March 24, 2000

Mr. Thanh "Minh" Trinh
Regional Environmental Compliance Officer
U.S. Department of Commerce
National Oceanic and Atmospheric Administration (WC-42)
7600 Sand Point Way NE, Bin C-15700
Seattle, Washington 98115-0070

Subject: **Final Fuel Storage Tank Removal Report**
National Weather Service Station, St. Paul, Alaska
Contract No. 50WCNA906018, Modification No. 56WCNA901101
Tetra Tech Task Order No. G1063-0027

Dear Mr. Trinh:

Tetra Tech EM Inc. (Tetra Tech) is pleased to submit one original and two copies of a final Fuel Storage Tank Removal Report describing tank removal and investigative sampling work conducted at the National Weather Service station at St. Paul, Alaska. The February 11 draft report has been modified based on your comments, which were transmitted on March 22.

We have enjoyed working with you on this project. After you have reviewed the report, I would appreciate the opportunity to meet with you and discuss site closure with you. Meanwhile, if you have any questions or comments regarding this submittal, please call me at (206) 587-4680.

Sincerely,

Ken Valder
Project Manager

Enclosure

cc: Mamie Wandick, NOAA Contracting Officer (letter only)
Paula Hirtz, Tetra Tech Program Manager
Jerry Shuster, Tetra Tech Regional Program Manager

FINAL

FUEL STORAGE TANK REMOVAL REPORT

NATIONAL WEATHER SERVICE STATION
ST. PAUL, ALASKA

Prepared for

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Central Administrative Support Center
Kansas City, Missouri 64106

Prepared by

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Contract No.	:	50WCNA906018
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1.0 INTRODUCTION

Under Contract No. 50WCNA906018, Tetra Tech EM, Inc. (Tetra Tech), received Contract Modification No. 56WCNA901101 (Tetra Tech Task Order No. 27) from the National Oceanic and Atmospheric Administration (NOAA). This task order calls for Tetra Tech to oversee the removal of one aboveground storage tank (AST) and three underground storage tanks (UST) from the National Weather Service (NWS) station in St. Paul, Alaska. Specific Activities described by the statement of work (SOW) dated September 13, 1999, include removing one inactive, 10,000-gallon, arctic diesel fuel AST and three inactive, arctic diesel fuel USTs. All four of these tanks are considered by the Alaska Department of Environmental Conservation (ADEC) to be unregulated.

Tetra Tech subcontractor Bering Sea Eccotech, Inc. (BSE), performed the heavy equipment-related field activities, including tank excavation, demolition, soil stockpile cell construction, and site restoration. Field activities commenced on October 6 and were completed on October 21, 1999. This removal report is part of the documentation required by the SOW and substantively meets reporting requirements outlined at 18 AAC 75 and 78 pertaining to releases of oil and hazardous substances. Because site closure cannot be sought at this time, this report may not meet all requirements of those regulations.

In addition to this introduction, this report summarizes island and site background information (Section 2.0), site health and safety procedures (Section 3.0), tank removal activities (Section 4.0), the borehole investigation (Section 5.0), analytical data obtained during field work (Section 6.0), cleanup levels applicable at the site (Section 7.0), conclusions (Section 8.0), and recommendations (Section 9.0). In addition, the appendixes include photographs taken during the field effort (Appendix A), correspondence with ADEC regarding water treatment protocols (Appendix B), logs of boreholes installed at the site (Appendix C), laboratory analytical reports (Appendix D), and a site-specific cleanup level evaluation worksheet (Appendix E).

1.1 OBJECTIVES

Objectives identified in the project work plan (Tetra Tech 1999d) included: (1) removal and demolition of one, 10-000-gallon AST that formerly stored arctic diesel fuel; (2) removal and demolition of three, 3,000-gallon USTs that formerly stored arctic diesel fuel; (3) collection of soil and groundwater (if encountered) samples using a Geoprobe® hydraulic push sampler; and (4) location, sampling, and abandonment of a former water supply well, if found.

1.2 APPLICABLE REGULATIONS

ASTs with a storage capacity of less than 420,000 gallons are not regulated by ADEC, although they are subject to operational jurisdiction of the State of Alaska Fire Marshall and the local fire authority. According to Alaska Statute (A.S.) 46.03.450, USTs storing heating oil for on-premises use are also not regulated as USTs, but releases are subject to the Oil and Hazardous Substances Pollution Control Regulations codified at 18 AAC 75. The guidance document entitled *Underground Storage Tank Procedures Manual, Guidance for Treatment of Petroleum-Contaminated Soil and Water and Standard Sampling Procedures* (ADEC 1998) was also used for management of petroleum-contaminated soil (PCS) and assessment sampling at the site.

2.0 SITE BACKGROUND

This section provides a brief discussion of the location and history of the Pribilof Islands, environmental conditions on St. Paul Island, a site description, and a summary of previous investigations conducted at the site.

2.1 ST. PAUL ISLAND HISTORICAL INFORMATION

Russia first discovered St. Paul Island in 1786. In the 1820s, Russia established a settlement on St. Paul Island to support northern fur seal harvesting operations. The United States acquired the Pribilof Islands in 1867, when Alaska was purchased from Russia. From 1867 to 1907, the United States contracted seal harvesting and pelt processing to private companies. In 1869, the United States made the Pribilof Islands a federal reservation. From 1910 to 1979, the federal government was the sole operator and administrator of the Pribilof Islands. In 1971, the Alaska Native Claims Settlement Act provided for the gradual transfer of property and management of the islands to Alaskan Native corporations, and St. Paul was incorporated in June of that year.

