 Selected Groundwater Analytical Data (1993-2007)

Well	Analyte	RAOs [1] (mg/L)	July 1993 Sampling (ENSR)	June 1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
WW-01 1993	Benzene (mg/L)	0.005	ND	**0.310 J**	NS	NS	NS	NS	NS	**0.0215**
	Total BTEX (mg/L)	None	ND	0.763 J	NS	NS	NS	NS	NS	0.1153
	GRO (mg/L)	1.3	NA	**2.53 J**	NS	NS	NS	NS	NS	0.788
	DRO (mg/L)	1.5	0.33	**59.0**	NS	NS	NS	NS	NS	**19.1**
	RRO (mg/L)	1.1	NA	0.414	NS	NS	NS	NS	NS	0.804
	Iron (mg/L)	None	NA	1.4	NS	NS	NS	NS	NS	0.781
	Sulfate (mg/L)	None	NA	8	NS	NS	NS	NS	NS	18.4
	DO (mg/L)	None	NA	4.07	NS	NS	NS	NS	NS	4.8
WW-02 1993	Benzene (mg/L)	0.005	**1.30**	**1.11 J**	NA	**0.7**	**0.563**	**0.311**	**0.232**	NS
	Total BTEX (mg/L)	None	2.04	2.12 J	NA	1.38	1.53	0.870	0.469	NS
	GRO (mg/L)	1.3	NA	**7.95 J**	NA	**4.4**	**3.16**	**8.38**	**1.66**	NS
	DRO (mg/L)	1.5	**26**	**400**	**7.23**	**3.2**	**50.4**	**387**	**34.3**	NS
	RRO (mg/L)	1.1	NA	**1.38**	ND	ND	0.628 F	ND	0.995 F	NS
	Iron (mg/L)	None	NA	10	8.52	10	16.2	7.61	11	NS
	Sulfate (mg/L)	None	NA	55	54.3	42.0	39.6	34.1	36	NS
	DO (mg/L)	None	NA	2.36	3.2	9.85	ND	NA	NA	NS
WW-03 1993	Benzene (mg/L)	0.005	ND	ND	NS	NS	NS	NS	NS	NS
	Total BTEX (mg/L)	None	ND	ND	NS	NS	NS	NS	NS	NS
	GRO (mg/L)	1.3	NA	ND	NS	NS	NS	NS	NS	NS
	DRO (mg/L)	1.5	0.32	0.156 J	NS	NS	NS	NS	NS	NS
	RRO (mg/L)	1.1	NA	ND	NS	NS	NS	NS	NS	NS
	Iron (mg/L)	None	NA	0.5	NS	NS	NS	NS	NS	NS
	Sulfate (mg/L)	None	NA	80	NS	NS	NS	NS	NS	NS
	DO (mg/L)	None	NA	3.36	NS	NS	NS	NS	NS	NS

Table 5-1: SS015 Selected Groundwater Analytical Data (1993-2007)

Well	Analyte	RAOs [1] (mg/L)	July 1993 Sampling (ENSR)	June 1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
WW-04 1993	Benzene (mg/L)	0.005	**0.27**	**0.34 J**	NS	NS	NS	NS	NS	NS
	Total BTEX (mg/L)	None	0.44	0.73 J	NS	NS	NS	NS	NS	NS
	GRO (mg/L)	1.3	NA	**2.35 J**	NS	NS	NS	NS	NS	NS
	DRO (mg/L)	1.5	**9.6**	**9.59**	NS	NS	NS	NS	NS	NS
	RRO (mg/L)	1.1	NA	0.537	NS	NS	NS	NS	NS	NS
	Iron (mg/L)	None	NA	7.0	NS	NS	NS	NS	NS	NS
	Sulfate (mg/L)	None	NA	8	NS	NS	NS	NS	NS	NS
	DO (mg/L)	None	NA	6.65	NS	NS	NS	NS	NS	NS
WW-05 1993	Benzene (mg/L)	0.005	ND	ND	NS	NS	NS	NS	NS	ND
	Total BTEX (mg/L)	None	ND	ND	NS	NS	NS	NS	NS	ND
	GRO (mg/L)	1.3	NA	ND	NS	NS	NS	NS	NS	ND
	DRO (mg/L)	1.5	0.35	0.186 J	NS	NS	NS	NS	NS	ND
	RRO (mg/L)	1.1	NA	0.119 J	NS	NS	NS	NS	NS	0.164 F
	Iron (mg/L)	None	NA	ND	NS	NS	NS	NS	NS	ND
	Sulfate (mg/L)	None	NA	8	NS	NS	NS	NS	NS	5.57
	DO (mg/L)	None	NA	3.8	NS	NS	NS	NS	NS	7.8
WW-06 1993	Benzene (mg/L)	0.005	NA	ND	NS	NS	NS	NS	NS	ND
	Total BTEX (mg/L)	None	NA	ND	NS	NS	NS	NS	NS	ND
	GRO (mg/L)	1.3	NA	ND	NS	NS	NS	NS	NS	ND
	DRO (mg/L)	1.5	**33**	1.41	NS	NS	NS	NS	NS	1.08
	RRO (mg/L)	1.1	NA	0.278 J	NS	NS	NS	NS	NS	0.406 F
	Iron (mg/L)	None	NA	>10	NS	NS	NS	NS	NS	0.185 F
	Sulfate (mg/L)	None	NA	NA	NS	NS	NS	NS	NS	1.48
	DO (mg/L)	None	NA	9.17	NS	NS	NS	NS	NS	11.2

Table 5-1: SS015 Selected Groundwater Analytical Data (1993-2007)

Well	Analyte	RAOs [1] (mg/L)	July 1993 Sampling (ENSR)	June 1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
WW-07 1997	Benzene (mg/L)	0.005	NS	ND	ND	0.0013	NS	NS	NS	NS
	Total BTEX (mg/L)	None	NS	0.0006 J	ND	0.0057	NS	NS	NS	NS
	GRO (mg/L)	1.3	NS	ND	ND	ND	NS	NS	NS	NS
	DRO (mg/L)	1.5	NS	0.063 J	ND	0.46	NS	NS	NS	NS
	RRO (mg/L)	1.1	NS	ND	ND	0.69	NS	NS	NS	NS
	Iron (mg/L)	None	NS	7.4	62.3	110	NS	NS	NS	NS
	Sulfate (mg/L)	None	NS	NA	NA	3.1	NS	NS	NS	NS
	DO (mg/L)	None	NS	13.5	12.9	11.98	NS	NS	NS	NS
WW-08 1997	Benzene (mg/L)	0.005	NS	ND	ND	ND	ND	ND	NS	NS
	Total BTEX (mg/L)	None	NS	ND	ND	0.002	0.00247 F	ND	NS	NS
	GRO (mg/L)	1.3	NS	ND	ND	ND	ND	0.0212 F	NS	NS
	DRO (mg/L)	1.5	NS	0.165	0.363	0.16	0.129 F	0.315 F	NS	NS
	RRO (mg/L)	1.1	NS	0.275 J	ND	0.23	ND	0.223 F	NS	NS
	Iron (mg/L)	None	NS	2.2	43.9	28	0.144 F	ND	NS	NS
	Sulfate (mg/L)	None	NS	6.0	NA	1.90	1.93	4.04	NS	NS
	DO (mg/L)	None	NS	13.9	11	12.13	4.51	4.4	NS	NS

Notes: Total BTEX is the sum of benzene, toluene, ethylbenzene, and xylene concentrations.

Results shown in **BOLD** exceed the ADEC 18 AAC 75 Method 2 cleanup levels.

