Final
Corrective Action Report

Sites 34 and 35/TPA Sites 13a and 13b – Salt Lagoon Diesel Seep
St. Paul Island, Alaska

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ACRONYMS AND ABBREVIATIONS

μg/L	Microgram per liter
18 AAC	Title 18 *Alaska Administrative Code*
ACS	Alaska Communications System, Inc.
ADEC	Alaska Department of Environmental Conservation
bgs	Below ground surface
BSE	Bering Sea Eccotech, Inc.
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
CC	Conditional closure
CAP	Corrective action plan
CESI	Columbia Environmental Sciences, Inc.
cm	Centimeter
COC	Chain of custody
CSM	Conceptual site model
CY	Cubic yard
DRO	Diesel-range organic compounds
EPA	U.S. Environmental Protection Agency
ft	Feet
GAC	Granular activated carbon
GIS	Geographic information system
GPS	Global positioning system
GRO	Gasoline-range organic compounds
IDW	Investigation-derived waste
KRI	Kelly-Ryan, Inc.
LCS	Laboratory control sample
mg/kg	Milligram per kilogram
mL	Milliliter
MLLW	Mean lower low water
MS/MSD	Matrix spike and matrix spike duplicate
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PAH	Polynuclear aromatic hydrocarbon
PCS	Petroleum-contaminated soil
ppm	Parts per million
QAP	Quality assurance plan
QA/QC	Quality assurance and quality control
RPD	Relative percent difference
RRO	Residual-range organic compounds
TDX	Tanadgusix Corporation
Tetra Tech	Tetra Tech EM Inc.
TLC	Thin-layer chromatography
TPA	Two-Party Agreement
TPH	Total Petroleum Hydrocarbon
USACE	U.S. Army Corps of Engineers
UST	Underground storage tank

EXECUTIVE SUMMARY

This corrective action report was prepared for the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). The report details corrective actions conducted at the Salt Lagoon Diesel Seep Site (Sites 34 and 35/Two-Party Agreement [TPA] Sites 13a and 13b) on St. Paul Island, Alaska. Activities associated with this site were conducted during the 2004 field season.

The Salt Lagoon Diesel Seep is situated within and adjacent to the eastern portion of the Salt Lagoon Channel, north of the NOAA administrative complex at Tract 50. Presently, the site is undeveloped and no aboveground structures are present. The site was formerly the location of a seal carcass by-products plant that dates to 1918. When U.S. government management of commercial fur seal harvests ended in the early 1980s, the by-products plant ceased operation. The building was demolished in 1988. During operation, the by-products plant used 55-gallon drums and steel transfer pipelines for storing and transferring diesel fuel to aboveground and underground storage tanks for heating purposes. Historic releases of diesel fuel were reported and petroleum sheen was observed emanating from the east bank of the Salt Lagoon Channel adjacent to the former by-products plant. This sheen constituted a violation of the federal Clean Water Act and State of Alaska surface water quality standards.

NOAA prepared a corrective action plan with a primary objective to eliminate the petroleum sheen emanating from the east bank of the Salt Lagoon Channel and selected Tetra Tech EM Inc. (Tetra Tech) to implement it. To achieve this objective, petroleum-contaminated soil (PCS) at the site was excavated in order to remove the source of the sheen. PCS was removed to elevations that varied from -1 ft MLLW to -4 ft MLLW, with excavation conducted until no petroleum sheen was noted or no further excavation was practicable because of groundwater and sloughing excavation sidewalls. Also, two granular activated carbon (GAC) barriers were installed underground at the Salt Lagoon Diesel Seep Site to provide treatment of petroleum sheen floating atop groundwater flowing through the site toward the Salt Lagoon Channel, should some of the source still remain after removal of the PCS. The installation of the GAC barriers involved the excavation of trenches oriented from north to south across the site and the placement of sand bags containing GAC between elevations of -1 feet (ft) mean lower low water (MLLW) and +5 ft MLLW.

This corrective action included the removal of contaminated sediments and PCS from the east shoreline of the Salt Lagoon Channel as well as the restoration of the shoreline. Before doing this, NOAA obtained permit approval from the U.S. Army Corps of Engineers (USACE) to conduct work in federal waters; specifically, NOAA received authorization from USACE to conduct work under Nationwide Permits 13

(Bank Stabilization) and 38 (Cleanup of Hazardous and Toxic Waste). Contaminated sediments and PCS were removed from the shoreline, which was subsequently restored using a combination of “B” rock, sand, and filter fabric. The top of the shoreline was restored using topsoil, which was seeded, fertilized, and wrapped with erosion control matting.

During the corrective action, NOAA removed approximately 9,234 cubic yards of PCS and sediments from the Salt Lagoon Diesel Seep Site. Because excavation activities involved the removal of sediments with elevated levels of diesel range organics from the Salt Lagoon Channel and PCS from the saturated zone, NOAA constructed a dewatering cell for the temporary stockpiling and drainage of water. When dewatering was complete, PCS was transported to the designated disposal site. Initially, PCS was transported to NOAA’s lined short-term stockpile located at Tract 42. Upon receiving ADEC approval, NOAA directed that PCS be transported to NOAA’s National Weather Service landspreading area, where it was leveled to a maximum thickness of 18 inches ± 0.5 feet and later tilled using a tractor and rotary disc attachment to increase evaporation of the diesel fuel and allow for further natural attenuation.

Because no more oil sheen has been observed, GAC barriers have been installed to provide treatment of petroleum sheen potential floating atop site groundwater, and because PCS has been excavated to the maximum extent practicable, NOAA should request a no further remedial action planned determination from the Alaska Department of Environmental Conservation for the Salt Lagoon Diesel Seep Site.

1.0 INTRODUCTION

The U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) is responsible for site characterization and restoration on St. Paul Island, Alaska. Public Law 104-91 of 1996 and Public Law 106-562 of 2000 provide the mandate for these activities. A Two-Party Agreement (TPA), signed in 1996 by NOAA and the State of Alaska, provides the framework for corrective action on St. Paul Island (NOAA 1996). The State of Alaska provides TPA oversight through the Alaska Department of Environmental Conservation (ADEC). Under the TPA, NOAA is required to comply with State of Alaska regulations that were in effect in 1991 (ADEC 1991); however, with ADEC agreement, NOAA has chosen to follow more current regulations whenever possible.

St. Paul Island is located north of the Aleutian Islands chain in the Bering Sea and approximately 800 miles west-southwest of Anchorage, Alaska (Figure 1-1). The Salt Lagoon Diesel Seep Site is situated within and adjacent to the eastern portion of the Salt Lagoon Channel, north of the NOAA administrative complex at Tract 50 (Figure 1-2). The site was formerly the location of a seal carcass by-products plant that dates back to 1918. NOAA has designated the Salt Lagoon Diesel Seep Site as Site 34/TPA Site 13a (uplands) and Site 35/TPA Site 13b (channel). NOAA arbitrarily divided the site into an uplands portion and a surface water/sediments portion for planning purposes.

Tetra Tech EM Inc. (Tetra Tech) was selected by NOAA to implement the corrective action plan (CAP) prepared by NOAA (2004a). The primary objective of the corrective action was to eliminate the petroleum sheen emanating from the east bank of the Salt Lagoon Channel. Tetra Tech subcontracted Kelly Ryan, Inc. (KRI) and Bering Sea Eccotech, Inc. (BSE) to provide the personnel, equipment, and materials necessary to implement the requirements of the CAP. The subcontractors completed removal activities under the oversight of Tetra Tech and in accordance with the CAP, the TPA, and State of Alaska regulations and guidance.

The overall objectives of this corrective action, as outlined in the CAP (NOAA 2004a), were as follows:

- Elimination of petroleum sheen emanating from the east side of the Salt Lagoon Channel
- Removal, dewatering, and stockpiling of petroleum-contaminated sediments from the Salt Lagoon Channel.
- Removal and temporary staging of clean overburden.
- Removal of petroleum-contaminated soils (PCS) associated with the former seal by-products plant.
- Collection of field screening samples for analysis by thin-layer chromatography (TLC).

- Collection of confirmation samples for fixed laboratory analyses.
- Transportation of contaminated sediments and PCS to the NOAA short-term stockpile location or other approved location.
- Restoration of the uplands area to grade.
- Restoration of the shoreline and channel to a condition consistent with the two Nationwide Permits approved by the U.S. Army Corps of Engineers (USACE) for use by NOAA at this site (USACE 2004).
- Incorporation of site features and sampling locations into a geographic information system (GIS) database.
- Reporting of CAP activities and results to ADEC for approval, consistent with the TPA.

Except as noted in this report, field activities for this corrective action were performed in accordance with the following documents:

- CAP for Site 34/TPA Site 13a and Site 35/TPA Site 13b – Salt Lagoon Diesel Seep (NOAA 2004a)
- Master Quality Assurance Plan (QAP) (NOAA 2003a)
- Master Health and Safety Plan (NOAA 2003b)
- Master Investigation-Derived Waste (IDW) Plan (NOAA 2003c)

2.0 SITE DESCRIPTION

The following subsections provide a description of the site background, site geology, site hydrogeology, and previous investigations for the Salt Lagoon Diesel Seep Site.

2.1 SITE BACKGROUND

The Salt Lagoon Channel is tidally connected to St. Paul Harbor and the Bering Sea. Presently, the site is undeveloped and no aboveground structures are present. The Salt Lagoon Diesel Seep Site was formerly the location of a fur seal carcass rendering and by-products plant that dates back to 1918. The plant was originally constructed for rendering seal oil and subsequently animal feed. In 1977, the Tanadgusix Corporation (TDX), the St. Paul Island Native Village Corporation, reached agreement with NOAA's National Marine Fisheries Service (NMFS) to take control of the plant (USACE 1990). When commercial fur seal harvests ended in the early 1980s, the by-products plant ceased operation, and the building was demolished in 1988 (NOAA 2004a). By 1989, TDX was using the site to store crab pots and fishing-related equipment (USACE 1990).

During its period of operation, the by-products plant relied on 55-gallon drums and steel transfer pipelines to supply diesel fuel to aboveground storage tanks (ASTs) and underground storage tanks (USTs) for heating purposes. Historic releases of diesel fuel from the drums, piping, and ASTs are suspected as the original source of contamination to the uplands portion of the site (Site 34, TPA Site 13a). Purportedly, a 10,000-gallon diesel fuel release from an AST occurred in 1957 as a result of a cracked valve. Purportedly, 2,000 gallons were recovered. In 1983, an asphalt substance was reported leaking from 197 drums stored on their sides within 100 feet (ft) of the Salt Lagoon Channel (IT 2002).

By 1989, petroleum sheen was observed and recorded emanating from the east bank of the Salt Lagoon Channel adjacent to the former by-products plant (Site 35/TPA Site 13b). This sheen constituted a violation of the federal Clean Water Act (U.S. Code 2002) and State of Alaska surface water quality standards (ADEC 2003c). On June 8, 1989, NOAA was issued a Notice of Violation/Request for Corrective Action by ADEC (ADEC 1989). NOAA responded to the *Notice of Violation/Request for Corrective Action* and implemented corrective action in 1994. ADEC issued NOAA a *No Further Action* determination for the Salt Lagoon Diesel Seep on November 2, 1995. Subsequently, ADEC reopened the Salt Lagoon Diesel Seep Site (ADEC 1999) amid concerns expressed by the St. Paul community over the continuation of sheening and its potential threat to human health and welfare.

2.2 SITE GEOLOGY

St. Paul Island was formed as a result of volcanic eruptions of basaltic lavas onto the southern edge of the Bering Sea Shelf. The island has never been glaciated, and many cinder cones with steep slopes and sharp crater rims are present on the island. The island soil is characterized as primarily volcanic deposits consisting of scoria of varying sizes (pebbles to cobbles) and colors (lenses of gray, red, and black) with fractured basalt occurring at depth (Barth 1956).