Major landowners on St. Paul Island are the Tanadgusix Corporation and the federal government. The federal government currently retains title to 1,515 acres on St. Paul Island, which consist of seal rookeries managed by the National Marine Fisheries Service, bird rookeries managed by the U.S. Fish and Wildlife Service, a U.S. Coast Guard station, and the NWS station. The island airport, which consists of about 67 acres, was conveyed to the State of Alaska in 1989.

2.2 ISLAND ENVIRONMENTAL SETTING

St. Paul Island is located between latitude 57°06’ and 57°15’ north and longitude 170°05’ and 170°25’ west in the Bering Sea, about 800 miles west-southwest of Anchorage and 300 miles north-northwest of Dutch Harbor, Alaska. The island is about 44 square miles in area (see Figure 1).

The City of St. Paul is located on the island’s southern peninsula; its 1999 population included 673 people (Alaska Department of Labor 2000). St. Paul Harbor, which opened in 1990, is reported to be one of Alaska’s most important commercial fishery processing and supply ports (CBSFA, undated).

The following subsections discuss the island’s climate, geography, geology and hydrogeology, groundwater resources, and surface water resources.

2.2.1 Climate

The climate at St. Paul Island is classified as subpolar. Maritime weather conditions prevail, with predominantly cloudy, foggy, and windy conditions.

According to the National Climatic Data Center (NCDC 2000), the average annual precipitation for the 30-year period ending in 1998 was 23.32 inches. Average monthly precipitation ranges from a low of 1.22 inches in March to a high of 2.81 inches in October (NCDC 2000). According to NWS, the maximum daily rainfall ever recorded on St. Paul Island is 1.93 inches, which was recorded on October 6, 1949. The maximum annual precipitation ever recorded on the island is 36.61 inches, which was recorded in 1964 (NWS 2000).

Average monthly snowfall (including ice pellets and sleet) ranges from none in the summer months of July and August to a maximum of 11.6 inches in January (NCDC 2000). NWS reports that the maximum daily snowfall ever recorded on the island is 13.8 inches, which was recorded on January 30, 1964. That same year experienced the maximum annual snowfall ever recorded on St. Paul Island—158.6 inches (NWS 2000).

The mean monthly temperature at St. Paul Island ranges from 22.4 °F in February to 47.7 °F in August. The annual mean temperature is 34.7 °F (NCDC 2000). Based on 82 years—1917 through 1999—of meteorological data available for St. Paul Island, temperature extremes include a low of –26 °F and a high of 66 °F.

Because of their location in the Bering Sea, the Pribilof Islands are quite windy. The average monthly wind speed ranges from a low of 12.2 miles per hour (mph) in July to 20.6 mph in December (NCDC 2000). Although calm days are recorded, storms are not uncommon on St. Paul Island, and gale-force winds are recorded fairly often, especially during the winter months. The fastest sustained wind ever recorded on the island was 84 mph, recorded in November 1990 (NWS 2000).

2.2.2 Geography

The terrain on St. Paul Island is quite diverse, consisting of diverse and rocky uplands, rugged hills, and smooth volcanic cones that fade into the sea; into broad expanses of wet, flat tundra; or into dry, drifting sand dunes. The island is surrounded by 42 miles of shoreline. The southern and western shorelines predominantly are characterized by high bedrock cliffs, low bluffs, and rock platforms. Boulder beaches and basalt shelves often are present at the base of cliffs and bluffs. The shoreline along the island's northern and eastern sides consists primarily of sandy beaches; some gravel and rocky beaches also are present. The St. Paul Harbor is protected by breakwater structures composed of boulders, affording the harbor and Salt Lagoon with some protection from the harsh Bering Sea environment (Elliot 1976; NOAA and USCG 1998).

2.2.3 Geology and Hydrogeology

The Bering Sea is a triangular basin between Alaska and Siberia; it is bounded to the south by the Aleutian Island chain. The Pribilof Islands are situated within the triangular basin near the edge of the Bering Sea shelf, a notably flat and shallow (100 fathoms or less) feature in the northeastern part of the basin. The Pribilof Islands area was built up by large fissure volcanic eruptions that occurred in the late Pleistocene (about 100,000 to 10,000 years ago). The geology of the Pribilof Islands consists of lava flows and sills, with lesser amounts of pyroclastic (explosive volcanic ejecta) and tuffaceous (fine-grained volcanic fragments, particularly ash) material, as well as glacial deposits (Barth 1956).

The bedrock geology of St. Paul Island consists primarily of basaltic lava flows and sills. A majority of the flows and sills are porphyritic (containing larger crystals, or phenocrysts in a fine-grained matrix), with primarily olivine phenocryts and a very fine-grained groundmass of augite, plagioclase, olivine, magnetite and glass. No trace of glaciation is observed on the surface of St. Paul Island. However, glacial sediments have been noted to occur between lava flows and sills in many locations on the island, indicating glaciation between periods of volcanic activity. The most prominent topographic landmarks on the island are relict features related to pyroclastic events, including Bogoslof Hill—a volcanic cone—and Crater Hill—an explosion crater (Barth 1956).