GRO- Gasoline Range Organics; DRO - Diesel Range Organics; RRO - Residual Range Organics

NS- Well Not sampled; NA - Analyte Not analyzed; ND - Analyte Not detected

[1] 18 AAC 75.345(b)(1) ADEC Oil and Hazardous Substances Pollution Control Regulations, as amended through December 30, 2006; Method Two (Table C) groundwater cleanup levels

Table 5-2: SS015 Groundwater PAH Analytical Data (1997-2007)

Location ID	Analyte	RAOs (µg/L)[1]	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
WW-01	Acenaphthene	2,200	0.1	NS	NS	NS	NS	NS	1.09
	Acenaphthylene	2,200	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Anthracene	11,000	ND(0.1)	NS	NS	NS	NS	NS	0.0274 F
	Benzo(a)anthracene	1	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Benzo(a)pyrene	0.2	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Benzo(b)fluoranthene	1	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Benzo(g,h,i)perylene	1,100	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Benzo(k)fluoranthene	10	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Chrysene	100	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Dibenzo(a,h)anthracene	0.1	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Fluoranthene	1,460	ND(0.1)	NS	NS	NS	NS	NS	0.018 F
	Fluorene	1,460	0.20	NS	NS	NS	NS	NS	1.20
	Indeno(1,2,3-cd)pyrene	1	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	Naphthalene	700	260	NS	NS	NS	NS	NS	148
	Phenanthrene	11,000	0.09 F	NS	NS	NS	NS	NS	0.212 F
	Pyrene	1,100	ND(0.1)	NS	NS	NS	NS	NS	ND (0.05)
	1-Methylnaphthalene	1,500	NA	NS	NS	NS	NS	NS	13.0
	2-Methylnaphthalene	780	73	NS	NS	NS	NS	NS	9.61
WW-02	Acenaphthene	2,200	6	ND(10)	ND(5)	ND(15)	24.6	NS	NS
	Acenaphthylene	2,200	ND(1)	ND(10)	ND(5)	ND(15)	ND(5)	NS	NS
	Anthracene	11,000	ND(1)	ND(10)	ND(5)	ND(15)	1.17	NS	NS
	Benzo(a)anthracene	1	0.2 F	**ND(10)**	**ND(5)**	**ND(15)**	0.631	NS	NS
	Benzo(a)pyrene	0.2	**0.2 F**	**ND(10)**	**ND(5)**	**ND(15)**	**0.434**	NS	NS
	Benzo(b)fluoranthene	1	0.3 F	**ND(10)**	**ND(5)**	**ND(15)**	0.438	NS	NS
	Benzo(g,h,i)perylene	1,100	ND(1)	ND(10)	ND(5)	ND(15)	0.278	NS	NS
	Benzo(k)fluoranthene	10	0.1 F	ND(10)	ND(5)	ND(15)	0.406	NS	NS
	Chrysene	100	0.3 F	ND(10)	ND(5)	ND(15)	0.866	NS	NS
	Dibenzo(a,h)anthracene	0.1	**ND(1)**	**ND(10)**	**ND(5)**	**ND(15)**	0.0756	NS	NS
	Fluoranthene	1,460	0.8 F	ND(10)	ND(5)	ND(15)	2.46	NS	NS
	Fluorene	1,460	10	ND(10)	ND(5)	ND(15)	49.6	NS	NS
	Indeno(1,2,3-cd)pyrene	1	ND(1)	**ND(10)**	**ND(5)**	**ND(15)**	0.213	NS	NS
	Naphthalene	700	450	83.1	40	190	**967**	NS	NS
	Phenanthrene	11,000	5	ND(10)	ND(5)	ND(15)	18.2	NS	NS
	Pyrene	1,100	1	ND(10)	ND(5)	ND(15)	3.02	NS	NS
	1-Methylnaphthalene	1,500	NA	ND(10)	NA	NA	NA	NS	NS
	2-Methylnaphthalene	780	530	35.2	11	110	NA	NS	NS
WW-03	Acenaphthene	2,200	ND(0.1)	NS	NS	NS	NS	NS	NS
	Acenaphthylene	2,200	ND(0.1)	NS	NS	NS	NS	NS	NS
	Anthracene	11,000	ND(0.1)	NS	NS	NS	NS	NS	NS
	Benzo(a)anthracene	1	ND(0.1)	NS	NS	NS	NS	NS	NS
	Benzo(a)pyrene	0.2	ND(0.1)	NS	NS	NS	NS	NS	NS
	Benzo(b)fluoranthene	1	ND(0.1)	NS	NS	NS	NS	NS	NS
	Benzo(g,h,i)perylene	1100	ND(0.1)	NS	NS	NS	NS	NS	NS
	Benzo(k)fluoranthene	10	ND(0.1)	NS	NS	NS	NS	NS	NS
	Chrysene	100.000	ND(0.1)	NS	NS	NS	NS	NS	NS
	Dibenzo(a,h)anthracene	0.1	ND(0.1)	NS	NS	NS	NS	NS	NS
	Fluoranthene	1,460	ND(0.1)	NS	NS	NS	NS	NS	NS
	Fluorene	1,460	ND(0.1)	NS	NS	NS	NS	NS	NS
	Indeno(1,2,3-cd)pyrene	1	ND(0.1)	NS	NS	NS	NS	NS	NS
	Naphthalene	700	0.02 F	NS	NS	NS	NS	NS	NS
	Phenanthrene	11,000	ND(0.1)	NS	NS	NS	NS	NS	NS
	Pyrene	1,100	ND(0.1)	NS	NS	NS	NS	NS	NS
	1-Methylnaphthalene	1,500	NA	NS	NS	NS	NS	NS	NS
	2-Methylnaphthalene	780	ND(0.1)	NS	NS	NS	NS	NS	NS

Table 5-2: SS015 Groundwater PAH Analytical Data (1997-2007)

Location ID	Analyte	RAOs (µg/L)[1]	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
WW-04	Acenaphthene	2,200	0.5 F	NS	NS	NS	NS	NS	NS
	Acenaphthylene	2,200	ND(5)	NS	NS	NS	NS	NS	NS
	Anthracene	11,000	ND(5)	NS	NS	NS	NS	NS	NS
	Benzo(a)anthracene	1	**ND(5)**	NS	NS	NS	NS	NS	NS
	Benzo(a)pyrene	0.2	**ND(5)**	NS	NS	NS	NS	NS	NS
	Benzo(b)fluoranthene	1	**ND(5)**	NS	NS	NS	NS	NS	NS
	Benzo(g,h,i)perylene	1,100	ND(5)	NS	NS	NS	NS	NS	NS
	Benzo(k)fluoranthene	10	ND(5)	NS	NS	NS	NS	NS	NS
	Chrysene	100	ND(5)	NS	NS	NS	NS	NS	NS
	Dibenzo(a,h)anthracene	0.1	**ND(5)**	NS	NS	NS	NS	NS	NS
	Fluoranthene	1,460	ND(5)	NS	NS	NS	NS	NS	NS
	Fluorene	1,460	0.8 F	NS	NS	NS	NS	NS	NS
	Indeno(1,2,3-cd)pyrene	1	**ND(5)**	NS	NS	NS	NS	NS	NS
	Naphthalene	700	ND(5)	NS	NS	NS	NS	NS	NS
	Phenanthrene	11,000	ND(5)	NS	NS	NS	NS	NS	NS
	Pyrene	1,100	ND(5)	NS	NS	NS	NS	NS	NS
	1-Methylnaphthalene	1,500	ND(5)	NS	NS	NS	NS	NS	NS
	2-Methylnaphthalene	780	4 F	NS	NS	NS	NS	NS	NS
WW-05	Acenaphthene	2,200	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Acenaphthylene	2,200	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Anthracene	11,000	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(a)anthracene	1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(a)pyrene	0.2	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(b)fluoranthene	1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(g,h,i)perylene	1,100	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(k)fluoranthene	10	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Chrysene	100	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Dibenzo(a,h)anthracene	0.1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Fluoranthene	1,460	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Fluorene	1,460	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Indeno(1,2,3-cd)pyrene	1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Naphthalene	700	0.1	NS	NS	NS	NS	NS	0.101 F
	Phenanthrene	11,000	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Pyrene	1,100	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	1-Methylnaphthalene	1,500	NA	NS	NS	NS	NS	NS	ND(0.05)
	2-Methylnaphthalene	780	0.05 F	NS	NS	NS	NS	NS	ND(0.05)
WW-06	Acenaphthene	2,200	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Acenaphthylene	2,200	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Anthracene	11,000	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(a)anthracene	1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(a)pyrene	0.2	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(b)fluoranthene	1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(g,h,i)perylene	1100	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Benzo(k)fluoranthene	10	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Chrysene	100.000	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Dibenzo(a,h)anthracene	0.1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Fluoranthene	1,460	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Fluorene	1,460	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Indeno(1,2,3-cd)pyrene	1	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Naphthalene	700	ND(0.1)	NS	NS	NS	NS	NS	ND(0.1)
	Phenanthrene	11,000	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	Pyrene	1,100	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)
	1-Methylnaphthalene	1,500	NA	NS	NS	NS	NS	NS	0.0185 F
	2-Methylnaphthalene	780	ND(0.1)	NS	NS	NS	NS	NS	ND(0.05)

Table 5-2: SS015 Groundwater PAH Analytical Data (1997-2007)