Soils in the vicinity of the Salt Lagoon Diesel Seep Site generally consist of sand overlying basalt (NOAA 2004a), with sand extending from ground surface into the saturated ("groundwater") zone.

2.3 SITE HYDROGEOLOGY

Groundwater in the vicinity of the Salt Lagoon Diesel Seep is present at approximately 3 ft above mean sea level, and most likely flows to the west toward the Salt Lagoon Channel (Mitretek Systems 2002).

2.4 PREVIOUS INVESTIGATIONS

In September 1989, USACE conducted a site investigation on behalf of NOAA, supported by the contractor Shannon and Wilson, Inc. USACE recorded the site conditions, soils, demolition debris and fill used on site. A subsurface investigation was conducted in two phases. In phase 1, twelve test pits were excavated by backhoe for the collection of soil samples, and in phase 2, six test pits were similarly excavated for the collection of both soil and groundwater samples. Collection of test pit groundwater samples was somewhat hampered by seal oil that congealed on the water surfaces in the excavations. Field screening was conducted *via* TLC for total petroleum hydrocarbons (TPH). The fur seal oil, as well as in some instances, seal blood found in subsurface lenses, inhibited TPH TLC interpretation. Soil TPH concentrations from fixed laboratory results ranged from non-detect to 50,000 milligrams per kilogram (mg/kg). TPH in groundwater ranged from 2,000 milligrams per liter (mg/L) to 70,800 mg/L (USACE 1990).

In 1994, Oil Spill Consultants removed approximately 9,000 cubic yards (CY) of PCS from the vadose (unsaturated) and upper saturated zones of the uplands portion of the Salt Lagoon Diesel Seep Site. In addition, a skimmer and oil-water separator recovered approximately 150 gallons of oil (diesel fuel and potentially animal fat) floating on the groundwater seeping into the excavations. No excavation was conducted along the shoreline of the Salt Lagoon Channel because of concerns regarding potential surface water intrusion. PCS removed during this corrective action was transported to the Blubber Dump (NOAA Site 47), where much of it was treated using the Enhanced Thermal Conduction (ETC) system during the 2000, 2001 and 2002 field seasons (NOAA 2005). The portion that was not treated in the ETC was moved to the NOAA Tract 42 short-term PCS storage pile in 2003 and 2004 (NOAA 2003d, Tetra Tech 2004a). Ultimately, this PCS was either incorporated into the cap of the Tract 42 landfill, or was landspread at the NOAA National Weather Service (NWS) property in 2004 (NOAA 2005). Excavations at the Salt Lagoon Diesel Seep Site were backfilled using clean fill material and pieces of concrete remaining from the demolition of the former by-products plant (Oil Spill Consultants 1995).

In 1999, Tetra Tech conducted a preliminary site investigation that documented the presence of significant concentrations of diesel-range organic compounds (DRO) remaining in soil at depths of at least 5 ft below ground surface (bgs). The vertical and horizontal extent of contamination was not determined during this investigation, nor was the nature and extent of groundwater contamination (Tetra Tech 2000).

In 1999, Columbia Environmental Sciences, Inc. (CESI) conducted a historical review of the operational history of the former by-products plant. The review indicated several features of interest, including fuel transfer piping, USTs, ASTs, and a saltwater well that may have been installed for a facility that was never completed (CESI 2001).

In 2000, CESI conducted a site characterization of the Salt Lagoon Diesel Seep. NOAA found much of the data generated from colorimetric field screening analyses of suspect quality and potentially unreliable (NOAA 2004a). The draft report was not submitted to ADEC (CESI 2001; NOAA 2004a). CESI also installed five groundwater monitoring wells (MW) at the Diesel Seep Site (Figure 3-1). In well MWDS-2* they found DRO contamination at 9,000 micrograms per liter (μg/L). In the other four wells, DRO varied from 82 to 400 μg/L. The only other analyte detected was GRO in MWDS-2* at 190 μg/L. No other analytes were detected in groundwater (CESI 2001).

In 2001, IT Alaska, Inc. (IT) conducted a comprehensive site characterization, which included the collection of soil, sediment, surface water and groundwater samples. Analytical data indicated the presence of DRO in soil at concentrations above the ADEC Method Two cleanup level of 250 mg/kg. ADEC has no regulatory criteria for sediment contamination. Regardless, the DRO concentrations in sediments reached 470 mg/kg. Analytical data for groundwater samples indicated the presence of DRO at a concentration of 2,500 µg/L in monitoring well MWDS-2*, exceeding the ADEC Table C cleanup level; no other groundwater samples contained analytes at concentrations above the cleanup levels. Surface water samples did not contain any contaminants at concentrations above the laboratory detection limits (IT 2002).

In 2002, NOAA collected sediment samples from the Salt Lagoon Channel to supplement the site characterization work conducted by CESI and IT. Analytical data indicated DRO concentrations up to 80 mg/kg (NOAA 2002b).

In April and July 2004, Tetra Tech collected groundwater samples from the five Salt Lagoon Diesel Seep Site monitoring wells. Analytical data for groundwater samples indicated the presence of DRO at a maximum concentration of 2,900 µg/L in monitoring well MWDS-2*, exceeding the ADEC Table C cleanup level; no other groundwater samples contained analytes at concentrations above the cleanup levels (Tetra Tech 2005).

In 2004, KRI, USACE's prime contractor for the St. Paul Harbor Improvement Project, Phase II, collected sediment samples from the Salt Lagoon Channel and Salt Lagoon in preparation for dredging and removal actions (KRI 2004a). KRI used sample results to determine background levels and suitability of dredge materials as clean fill. KRI collected samples at 276 locations along the entire length of the Salt Lagoon Channel and into the Salt Lagoon (Figure 2-1; KRI 2004b). They analyzed the samples for gasoline-range organic compounds (GRO), DRO, residual range-organic compounds (RRO), benzene, toluene, ethylbenzene and total xylene (BTEX), and grain size. KRI determined that no sample exceeded its ADEC Method Two soil cleanup level (KRI 2005); there is no cleanup level for grain size as it is a physical parameter.

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*Note: Three consulting firms investigated groundwater at the Salt Lagoon Diesel Seep Site since the installation of five monitoring wells in 2000: Columbia Environmental Sciences, Inc. (CESI 2001), IT Alaska, Inc. (IT 2002), and Tetra Tech EM, Inc. (Tetra Tech 2005). IT's and Tetra Tech's investigation reports conflict with the CESI report regarding well identifications. IT's analytical results also seemingly conflict with results from the CESI and Tetra Tech investigations for two wells. In addition, two wells were removed and then replaced by NOAA during the 2004 site excavation. The table and discussion on the following pages summarizes the history of groundwater monitoring at the Diesel Seep Site, and proposes explanations for noted report discrepancies.

*Note (cont'd…): CESI installed five monitoring wells at the Diesel Seep Site in 2000. Figure 5 in the CESI report identified the generic "Well 1" in the table above as "MWDS-1" and "Well 2" as "MWDS-2". As indicated in the above table, Figure 3 in the IT report reversed the identification of these wells. All reports generated subsequent to the IT report used IT's identification, *i.e.*, "Well 1" became "MWDS-2", and "Well 2" became "MWDS-1".

A possible discrepancy also exists with the assignment of IT's DRO analytical results between "Well 1" and "Well 3". The IT "Well 1" result of 320 µg/L differs significantly from the CESI and Tetra Tech DRO results that were above the ADEC cleanup criterion of 1,500 µg /L. Similarly, the IT "Well 3" DRO result of 2,500 µg/L differs significantly from CESI's and Tetra Tech's DRO results that were well below cleanup levels. As indicated by the table above, if IT's DRO "Well 1" and "Well 3" results were reversed, then they would closely match the corresponding levels found at those wells by CESI and Tetra Tech. IT's report does not provide clues that the wells were misidentified during sampling, or sample labels/results were inadvertently switched in the field or the lab. However, DRO results shown in the above table suggest that IT inadvertently misidentified the two wells.

*Note (cont'd…):

Salt Lagoon Diesel Seep	Well 1	Well 2	Well 3	Well 4	Well 5
CESI 2000					
Report's Well ID	***MWDS-1***	***MWDS-2***	***MWDS-3***	***MWDS-4***	***MWDS-5***
GRO (µg/L)	190	ND	ND	ND	ND
DRO (µg/L)	**9,000**	83	400	130	150
IT 2001					
Report's Well ID	***MWDS-2***	***MWDS-1***	***MWDS-3***	***MWDS-4***	***MWDS-5***
GRO (µg/L)	ND	ND	ND	ND	ND
DRO (µg/L)	320	ND	**2,500**	130	ND
TETRA TECH APRIL 2004					
Report's Well ID	***MWDS-2***	***MWDS-1***	***MWDS-3***	***MWDS-4***	***MWDS-5***
GRO (µg/L)	85	ND	ND	ND	ND
DRO (µg/L)	**2,900**	ND	370	110	75
TETRA TECH JULY 2004					
Report's Well ID	***MWDS-2***	***MWDS-1***	***MWDS-3***	***MWDS-4***	***MWDS-5***
GRO (µg/L)	76	ND	ND	ND	ND
DRO (µg/L)	**2,700**	ND	240	100	ND

Bold Result– Above ADEC Table C criterion.

ND **–** Not detected above Practical Quantitation Limit.

3.0 REMOVAL OBJECTIVES

The primary objective of this corrective action was to eliminate the petroleum sheen and mitigate risk to potential receptors in accordance with federal Clean Water Act (U.S. Code 2002) and State of Alaska surface water quality standards (ADEC 2003c). To this end, NOAA evaluated available alternatives (Mitretek Systems 2003). The selected alternative included removal of PCS from the upland portion of the Salt Lagoon Diesel Seep Site, installation of barriers containing granular activated carbon (GAC) to treat potentially contaminated groundwater flowing through the site to remove any groundwater sheen migrating subsurface toward the Salt Lagoon Channel, and the removal of shoreline sediments containing detectable levels of petroleum product constituents. .

Removal of PCS from the Salt Lagoon Diesel Seep Site uplands was conducted in support of the primary objective to eliminate the petroleum sheen emanating from the east bank of the Salt Lagoon Channel. As a result, the use of performance objectives was applied for the removal of PCS and sediments. Performance objectives for this corrective action were selected in accordance with the TPA and are summarized in the following paragraphs.

NOAA recognizes that the State of Alaska does not have specified sediment quality standards or cleanup levels. In lieu of a sediment cleanup level, NOAA used a performance objective of removing sediments from locations found to have detectable levels of DRO in sediment during previous investigations. Methods for establishing soil cleanup levels for the Pribilof Islands Environmental Restoration Project are described in the TPA (NOAA 1996). However, the objective of this corrective action was the elimination of the visible sheen, which will mitigate potential risk to receptors as described in Section 8. As a result, NOAA used a performance objective of removing soil, to the extent practicable, from upland Areas 2, 3A, 3B, 3C, and 3D (Figure 3-1) found to have concentrations of DRO greater than ADEC Method Two cleanup levels. Additional removal from other upland areas (*i.e.*, Area 4) was not feasible based on the presence of buried demolition debris, and input by ADEC (see Section 4 for additional information).

Potential contaminants of concern at the Salt Lagoon Diesel Seep Site were limited to: BTEX, GRO, DRO, RRO, and select polynuclear aromatic hydrocarbons (PAH). Although not identified as a contaminant of concern in the CAP for this site, lead is included because some clean backfill characterization samples were analyzed for lead. Characterization for lead allowed NOAA to use the dredge materials as clean fill at all potential 2004 corrective action sites, as KRI had not analyzed their Salt Lagoon Channel and Salt Lagoon sediment samples for lead. Based on past characterization results and historic information for the Salt Lagoon Diesel Seep Site, lead was not evaluated for removed sediments or uplands PCS. Table 3-1 provides a summary of the uplands soil performance objective concentrations and clean backfill evaluation parameters.