Surface geology consists of weathered volcanic materials and recently-formed alluvial sediments composed primarily of sand. Sand covers about one-seventh of the island (Barth 1956).

At St. Paul Island, groundwater is contained and transmitted within fractures in the volcanic rocks. The absence of streams on the island suggests rapid infiltration of rainwater and snowmelt and implies relatively high permeabilities and porosities in subsurface materials. In the central, upland portion of the island, groundwater occurs in fractured basalt aquifers that are the drinking water resource used on the island (Woodward-Clyde 1994). Groundwater also occurs in the unconsolidated materials on the island. However, because of their low elevation and proximity to the coast, these shallow, localized aquifers may contain nonpotable water, especially toward the sea. In addition, it is unlikely that aquifers in the unconsolidated deposits could provide a sustainable municipal drinking water source, because significant pumping most likely would induce saltwater intrusion.

Depth to groundwater in the regional, fractured basalt aquifer occurs at depths between 38 and 80 feet below ground surface (bgs), based on measurements made in the municipal supply wells. Groundwater elevations range from about 1 to 3 feet above mean sea level (Dames and Moore 1999). The aquifer's transmissivity is estimated at 0.1 to 2.5 million gallons of water per day per foot (URS 1987; Munter and Allely 1994). Based on the island's topography, regional groundwater flow is most likely radial from the central, upland part of the island (groundwater recharge area) toward the coast (groundwater discharge area). Based on geologic conditions, locally differing groundwater flow directions also may exist.

2.2.4 Groundwater Resources

The City of St. Paul obtains its water supply from seven municipal wells that are located northeast of Telegraph Hill and about 1.5 miles northeast of the city. The municipal water supply wells are completed within the regional fractured basalt aquifer. Groundwater is pumped from the wells by pipelines to three 200,000-gallon aboveground water storage tanks located on a hill west of the city. The water is treated with chlorine and fluoride prior to distribution.

2.2.5 Surface Water Resources

As discussed in Section 2.2.3, no streams exist at St. Paul Island. Surface water on the island generally is contained in small, shallow lakes. Big Lake and Sheep Lake are the two largest lakes on the island and are located in the northeastern part of the island. Pump House Lake is located within about 900 feet of the NWS Station; this lake formerly was used as a backup water supply before the City of St. Paul installed the municipal water supply wells currently used. Smaller lakes are situated near the southeastern coast of the island and typically are located nearer the shoreline than the interior.

2.3 NATIONAL WEATHER SERVICE OPERATIONS

The NWS station at St. Paul, Alaska, currently consists of two large operational buildings containing office space, a garage, a warehouse, and staff quarters. NWS uses three small houses located south of the NWS office as additional staff quarters. Other small outbuildings include a hydrogen generator building and a formerly used weather balloon inflation building (see Figure 2).

NWS and its predecessor agencies, including the Weather Bureau, have operated portions of the current station since at least 1946, when the Weather Bureau accepted the property from the U.S. Coast Guard, the former site operator. Additional portions of the facility were transferred from the U.S. Coast Guard to the Weather Bureau in 1949, 1950, and 1960. The station heating boilers have been fueled with arctic diesel fuel stored in USTs and ASTs since before NWS received the property from the U.S. Coast Guard. The AST was supplied by a fuel tank farm at the current U.S. Coast Guard facility located north of and across Airport Road from the NWS station. The AST in turn supplied the USTs with fuel. The pipelines between the storage tanks and the U.S. Coast Guard facility were reportedly removed, although dates and observations made during the pipeline removal could not be obtained. The AST and USTs were removed from the site concurrent with waste trench investigative activities, and the removal is documented in a separate report. The station and adjacent buildings currently are heated with arctic diesel stored in skid-mounted, concrete, vaulted ASTs that were installed in 1994. These ASTs are located next to the buildings they serve.

The 10,000-gallon AST was reportedly taken out of service in 1994. Dates of service of the three USTs are not known. The station and adjacent buildings currently are heated with arctic diesel stored in skid-mounted, concrete, vaulted ASTs that were installed in 1994. These ASTs are located next to the buildings they serve.

2.4 PREVIOUS INVESTIGATIONS

File reviews conducted at NOAA and NWS did not reveal any environmental investigations previously conducted at the site. However, when the AST was taken out of service in 1994, the fuel pipelines between the AST and the buildings were removed. Where pipeline removal was not feasible because of the presence of building foundations or other structural features, the lines reportedly were drained, cut, and plugged near the building foundations. No documentation of these activities was available during this report's preparation.

3.0 HEALTH AND SAFETY

All field activities initially were performed in Level D PPE. Level of protection upgrades were not required during the course of field activities depending on site-specific conditions. Field activities were conducted in accordance with procedures detailed in the master health and safety plan (Tetra Tech 1999a) for the Pribilof Islands Site Restoration project. No injuries or accidents occurred during site activities.

4.0 FIELD ACTIVITIES

Principal field activities at the NWS site consisted of underground utility location, removal and demolition of the AST and three USTs, Geoprobe® borehole installation and soil sampling, excavation of PCS, construction of on-site PCS stockpiles, and site restoration. All work under this task order was conducted in compliance with master planning documents prepared for the Pribilof Islands Site Restoration project, including a master quality assurance plan (Tetra Tech 1999c), master health and safety plan (Tetra Tech 1999a), and master investigation-derived waste plan (Tetra Tech 1999b). Photographs documenting the field activities are provided in Appendix A.