Location ID	Analyte	RAOs (µg/L)[1]	1997 Sampling (HLA)	1999 Sampling (BNCI)	2000 Sampling (BNCI)	2003 Sampling (BNCI)	2004 Sampling (Paug-Vik)	2006 Sampling (Paug-Vik)	2007 Sampling (Paug-Vik)
WW-07	Acenaphthene	2,200	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Acenaphthylene	2,200	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Anthracene	11,000	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Benzo(a)anthracene	1	ND(0.1)	NS	**ND(5)**	NS	NS	NS	NS
	Benzo(a)pyrene	0.2	ND(0.1)	NS	**ND(5)**	NS	NS	NS	NS
	Benzo(b)fluoranthene	1	ND(0.1)	NS	**ND(5)**	NS	NS	NS	NS
	Benzo(g,h,i)perylene	1,100	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Benzo(k)fluoranthene	10	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Chrysene	100	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Dibenzo(a,h)anthracene	0.1	ND(0.1)	NS	**ND(5)**	NS	NS	NS	NS
	Fluoranthene	1,460	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Fluorene	1,460	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Indeno(1,2,3-cd)pyrene	1	ND(0.1)	NS	**ND(5)**	NS	NS	NS	NS
	Naphthalene	700	ND(0.1)	NS	ND(11)	NS	NS	NS	NS
	Phenanthrene	11,000	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	Pyrene	1,100	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
	1-Methylnaphthalene	1,500	NA	NS	NA	NS	NS	NS	NS
	2-Methylnaphthalene	780	ND(0.1)	NS	ND(5)	NS	NS	NS	NS
WW-08	Acenaphthene	2,200	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	Acenaphthylene	2,200	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	Anthracene	11,000	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	Benzo(a)anthracene	1	ND(0.1)	NS	**ND(5)**	**ND(15)**	ND(0.056)	NS	NS
	Benzo(a)pyrene	0.2	ND(0.1)	NS	**ND(5)**	**ND(15)**	ND(0.056)	NS	NS
	Benzo(b)fluoranthene	1	ND(0.1)	NS	**ND(5)**	**ND(15)**	ND(0.056)	NS	NS
	Benzo(g,h,i)perylene	1,100	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	Benzo(k)fluoranthene	10	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	Chrysene	100	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	Dibenzo(a,h)anthracene	0.1	ND(0.1)	NS	**ND(5)**	**ND(15)**	ND(0.056)	NS	NS
	Fluoranthene	1,460	ND(0.1)	NS	ND(5)	ND(15)	ND(0.11)	NS	NS
	Fluorene	1,460	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	Indeno(1,2,3-cd)pyrene	1	ND(0.1)	NS	**ND(5)**	**ND(15)**	ND(0.056)	NS	NS
	Naphthalene	700	ND(0.1)	NS	ND(10)	ND(15)	0.0509 F	NS	NS
	Phenanthrene	11,000	ND(0.1)	NS	ND(5)	ND(15)	ND(0.11)	NS	NS
	Pyrene	1,100	ND(0.1)	NS	ND(5)	ND(15)	ND(0.056)	NS	NS
	1-Methylnaphthalene	1,500	NA	NS	NA	NA	NA	NS	NS
	2-Methylnaphthalene	780	ND(0.1)	NS	ND(5)	ND(15)	NA	NS	NS

Notes:

[1] 18 AAC 75.345(b)(1) ADEC Oil and Hazardous Substances Pollution Control Regulations, as amended through December 30, 2006; Method Two (Table C) groundwater cleanup levels and

ADEC Technical Memorandum-01-007, dated Nove 24, 2003, Additional Cleanup Values, Calculated Table C

NS- Well Not sampled; NA - Analyte Not analyzed; ND - Analyte Not detected

5.6 FIVE-YEAR REVIEW PROCESS

5.6.1 Administrative Components

The request to complete a five-year review was issued by Mr. Keith Barnack of USAF 611th CES and Remedial Project Manager for Cape Romanzof. Mr. Louis Howard of ADEC cooperated with Mr. Barnack to complete a draft of this report, present the findings to the public, and finalize the report.

5.6.2 Community Involvement

All aspects of the environmental restoration program activities at Cape Romanzof have been made available to the public through public meetings, public announcements, administrative record repositories, and public comment periods. The USAF has been proactive in communicating findings and soliciting input from concerned citizens. This draft document will be sent to the USAF, ADEC, EPA, local communities, and placed in two local information repositories for the public to review and comment. The general public was notified of the opportunity through public announcement. The final document, public comments and responses, and meeting minutes describing the findings and resolution of the final review will be available to the public in the administrative record information repositories.

5.6.3 Document Review

This five-year review consisted of a review of all relevant documents and monitoring data. Interim groundwater RAOs, as listed in the Interim ROD, were reviewed. Documents in the administrative record repositories e.g., http://www.adminrec.com) were reviewed.

5.6.4 Data Review

Existing monitoring data were compiled and summarized on data summary tables. Data from 1993 through 2007 for multiple contractors were combined to produce historical representations of site data for this five-year review.

5.6.5 Site Inspection

Periodic site inspections have occurred as part of systems operation, maintenance, and monitoring programs. Site inspections were conducted during each of the long-term monitoring events performed in 1997, 1999, 2000, 2003, 2004, 2006, and 2007.

Monitoring well damage or inability to sample certain monitoring wells were the only problems reported (see Section 5.4.3).

5.6.6 Interviews

Interview forms were mailed to ADEC, ARTEC (on site manager), USAF, and Cape Romanzof contractor representatives. A list of interviewees and completed interview forms are presented in Appendix A. No major problems were reported by interviewees that suggest there exists any unacceptable threat to human health or the environment.

5.7 TECHNICAL ASSESSMENT

5.7.1 Question A: Is the remedy functioning as intended by the decision documents?

Contaminants of concern at SS015 were identified as petroleum hydrocarbons in subsurface soil and groundwater. An evaluation of monitoring well data collected until 2007 indicate that groundwater contaminants (GRO and DRO) appear stable over time and that benzene concentrations in WW-01 and WW-02 appear to be declining.

One primary line of evidence for natural attenuation in groundwater, a stable to shrinking groundwater plume size, can be demonstrated from the groundwater data collected at this site. Downgradient wells have not historically had petroleum hydrocarbon impacts and the hydrocarbon concentrations at WW-01 and WW-02 appear stable.

The SS015 DRO levels in subsurface soil samples have generally been above ADEC soil cleanup levels at WW-01, WW-02, WW-09 and one sample from WW-04. Several surface soil sample locations have also been above ADEC soil cleanup levels for DRO at LB-04, LB-05, and SB-04B (USAF, 1998b).

Overall the monitoring data indicate that the hydrocarbon impacts are primarily limited to the spill site area with no evidence of spreading, and that natural attenuation may be occurring.

5.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. There have been no substantial changes to land use, toxicity information, or other factors that would indicate that exposure assumptions, toxicity data, cleanups levels, and RAOs are not fully protective of human health and the environment. The current

ADEC groundwater cleanup levels for GRO, DRO, RRO, and benzene are the same as those provided in the Interim ROD (USAF, 2002). There have been no substantial changes to the land use factors that were used at the time of remedy selection. Land use represents a low level of occupancy and activity. Land use controls have been established and maintained.

5.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. The land use is industrial, ROD provisions have been followed and the probability that unacceptable exposure to site contaminants could occur is negligible.

5.7.4 Technical Assessment Summary

The remaining contamination at SS015 is petroleum hydrocarbons contained in subsurface soils and groundwater. The groundwater is not used for any purpose and its use is not permitted as per land use restrictions. Existing land use controls are effectively preventing exposure to subsurface contaminants. Long-term monitoring data confirms that no unexpected or unacceptable changes in contaminant concentration or distribution will occur. The intent of the SS015 Interim ROD is being met.

5.8 ISSUES

Issues related to the Interim ROD and remedy selection are outlined in Table 5-3.

Table 5-3 Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Several of the SS015 groundwater monitoring wells have been destroyed or are no longer useable for their intended purpose and should be properly abandoned.	**N**	**N**

5.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions for SS015 are presented in Table 5-4.

Table 5-4 Recommendations and Follow-up Actions

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
Long-term monitoring activities prescribed by Interim ROD shall be performed at least once every five years. LUC that prohibits excavation activities and groundwater use is protective.	USAF – 611 CES/CEVR	ADEC	2013	**N**	**N**
Monitoring well abandonment. Wells WW-02, WW-04, WW-07, WW-08, and WW-09 need to be properly abandoned.	USAF – 611 CES/CEVR	ADEC	2008	**N**	**N**

5.10 PROTECTIVENESS STATEMENT(S)

The remedy at SS015 is expected to be protective of human health and the environment when completed, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

5.11 NEXT REVIEW

The next five-year review for SS015 at Cape Romonzof is required by 2013, five years from the date of this review.