Because this corrective action involved the placement of fill into federal waters, NOAA requested and received a permit from USACE. Specifically, NOAA received authorization from USACE to conduct work under Nationwide Permits 13 (Bank Stabilization) and 38 (Cleanup of Hazardous and Toxic Waste) (USACE 2004). In addition, NOAA's corrective action activities at the Salt Lagoon Diesel Seep Site were coordinated closely with the ongoing work conducted by KRI for the USACE harbor improvement project (USACE 2003), particularly in regards to the installation of a plug at the south end of the Salt Lagoon Channel. USACE used the plug to lower water levels in the channel and facilitate dredging the channel as required under the harbor improvement project. The lowering of the water levels and elimination of currents also facilitated NOAA's excavation and restoration activities at the Salt Lagoon Diesel Seep Site.

The channel plug, along with several containment booms installed upstream of the channel plug by the USACE and NOAA contractors, also served as protective barrier for St. Paul Harbor and the Salt Lagoon. These barriers functioned to confine and block any petroleum or sediment plumes from sweeping down the channel to the St. Paul Harbor, and during high flood tides from sweeping into the Salt Lagoon. Further, the plug prevented inquisitive fur seals from entering the Salt Lagoon Channel during both site remedial and dredging activities. The plug served to eliminate potential petroleum exposure to the marine mammals, and was a permit condition approved and supported by NMFS (NOAA 2004d).

4.0 FIELD ACTIVITIES

The following subsections summarize the equipment used and the activities performed during this corrective action. Appendix A provides photographic documentation of the corrective action. Appendix B provides copies of the daily reports as well as logbook notes generated during the corrective action.

4.1 CONTRACTORS AND EQUIPMENT

Tetra Tech provided overall site management and engineering services including the direction of excavation activities and the collection of TLC screening and confirmation samples during implementation of the CAP. Tetra Tech subcontracted KRI and BSE to provide the personnel and equipment, including excavators and dump trucks, necessary to implement the CAP requirements. NOAA also furnished several pieces of government-owned equipment for use during the corrective action. Health and safety meetings were conducted before the commencement of each day’s activities. NOAA provided survey support using real-time kinematic global positioning system (GPS) techniques and equipment. Laboratory analytical services were subcontracted to Friedman & Bruya, Inc. (Seattle, Washington) and North Creek Analytical, Inc. (Bothell, Washington).

Equipment used on site during field activities included the following:

- Hitachi EX800 Excavator (KRI)
- Hitachi EX700 Excavator (KRI)
- Hitachi EX350 Excavator (KRI)
- Hitachi EX300 Excavator (KRI)
- Komatsu PC200 Excavator (KRI)
- Bell B25B 15-CY Dump Trucks (3) (KRI)
- Caterpillar 773 30-CY Dump Trucks (3) (KRI)
- International 12-CY Dump Truck (BSE)
- Kenworth 12-CY Dump Truck (BSE)
- Kenworth 14-CY Dump Truck (NOAA)
- Caterpillar D5 Bulldozer (NOAA)
- Caterpillar 980C Loader (KRI)
- Gradall Forklift (KRI)
- Elastec Pneumatic Oil Skimmer System (NOAA)
- Dewalt Air Compressor (NOAA)

- 2-Inch Diaphragm Pump (NOAA)
- Submersible Pump (NOAA)
- 55-Gallon Liquid Phase Adsorption Unit (NOAA)
- Laser Level and Receiver (KRI)
- Trimble GPS Total Station® 5700 (NOAA)

4.2 DEWATERING CELL CONSTRUCTION

Because proposed excavation activities included the removal of potentially contaminated sediments from the Salt Lagoon Channel and PCS from the saturated zone, this project required the construction of a dewatering cell. The dewatering cell was designed and sited based on the following considerations.

- Proximity to the proposed areas of excavation to minimize transport times and allow for the discharge of treated water to the open excavations at the site.
- Interference with other activities in the vicinity, including KRI's active work for the USACE harbor improvement project that included the construction of a separate dewatering cell on Tract 50 for saturated sediments removed from the Salt Lagoon Channel.
- Presence of groundwater monitoring wells in the vicinity.
- Extent of contamination at the Salt Lagoon Diesel Seep Site, including the potential expansion of proposed areas of excavation.

Ultimately, NOAA and Tetra Tech representatives determined that the NOAA dewatering cell would be best situated in a location south of the proposed areas of excavation and north of Tract 50 (Figure 3-1). Construction of the NOAA dewatering cell involved the construction of berms up to three ft high along three sides of the cell leaving the east side open for heavy equipment access, and the placement of an impervious 10-mil thickness plastic liner that lined the bottom and berms. Dewatering cell construction required a bottom slope of approximately 3.6 percent to provide proper drainage of saturated soils. The interior of the dewatering cell measured approximately 108 ft by 48 ft, and provided for the storage of up to 90,000 gallons of water while maintaining 1 ft of freeboard with no soil or sediment present.

After construction, an approximately 1-ft thick layer of clean fill material was placed over the eastern portion of the NOAA dewatering cell to provide a driving surface for dump trucks and equipment while protecting the integrity of the liner. The western portion of the NOAA dewatering cell, separated by a row of sand bags functioning as a weir, was left open for the accumulation of water.

Dewatering cell construction began on June 23, 2004 and finished on June 25, 2004.

4.3 WATER TREATMENT SYSTEM

In accordance with the CAP (NOAA 2004a), measures were taken during this corrective action to ensure that water accumulating in the dewatering cell met the requirement for no visible sheen prior to discharge. No water was discharged to the Salt Lagoon Channel. Instead, routine monitoring and a water treatment system were used to regulate the discharge of water from the NOAA dewatering cell to the open excavations in the upland portion of the Salt Lagoon Diesel Seep Site.

Prior to the start of excavation activities, a water treatment system was designed to separate free-phase product (diesel fuel) and animal fats from water if encountered during the excavation. Equipment included the following:

- Oil-Water Separator
- Elastec Pneumatic Oil Skimmer System
- 55-gallon Liquid Phase Adsorption Unit (GAC Drum)
- Submersible Pump and Hoses
- 2-Inch Diaphragm Pump and Hoses
- 55-gallon recovery drum

Several variations of the water treatment system were utilized during the corrective action. Generally, the pneumatic oil skimmer system was used to remove petroleum sheen from the water surface either in the NOAA dewatering cell or on groundwater in open excavations by placing it on the surface of the contaminated water and pumping the skimmed liquids to a 55-gallon recovery drum. The system was originally designed so that a small submersible pump could transfer water with free phase petroleum contamination from the NOAA dewatering cell to the oil-water separator on top of the berm at the northwest corner of the dewatering cell (Figure 4-1). Petroleum sheen and foam were periodically skimmed from the oil-water separator or open excavation and transferred to the recovery drum. However, the oil water separator was rarely used because the water that accumulated in the dewatering cell never contained enough petroleum to require its use, so the transfer to the recovery drum was discontinued. Water that passed through the oil-water separator flowed by gravity to the top of the GAC drum staged at the bottom of the berm. After flowing through the GAC drum, treated water was subsequently discharged to open excavations at the site. In accordance with the CAP, visual observations were made at least once per hour when water was being discharged from the water treatment system; no sheen was detected in treated water discharging to open excavations. The contents of the recovery drum were placed with PCS in the NOAA dewatering area for disposal purposes.

During water treatment system operations, Tetra Tech encountered problems with the pneumatic oil skimmer system. Occasionally, suction was lost on the unit because of obstructions including grass stems and pebbles. In addition, excessive moisture sometimes caused the equipment's lubricating oil to emulsify. As a result, the system required periodic maintenance , including installation of a heavy-duty moisture filter, to enable the system to operate more reliably.

Based on observations, the water treatment system was periodically modified to increase the volume of water being pumped from the dewatering cell. Because the oil-water separator was originally designed to remove free-phase product and because no free-phase product was identified in either the dewatering cell or open excavations at the site, NOAA and Tetra Tech representatives determined that the oil-water separator would be by-passed unless site conditions changed. As a result, water from the dewatering cell containing visible petroleum sheen was subsequently pumped directly to the GAC drum using the submersible pump. Occasionally, flow rates through the water treatment system decreased due to settling or compaction within the GAC drum. In these instances, the flow was reversed through the GAC drum to backwash and "fluff" the GAC inside the drum and improve the flow. To accomplish this, water from the dewatering cell was simply pumped into the outlet at the bottom of the drum and allowed to exit the inlet at the top of the drum where it was then discharged back to the dewatering cell. In this manner, maximum flow rates through the GAC drum were maintained at approximately 6 gallons per minute.

In addition, Tetra Tech encountered several instances where no sheen was present in the dewatering cell. As a result, dewatering cell water was periodically pumped directly back to open excavations at the site using a 2-inch diaphragm pump.

4.4 EXCAVATION ACTIVITIES

4.4.1 General

The CAP divided the excavation activities among the following areas:

- Area 1, located within the east side of the Salt Lagoon Channel
- Area 2, located along the east shoreline of the Salt Lagoon Channel
- Areas 3A, 3B, 3C, 3D and 4, located in the uplands portion of the site (Figure 3-1).

Prior to excavation activities, a NOAA representative staked each area using the Trimble GPS Total Station® 5700.

Before initiating excavation activities, NOAA met with representatives of the City of St. Paul, TDX and the Alaska Communications Systems (ACS). The City of St. Paul assisted with the identification and location of known utilities in the vicinity of the site, as well as removal of municipal water piping and debris from the site. At various stages of the project, TDX assisted with removal of crab pots, fishing gear and debris atop the site. ACS assisted in identifying known communications utilities within the project area and vicinity. NOAA also met with representatives from the Tribal Government of the Aleut Community of St. Paul Island on June 16, 2004, prior to site excavation. This meeting was to arrange for the transfer of stainless steel hooks, steel pulleys and steel cable segments discovered during site clearance, and formerly used to hang fur seal carcasses on the "Turkey Trot Line" of the demolished Fur Seal By-Products Plant.

NOAA selected initial areas of excavation based on contamination identified during previous investigations, while the extent of excavation was determined based on TLC screening sample analyses as well as visual and olfactory observations (Figure 4-2). Tetra Tech removed PCS from the Salt Lagoon Diesel Seep Site in accordance with the objectives discussed in Section 3.0 of this report, as well as, those identified in the CAP. Excavation in each designated area generally involved the following activities:

- Removal of clean overburden from the upland area and staging it in the backfill staging area to the east of the Salt Lagoon Diesel Seep Site for future use as backfill.
- Removal and transportation of "dry" PCS from the upland area of the unsaturated zone to the designated disposal site.
- Removal and relocation of PCS from the saturated zone of the upland area and sediments from the channel to the NOAA dewatering cell. PCS from the saturated zone in the upland area was removed until no petroleum sheen was observed or to the maximum extent practicable. Channel sediments were removed from Areas 1 and 2 until no petroleum sheen was observed or to the maximum depth practicable.
- Verification of dewatered PCS and sediments in the NOAA dewatering cell using the U.S. Environmental Protection Agency (EPA) Method SW-846 9095A (EPA 1996) paint filter liquids test prior to transportation to the designated disposal site.
- Transportation of PCS and sediments from the NOAA dewatering cell to the designated disposal site.
- Backfilling of excavations in the upland areas.
- Reconstruction of the shoreline and channel bottom in Areas 1 and 2.

During the 2004 field season, Tetra Tech removed approximately 9,234 CY of PCS and sediments from the Salt Lagoon Diesel Seep Site. Of this total, NOAA transported 2,034 CY of PCS to the lined stockpile located at Tract 42 and 7,200 CY of PCS to the NWS landspreading area. All volumes were estimated using dump truck bed and frontend loader bucket volumes and load counts.

To achieve the primary objective of eliminating the petroleum sheen, excavation at the Salt Lagoon Diesel Seep Site proceeded in the following order: Area 3B; Area 3C; Areas 1 and 2; Area 3A; and Area 3D. Additionally, two test pits were excavated in Area 4. Excavation activities were completed between June 25 and October 15, 2004. The following sections provide a chronological, area-specific summary of excavation activities.