4.1 UNDERGROUND UTILITY LOCATION

Underground utilities at the site consisted of electrical supply, telephone line, and water supply distribution piping. City of St. Paul personnel marked utilities prior to intrusive activities. The main facility electrical line, a pad-mounted transformer, and a telephone line were located immediately north of the USTs. A secondary electrical line was located east of the AST, at the edge of the bermed area surrounding the tank. The utility locator believed that the line connected the main NWS building to House No. 5.

During trenching activities along the western edge of the AST containment area, an unmarked electrical supply for an automated weather data transmitter was identified. This electrical line was cut during the trenching operation, but City of St. Paul personnel repaired the line within 4 hours.

4.2 ABOVEGROUND STORAGE TANK REMOVAL

Tetra Tech and BSE began demolition of the 10,000-gallon AST on October 6, 1999, after visual inspection and monitoring of the tank atmosphere with an explosimeter, which measures both lower explosive limit (LEL) and oxygen concentration. The AST was intact, in good condition, contained no holes, and contained no free liquids. Because LEL inside of the tank was 0 percent, inerting procedures were not required.

The procedure used to demolish the AST included removing both ends of the AST and cutting the tank horizontally (see Appendix A, Photograph No. 1). The tank ends were removed with the excavator using chain rigging. Tank bottom sediment was removed by shoveling the material into a 55-gallon, open-top Department of Transportation-rated drum (see Appendix B, Photograph No. 2). The tank pieces were transported to a nearby airport hangar, where they were cut into 4- by 4-foot pieces, palletized and banded, and staged. The concrete AST support saddles were removed, broken into smaller pieces with the excavator, and staged near the excavation area. Scrap metal was later transported to the Pribilof Islands Restoration Project debris staging area at Tract 38, on the northern face of Polovina Hill.

The AST was located within a bermed and lined secondary containment area. The dimensions of this area were about 50 feet (east-west) by 35 feet (north-south). After the concrete AST support saddles were removed, the liner within the bermed area was removed, cut into manageable pieces, palletized and banded, and staged for later disposal. Soil beneath the liner was screened using a headspace photoionzation detector (PID) technique. Elevated PID readings up to 50 parts per million (ppm) were noted in soil samples collected at 6 inches bgs on the southern end of the bermed area. One surface soil sample (0 to 1.0 feet bgs) was collected for volatile organic compound analysis from the area of elevated PID readings. Demolition of the AST was completed on October 8, 1999.

A trench was excavated along the southern side of the bermed area on October 12, 1999, to evaluate the source of elevated PID readings in near-surface soils (see Appendix A, Photograph No. 3). Heavily stained soil with a strong diesel odor was observed in the trench from 2 to 6 feet bgs (see Appendix A, Photograph No. 4). The principal investigator also noted solvent odor similar to turpentine. Headpsace PID readings exceeded 500 ppm in stained soils, and PID readings in the trench ranged from 5 to 10 ppm. PCS was stockpiled on a pad of imported fill. The pad was constructed with a berm and lined with impermeable sheeting. The stockpile cell is located about 150 feet east of the UST and AST excavation.

Because soil within the trench exhibited solvent odor, Tetra Tech collected one sample from an area of obvious soil contamination within the trench and sent it to the project laboratory for analysis of volatile organic compounds. These compounds were not detected, suggesting that fuels are most likely the primary contaminants of concern in this area. The laboratory report is provided in Appendix D.

4.3 UNDERGROUND STORAGE TANK REMOVAL

Tetra Tech and BSE uncovered the three USTs following the removal of the AST and the concrete support saddles. The work plan (Tetra Tech 1999d) originally identified the location of the three USTs south of the berm that surrounded the AST. However, a metal detector indicated that shallow anomalies were present north of the AST. Initial excavation revealed piping, and the tops of the USTs were located about 2 feet bgs and north of the AST (see Figure 3). All three USTs were measured and found to be about 6 feet in diameter and 13 feet long, with a calculated capacity of about 3,000 gallons. Tetra Tech contacted ADEC and reported that stained PCS was encountered during UST excavation and that a release of petroleum had occurred at the site.

The piping system on the USTs consisted of a manifold system for both filling and supply piping. Piping ran to the north from the UST manifolds; however, these were not excavated and removed because two underground electrical lines and a telephone line were present north of the excavation. Piping was cut off and capped at the northern edge of the excavation before backfilling. All piping and tanks showed evidence of minor surface corrosion (rust), but no corrosion holes were observed.

The UST manhole covers were not bolted to two of the USTs, and the cover on the third and westernmost UST was missing. After removing the manholes, Tetra Tech noted that the tanks were filled with water and sediment (see Appendix A, Photograph No. 5). The sediment had apparently been placed in the USTs through the manhole as an in-place closure method. No free diesel product was present in the top of the USTs, but the water exhibited diesel odor. Gray-stained PCS with elevated headspace readings was present over the top and down the sides of the tanks. The source of leakage, either from overfills or piping leaks, could not be determined.

Further excavation of the USTs was delayed until a water treatment system could be mobilized to the site. Approval was obtained from ADEC to treat the water in the USTs through a series of three Colloid Environmental MX-200-L granular activated carbon (GAC) units and to discharge the treated water to the ground (see Appendix B). The estimated volume of treated water from the three USTs was about 4,000 to 5,000 gallons.