Table 5-5 SS015 Interim RAOs and ADEC Cleanup Levels

Media	Contaminant of Concern	Site	Human Health/ADEC Criteria	Ecological Screening Criteria	Basis	Interim ROD RAO	Basis	Revised/ Current RAO
Groundwater (mg/L)	GRO	SS015	1.3	NA	18-AAC-75 Table C	1.3	18-AAC-75 Table C	1.3
	DRO	SS015	1.5	NA	18-AAC-75 Table C	1.5	18-AAC-75 Table C	1.5
	RRO	SS015	1.1	NA	18-AAC-75 Table C	1.1	18-AAC-75 Table C	1.1
	Benzene	SS015	0.005	NA	18-AAC-75 Table C	0.005	18-AAC-75 Table C	0.005
Surface Water (mg/L)	PCB	LF003	0.0005	0.000014	18-AAC-70	0.0005	18-AAC-70	0.000014
	TAH	LF003	NA	0.01			18-AAC-70	0.01
	TAqH	LF003	NA	0.015			18-AAC-70	0.015
Sediment (mg/Kg)	DRO	SS013	NA	NA	18-AAC-75.341	250 [1]		
	PCB	LF003		0.0341	18-AAC-75.341	10 [1]	NOAA	0.0341
Near-Surface Soil (mg/Kg)	DRO	SS013	250		18-AAC-75.341	250	18-AAC-75.341	250
	RRO	SS013	10,000		18-AAC-75.341	10,000	18-AAC-75.341	10,000
	PCB	LF003	1.0		18-AAC-75.341	10	18-AAC-75.341	1.0

Definitions
18 AAC 75 Oil and Hazardous Substances Pollution Control Regulations (ADEC, 2006a)
18 AAC 70 Alaska Water Quality Standards (ADEC, 2006b)
NOAA – NOAA Screening Quick Reference Tables, updated September 1999.
RAO – Remedial Action Objective
TAH – Total Aromatic Hydrocarbons (BTEX)
TAqH – Total Aqueous Hydrocarbons (BTEX + PAH)
mg/L – milligrams per liter
mg/Kg –milligrams per kilogram
1 – ADEC soil cleanup levels are being used for sediments that being reclassified as soils because these locations are predominantly dry

6 AUTHORIZING SIGNATURES

This signature sheet documents the Five-Year Review of the following Cape Romanzof LRRS sites Landfill No. 2 (LF003), Diesel Seep Area (SS013), and UST Spill Area (SS015). By signing this declaration the ADEC concurs with the Air Force's findings contained in this Five-Year Review.

BRENT A. JOHNSON, Colonel, USAF Date
Commander, 611th Air Support Group

JOHN HALVERSON, Environmental Program Manager Date
Department of Defense Cleanup Unit, Contaminated Sites Program
Alaska Department of Environmental Conservation

7 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 1999. 18 AAC 70, *Water Quality Standards*. May 27, 1999.

ADEC, 2000a. 18 Alaska Administrative Code (AAC) 75, *Oil and Hazardous Substances Pollution Control Regulations, as amended through October 28, 2000.*

ADEC, 2000b. *18 AAC 80, Drinking Water, as amended through August 23, 2000.*

ADEC, 2000c. *Risk Assessment Procedures Manual*. June 2000.

ADEC, 2003. *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*. May 15, 2003.

ADEC, 2006a. 18 AAC 75, *Oil and Hazardous Substances Pollution Control Regulations*, *as amended through December 30, 2006.*

ADEC, 2006b. 18 AAC 70, *Water Quality Standards, as amended through December 28, 2006*.

EPA, 1980. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 USC §§ 9601-9675). December 1980. *http://www.epa.gov/superfund/action/law/cercla.htm*.

EPA,1994. National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300). *http://www.epa.gov/oilspill/ncpover.htm*

EPA, 2001. *Comprehensive Five-Year Review Guidance*. June 2001.

EPA, 2004. Toxic Substance Control Act (TSCA) (40 CFR 761). Updated May 2004. *http://www.epa.gov/region5/defs/html/tsca.htm*

National Oceanic and Atmospheric Administration (NOAA), 1999. Screening Quick Reference Tables. From website updated on 10/6/04: http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

United States Air Force (USAF), 1985. Phase I Records Search, AAC-Southern Region. (Prepared by Engineering-Science). September 1985.

USAF, 1991. Results of Cape Romanzof Site Reconnaissance. (Prepared by ENSR). December 9, 1991.

USAF, 1992. Remedial Investigation/Feasibility Study Technical Report, Cape Romanzof LRRS, Alaska. Final Report. (Prepared by Woodward-Clyde). December 1992.

USAF, 1993. Final RI/FS Spill Site SS15, Cape Romanzof LRRS, Alaska. (Prepared by ENSR). September 1993.

USAF, 1995. Cape Romanzof LRRS Alaska Final Report: Investigation, Delineation, and Excavation of Contaminated Soil from Stockpile Near SS15 site, Waste Accumulation Area 3 (SS08), Drum Storage Area (SS14), Petroleum, Oil, and Lubricants Fill Stand (ST09); Construction of Cells for Contaminated Soil, Capping of Landfill-2 (LF-03); and Geology/Water Resources of Nilumat Creek Valley. April 1995.

USAF, 1996. Community Relations Plan, Cape Romanzof Long Range Radar Site (Prepared by Harding Lawson Associates). September 1986.

USAF, 1997. Closure Monitoring Landfill No. 2 (LF03), Cape Romanzof LRRS, Alaska. (Prepared by HLA). April 1997.

USAF, 1998a. Closure Monitoring Landfill No. 2 (LF03), Cape Romanzof LRRS, Alaska. (Prepared by HLA). April 1998.

USAF, 1998b. SS15 Technical Report. Final. July 1998.

USAF, 1998c. Remedial Investigation/Feasibility Study Report for SS13. Final. August 1998.

USAF, 1999. Site Investigation and Closure Monitoring Landfill No. 2 (LF03), Cape Romanzof LRRS, Alaska. August 1999.

USAF, 2000a. Preliminary Assessment/Site Inspection, Tramway Facilities at Cape Newenham, Cape Romanzof, and Tin City LRRS. (Prepared by Montgomery Watson). January 2000.

USAF, 2000b. Landfill 2 (LF03), SS13, and SS15 Long Term Monitoring, Landfill Cap Inspection, Conducted October 1999, Cape Romanzof LRRS, Alaska. (Prepared by BNC International.) November 2000.

USAF, 2000c. Biocell Closure Report, Biotreatment Cell Construction, Operation, and Maintenance, Cape Romanzof LRRS, Alaska. (Prepared by Harding Lawson Associates/Wilder Construction). June 23, 2000.

USAF. 2001a. Proposed Plan for Cleanup, Landfill (LF03), Spill Site SS13, and Spill Site SS15, Cape Romanzof LRRS, Alaska. 2001.

USAF, 2001b. Landfill 2 (LF03), SS13, and SS15 Long Term Monitoring, Conducted September 2000, Cape Romanzof LRRS, Alaska. (Prepared by BNC International.) August, 2001.

USAF, 2002. Record of Decision for Interim Remedial Action, Sites: Spill Site SS013, Spill Site SS015 and Landfill Site LF003, Cape Romanzof LRRS, Alaska. March

2002.

USAF, 2004a. Clean Sweep Program, Cape Romanzof LRRS, Alaska, Draft Final Report (Prepared by BNC International). January 2004.

USAF, 2004b. Landfill 2 (LF03), SS13, and SS15 Long Term Monitoring, Conducted October 2003, Cape Romanzof LRRS, Alaska. (Prepared by BNC International.) November, 2004.

USAF, 2005a. Former Landfill (LF03) Surface Soil Investigation Report, Cape Romanzof LRRS, Alaska. (Prepared by Paug-Vik, Inc.). February, 2005.

USAF, 2005b. Final Environmental Monitoring Report, Landfill 2 (LF03) and Spill Sites SS13 and SS15, Conducted June and August 2004, Cape Romanzof LRRS, Alaska (Prepared by Paug-Vik, Inc.). June 2005.

USAF, 2006. General Plan, 611th Air Support Group, Alaska. Appendix C – Land Use Controls. May 2006.