4.4.2 Area 3B

Tetra Tech conducted excavation activities at Area 3B in two phases: 1) June 25 to June 30, 2004, and 2) August 9 to August 17, 2004

1. June 25 to June 30. Tetra Tech/KRI removed clean overburden from the western portion of Area 3B and staged it at the backfill staging area for future use. Subsequently, Tetra Tech/KRI excavated PCS from the vadose zone and transported it to the lined stockpile located at Tract 42. PCS from within the saturated zone was removed to an elevation of -1 ft mean lower low water (MLLW) and placed in the NOAA dewatering cell. Upon passing the paint filter liquids test (EPA 1996), PCS from the NOAA dewatering cell was transported to Tract 42.

Because of high tides associated with an upcoming full moon event and concerns regarding the potential breaching of the narrowed strip of land between the Salt Lagoon Channel and the northwest corner of the excavation, NOAA decided to backfill the northwest corner of the excavation on June 30, 2004. NOAA subsequently postponed operations at the Salt Lagoon Diesel Seep until the high tide event passed and KRI installed a working channel plug and dewatered the Salt Lagoon Channel for the USACE/KRI work.

2. August 9 to August 17. Excavation activities resumed at Area 3B. Initially, backfill was placed in the open excavation on the west side of Area 3B, leaving a small portion open at the southwest corner to allow discharge from the water treatment system. Subsequently, KRI removed remaining clean overburden from the eastern portion of Area 3B and resumed PCS removal activities. Depths of excavation varied from -1 ft MLLW to -4 ft MLLW. This portion of Area 3B was partially backfilled between August 23 and August 25 to facilitate installation of the first GAC barrier.

During excavation activities in Area 3B, Tetra Tech collected 16 confirmation samples, including 14 samples from the bottom of the excavation and two samples from the excavation sidewalls. Figure 4-2 illustrates the sampling locations. In addition, three characterization samples were collected from clean overburden removed from Area 3B.

4.4.3 Area 3C

Tetra Tech conducted excavation activities at Area 3C in three phases: 1) August 20 to August 21, 2004; 2) September 14 to September 21, 2004; and 3) October 6 to October 9, 2004.

1. August 20 to August 21. KRI excavated several test pits across Area 3C to determine the presence of petroleum sheen on groundwater. Subsequently, KRI used clean fill material to construct a dike in the open excavation along the east side of Area 3C to minimize the flow of potentially contaminated groundwater into previously excavated areas. Absorbent boom placed in the open excavation prevented petroleum sheen and foam migration generated during excavation activities. The excavation was advanced to approximately -3 ft MLLW. KRI encountered apparent high levels of contamination in soil at the bottom of the vadose zone in the northwest portion of Area 3C, and Tetra Tech observed a thin layer of apparent diesel or seal oil free-phase product floating atop groundwater in the excavation. Based on input from NOAA, Tetra Tech directed KRI to stabilize the Area 3C excavation side slopes using clean backfill and to postpone further excavation of Area 3C until the completion of other activities, including installation of the first GAC barrier, and removal of contaminated soil and sediment in Areas 1 and 2.

2. September 14 to 21. During this time, KRI removed PCS from Area 3C in discrete sections to minimize the lateral migration of PCS from surrounding areas caused by sloughing side walls; that is, KRI excavated and backfilled a small section prior to excavating the next section. KRI excavated adjacent sections in an overlapping manner to ensure maximum removal of PCS. They removed PCS from each section to a depth of -3 ft MLLW and transported it to the NOAA dewatering cell. Greater excavation depths into the water table were not possible with the existing equipment because the surrounding sandy soil liquefied and flowed into the center of the excavation. Eventually the pit became so wide that the excavator had to move back, inhibiting the continued removal of soil. On September 21, NOAA shifted the focus of operations to Area 3D and the installation of a second GAC barrier.

3. October 6 to October 9. Tetra Tech/KRI resumed PCS removal activities at Area 3C. They moved clean overburden from the eastern portion of Area 3C to backfill staging area. KRI excavated PCS to a depth of -3 ft MLLW, again using discrete sections to minimize the potential for lateral migration of PCS from surrounding areas caused by sloughing side walls.

Tetra Tech collected 20 confirmation samples from Area 3C, including 12 samples from the bottom of the excavation and 8 samples from the excavation sidewalls. Figure 4-2 illustrates the sampling locations. In addition, they collected 4 characterization samples from clean overburden removed from Area 3C.

4.4.4 Areas 1 and 2

Tetra Tech conducted excavation and restoration activities at Areas 1 and 2 in two phases: 1) August 28 to September 13, 2004 and 2) October 4 to October 13, 2004. Excavation of PCS was initiated at the north end of the shoreline and progressed to the south over a distance of approximately 250 ft. Because of limitations associated with the reach of the excavator, activities in Areas 1 and 2 were conducted in discrete sections along the length of the shoreline; that is, sediments and PCS were removed from discrete sections of the shoreline and each section was restored prior to beginning the next section. Restoration activities were conducted in a manner to follow the contour of the original shoreline.

1. August 28 and September 13. Tetra Tech/KRI removed sediments from each section of the Salt Lagoon Channel in Area 1 to a minimum depth of -1 ft MLLW and extending up to 15 ft out into the channel. Tetra Tech collected confirmation samples and then backfilled the section with "B" rock. Removal resumed at Area 2 to a minimum depth of -1 ft MLLW. After taking confirmation samples, Tetra Tech partially backfilled each section of Area 2 with a mixture of base rock and sand up to an elevation at least 1 ft above the adjacent surface water in the Salt Lagoon Channel. They maintained a side slope along the channel no steeper than 2 to 1 (horizontal to vertical). Subsequently, a 15 ft wide section of filter fabric was cut to the length of completed "B" rock backfill and anchored to the top of the side slope, extending down the bank into the water. Next a 2.5-ft thick layer of erosion rounded "B" rock was placed over the filter fabric to create a embankment shoulder and to meet the "B" rock placed previously in Area 1; the bank slope remained no steeper than 2 to 1. An estimated 950 CY of rock completed shoreline reconstruction in Areas 1 and 2. NOAA delayed final revegetation of Area 2 until completion of PCS removal activities in other areas of the site.

Throughout excavation and restoration activities in Areas 1 and 2, Tetra Tech/KRI maintained containment boom along the 250 ft length of the shoreline. In addition, they used absorbent booms to partition restored sections from remaining sections to minimize potential re-contamination of restored areas.

On September 13, KRI removed the plug at the south end of the Salt Lagoon Channel in accordance with their contract with USACE. As a result, the current through the channel increased significantly causing a release of petroleum sheen contained behind the containment boom. NOAA and TTEMI personnel applied sorbant material inside the boom and used shovels to removed the sorbed sheen.

2. October 4 to October 13. Tetra Tech/KRI conducted final restoration activities in Area 2. These activities involved the placement of soil and the anchoring of erosion control matting along the previously

established rock shoulder. The contractors used topsoil to secure the erosion control matting along the length of the rock shoulder. Once secure, the contractors applied seed and fertilizer to the shoulder topsoil. The erosion control matting was then wrapped over the topsoil and anchored on the east side of Area 2 using scoria. A cross section of the reconstructed shoreline is shown in Figure 4-3.

On October 13, additional backfill, including soil and rock, was placed at the north end of Area 2 because a recent storm had eroded some of the topsoil and matting from this area.

Tetra Tech collected 7 confirmation samples from Areas 1 and 2, including 6 samples from the bottom of the excavation and 1 sample from the excavation sidewall. Figure 4-2 illustrates the sampling locations.

4.4.5 Area 3A

Tetra Tech conducted excavation activities at Area 3A between September 4 and September 6, 2004, in conjunction with ongoing activities at Areas 1 and 2. PCS from Area 3A was removed to a minimum depth of -1 ft MLLW and the area was backfilled to original grade.

Tetra Tech collected one confirmation sample from the excavation sidewall in Area 3A. Figure 4-2 illustrates the sampling location.

4.4.6 Area 3D

Tetra Tech conducted excavation activities in Area 3D from September 21 to September 27, 2004. Because Area 3D was partly located in a heavily vegetated area, excavation was conducted by extending the excavator arm into the area rather than tracking equipment to minimize damage.

Initially, the clean vegetative overburden was removed from Area 3D and staged for Area 3D site restoration. KRI conducted PCS removal from Area 3D in discrete sections to minimize the potential for lateral migration of PCS from surrounding areas because of sloughing sidewalls. Each section was excavated in an overlapping manner to ensure maximum removal of PCS. Excavation activities included the removal of PCS to an elevation of -2 ft MLLW. KRI transported PCS to the NOAA dewatering cell. Upon completion of backfill activities at Area 3D, KRI restored the site with vegetated soils.

Tetra Tech collected 12 confirmation samples from Area 3D, including 8 samples from the excavation bottom and 4 samples from the excavation sidewalls. Figure 4-2 illustrates the sampling locations. In addition, 3 characterization samples were collected from clean overburden removed from Area 3D.

4.4.7 Area 4

On October 8, 2004, KRI excavated two test pits in Area 4 to investigate potential contamination. The test pits revealed a concrete slab at approximately 2 ft bgs at the west end of Area 4, and 2-inch metal piping at approximately 3 ft bgs at the east end of Area 4. Based on the presence of this demolition debris, NOAA ceased further excavation in Area 4

4.5 INSTALLATION OF GRANULAR ACTIVATED CARBON BARRIERS

NOAA installed two GAC barriers to provide additional protection against the migration of petroleum sheen and residual dissolved petroleum hydrocarbons from the groundwater to the Salt Lagoon Channel. The surface of the water table occurs at a depth of approximately +3 ft MLLW at this site. Tetra Tech placed GAC bags inside each trench box extending from an elevation of -1 ft MLLW to +5 ft MLLW to intercept groundwater flowing at these depths. The GAC filled trenches provide a permeable groundwater barrier that should passively adsorb sheen causing contaminated groundwater flowing through the site toward the Salt Lagoon Channel.

Barrier installation involved the use of two trench boxes constructed by KRI. The boxes measured 8 ft long by 8 ft high by 2.5 ft wide. The trench boxes provided shoring to keep the excavation walls from collapsing and filling in the trench. Installation of each GAC barrier was advanced by using the trench boxes in a “leap frog” fashion as each box was filled with GAC bags, the second box was placed in position and the first box was then withdrawn and placed in position behind the second box. The soil removed from the trenches prior to GAC placement was deemed PCS and transported to the NOAA dewatering cell. KRI placed clean fill material along the outside of the trench box, and then stacked GAC bags inside the trench box using an overlapping pattern to minimize potential gaps and maximize contact with groundwater passing through the barrier. Once the inside of the trench box was filled with GAC bags to the desired elevation, the trench box was carefully withdrawn, allowing the GAC bags to remain in place. NOAA surveyed the top layer of GAC sandbags both to map the trenchline and to ensure the required depth of GAC coverage. KRI then backfilled the trench to final grade with clean fill.

NOAA procured approximately 100,000 pounds (lbs) of GAC for the project. Workers placed the GAC in burlap sand bags, about half of which were stacked in the two trenches, as described below. The remaining half of the GAC filled sandbags was stored on island and are available for future use. GAC barrier installation was conducted in two phases: 1) August 26 to August 28, 2004 and 2) September 28 to September 30, 2004. Figure 4-2 illustrates the locations of the GAC barriers.

1. August 26 to August 28. Tetra Tech and KRI installed the first GAC barrier near the west edge of Area 3B (Figure 4-2). NOAA modified its original trench installation design for the first GAC barrier along the boundary between Areas 3A and 3B because it would impair PCS removal actions in Areas 1, 2, and 3A. As a result, the first GAC barrier location is approximately 10 ft east of the west edge of Area 3B. . The GAC barrier extends approximately 120 ft from north to south across Area 3B.