After water was removed from each tank with a diaphragm pump, the tops of the USTs were cut open, and fill sand was removed with the excavator (see Appendix A, Photograph No. 6). Each UST was emptied and removed sequentially in this manner. Fill sand removed from the USTs was placed on a stockpile pad constructed with a drain sump to collect water from the tank fill material. The water was then pumped through the GAC treatment system and discharged. The USTs were transported to the airport hangar, where they were cut into 4- by 4-foot pieces, palletized and banded, and staged (see Appendix A, Photograph No. 7). Additional PCS was removed from the excavation following UST removal. Final excavation dimensions were 19 by 24 feet across and 8 feet deep.

An effort was made to reach bedrock during the excavation activity. At about 10 feet bgs beneath the tanks, Tetra Tech observed stiff silt at least 2 feet thick; cobbles were noted toward the bottom of the stiff silt layer. Stiff silt also was noted at Geoprobe® refusal in several boreholes installed around the UST excavation.

Additional information on PCS management is presented in Section 4.6. Water removal from the USTs and treatment was initiated on October 13, and UST removals were completed on October 19, 1999.

4.4 GROUNDWATER SAMPLING

A drinking water supply well that is no longer used reportedly existed southeast of the NWS office and northeast of the AST and USTs. Tetra Tech attempted to locate the well using a metal detector and hand excavation tools. The well could not be located, so a groundwater sample was not collected at the well's reported location. Groundwater also was not encountered in the UST excavation up to a depth of 8 to 10 feet bgs, where the excavation was stopped.

Ten Geoprobe® boreholes were completed in immediate vicinity of the UST excavation and the bermed area formerly containing the AST. Borehole GP-2 (see Figure 3) encountered groundwater at about 10 feet bgs, but insufficient groundwater volume was available from the borehole for laboratory analysis. The recovered amount of sample did not exhibit any petroleum odor. The remaining nine borings met refusal before encountering groundwater.

4.5 SITE RESTORATION

On October 20, 1999, the trench on the southern side of the AST area and the UST excavation were backfilled. Clean fill was obtained from a borrow pit located on Polovina Hill. The three AST support saddles were also used as backfill in the UST excavation. BSE used a trackhoe and loader to compact soil up to surface grade.

4.6 PETROLEUM-CONTAMINATED SOIL MANAGEMENT

PCS was encountered in the trench completed on the southern end of the bermed area beneath the AST and throughout the UST excavation. PCS was placed in two bermed, lined, and covered stockpiles east of site. The smaller PCS stockpile located furthest east at the site contains PCS excavated from the trench on the southern side of the AST containment area, as well as petroleum-contaminated fill from the USTs. The adjacent PCS stockpile, the larger stockpile located closest to the main NWS building, contains PCS from the AST trench and the PCS removed from the UST excavation. Both PCS stockpiles were covered lined and covered with visqueen sheeting (see Appendix A, Photographs No. 8 and 9).

PCS volume removed from the excavation was estimated at 90 cubic yards (yd^3), based on an UST excavation dimensions of 19 by 24 by 8 feet deep (135 yd^3), less the calculated volume of the tanks (45 yd^3). The volume of fill sand removed from the USTs is about 20 yd^3. The PCS volume removed from the trench on the southern side of the AST containment area was estimated at 89 yd^3, based on an excavation dimension of 12 by 50 by 4 feet deep. Applying a bulking factor of 11 percent for loose, damp sand, the stockpile volume for the PCS placed in the two stockpiles is about 221 yd^3.

5.0 BOREHOLE INVESTIGATION

A truck-mounted Model 4500 Geoprobe® was used to complete a preliminary subsurface investigation at the site during and immediately following AST and UST removal activities. On October 9, 1999, Tetra

Tech installed two boreholes east (GP-1) and southeast (GP-2) of the UST excavation to evaluate subsurface lithology and depth to groundwater (see Figure 3). Soil samples were collected with a 4-foot-long Macrocore® sampler with a clear polyvinyl chloride (PVC) liner. Samples were visually logged and field screened using a headspace PID technique.

On October 21, 1999, Tetra Tech installed eight additional boreholes east, south, and west of the UST excavation (see Figure 3). Boreholes could not be completed north of the USTs because of the presence of subsurface electrical lines and an aboveground electrical transformer located immediately north of the UST location.

Tetra Tech did not note visual staining in any soil samples, but diesel fuel odor was noted in samples collected from the 0- to 4-foot bgs interval in boreholes NWS04, NWS05, and NWS11. This shallow contamination may be the result of AST overfills that spread east and west of the tank. Boreholes NWS06, NWS07, and GP-2, all located east of NWS04 and NWS 05, did not encounter visual or olfactory evidence of contamination. Also, no evidence of contamination was noted west of the UST excavation in boreholes NWS08 and NWS09.

Deep subsurface soil contamination was evidenced by a strong diesel fuel odor and an elevated headspace reading (144 ppm) obtained from the sample collected from 8 to 12 feet bgs in borehole NWS10. This borehole was installed within the bermed area that surrounded the AST. One soil and one duplicate soil sample were collected from this interval and submitted to the laboratory for analysis of DRO, BTEX, and PAHs. At borehole NWS11, located west of the AST, the 0- to 4-foot bgs sampling interval exhibited olfactory evidence of release as well.