USAF, 2007. Final 2006 Environmental Monitoring Report, Landfill 2 (LF03) and Spill Sites SS13 and SS15, Cape Romanzof LRRS, Alaska (Prepared by Paug-Vik, Inc.). May 2007.

Yukon Kuskokwim Health Services (YKHC), 2005. Cape Romanzof Contaminant Migration and Subsistence Receptor Study. (Prepared by OASIS Environmental, Inc.).

FIGURES

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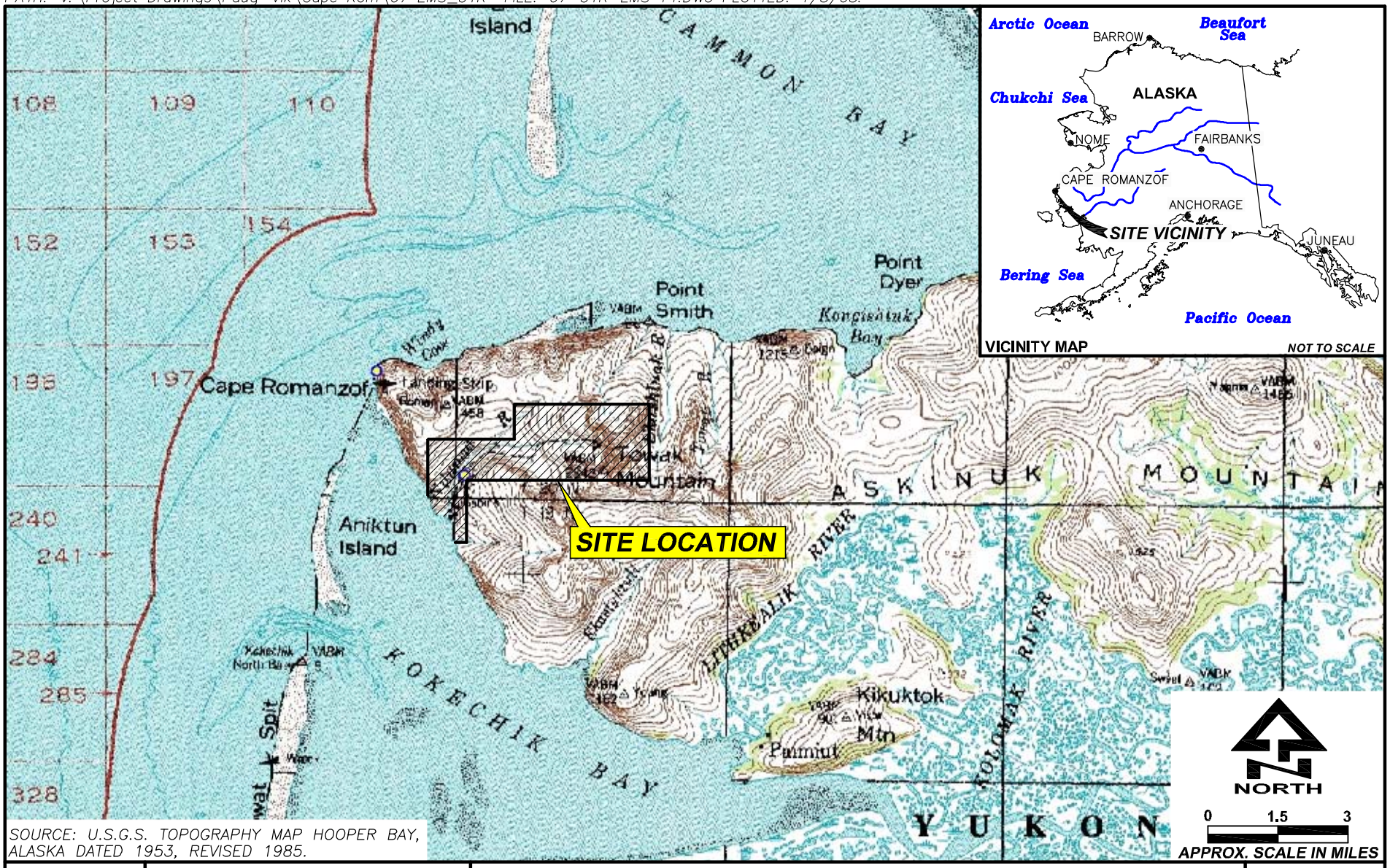

SOURCE: U.S.G.S. TOPOGRAPHY MAP HOOPER BAY, ALASKA DATED 1953, REVISED 1985.

DATE	JAN. 2008
CHKD	T.M.
DRAWN	C.E.H.
PROJ. NO	7004-06

611TH AIR SUPPORT GROUP
611TH CIVIL ENGINEER SQUADRON
ELMENDORF AFB, ALASKA

SITE LOCATION MAP

2007 FIVE-YEAR REVIEW
Cape Romanzof LRRS, Alaska

FIGURE
1

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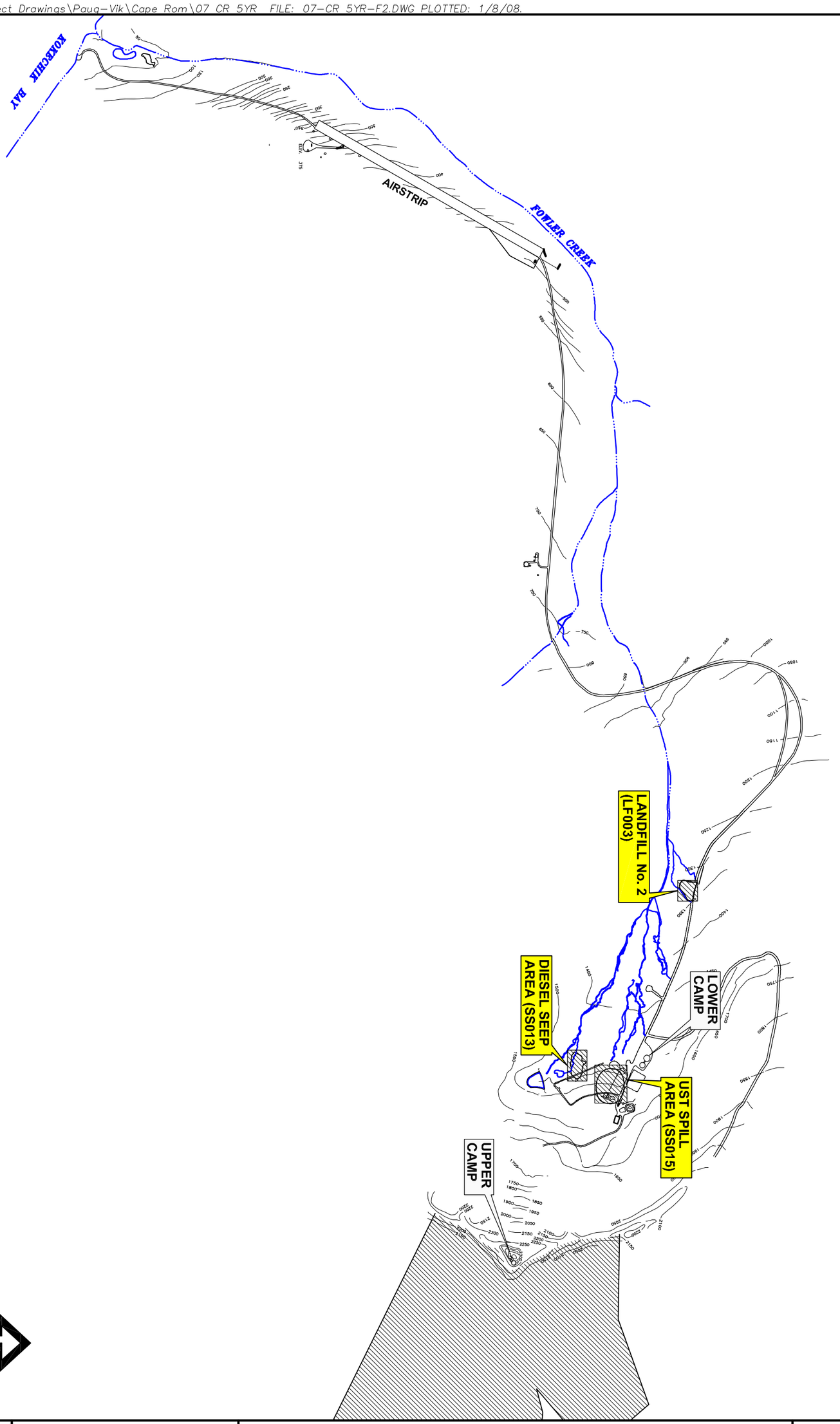