2. September 28 to September 30. Tetra Tech/KRI installed a second GAC barrier approximately 90 ft east of the first barrier. The second GAC barrier extends approximately 150 ft from north to south through Area 3C and along the west edge of Area 3D (Figure 4-2).

After completion of the first GAC barrier, occasional spots of sheen continued to emanate from the nearshore Salt Lagoon Channel sediments. NOAA interpreted this sheen as deriving from soil particles with sorbed petroleum released during excavation. Prior to completion of the second GAC barrier, sheen was only occasionally seen and after September 27, 2004 sheen was no longer visible during the daily shoreline inspections.

4.6 DEWATERING CELL REMOVAL

Tetra Tech/KRI removed the NOAA dewatering cell between October 11 and October 13, 2004 following completion of excavation activities. Tetra Tech staged the decontaminated equipment associated with the water treatment system at the NOAA administrative complex on Tract 50. The dewatering cell's plastic liner was removed and placed in a conex box, which was shipped off-island and disposed in Washington State in March 2005.

Tetra Tech/KRI scraped residual contamination from the area beneath the former liner, as well as, from the work areas around the dewatering cell, hauling it to the NWS landspreading area. The contractors reapplied clean fill material from the dewatering cell berms during final site restoration activities.

Tetra Tech collected three confirmation samples from soils located under the liner footprint. Tetra Tech also collected one sample south of the dewatering cell, from a location along the temporary haul route used by KRI's dump trucks to haul soil and sediment removed from Areas 1 and 2 for dewatering and disposal. This sample's purpose was to confirm hauling activities did not cause cross contamination of the haul route by the dump truck tires or material potentially falling from the trucks' chasses or beds. The CAP did not specify the collection of any samples from the dewatering cell area or haul route after completion of corrective action activities at Areas 1, 2, 3A, 3B, 3C, 3D, and 4 (NOAA 2004a). NOAA and Tetra Tech selected the number of samples based on NOAA's desire to collect a set of representative samples to identify any cross contamination, even though these samples were not required by ADEC.

4.7 CONTAMINATED SOIL AND SEDIMENTS STOCKPILING

During the 2004 field season, NOAA removed approximately 9,234 CY of PCS and sediments from the Salt Lagoon Diesel Seep Site. Of this total, NOAA transported 2,034 CY of PCS to the lined stockpile located at Tract 42. NOAA located the remaining 7,200 CY of PCS at the NWS landspreading area. A bulldozer leveled the PCS to a maximum thickness of 18 inches ± 0.5 feet and a tractor periodically tilled the PCS with rotary disc attachment to enhance volatilization (NOAA 2004c).

4.8 BACKFILLING AND SITE RESTORATION

During this corrective action, excavations at the Salt Lagoon Diesel Seep Site were backfilled when at least one of the following parameters was met:

- No petroleum sheen on groundwater in the excavation.
- TLC screening sample analyses indicated contaminant concentrations below ADEC Method Two cleanup levels, and the collection of fixed laboratory confirmation samples.
- Excavation proceeded below the water table to the maximum extent practicable.

Backfill operations involved transporting clean fill material to the site, dumping the material into the excavation, and compacting the fill material with the excavator bucket or by track-walking the excavator over the area.

KRI backfilled the excavations and restored the site with approximately 12,919 CY of clean fill material. The following sources provided clean fill material during the 2004 field season:

- Clean overburden removed during the 2004 field season backfilled portions of the uplands excavations, as well as, in the construction of berms for the NOAA dewatering cell.
- Clean sediments removed from the Salt Lagoon Channel by KRI under their USACE harbor improvement project.
- Scoria and vegetated topsoil obtained from the NOAA-owned portion of the Telegraph Hill quarry.
- Scoria obtained from the TDX-owned Ridgewall quarry.
- Rock obtained from the NOAA-owned portion of the Telegraph Hill quarry.

KRI restored the excavation area to its original grade with an additional 1-ft thick wear surface using scoria obtained by BSE from the TDX-owned Ridgewall quarry. Final site cleanup took place on October 28, 2004. KRI placed boulders to provide protection for the monitoring wells along the Salt Lagoon Channel shoreline.

4.9 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW generated during this corrective action included:

- Used nitrile sampling gloves, which were placed in trash bags and disposed as municipal solid waste.
- Plastic bags and glassware, which were emptied of soil and disposed as municipal solid waste.
- Soil not extracted during TLC screening sample analyses, which was disposed in the PCS stockpile located at Tract 42.
- Spent methylene chloride and small vials of soil that had been extracted using methylene chloride for TLC screening sample analyses were containerized in glass jars and placed in lab pack containers for off-island disposal as hazardous waste.
- Silica gel plates that had been spotted with methylene chloride during TLC screening sample analyses containerized in plastic jars were placed in lab pack containers and staged for off-island disposal as hazardous waste.
- Lab packs with IDW were placed in NOAA shipping container TTSU 2024672 and shipped to Onyx Environmental, Inc., of Tukwila, Washington (Onyx) in March 2005. Onyx disposed of this IDW in April 2005.

4.10 SITE SURVEYING

NOAA representatives surveyed sampling locations, benchmarks, extent of excavations, locations of GAC barriers, and building foundations using a survey-grade Trimble GPS Total Station® 5700. The Trimble GPS Total Station® 5700 is a GPS and GIS data collection and mapping system that combines a high-performance, dual-channel GPS receiver and antenna with a local base station and real-time differential correction system to provide survey-grade accuracy in real time. Horizontal positions of soil sampling locations and excavation boundaries were determined to within approximately plus or minus 1 centimeter (cm), and elevations were determined to within approximately plus or minus 2 cm. Data were collected in latitude and longitude referenced to the World Geodetic System 84 Datum, Universal Transverse Mercator Zone 2 coordinate system in meters.

In addition, NOAA used the Trimble GPS Total Station® 5700 to establish elevation control points at the Salt Lagoon Diesel Seep using the “DUMP” monument located at the northwest corner of the Trident dock as the elevation basis. Subsequently, a laser level and receiver were calibrated to the elevation control points to provide accurate elevation readings during excavation activities.

5.0 FIELD SCREENING AND ANALYTICAL SAMPLING

Throughout this corrective action, Tetra Tech collected TLC screening and analytical confirmation samples, as well as, paint filter liquids test samples in accordance with the CAP (NOAA 2004a), 18 AAC 78 (ADEC 2003b), and the ADEC UST procedures manual (ADEC 2002a). Tetra Tech performed TLC screening sample analyses to direct excavation activities and identify locations for analytical confirmation samples.

The following subsections describe the instrumentation used and procedures followed during the collection of TLC screening and analytical confirmation samples.

5.1 THIN-LAYER CHROMATOGRAPHY SCREENING SAMPLES

TLC involves the use of solid-liquid chromatography for the semi-quantitative analysis of DRO in soil. This analytical method, designed by NOAA, was originally used in support of field efforts during a crude oil spill in the State of Washington (NOAA 2002a).

The procedure involves the extraction of screening samples in a field laboratory and subsequent comparison of the extracts to a range of standard diesel concentrations. By using standards that include diesel concentrations equal to, above, and below site-specific cleanup levels, the analyst is able to determine whether the sample contains concentrations above or below the site cleanup level; in addition, the analyst is able to determine an approximate concentration of DRO in each sample.

TLC screening samples were collected during the corrective action by placing a small amount of soil (approximately 20 grams) into a clean, resealable plastic bag. Each sample was homogenized and kept cool until it could be processed at the NOAA field laboratory located in the NMFS Laboratory / Administration Building.

In July 2004, at TPA Site 12c (Lukanin Bay PCS), it was discovered during a quality assurance review of TLC field screening that false positive results were being obtained from TLC screening sample analyses. This problem was due to interference caused from methylene chloride dissolution of rubber-lined lids on the glass vials used in the procedure. Once identified, this issue was resolved by using only paper-lined lids. When Diesel Seep Site work resumed in August 2004, only paper-lined vial lids were used in the TLC process. Any TLC field screening for the Salt Lagoon Diesel Seep Site conducted in June 2004, potentially was subject to false positive results due to the rubber-lined lid vial caps used.

5.2 PAINT FILTER LIQUIDS TEST SAMPLES

Throughout the corrective action, paint filter liquids test samples were collected from soils placed in the NOAA dewatering cell prior to being relocated to Tract 42 or the NWS landspreading area. Samples were collected at a rate of 1 per 100 CY of dewatered soil, and were analyzed in accordance with ADEC requirements using EPA Method SW-846 9095A (EPA 1996). Soil represented by samples that passed the paint filter liquids test were transported to the designated disposal area while soils represented by samples that failed the paint filter liquids test were left in the NOAA dewatering cell to drain further prior to retesting and eventual transport to the designated disposal area.

5.3 CONFIRMATION SAMPLES

Confirmation samples were collected for fixed laboratory analyses to verify contaminant concentrations in soil remaining in the excavations. Confirmation samples were collected according to the following procedures. First, a minimum of 6 inches of soil was removed from the sampling location just prior to sample collection; if the excavation had been open for longer than 1 hour, then a minimum of 18 inches of soil was removed from the sampling location. However, most of the confirmation samples were collected from the bottom of an excavation site that was filled with several ft of water. In these cases, the excavator was used to remove a quantity of soil from the area under the water. The excavator bucket was brought up to the ground surface next to the excavation, and a soil sample was collected directly from the material as it sat in the excavator bucket.

Second, approximately 25 grams of soil were placed directly from the sampling location into a 4-ounce glass jar with a septum; this container was later field extracted with 25 milliliters (mL) of methanol for BTEX and GRO analyses. Although this represents a deviation from the master QAP, which called for only 10 grams of soil, these procedures are consistent with those described in analytical method AK101 as well as those recommended by the ADEC-approved laboratory performing the analyses. Third, more than 8 ounces of soil was placed into a clean, resealable plastic bag and homogenized; the jars were then filled with homogenized soil for DRO, RRO, and select PAHs. Remaining homogenized soil was used for TLC screening sample analyses. Confirmation samples were packaged and shipped to Friedman & Bruya, Inc. (Seattle, Washington) using the U.S. Postal Service Express Mail, for the following analyses:

- BTEX by EPA Method SW-846 (EPA 1996) Method 8021B
- GRO by Method AK101
- DRO by Method AK102
- RRO by Method AK103

In accordance with the CAP (NOAA 2004a), analyses for select PAHs were conducted on approximately 20 percent of the confirmation samples using the following analytical method:

- Select PAHs by EPA SW-846 (EPA 1996) Method 8270C Selected Ion Monitoring

Sixty confirmation samples and six field duplicate samples were collected during corrective action activities at the Salt Lagoon Diesel Seep Site. Tables 5-1 and 5-2 provide a summary of the confirmation samples. Figure 4-2 illustrates the sampling locations.

5.4 STOCKPILE SAMPLES

Based on the modified stockpile sampling approach approved by ADEC (NOAA 2004b), 32 stockpile samples and 5 field duplicate samples were collected from the estimated 9,234 CY of PCS and sediments removed from the Salt Lagoon Diesel Seep. Stockpile samples were analyzed for BTEX, GRO, DRO, and RRO. In addition, approximately 20 percent of the stockpile samples were also analyzed for select PAHs. Tables 5-1 and 5-2 provide a summary of the stockpile samples.

5.5 CLEAN OVERBURDEN CHARACTERIZATION SAMPLES

Ten characterization samples and 1 field duplicate sample were collected from the approximately 1,615 CY of clean overburden removed during corrective action activities. Clean overburden characterization samples were analyzed for BTEX, GRO, DRO, and RRO. In addition, approximately 20 percent of the clean overburden characterization samples were also analyzed for select PAHs. Tables 5-1 and 5-2 provide a summary of the clean overburden characterization samples.