Additional boreholes were not completed due to limitations of available Geoprobe® consumable sampling tools. Tetra Tech was able to install a total of 13 boreholes, but was unable to delineate the extent of contamination north of the former USTs and west, south, and east of the former AST. Borehole logs are included in Appendix C, and headspace PID readings collected from soil samples collected in these boreholes are presented in Table 1.

6.0 ANALYTICAL RESULTS

All soil samples collected for laboratory analysis during the assessment were shipped under a chain-of-custody protocol to Columbia Analytical Services, Inc. (Columbia), in Anchorage, Alaska, or Seattle, Washington. Both Columbia laboratories are approved by ADEC for UST investigations.

Because soil contamination was evident in the UST excavation, Tetra Tech collected duplicate samples from the borehole interval exhibiting the highest headspace PID reading of all borehole intervals sampled. The samples were collected in borehole NWSSNP10 between depths of 8 and 11 feet bgs. The samples were analyzed for diesel-range organics (DRO); benzene, toluene, ethylbenzene, and total xylenes (BTEX); and polycyclic aromatic hydrocarbons (PAH). The samples contained detectable DRO as high as 25,000 milligrams per kilogram (mg/kg). In addition, ethylbenzene, xylenes, and seven PAHs were detected above the laboratory practical quantitation limits for those analytes, but below Method Two soil cleanup levels. Analytical results are summarized in Table 2, and laboratory analytical reports are included as Appendix D.

7.0 CLEANUP LEVELS

Tetra Tech evaluated the site-specific Method One cleanup level against the criteria set forth at 18 AAC 75.341(a), using a matrix score sheet provided in Appendix E. Using this method, the site-specific cleanup level for DRO is 200 mg/kg.

To calculate Method One cleanup levels, several factors are required, including the depth to groundwater and volume of contaminated soil. Depth to groundwater at the NWS site has not been determined, but information obtained during the installation of borehole GP-2 indicates that subsurface water is present at less than 15 feet bgs. Tetra Tech was unable to determine whether this water is perched or is in the shallow aquifer beneath the site.

In addition, based on the size of the bermed area surrounding the former AST, and assuming that the source of most of the soil contamination was primarily from AST overfills, the remaining volume of PCS exceeding the Method One cleanup level is estimated at 430 yd^3, and the total volume of contaminated soil at the site before removal exceeds 500 yd^3. Additional data from the limited Geoprobe® assessment indicates that PCS extends beyond the limits of the bermed area, and that further delineation is required.

Tetra Tech also evaluated the Method Two cleanup levels set forth at 18 AAC 75.341(c) and (d). Method Two provides for less stringent DRO cleanup levels where BTEX constituents and PAHs do not exceed the values specified at 18 AAC 75.341(c). This is the case at the NWS site; these analytes were detected well below the specified levels in the most obviously contaminated sample collected at the site. Therefore, the use of Method Two cleanup levels is appropriate. Depending on the primary threat, the Method Two DRO cleanup level is 250 mg/kg (migration to groundwater); 10,250 mg/kg (ingestion); or 12,500 mg/kg (inhalation). For example, certain conditions exist whereby the cleanup level based on migration to groundwater may not be appropriate. With available, site-specific information, the threat posed by the site to the island's drinking water aquifer is not known. Although the site most likely does not threaten the water supply because of its distance from the municipal water supply wells, detailed hydrologic regime information is not available at this time.

8.0 CONCLUSIONS

Tetra Tech removed and demolished three 3,000-gallon USTs and one 10,000-gallon AST that formerly stored arctic diesel fuel used as a heating fuel at the NWS Station. PCS was identified during excavation and removal activities by the presence of staining, odor, and elevated headspace PID readings (up to 500 ppm). PCS was encountered between the USTs and throughout the UST excavation. Apparent PCS was also encountered throughout a 50-foot-long test trench dug along the southern side of the AST containment area. About 221 yd^3 of PCS was stockpiled east of the UST excavation in two bermed, lined, and covered cells. Assuming that all of the soil beneath the former AST containment area is contaminated with diesel fuel, a preliminary estimate of the remaining PCS volume beneath the area and above the stiff silt layer is about 430 yd^3.

A limited Geoprobe® soil assessment was conducted at the site during and following tank removal activities. Subsurface lithology included medium alluvial sand and silts to about 8 to 10 feet bgs, underlain by stiff silt with cobbles; basalt bedrock may underlie this silt layer. Two Geoprobe® soil samples collected in duplicate from 8 to 11 feet bgs in the AST containment area southwest of the UST excavation, were submitted for laboratory analysis for DRO, BTEX, and PAHs. The samples contained DRO ranging from 15,000 to 25,000 mg/kg. This DRO concentration exceeded the site-specific Method One cleanup level of 200 mg/kg, as well as the most stringent of the Method Two cleanup levels available. Diesel odor and elevated headspace PID readings were detected in Geoprobe® soil samples collected outside of the AST containment area, indicating that the volume of PCS above ADEC action levels remaining at the site may be larger than estimated beneath the former AST containment area.

Groundwater was encountered in one borehole at 10 feet bgs about 50 feet east of the AST. However, it could not be sampled because of limited recovery. An abandoned facility water well, located east of the UST excavation, could not be located. Therefore, assessment activities were insufficient to determine whether or not petroleum releases associated with the UST and AST have affected groundwater quality at the site.