DATE JAN. 2008 CHKD T.M. DRAWN OASIS-PDC PROJ. NO 7004-06	611TH AIR SUPPORT GROUP 611TH CIVIL ENGINEER SQUADRON ELMENDORF AFB, ALASKA	**INSTALLATION LAYOUT AND OVERVIEW** 2007 FIVE-YEAR REVIEW Cape Romanzof LRRS, Alaska	FIGURE **2**

LEGEND

- MONITORING WELL LOCATIONS
- SEDIMENT/SURFACE WATER SAMPLE LOCATIONS
- GROUNDWATER RESULTS (mg/L)
- SURFACE WATER RESULTS (mg/L)
- SEDIMENT RESULTS (mg/Kg)

DRO	DIESEL–RANGE ORGANICS
BTEX	BENZENE, TOLUENE, ETHYLBENZENE, XYLENES
PCBs	POLYCHLORINATED BIPHENYLS
ND	NOT DETECTED

GROUNDWATER FLOW DIRECTION

NOTE:
BOLD/RED TEXT INDICATES CONTAMINANT EXCEEDS PRELIMINARY REMEDIAL ACTION OBJECTIVES (RAO).

DRAWING MUST BE PRINTED IN COLOR

CMW-1
NOT SAMPLED

ACCESS ROAD

MW-2
NOT SAMPLED

MW-1
DAMAGED
NOT SAMPLED

CMW-5
DRO = 0.163
B = 0.000324
T = 0.000853
E = 0.001
X = 0.002875
PCBs = ND

SEEP 2

SD-2 PCBs = 135 | **SW-2** PCBs = 0.00462

LANDFILL (LF03)

SEEP 3

SD-3 PCBs = ND | **SW-3** PCBs = ND

AREA OF PCB SOIL INVESTIGATION

SEEP

INTERMITTENT DRAINAGE

CMW-2
NOT SAMPLED

CMW-4
DRO = 1.26
B = 0.000698
T = ND
E = 0.000781
X = 0.002692
PCBs = ND

SEEP 1

SD-1 PCBs = ND | **SW-1** PCBs = ND

CMW-7
DRO = ND
B = 0.00504
T = 0.0019
E = 0.0014
X = 0.00397
PCBs = ND

CMW-3
DRO = 0.789
BTE = ND
X = 0.000744
PCBs = ND

CMW-6
NOT SAMPLED

NORTH

0 30 60

APPROX. SCALE IN FEET

FIGURE 5-3

LF003 (LANDFILL No. 2) 2007 SAMPLE LOCATIONS AND ANALYTICAL RESULTS

2007 ENVIRONMENTAL MONITORING STUDY
Cape Romanzof LRRS, Alaska

611TH AIR SUPPORT GROUP
611TH CIVIL ENGINEER SQUADRON
ELMENDORF AFB, ALASKA

611 CES PRIDE IN PROFESSIONALISM

DATE MARCH 2008
CHKD T.M.
DRAWN C.E.H.
PROJ. NO 7004-05

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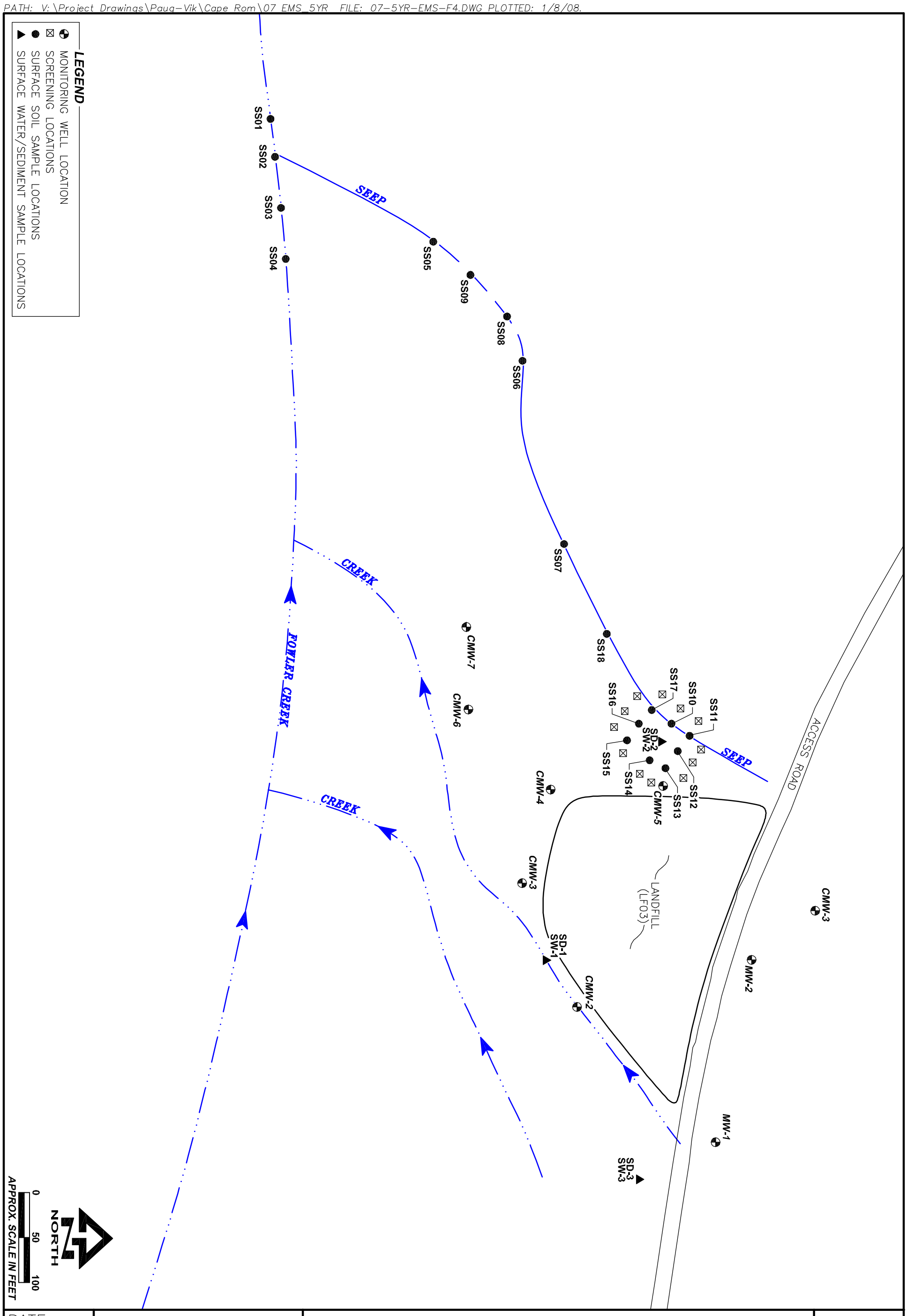

DATE JAN. 2008 CHKD T.M. DRAWN C.E.H. PROJ. NO 7004-06	611TH AIR SUPPORT GROUP 611TH CIVIL ENGINEER SQUADRON ELMENDORF AFB, ALASKA	**LF003 (LANDFILL No. 2)** **2004 SURFACE SOIL INVESTIGATION** 2007 FIVE-YEAR REVIEW Cape Romanzof LRRS, Alaska	FIGURE **4**