5.6 BACKFILL CHARACTERIZATION SAMPLES

Since USACE agreed to provide KRI's clean, dewatered dredge spoils to NOAA for its use as clean backfill, NOAA used KRI's sampling results to screen for suitability for use as backfill (KRI 2005). As described in Section 2.4, none of KRI's 276 characterization samples exceeded ADEC Method Two cleanup levels for GRO, DRO, RRO, or BTEX. Accordingly, NOAA collected an additional three clean backfill characterization samples, as described below, from the estimated 7,984 CY of dewatered dredge spoils provided to NOAA. [Note: Only an estimated 6,651 CY of dewatered dredge spoils were used for backfill at the Diesel Seep Site. The remaining dredge spoils were used for backfill at the Icehouse Lake and Lukanin Bay PCS sites.]

Nine characterization samples and 1 field duplicate sample were collected from the approximately 12,919 CY of material used as backfill during restoration activities at the Salt Lagoon Diesel Seep, including the sand and scoria mixture obtained from the NOAA-owned portion of the Telegraph Hill quarry, scoria obtained from the TDX-owned Ridgewall quarry, and sand obtained from KRI's excavation activities in the Salt Lagoon Channel. Backfill characterization samples were analyzed for BTEX, GRO, DRO, RRO, and select PAHs. In addition, the 3 backfill characterization samples collected from the Salt Lagoon Channel sand were analyzed for total lead. Tables 5-1 and 5-2 provide a summary of the backfill characterization samples.

6.0 ANALYTICAL RESULTS

The following subsections provide a brief summary of the analytical results for laboratory analytical samples collected at the Salt Lagoon Diesel Seep Site. Tables 5-1 and 5-2 provide an analytical data summary.

6.1 CONFIRMATION SAMPLES

Confirmation samples collected from the excavation at the Salt Lagoon Diesel Seep Site indicated DRO concentrations varying from not detected to 14,000 mg/kg. Eleven of the 60 samples collected from this area contained concentrations of DRO above the soil cleanup objective of 250 mg/kg. Figure 4-2 illustrates the distribution of DRO concentrations.

Confirmation samples collected from the excavation at the Salt Lagoon Diesel Seep indicated GRO concentrations varying from not detected to 310 mg/kg. Only one of the 60 samples collected from this area contained concentrations of GRO above the soil cleanup objective of 300 mg/kg. Figure 4-2 illustrates the distribution of GRO concentrations.

Concentrations of all other contaminants were below the soil cleanup objectives.

6.2 STOCKPILE SAMPLES

Stockpile samples collected from PCS removed from the excavations contained concentrations of DRO up to 22,000 mg/kg as well as toluene up to 0.2 mg/kg, ethylbenzene up to 0.1 mg/kg, total xylenes up to 0.3 mg/kg, GRO up to 91 mg/kg, and RRO up to 1,800 mg/kg.

6.3 CLEAN OVERBURDEN CHARACTERIZATION SAMPLES

Concentrations of all contaminants of concern were found to be below site cleanup levels for all clean overburden characterization samples.

6.4 CLEAN FILL CHARACTERIZATION SAMPLES

Concentrations of all contaminants of concern were found to be below site cleanup levels for all clean fill characterization samples.

7.0 QUALITY ASSURANCE AND QUALITY CONTROL

To ensure that information obtained from field and laboratory procedures is an accurate and defensible representation of site conditions, quality assurance and quality control (QA/QC) procedures were implemented. Tetra Tech followed the operational guidelines set forth in the ADEC UST procedures manual (ADEC 2002a) as well as those stipulated in the Pribilof Islands site restoration master QAP (NOAA 2003a). These documents provide detailed QA/QC information pertaining to each quality control item discussed in this section.

7.1 FIELD PROCEDURES

Several field QA/QC procedures were implemented to ensure sample integrity and the accurate representation of site conditions.

7.1.1 Field Screening Procedures

Field screening was conducted using the TLC field laboratory method. Quality control procedures for the TLC method included adherence to standard operating procedures (NOAA 2002) such as analysis of duplicate samples and verification of method standards. TLC samples were collected by placing a small amount of soil (approximately 20 grams) into a clean, resealable plastic bag and homogenizing the soil. TLC screening sample analyses were conducted by Tetra Tech in NOAA's on-island laboratory.

7.1.2 Sampling Procedures

Each soil sample was collected from freshly uncovered soil. First, a minimum of 6 inches of soil was removed from the surface of the sampling location just prior to sample collection; if the excavation had been open for longer than 1 hour, then a minimum of 18 inches of soil was removed from the sampling location. However, most of the confirmation samples were collected from the bottom of an excavation site that was filled with several ft of water, and the sampler could not safely access the sample location. In these cases, the excavator was used to remove a quantity of soil from the area under the water. The excavator bucket was brought up to the ground surface next to the excavation, and a soil sample was collected directly from the material as it sat in the excavator bucket. Samples collected from the excavator bucket for health and safety purposes were collected from the center of the bucket, and again, a minimum of 6 inches of soil was removed from the surface before collection. Each sample consisted of three containers. First, a small amount of soil (approximately 25 grams) was placed directly into a 4-ounce glass jar with septum; this container was then field extracted using 25 mL of methanol for BTEX and GRO analyses. Although this represents a deviation from the master QAP, which called for only 10 grams, these procedures are consistent with those described in analytical method AK101 as well as those recommended by the ADEC-approved laboratory performing the analyses. Second, at least 8 ounces of soil was placed into a clean, resealable plastic bag and homogenized; two 4-ounce glass jars (no septa) were then filled with homogenized soil.

7.1.3 Equipment Decontamination

All sampling equipment used during this corrective action was disposable; therefore, decontamination of sampling equipment was not necessary.

7.1.4 Sample Control Procedures

Samples were collected in clean, resealable plastic bags and clean jars provided by the laboratory. After each sample was collected, the sample container was labeled with a unique sample identification number that was also recorded on the chain-of-custody (COC) form and in the field logbook. Sample containers were kept cool and in Tetra Tech custody until they were shipped directly to the laboratory; TLC samples were delivered directly to the Tetra Tech representative for analyses. Samples were shipped on ice and in sealed, signed coolers. The appropriate COC forms accompanied each sample shipment to the laboratory.

7.1.5 Documentation

Field activities were documented in bound field logbooks. Field procedures, sample collection information, and sample identification information were recorded to ensure that samples were properly acquired, preserved, and identified in the field. TLC screening sample results were documented in bound laboratory notebooks.

7.2 ANALYTICAL PROCEDURES

Several analytical data QA/QC procedures were implemented during this corrective action, both in the field and in the project laboratory, to ensure accurate representation of site conditions. Friedman & Bruya, Inc. (Seattle, Washington) conducted laboratory analyses for BTEX, GRO, DRO, RRO, and select PAHs. Friedman & Bruya, Inc. is an approved laboratory in accordance with 18 AAC 78.800.

7.2.1 Trip Blanks

Trip blanks are used to verify that contamination is not originating from sample containers or other external factor during sample transport. A trip blank originates at the laboratory as one 4-ounce glass jar with septum typically used for volatile organic compound analysis (*e.g.,* GRO and BTEX). The vials were filled at the laboratory with clean sand and were then transported to the site with the empty containers to be used for field sample collection. The trip blanks were stored at the site until the field samples had been collected. Each trip blank was extracted with 25 mL of methanol in the same manner as field samples and analyzed for BTEX and GRO. Eleven sample shipments included GRO and BTEX. Ten of these shipments included a trip blank, none of which had detectable levels of GRO or BTEX compounds. One GRO/BTEX sample shipment did not include a trip blank, which was an unintended deviation from the master QAP as Tetra Tech's qualified sampler erroneously omitted the trip blank from the cooler.

7.2.2 Equipment Rinsate Blanks

Because all sampling equipment used during the corrective action was disposable, rinsate blanks were not applicable to this sampling project.

7.2.3 Field Duplicate Samples

Field duplicate samples are collected and analyzed to check sampling and analytical precision, accuracy, and representativeness. Field duplicate samples are collected at the same time and from the same source, and then submitted as separate samples to the laboratory for analyses.

During this corrective action, 111 field samples and 13 field duplicate samples were collected. All relative percent differences (RPD) between field duplicate samples were within the control limit of 50 percent for soil samples with the following exceptions:

- The RPDs for DRO (152 percent), naphthalene (105 percent), fluorene (122 percent), and phenanthrene (130 percent) in confirmation sample SP34-CS-007-070 and field duplicate sample SP34-CS-007-250 were high and outside the control limit.
- A low-level concentration of acenaphthene was detected in field duplicate sample SP34-CS-007-250, but not in confirmation sample SP34-CS-007-070.
- The RPD for DRO (179 percent) was high and outside the control limit in stockpile sample SP34-SS-010-000 and field duplicate sample SP34-SS-010-305.
- DRO was detected in field duplicate sample SP34-CS-014-250, but not in confirmation sample SP34-CS-014-070.
- The RPDs for naphthalene (108 percent) and fluorene (52 percent) in confirmation sample SP34-CS-036-070 and field duplicate sample SP34-CS-036-300 were high and outside the control limit.
- A low-level concentration of acenaphthene was detected in confirmation sample SP34-CS-036-070, but not in field duplicate sample SP34-CS-036-300.
- The RPD for DRO (70 percent) in confirmation sample SP34-CS-041-045 and field duplicate sample SP34-CS-041-300 were high and outside the control limit.
- RRO was detected in field duplicate sample SP34-CS-060-315, but not in confirmation sample SP34-CS-060-015.

- Low-level concentrations of toluene, total xylenes, GRO, and anthracene were detected in field duplicate sample SP34-SS-017-300, but not in stockpile sample SP34-SS-017-000. However, stockpile sample SP34-SS-017-000 was analyzed at a dilution for BTEX and GRO analyses while field duplicate sample SP34-SS-017-300 was analyzed undiluted.
- The RPD for acenaphthene (58 percent) in stockpile sample SP34-SS-026-015 and field duplicate sample SP34-SS-026-300 were high and outside the control limit.
- A low-level concentration of pyrene was detected in stockpile sample SP34-SS-026-015, but not in field duplicate sample SP34-SS-026-300.
- The RPD for DRO (64 percent) in stockpile sample SP34-SS-030-015 and field duplicate sample SP34-SS-030-300 were high and outside the control limit.
- DRO was detected in field duplicate sample SP34-CH-027-300, but not in characterization sample SP34-CH-027-015.

Analytical data are not qualified because of field duplicate results.

7.2.4 Matrix Spike and Matrix Spike Duplicates

Matrix spike and matrix spike duplicate (MS/MSD) samples were analyzed at a frequency of approximately 1 per 20 field samples to evaluate analytical accuracy. Samples were spiked in the laboratory to measure the efficiency of the analytical method's ability to recover target analytes from a particular sampling matrix. Percent recoveries were analyzed for each of the spiked analytes and used to evaluate the analytical accuracy. The RPD between the spiked samples was also calculated to evaluate analytical precision. MS/MSD samples were obtained from specified field samples indicated on the COC forms; no additional sample volume was required. Acceptable percent recoveries for each sample differ, depending on the analytical method used. In the event that a sample displayed a percent recovery outside the allowable range, sample data in that particular analytical batch were flagged by the laboratory with a qualifier indicating the discrepancy. Flags are typically posted adjacent to the laboratory's reported value.

7.2.5 Laboratory Quality Assurance and Quality Control

Laboratory QA/QC included laboratory duplicate samples used to measure data precision; laboratory control samples (LCS), surrogate standards, and method blanks used to evaluate data accuracy; and laboratory blank samples used to evaluate data representativeness.

7.3 OBJECTIVES AND RESULTS

The following subsections describe the objectives and results for precision, accuracy, representativeness, completeness, and comparability associated with analytical data for this corrective action.

7.3.1 Data Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Laboratory analytical precision is evaluated by analyzing laboratory duplicates, specifically MS/MSD sample pairs. The results of analyses for each MS/MSD pair were used to calculate an RPD for evaluating precision.