Based on current site information, PCS remains in the area between the UST excavation and the AST trench. The depth of the PCS is not known. However, assuming that PCS is continuous to a depth of 8 feet bgs, the remaining volume under the AST is about 430 yd^3. This volume estimate was based on the dimensions of the AST containment area of 35 by 50 feet and the calculated volume of PCS removed from the trench (89 yd^3).

In addition, the extent of soil contamination north of the USTs has not been characterized. Because electrical lines and a transformer are located immediately north of the UST excavation, Tetra Tech did not install Geoprobe® boreholes in this area. The extent of contamination around the former AST also has not been delineated. Tetra Tech initially planned to install up to four boreholes at the NWS site, three as part of a separate project and one as part of the groundwater sampling effort. After Tetra Tech identified evidence of a release at the site, NOAA requested that Tetra Tech install additional boreholes to delineate the horizontal and vertical extent of contamination. With the available Geoprobe® consumable sampling tools, Tetra Tech was able to install a total of 13 boreholes, but was unable to delineate the extent of contamination.

9.0 RECOMMENDATIONS

Tetra Tech was unable to characterize the horizontal and vertical extent of contamination within the scope of the task order. NOAA should therefore expand the scope of the site investigation to evaluate the extent of DRO contamination above cleanup levels. With ADEC approval, NOAA should consider conducting a limited trenching investigation around the contaminated areas in an attempt to reach the bounds of contamination. To reduce analytical costs, ADEC-approved field screening techniques should be proposed. After the boundary is identified, NOAA should propose to ADEC that soil contaminated above the 250-mg/kg cleanup level be removed with soil currently stockpiled at the NWS station. If possible, it should be staged and consolidated with other contaminated soil that will be treated at St. Paul Island.

Because utilities exist near the former fuel tanks, it may not be possible to completely remove all soil contaminated above Method Two cleanup levels. Nevertheless, the bulk of contaminated soil can most likely be removed, and removal of highly contaminated soil will reduce the contaminant mass available for migration through subsurface soil and potentially groundwater. In areas where contaminated soil is inaccessible, or in areas where contaminant levels exceed Method Two cleanup levels but are acceptable to ADEC if other remedies are implemented, NOAA should consider implementing an in situ remedy such as monitored natural attenuation, bioaugmentation, soil vapor extraction, or bioventing.

Two significant data gaps include (1) depth to groundwater and (2) potential site impacts to the underlying water table. If contamination is identified at depths near the water table, ADEC will most likely require the installation of groundwater monitoring wells and short-term monitoring, at a minimum. If this is the case, NOAA should install several wells in and around the area of documented contamination to evaluate whether or not a release to the water table has occurred. Any release will require remedial work pursuant to applicable regulations at 18 AAC 75.345.

REFERENCES

Alaska Department of Environmental Conservation (ADEC). 1998. *Underground Storage Tanks Procedures Manual, Guidance for Treatment of Petroleum-Contaminated Soil and Water and Standard Sampling Procedures.* December 10.

ADEC. 1999. *Handbook for Conducting Cleanups of Contaminated Sites Under the Voluntary Cleanup Program.* December 29.

Alaska Department of Labor. 2000. Internet Site http://www.labor.state.ak.us/research/pop/place2.htm. January 15.

Barth, T.F.W. 1956. "Geology and Petrology of the Pribilof Islands, Alaska." U.S. Geological Survey Bulletin 1028-F.

Central Bering Sea Fisherman's Association (CBSFA). No Date. "St. Paul Harbor, Alaska's Sustainable Opportunity."

Dames and Moore. 1999. "Hydrologic Monitoring Investigation, Fourth Quarterly Sampling Event, September 1998, USCG LORAN Station, St. Paul, Alaska, Final Report." Prepared for U.S. Coast Guard, Juneau, Alaska. January.

Elliott, H.W. The Seal-Islands of Alaska. Limestone Press, Kingston, Ontario, Canada.

Munter, J.A. and R.D. Allely. 1994. "Analysis of an Aquifer Test at St. Paul Island. Pribilof Islands, Alaska." State of Alaska Division of Geological and Geophysical Surveys. Public Data File No. 94-27.

National Climatic Data Center (NCDC). 2000. Internet Site http://www.ncdc.noaa.gov/ol/climate/climateresources.html. January 15.

National Oceanic and Atmospheric Administration (NOAA) and U.S. Coast Guard (USCG). 1998. Plate Entitled "Pribilof Islands, Alaska, Environmentally Sensitive Areas (Seal Islands National Historic Landmark and Part of the Alaska Maritime National Wildlife Refuge)." August.

National Weather Service (NWS). 2000. Telephone Conversation Between Robert Van De Graff, NWS, and Debbie Kutsal, Tetra Tech EM Inc. January 13.

Tetra Tech EM Inc. (Tetra Tech). 1999a. "Final Master Health and Safety Plan, Pribilof Islands Site Restoration, St. Paul Island, Alaska." September 22.

Tetra Tech. 1999b. "Final Master Investigation-Derived Waste Plan, Pribilof Islands Site Restoration,

St. Paul Island, Alaska." September 22.

Tetra Tech. 1999c. "Final Master Quality Assurance Plan, Pribilof Islands Site Restoration, St. Paul Island, Alaska." September 22.