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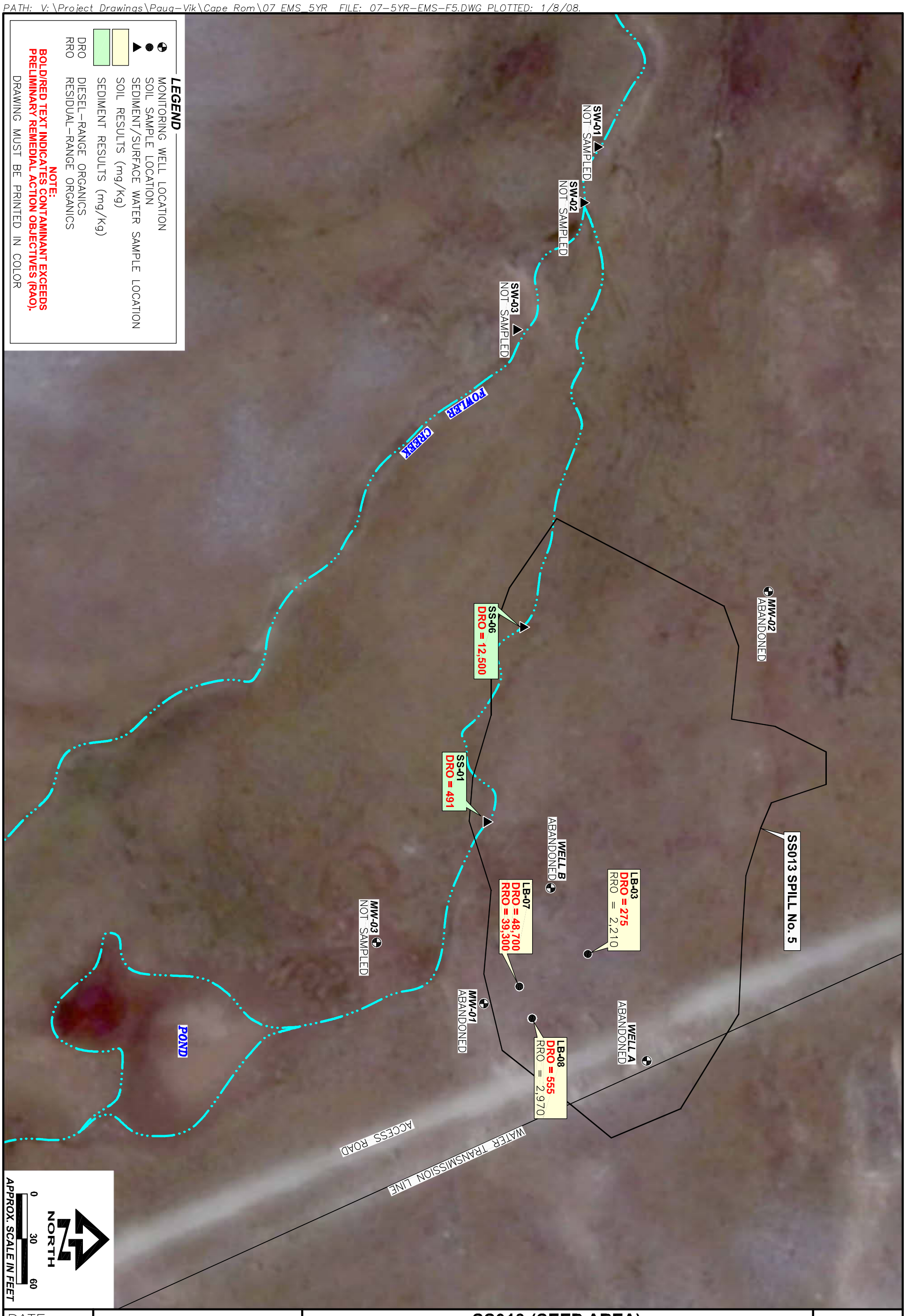

DATE JAN. 2008 CHKD T.M. DRAWN C.E.H. PROJ. NO 7004-06	611TH AIR SUPPORT GROUP 611TH CIVIL ENGINEER SQUADRON ELMENDORF AFB, ALASKA	**SS013 (SEEP AREA)** **2007 MNA SAMPLE LOCATIONS AND ANALYTICAL RESULTS** 2007 FIVE-YEAR REVIEW Cape Romanzof LRRS, Alaska	FIGURE **5**

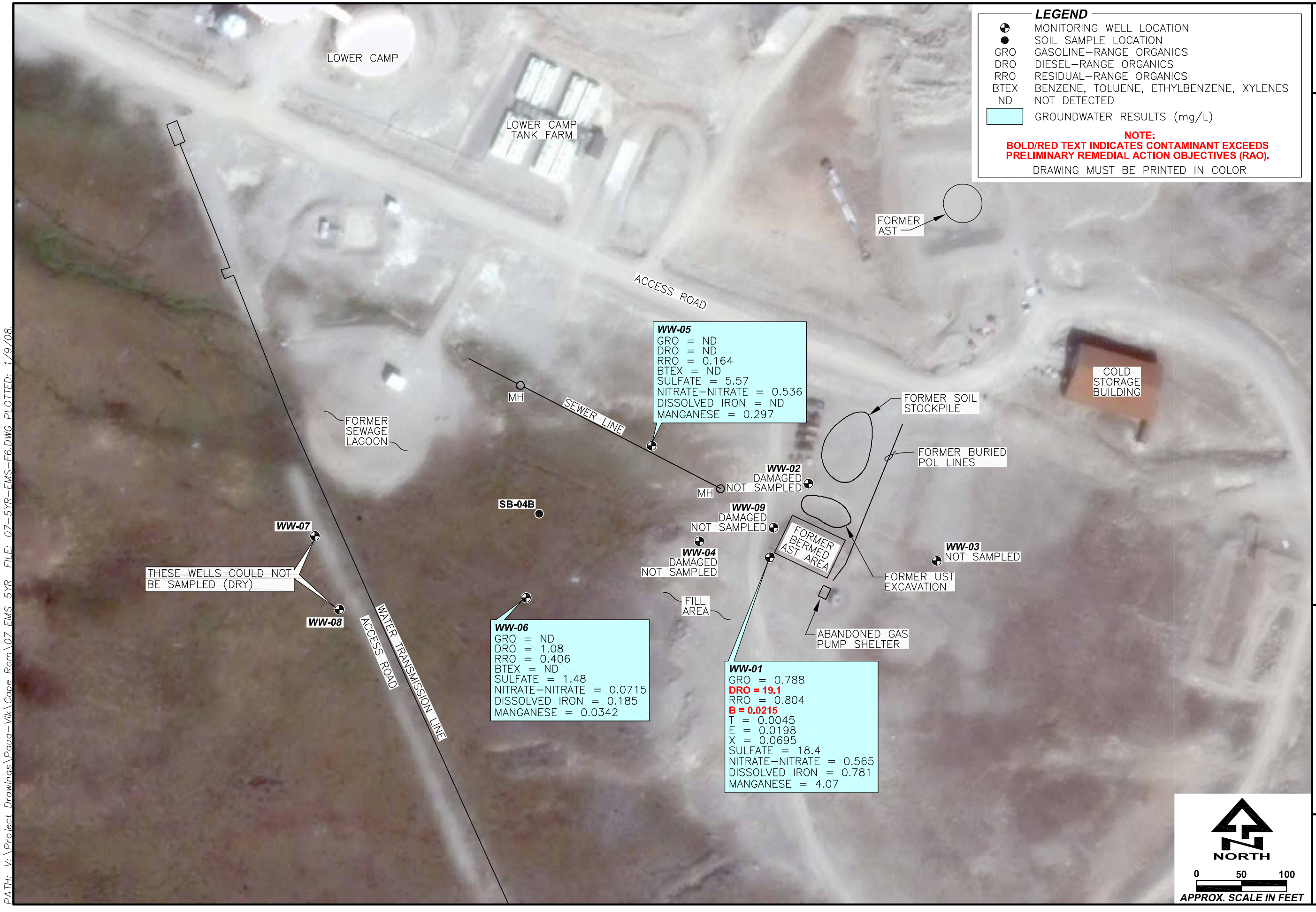

FIGURE 6

SS015 (UST AREA) 2007 MNA SAMPLE LOCATIONS AND ANALYTICAL RESULTS

2007 FIVE-YEAR REVIEW
Cape Romanzof LRRS, Alaska

611TH AIR SUPPORT GROUP
611TH CIVIL ENGINEER SQUADRON
ELMENDORF AFB, ALASKA

DATE JAN. 2008
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APPENDIX A

Site Interviews

INTERVIEW RECORD FOR FIVE-YEAR REVIEW

The United States Air Force (USAF), Alaska Department of Environmental Conservation (ADEC), and the United States Environmental Protection Agency (EPA) are conducting a five-year review of the remedy implemented at Spill Sites SS013 (Diesel Seep Area) and SS015 (UST Spill Area), and Landfill No. 2 (LF003) at the Cape Romanzof Long Range Radar Station (LRRS), Alaska. This review is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, the National Contingency Plan – Title 40 of the Code of Federal Regulations (CFR), Part 300.430 (f) (4) (ii), and Executive Order 12580 (January 23, 1987).

The five-year review team is requesting your input as part of the five-year review process. Please provide answers to the following questions:

1. What is your overall impression of the remedial actions at Cape Romanzof Sites LF003, SS013, and SS015 (general sentiment)?