RPD values for MS/MSD sample pairs and LCS and LCS duplicate sample pairs were within laboratory and method specified control limits with the following exceptions:

- For BTEX and GRO analyses, the MSD percent recovery value for benzene (134 percent) was biased high and outside control limits in confirmation sample SP34-CS-039-090. No qualifications were required because benzene was not detected in the parent sample (SP34-CS-041-300). The percent recovery for xylenes (55 percent) was biased low and outside control limits in the batch QC for sample delivery group 407030. No qualifications were required because the parent sample was not collected for this site.
- For DRO and RRO analyses, the MS and MSD percent recovery values for DRO (161 and 160 percent, respectively) were biased high and outside control limits in confirmation sample SP34-SS-013-015. Therefore, the detected result for DRO in the parent sample (SP34-SS-013-015) was qualified as estimated (J).
- For PAH analyses, the RPDs for fluoranthene (56 percent), pyrene (48 percent), and benzo(k)fluoranthene (35 percent) were biased high and outside control limits in the MSD analyses for stockpile sample SP34-SS-004-000. No qualifications were required because the sample concentrations were less than five times the reporting limits.
- For PAH analyses, the MS and MSD percent recovery values for phenanthrene (27 and 45 percent, respectively) were biased low and outside control limits in stockpile sample SP34-SS-013-015. Therefore, the result for phenanthrene in the parent sample (SP34-SS-013-015) was qualified as estimated (J).
- For PAH analyses, the MS percent recovery value for naphthalene (59 percent) was biased low and outside control limits, and the RPDs for acenaphthylene (31 percent) and naphthalene (30 percent) were high and outside of the control limit for sample delivery group 410137. No qualifications were required because the parent sample was not collected from this site.

7.3.2 Data Accuracy

A program of sample spiking was conducted to evaluate laboratory accuracy. This program included analysis of the MS/MSD samples, LCSs or blank spikes, surrogate standards, and method blanks. MS/MSD samples were analyzed at a frequency of 5 percent. LCS or blank spikes were also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

Percent recovery values for the surrogate spike samples were within laboratory control limits with the following exceptions:

- For BTEX and GRO analyses, the surrogate percent recovery value was extremely low in confirmation sample SP34-CS-012-070 (2 percent). Therefore, undetected results for BTEX and GRO in this sample were rejected (R).
- For BTEX and GRO analyses, the surrogate percent recovery values were biased low and outside control limits in confirmation samples SP34-CS-016-085 (34 percent) and SP34-CS-041-300 (32 percent). Therefore, all BTEX and GRO results were qualified as estimated (UJ) in these samples.
- For BTEX and GRO analyses, the surrogate percent recovery values were biased high and outside control limits in confirmation samples SP34-CS-018-050 (152 percent), SP34-CS-020-080 (155 percent), SP34-CS-025-090 (173 percent), and SP34-CS-026-060 (373 percent), stockpile samples SP34-SS-010-305 (163 percent), SP34-SS-025-015 (173 percent), and SP34-SS-026-300 (200 percent), and characterization sample SP34-CH-021-015 (163 percent). Therefore, detected results for toluene, total xylenes, and GRO in characterization sample SP34-CH-021-015; total xylenes and GRO in stockpile sample SP34-SS-026-300; BTEX and GRO in confirmation sample SP34-CS-026-060; ethylbenzene, total xylenes, and GRO in confirmation sample SP34-CS-120-030; and GRO in confirmation sample SP34-CS-025-090 and stockpile sample SP34-SS-025-015 were qualified as estimated (J). No qualifications were required for stockpile sample SP34-SS-010-305, or confirmation samples SP34-CS-018-050 and SP34-CS-020-080 because BTEX and GRO were not detected in these samples.
- For DRO analyses, surrogates were diluted out of stockpile samples SP34-SS-001-000, SP34-SS-002-000, SP34-SS-005-000, SP34-SS-006-000, SP34-SS-007-000, and SP34-SS-008-000 as well as confirmation samples SP34-CS-017-085 and SP34-CS-026-060. No qualifications were required because of these data gaps.
- For RRO analyses, the surrogate percent recovery value in confirmation sample SP34-CS-001-040 (124 percent) was biased high and outside control limits. No qualifications were required because RRO was not detected in confirmation this sample.

7.3.3 Data Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent.

For this project, representative data were obtained through careful selection of sampling locations and analytical parameters. Representative data were also obtained through the use of proper sample collection and handling techniques to avoid interference and minimize contamination. Representativeness of data was also ensured through the consistent application of established field and laboratory procedures. Laboratory blank samples were evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results.

7.3.4 Data Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with approved quality control procedures and when none of the quality control criteria that affect data usability is exceeded. When all data validation is completed, the percent completeness value is calculated by dividing the number of useable sample results by the total number of sample results obtained.

A completeness value of 99.4 percent was achieved for this project, meeting the master QAP completeness requirement of greater than 85 percent.

7.3.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data is achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

This project used standard procedures for both field and laboratory processes, and the units used to express sample results are reasonable for concentrations encountered. Data sets for this project are, therefore, deemed comparable.

7.3.6 Usability

Data quality was evaluated as part of a data quality evaluation process that resulted in the production of a data quality evaluation report (Tetra Tech 2004b), which is summarized here. The data quality evaluation report summarizes data quality findings and resulting impacts to the environmental data, and indicates whether data quality goals were met.

In accordance with the CAP (NOAA 2004a) and master QAP (NOAA 2003a), laboratory reporting limits were below the method-specified practical quantitation limits. The following adjustments were made to sample reporting limits.

- For BTEX analyses, stockpile samples SP34-SS-001-000, SP34-SS-002-000, SP34-SS-005-000, SP34-SS-006-000, SP34-SS-007-000, SP34-SS-008-000, SP34-SS-016-015, SP34-SS-017-000, SP34-SS-025-015, SP34-SS-026-015, SP34-SS-026-300, and SP34-SS-032-015, and confirmation samples SP34-CS-026-060, SP34-CS-028-090, and SP34-CS-055-080 were analyzed at dilutions because of matrix interference. Reporting limits were adjusted accordingly.

- For GRO analyses, stockpile samples SP34-SS-001-000, SP34-SS-002-000, SP34-SS-005-000, SP34-SS-006-000, SP34-SS-007-000, SP34-SS-008-000, SP34-SS-016-015, SP34-SS-017-000, SP34-SS-025-015, SP34-SS-026-015, SP34-SS-026-300, and SP34-SS-032-015 as well as confirmation samples SP34-CS-026-060, SP34-CS-028-090, and SP34-CS-055-080 were analyzed at dilutions because of matrix interference. Reporting limits were adjusted accordingly.
- For DRO and RRO analyses, stockpile samples SP34-SS-001-000, SP34-SS-002-000, SP34-SS-005-000, SP34-SS-006-000, SP34-SS-007-000, and SP34-SS-008-000 as well as confirmation samples SP34-CS-017-085 and SP34-CS-026-060 were analyzed at dilutions because of high concentrations of DRO. Reporting limits were adjusted accordingly.
- For DRO and RRO analyses, stockpile samples SP34-SS-001-000 and SP34-SS-002-000 as well as confirmation sample SP34-CS-017-085 were analyzed at dilutions because of high concentrations of RRO. Reporting limits were adjusted accordingly.

Data qualifiers that resulted from the validation process are depicted on the analytical data tables. Although sampling procedures deviated from the master QAP by using 25 grams of soil instead of 10 grams for GRO and BTEX analyses as called for in the master QAP, the data quality was improved because of increased sensitivity of the laboratory analyses for these compounds.

Overall, the analytical data for the soil samples submitted for BTEX, GRO, DRO, RRO, and PAH analyses are acceptable and usable with the following qualifications:

- For BTEX and GRO data, undetected results for confirmation sample SP34-CS-012-070 were rejected (R) because of an extremely low surrogate recovery.
- For BTEX data, results in confirmation sample SP34-CS-015-085 were qualified as estimated (J/UJ) because of continuing calibration issues.
- For BTEX data, results in confirmation samples SP34-CS-016-085 and SP34-CS-041-300 were qualified as estimated (UJ) because of low surrogate recoveries.
- For BTEX data, results for toluene and total xylenes in characterization sample SP34-CH-021-015, total xylenes in stockpile sample SP34-SS-026-300, and BTEX in confirmation sample SP34-CS-026-060 were qualified as estimated because of high surrogate recoveries.
- For GRO data, results for confirmation samples SP34-CS-016-085 and SP34-CS-041-300 were qualified as estimated (UJ) because of low surrogate recoveries.
- For GRO data, results for confirmation samples SP34-CS-025-090 and SP34-CS-026-060 as well as stockpile samples SP34-SS-025-015 and SP34-SS-026-300 were qualified as estimated (J) because of high surrogate recoveries.
- For DRO data, results for characterization samples SP34-CH-022-015 and SP34-CH-023-015 were qualified as estimated (J) because of continuing calibration issues.
- For DRO data, results for stockpile sample SP34-SS-013-015 was qualified as estimated (J) because of MS/MSD issues.
- For PAH data, results for phenanthrene in stockpile sample SP34-SS-013-015 was qualified as estimated (J) because of MS/MSD issues.

8.0 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is used to evaluate exposure pathways for human health and ecological receptors (ADEC 2000). The following subsections provide an evaluation for each of the elements of the CSM for the Salt Lagoon Diesel Seep Site, including historical contamination sources, release mechanisms, impacted media, migration pathways, exposure routes, potential receptors, and a cumulative risk assessment.

8.1 HISTORICAL SOURCES OF CONTAMINATION

Historical sources of contamination were removed prior to this corrective action and included 55-gallon drums, transfer piping, and ASTs containing diesel fuel used during operations at the former seal by-products plant.

8.2 RELEASE MECHANISMS

Potential release mechanisms included spills that occurred, or leaks from the drums, transfer piping, and ASTs during operations at the former seal by-products plant.

8.3 IMPACTED MEDIA

As a result of releases, sediments with elevated levels of DRO and PCS were identified during previous investigations. In addition, petroleum sheen was observed emanating from the east bank of the Salt Lagoon Channel adjacent to the former seal by-products plant. This sheen constituted a violation of the federal Clean Water Act (U.S. Code 2002) and State of Alaska surface water quality standards (ADEC 2003c).

During the 2004 field season, PCS was removed from the site to elevations varying from -1 ft MLLW to -4 ft MLLW. Following completion of the corrective action, remaining impacted media include soil within the saturated zone as well as potentially contaminated groundwater, and the vadose zone soil within Area 4. As described in Section 4.4.7, NOAA attempted to investigate potential contamination in Area 4 by excavating two test pits. Subsurface debris prevented NOAA from completing this investigation and no soil was removed from Area 4. Past site characterization data (CESI 2001, IT 2002) indicate Area 4 soil is contaminated at depth ranging approximately +4.5 ft MLLW to +0.0 ft MLLW (*i.e.*, approximately 3.5 ft bgs to 8.0 ft bgs), which includes both the vadose zone and saturated zones. Concentrations of DRO were found during past site characterizations of Area 4 as high as 17,000 mg/kg. Surface water and sediments in the Salt Lagoon Channel are no longer considered impacted due to the absence of a visible petroleum sheen as well as the in-situ treatment of potentially contaminated groundwater by the two GAC trenches.

8.4 MIGRATION PATHWAYS

Because PCS has been removed to depths up to -4 ft MLLW, most contamination associated with this site has been removed. PCS that could not be removed continues to be a potential source of contamination to groundwater. However, much of the PCS has been removed from this site, and the source volume has been reduced significantly. In addition, the installation of two GAC barriers provides treatment of potentially contaminated groundwater flowing through the site toward the Salt Lagoon Channel.