Tetra Tech. 1999d. " Final Work Plan, Solid Waste Trench Investigation and Fuel Tank Closure, National Weather Service Station, St. Paul Island, Alaska." October 4.

URS Corporation (URS). 1987. “City of St. Paul Water Supply Analyses Study – Final Report.”

Woodward-Clyde Corporation (Woodward-Clyde). 1994. “Site Inspection Report, St. Paul Island, Alaska.” Prepared for U.S. Army Corps of Engineers Seattle District. November.

FIGURES

TABLES

TABLE 1

SOIL SAMPLE SCREENING RESULTS

NATIONAL WEATHER SERVICE STATION
ST. PAUL, ALASKA

Borehole Number	Sample Depth (feet bgs)	Headspace Reading (ppm)	Diesel Odor
NWSSNP04	0.0 to 4.0	5.4	Slight
NWSSNP05	0.0 to 4.0	3.3	Slight
NWSSNP06	0.0 to 4.0	6.3	None
	4.0 to 6.0	23.2	None
NWSSNP07	0.0 to 4.0	6.3	None
	4.0 to 6.0	17.0	None
NWSSNP08	0.0 to 4.0	7.5	None
	4.0 to 8.0	18.5	None
	8.0 to 10.0	13.5	None
NWSSNP09	0.0 to 4.0	9.1	None
	4.0 to 8.0	5.8	None
	8.0 to 11.0	6.9	None
NWSSNP010	0.0 to 4.0	10.0	None
	4.0 to 8.0	36.3	None
	8.0 to 12.0	144.0	Strong
NWSSNP011	0.0 to 4.0	22.0	Strong

Notes:

bgs Below ground surface
ppm Parts per million (measured using a photoionization detector equipped with an 11.7-electron volt lamp and calibrated against 100 ppm isobutylene in air)

TABLE 2

SOIL SAMPLE ANALYTICAL RESULTS [a]

NATIONAL WEATHER SERVICE STATION
ST. PAUL, ALASKA

Analytical Parameter	Cleanup Level [b]		Sample No., Depth, and Result	
			NWSSNP10-110 (11 feet bgs [c])	NWSSNP10-110D (11 feet bgs)
Fuels				
Diesel-range organics (DRO)	250	(1)	25,000 H	15,000 H
Benzene, toluene, ethylbenzene, and total xylenes (BTEX)				
Benzene	0.02	(2)	< 0.05	< 0.05
Toluene	5.4	(2)	< 0.05	< 0.05
Ethylbenzene	5.5	(2)	0.3	0.3
Xylenes, total	78	(2)	0.6	1.5
Polycyclic aromatic hydrocarbons (PAH)				
Acenaphthene	210	(2)	0.4	0.3
Acenaphthylene	NA [d]	(2)	0.2	0.09 J
Anthracene	4,300	(2)	< 0.08 X	< 0.02 X
Benzo(a)anthracene	6	(2)	< 0.2 X	< 0.05 X
Benzo(a)pyrene	3	(2)	< 0.01	< 0.01
Benzo(b)fluoranthene	11	(3)	0.03	0.05
Benzo(g,h,i)perylene	NA	(2)	< 0.02	< 0.02
Benzo(k)fluoranthene	110	(3)	< 0.01	< 0.01
Chrysene	620	(2)	< 0.6 X	< 0.3 X
Dibenzo(a,h)anthracene	1	(2)	< 0.01	< 0.01
Fluoranthene	2,100	(2)	< 0.2 X	< 0.2 X
Fluorene	270	(2)	5.3	2.7
Indeno(1,2,3-cd)pyrene	11	(3)	0.02	< 0.01
Naphthalene	43	(2)	3.0	0.6
Phenanthrene	NA	(2)	7.0	3.1
Pyrene	1,500	(2)	< 16 X	< 9.0 X

Notes:

a Cleanup levels and analytical results are expressed in milligrams per kilogram (mg/kg)
b (1) Method Two petroleum hydrocarbon cleanup level specified at 18 AAC 75.341(d) for migration to groundwater threat
  (2) Method Two soil cleanup level specified at 18 AAC 75.341(c) for migration to groundwater threat
  (3) Method Two soil cleanup level specified at 18 AAC 75.341(c) for ingestion threat
c Below ground surface
d Not applicable

Data Qualifiers:

J Estimated value
H Holding time exceeded
X Practical quantitation limit elevated because of matrix interference

APPENDIX A

PHOTOGRAPHS

NATIONAL WEATHER SERVICE STATION
ST. PAUL, ALASKA

APPENDIX B

UNDERGROUND STORAGE TANK WATER TREATMENT PROPOSAL AND ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION ACCEPTANCE LETTER

NATIONAL WEATHER SERVICE STATION ST. PAUL, ALASKA

APPENDIX C

BOREHOLE LOGS

NATIONAL WEATHER SERVICE STATION
ST. PAUL, ALASKA

APPENDIX D

ANALYTICAL REPORTS

NATIONAL WEATHER SERVICE STATION
ST. PAUL, ALASKA

APPENDIX E

METHOD ONE PETROLEUM HYDROCARBON SOIL CLEANUP LEVELS IN NONARCTIC ZONES

NATIONAL WEATHER SERVICE STATION ST. PAUL, ALASKA