   LF003 removal action was unsuccessful and is being reinvestigated. SS013 and SS015 MNA has documented natural attenuation will be long term and should be moved into the final ROD with LTM.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding these sites? If so, please give purpose and results.

   Inspections, MNA, and LTM activities have been ongoing.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

   No

4. Is the remedy functioning as expected? What does the monitoring data show? Are there any trends that show that contaminant levels are decreasing?

   See answer in number 1.

5. Do you feel well informed about the site's activities and progress?

   Yes.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

   See answer number 1.

Name: Keith J. Barnack

Title: Project Manger Date: 28 Nov 2007

INTERVIEW RECORD FOR FIVE-YEAR REVIEW

The United States Air Force (USAF), Alaska Department of Environmental Conservation (ADEC), and the United States Environmental Protection Agency (EPA) are conducting a five-year review of the remedy implemented at Spill Sites SS013 (Diesel Seep Area) and SS015 (UST Spill Area), and Landfill No. 2 (LF003) at the Cape Romanzof Long Range Radar Station (LRRS), Alaska. This review is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, the National Contingency Plan – Title 40 of the Code of Federal Regulations (CFR), Part 300.430 (f) (4) (ii), and Executive Order 12580 (January 23, 1987).

The five-year review team is requesting your input as part of the five-year review process. Please provide answers to the following questions:

1. What is your overall impression of the remedial actions at Cape Romanzof Sites LF003, SS013, and SS015 (general sentiment)?

   The remedial actions at LF003, SS013and SS015 are acceptable.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding these sites? If so, please give purpose and results.

   No.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

   No.

4. Is the remedy functioning as expected? What does the monitoring data show? Are there any trends that show that contaminant levels are decreasing?

   Yes. See Administrative record for monitoring data and trend data.

5. Do you feel well informed about the site's activities and progress?

   Yes.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

   No.

Name: Louis Howard

Title: ADEC Project Manager Date: November 14, 2007

INTERVIEW RECORD FOR FIVE-YEAR REVIEW

The United States Air Force (USAF), Alaska Department of Environmental Conservation (ADEC), and the United States Environmental Protection Agency (EPA) are conducting a five-year review of the remedy implemented at Spill Sites SS013 (Diesel Seep Area) and SS015 (UST Spill Area), and Landfill No. 2 (LF003) at the Cape Romanzof Long Range Radar Station (LRRS), Alaska. This review is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, the National Contingency Plan – Title 40 of the Code of Federal Regulations (CFR), Part 300.430 (f) (4) (ii), and Executive Order 12580 (January 23, 1987).

The five-year review team is requesting your input as part of the five-year review process. Please provide answers to the following questions:

1. What is your overall impression of the remedial actions at Cape Romanzof Sites LF003, SS013, and SS015 (general sentiment)?

   LF003 still has PCB contamination and have observed lots of surface water runoff during spring breakup. SS013 still needs work. No issues with SS015.

2. What effects have site operations had on the surrounding community?

   None.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

   Community is concerned due to PCB warning sign on beach near Fowler Creek. Community residents were taking clams from the beach area.

4. Are you aware of any events, incidents, or activities at the sites such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

   No.

5. Do you feel well informed about the site's activities and progress?

   Yes for the most part, but don't receive reports from all investigation activities.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

   No, have gone a long way towards cleaning up sites.

Name: Don Ackers

Title: ARCTEC Site Operations Manager Date: August 24, 2007

APPENDIX B

Comments to Draft Report

STATE OF ALASKA

SARAH PALIN, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION
DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

555 Cordova Street
Anchorage, AK 99501-2617
Phone: (907) 269-7552
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File: 2526.38.001

March 4, 2008

Mr. Keith Barnack
611 CES/CEVR
10471 20th Street Suite 317
Elmendorf AFB, AK 99506-2200

RE: Draft Five Year Review for LF003, SS013, SS015 at Cape Romanzof LRRS February 13, 2008

Dear Mr. Barnack:

The Alaska Department of Environmental Conservation (ADEC) received the above document for review and comment on February 26, 2008. ADEC has the following comments.

General Comments
Sites with surface water and groundwater contamination at any point in time will need to have all groundwater and surface water monitoring points sampled one year prior to the five year review or in the same year to be included in the five year review. For example, LF003 at well CMW-1 LF03 1996, benzene was detected above 5 ug/L in 1996 sampling event at 17 ug/L. However, it was not sampled in 2007 to be included in the five year review to show that contamination is still below cleanup levels (non-detect for 1997-2006). SS015 Well WW-04 1993 had detections above cleanup levels for either: benzene, total benzene, toluene, ethylbenzene, total xylenes (BTEX), gasoline range organics (GRO), and diesel range organics (DRO) in 1993 and 1997. It was never sampled again after that time and was not sampled in 2007, prior to the five year review, for any constituents which had exceedances of groundwater cleanup levels.

1.3 Review Procedure Page 1-1
The text states the review is limited to only the sites specified that are being remediated under CERCLA authority. ADEC will require periodic reviews to evaluate whether current site conditions and remedial measures are and will continue to be protective of human health and the environment for those sites not remediated under CERCLA authority, i.e. State authority. ADEC considers these periodic reviews required by *18 AAC 75.380. Final reporting requirements and site closure.* "(J) other information requested by the department, as the department determines necessary to ensure protection of human health, safety, or welfare, or of the environment;(Eff. 1/22/99, Register 149) Authority: AS 46.03.020, AS 46.03.745, AS 46.04.070, AS 46.03.050, AS 46.03.755, AS 46.09.010, AS 46.03.710, AS 46.04.020, AS 46.09.020, and AS 46.03.740.

3.7.2 Question B: Are there exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
The text states: "The land use still represents a relatively low level of occupancy and activity, but *no land use controls have been established.* Therefore the potential for completed exposure pathways still exist at the present time." This is in direct conflict with statements at: 2.5 Installation Land Use Control and Remedy Implementation, 3.4.2 Remedy Implementation on Page 3-7 and 3.10 Protectiveness Statement on Page 3-15. If land use controls (LUCs) are not in place, then they will need to be established for the entire acreage covered by LF003 as well as the area where off-site migration of PCB contamination is present downgradient of the site. ADEC requests the text throughout the document be corrected to reflect current (if any) land use controls for LF003.

If not done already, ADEC requests a "restricted use area" be designated for LF003 that allows only for recreational use and construction of unmanned facilities (such as parking lots, storage buildings, taxiways, etc.). The construction of manned facilities (such as office buildings or residential structures) is strictly prohibited. As a former landfill, this designation will remain indefinitely. This language has been used at other Air Force installations where dumps/landfills have a decision document requiring them to have LUCs and five-year reviews (e.g. Operable Unit 6 LF02, LF03, and LF04).

3.10 Protectiveness Statement(s) Page 3-15
ADEC agrees that the remedy is not protective of human health and the environment at LF003. Removal of the PCB contaminated soil and sediment downstream of the landfill site to eliminate exposure and contaminant migration is an action the Air Force can take to restore protectiveness.

3.11 Next Review Page 3-15
The text states if the items discussed are not completed before 2013, five years from the date of this review, the next five-year review will be performed as required. ADEC disagrees. Typically, a statutory review is triggered by the initiation o- the first remedial action that leaves hazardous substances, pollutants or contaminants on site at levels that do not allow for unlimited use and unrestricted exposure. In cases where there are multiple remedial actions, the earliest remedial action that leaves such substances on site (at any source area on Cape Romanzof LRRS not just LF003) should trigger the initial review, *even if it is an interim remedial action.*

The Air Force will conduct a second five-year review at 2013 and additional reviews throughout the life of the site until hazardous substances, pollutants or contaminants no longer remain on site at levels that do not allow for unlimited use and unrestricted exposure[1]. LF003 as a former landfill will never have unlimited use or unrestricted exposure designation.

[1] Unrestricted use/unrestricted exposure (UU/UE) means that there are no restrictions placed on the potential use of land or other natural resources. In general, if the selected remedy relies on restrictions of land, ground water, or surface water use by humans or if any physical or engineered barrier is part of the remedy, then the use has been limited and a Five-Year Review should be conducted.

4.10 Protectiveness Statement(s)
ADEC concurs the remedy at SS013 is expected to be protective of human health and the environment when completed, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

5.10 Protectiveness Statement(s)
ADEC concurs the remedy at SS015 is expected to be protective of human health and the environment when completed, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

If you have any questions regarding this letter, please call me at (907) 269-7552.

Sincerely,

Louis Howard
Environmental Program Specialist
Federal Facilities Restoration Section