8.5 EXPOSURE ROUTES

Because PCS has been removed to depths up to -4 ft MLLW, direct exposure pathways such as dermal contact with or incidental ingestion of PCS do not exist in Areas 1, 2, 3A, 3B, 3C, or 3D at the site. Direct exposure pathways may exist in Area 4 based on past site characterization data (CESI 2001, IT 2002), however the potentially affected locations are presumed localized based on these data. Furthermore, several feet of clean scoria covers petroleum-contaminated native soil (Appendix A, Photo 52) and provides an effective barrier to dermal contact or incidental ingestion based on the property’s use for crab pot storage. Inhalation and ingestion of contaminated groundwater are not considered to be viable exposure routes because groundwater in the vicinity of this site is considered to be brackish and not potable. In addition, no potable water production wells are located in the City of St. Paul, so exposure to contaminated groundwater is highly unlikely. The installation of two GAC barriers also provides treatment of potentially contaminated groundwater flowing through the site toward the Salt Lagoon Channel.

8.6 POTENTIAL RECEPTORS

Because potential exposure routes have been mitigated through the removal of PCS and the installation of two GAC barriers and because indirect exposure routes are not considered viable given existing site conditions, no potential receptors have been identified.

8.7 CUMULATIVE RISK ASSESSMENT

Cumulative risk is defined as the sum of risks resulting from multiple sources and pathways to which humans are exposed. When more than one hazardous substance is present at a site or multiple exposure pathways exist, the cleanup levels in Table B1 of 18 AAC 75.341 and Table C of 18 AAC 75.345 may need to be adjusted downward. In accordance with the requirements outlined in 18 AAC 78.600, NOAA must ensure that the cumulative cancer risk remaining after the completion of the corrective action does not exceed 1 in 100,000 (1 x 10^{-5}) and that the cumulative non-carcinogenic hazard index does not exceed 1.0. Each contaminant detected above one-tenth of the Table B1 inhalation or ingestion cleanup levels (excluding DRO, GRO, and RRO) must be included in cumulative risk calculations (ADEC 2002b).

Based on these requirements, no contaminants were included in the cumulative risk calculation since none were detected in soil above one-tenth of the Table B1 cleanup levels.

8.8 MONITORING WELL NETWORK

Monitoring wells located in the vicinity of the Salt Lagoon Diesel Seep Site include MWDS-1, MWDS-2, MWDS-3, MWDS-4, and MWDS-5 (Figure 3-1).

On August 20, 2004, NOAA requested and ADEC approved removal of MWDS-2 and MWDS-3 without formal decommissioning, since the surrounding areas were to be excavated and the removed monitoring wells were to be reinstalled after site restoration (ADEC 2004). On October 29, 2004 boulders were placed around the location for the two reinstalled monitoring wells MWDS-2 and MWDS-3. By November 8, 2004, NOAA had completed both wells with the installation of flush mounted well monuments, and a survey of each well casing top. Well development, sampling and submittal of installation documentation to ADEC (ADEC 1992) are pending the 2006 field season, subject to the availability of funds.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The following subsections present conclusions and recommendations for the Salt Lagoon Diesel Seep Site based on field activities performed and analytical findings obtained from corrective action activities conducted during the 2004 field season.

9.1 CONCLUSIONS

During the corrective action, NOAA removed approximately 9,234 CY of PCS and sediments from the Salt Lagoon Diesel Seep Site and eliminated the sheening on the Salt Lagoon channel surface waters. Although contamination remains, further excavation with available equipment is not technically feasible in this area because contaminated soils reside in the saturated zone. The cumulative risk assessment demonstrates that the cumulative cancer risk and non-carcinogenic hazard index for contaminants remaining in soil are below the State of Alaska regulatory limits for cumulative cancer risk and the non-carcinogenic hazard index. In addition, the installation of two GAC barriers across the site affords treatment potential for sheen causing contaminated groundwater flowing through the site toward the Salt Lagoon Channel.

9.2 RECOMMENDATIONS

Since corrective action led to the sustained absence of petroleum sheen on the Salt Lagoon Channel surface waters, NOAA should request a no further remedial action determination for visible petroleum sheen migrating to the Salt Lagoon Channel and soil contamination at the Salt Lagoon Diesel Seep Site (Sites 34 and 35/TPA Sites 13a and 13b) from ADEC. .

Future activities should include periodic groundwater sampling of monitoring wells in the vicinity of the Salt Lagoon Diesel Seep Site with concurrent shoreline inspections to document either the presence or absence of sheen and site conditions. Five wells have been identified as available for sampling: MWDS-1, MWDS-2, MWDS-3, MWDS-4, and MWDS-5. Figure 4-1 illustrates the locations of these monitoring wells.

10.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 1989. *Notice of Violation/Request for Corrective Action, National Marine Fisheries Service Property, Saint Paul Island, Salt Lagoon Diesel Seep*. ADEC Anchorage Western District Office. June 8.

ADEC. 1991. *Interim Guidance for Non-UST Contaminated Soil Cleanup Levels.* Contaminated Sites Program. July 17.

ADEC. 1992. *Recommended Practices For Monitoring Well Design, Installation, And Decommissioning, Final.* Division of Environmental Quality, Water Quality Section. April.

ADEC. 1999. *Letter Regarding the Reopening of Closed Two-Party Agreement Site 13-1: Salt Lagoon Diesel Seep.* Sent from Louis Howard of ADEC to John Lindsay of the National Oceanic and Atmospheric Administration (NOAA). November 1.

ADEC. 2000. *Risk Assessment Procedures Manual*. June 8.

ADEC. 2002a. *Underground Storage Tanks Procedures Manual, Guidance for Treatment of Petroleum-Contaminated Soil and Water and Standard Sampling Procedures*. State of Alaska. November 7.

ADEC. 2002b. *Cumulative Risk Guidance*. November 7.

ADEC. 2003a. Title 18 *Alaska Administrative Code* (AAC) 75, Articles 3 and 9. *Oil and Hazardous Substances Pollution Control Regulations*. State of Alaska. Amended through January 30.

ADEC. 2003b. 18 AAC 78. *Underground Storage Tanks*. State of Alaska. Amended through January 30.

ADEC. 2003c. 18 AAC 70. *Water Quality Standards*. State of Alaska. Amended through June 22.

ADEC. 2004. *E-Mail Approval from Louis Howard, Project Manager, Contaminated Sites Program, Regarding Diesel Seep Monitoring Well Removal, St. Paul Island, Alaska*. August 20.

Barth, T.F.W. (Barth). 1956. *U.S. Department of the Interior Geological Survey Bulletin 1028-F, Geology and Petrology of the Pribilof Islands, Alaska*.

Columbia Environmental Sciences, Inc. 2001. *Draft Site Characterization Report, The Salt Lagoon Diesel Seep (TPA Site 13), St. Paul Island, Alaska*. Version 1.3. April 26.

IT Alaska Corporation. 2002. *Diesel Seep (TPA 13) Site Characterization, Draft, St. Paul Island, Alaska*. February.

Kelly-Ryan, Inc. (KRI). 2004a. *St. Paul Harbor Improvements Phase II, Excavation Work Plan.* May 27.

KRI. 2004b. *Kelly-Ryan Dredge Spoils, E-Mail forwarding Sample Point Locational Data, 2004 Salt Lagoon Channel & Salt Lagoon Sample Result, USACE St. Paul Harbor Improvements, Phase II, St. Paul Island, Alaska*. August 24.

KRI. 2005. *Kelly-Ryan Dredge Spoils, E-Mail forwarding SGS Environmental Analytical Results, 2004 Salt Lagoon Channel & Salt Lagoon Sample Result, USACE St. Paul Harbor Improvements, Phase II, St. Paul Island, Alaska*. Data from Sample Delivery Groups 1043867, 1043875, 1043942, 1043943, 1043944, 1043945, 1043946, 1043999, 1044000, 1044014, 1044015, 1044016, 1044052, 1044054, 1044056, 1044057, 1044058, 1044059, and 1046322. July 8.

Mitretek Systems. 2002. *Groundwater Use and Classification in the Vicinity of Tract 46, St. Paul Island, Pribilof Islands, Alaska, Technical Analysis and Recommendations*. June 5.

Mitretek Systems. 2003. *Focused Feasibility Study for TPA Site-13, the Diesel Seep Site, on St. Paul Island, Pribilof Islands, Alaska.* Mitretek Technical Report. Final. April.

(NOAA. 1996. *Pribilof Islands Environmental Restoration Two-Party Agreement, Attorney General's Office File No. 66-1-95-0126*. January 26.

NOAA. 2002a. *Standard Operating Procedure for the Analysis of Soils and Sediments for Diesel-Range Organics by Thin Layer Chromatography*. September 5.

NOAA. 2002b. *Summary Table of Results from Salt Lagoon Channel Sediments Characterization Activity Performed in September 2002, NOAA Pribilof Project Office*. December.

NOAA. 2003a. *Master Quality Assurance Plan, Pribilof Islands Environmental Restoration Project*. May.

NOAA. 2003b. *Master Health and Safety Plan, Pribilof Islands Environmental Restoration Project, St. Paul Island, Alaska*. May.

NOAA. 2003c. *Master Investigation Derived Waste Plan, Pribilof Islands Environmental Restoration Project, St. Paul Island, Alaska*. May.

NOAA. 2003d. Final Site Closure Plan for the Blubber Dump Petroleum-Contaminated Soil Stockpile Site. St. Paul Island, Alaska. October 24.

NOAA. 2004a. *Draft Corrective Action Plan, Sites 34 and 35, Two-Party Agreement Sites 13a and 13b, Diesel Seep Site (Uplands and Channel), St. Paul Island, Alaska*. April 28.

NOAA. 2004b. *Letter from John Lindsay, Project Manager, NOAA Pribilof Project Office to Louis Howard, Project Manager, Alaska Department of Environmental Conservation Regarding Proposed Sampling and Analysis Frequency for Two-Party Agreement Sites 13a and 13b, Diesel Seep Site (Uplands and Channel), St. Paul Island, Alaska*. April 28.

NOAA. 2004c. *Draft Operations Work Plan, Petroleum-Contaminated Soil Remediation by Landspreading, St. Paul Island, Alaska*. June 18.

NOAA. 2004d. *E-Mail from David R. Cormany, Manager, Pribilof Islands Programs, National Marine Fisheries Service, to Lizette P. Boyer, Alaska District, USACE, Regarding Retention of the Salt Lagoon Channel Tidal Block and Protection of Marine Mammals, St. Paul Island, Alaska.* September 10.

NOAA. 2005. *Project Report 2002 Petroleum-Contaminated Soil Remediation, St. Paul Island, Alaska*. February 8.

Oil Spill Consultants. 1995. *Final Report, Contaminated Soil Excavation and Stockpile on St. Paul Island, Alaska*. April.

Tetra Tech EM Inc. (Tetra Tech). 2000. *Technical Memorandum, Investigative Sampling, Diesel Seep Area.* St. Paul Island, Alaska. December 26.

Tetra Tech. 2004a. *Final Closure Report, Blubber Dump/Enhanced Thermal Conduction Soil Treatment Facility*. St. Paul Island, Alaska. October 22.

Tetra Tech. 2004b. *Data Quality Evaluation Report, Two-Party Agreement Site No. 13a, Salt Lagoon Diesel Seep, St. Paul Island, Alaska*. November 30.

Tetra Tech. 2005. Draft Groundwater Monitoring Report, St. Paul Island, Alaska. Pribilof Islands Environmental Restoration Project. May.

United States Army Corps of Engineers (USACE). 1990. *Final Report, Site Investigation, Salt Lagoon Diesel Seep, St. Paul Island, Alaska.* U.S. Army Corps of Engineers, Seattle District, Order Number 40ABNF902747. February.

USACE. 2004. *Letter from Valanne Glooschenko of the U.S. Army Engineer District Alaska to John Lindsay, NOAA Pribilof Project Office Regarding Approval of NOAA's December 19,2003 permit application requesting use of Nationwide Permit #13 and #38 for shoreline excavation and restoration at the Diesel Seep Site on St. Paul Island, Alaska*. February 19.

U.S. Code. 2002. Title 33 *Federal Water Pollution Control Act*. As amended through Public Law 107-303, November 27.

U.S. Environmental Protection Agency (EPA). 1996. *Test Methods for Evaluating Solid Waste*. EPA/SW-846. Third Edition and Updates. December

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