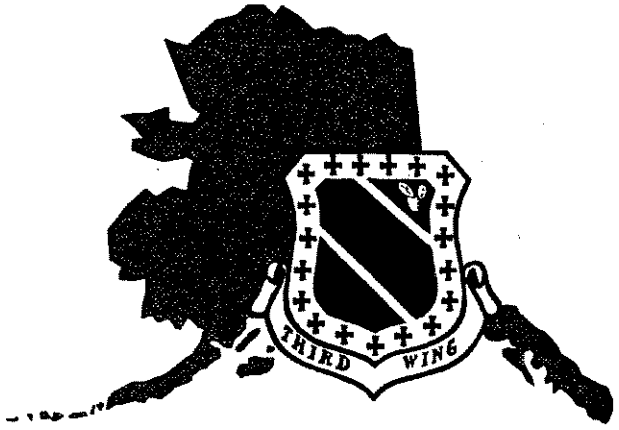

UNITED STATES AIR FORCE
ELMENDORF AIR FORCE BASE, ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

SERA PHASE IX RELEASE INVESTIGATION REPORT
ST505/9, AWACS HANGAR
UST AFID NOS. 306, 307, AND 308
FINAL

FEBRUARY 2002

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ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFID	Air Force Identification Number
AGE	Air-to-Ground Equipment
ASTM	American Society for Testing and Materials
AWACS	Airborne Warning and Control Squadron
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
C	Centigrade
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSRP	Contaminated Sites Remediation Program
DRMO	Defense Reutilization and Marketing Organization
DRO	Diesel range organics
EAFB	Elmendorf Air Force Base
EPH-D	extractable petroleum hydrocarbons-diesel
EPA	U.S. Environmental Protection Agency
ESF	Environmental Staging Facility
EV	Electron volt
F	Fahrenheit
FFA	Federal Facility Agreement
GRO	Gasoline range organics
HDPE	High-density polyethylene
HHS	Heated Headspace
IDW	Investigation-derived waste
JP-4	Jet propulsion fuel number 4
LNAPL	Light nonaqueous-phase liquids
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mL	Milliliter

ACRONYMS (Continued)

MNA	Monitored natural attenuation
mogas	Motor vehicle gasoline
MRL	Method reporting limit
MS	Matrix spike
MSD	Matrix spike duplicate
MS/MSD	Matrix spike/matrix spike duplicate
OU5	Operable Unit 5
PAHs	Polycyclic aromatic hydrocarbons
PID	Photoionization detector
POL	Petroleum, oil, and lubricants
mg/kg	Parts per million
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
RI	Release Investigation
RRO	Residual range organics
SERA	State-Elmendorf Environmental Restoration Agreement
SSHP	Site-Specific Safety and Health Plan
TOC	Total organic carbon
TPH-G	total petroleum hydrocarbons-gasoline
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USCS	Unified Soil Classification System
UST	Underground storage tank
VOA	Volatile organic analysis
VOC	Volatile organic compound

EXECUTIVE SUMMARY

The accompanying report presents findings of the State-Elmendorf Environmental Restoration Agreement (SERA) Phase IX Release Investigation (RI) at ST505/9 on Elmendorf Air Force Base (EAFB). Building 14410 (formerly Building 42-300) is associated with the Airborne Warning and Control Squadron (AWACS) Hangar and is situated near the aircraft hardstands north of the East-West Runway. The site is a former fueling station for air-to-ground equipment.

The fueling station was on the south side of the building and included three 2,500-gallon, single-walled underground storage tanks (USTs) (Air Force Identification Numbers 306, 307 and 308[1]) and an associated fuel dispenser island approximately 15 feet to the west. Tank 419 stored diesel, Tank 420 stored motor vehicle gasoline (mogas), and Tank 424 stored jet propulsion fuel number 4 (JP-4). The site remained active for approximately 10 years. The tanks, associated piping, and dispensers were removed in May 1994. During tank removal, no leaks from the tanks were observed, and the tanks appeared to be in good condition, with uniform surface corrosion. Field screening and soil analytical results showed that hydrocarbon concentrations in soils from the excavation were very low or non-detect. The tank excavation was backfilled with stockpiled soils and approximately 25 yards of clean soil.

Analytical results from soil samples collected from the dispenser island indicated the presence of contamination from petroleum, oil, and lubricant (POL) products.

The goal of the 2001 field program at ST505/9 has been to gather additional data that would address data gaps identified by EAFB and allow for evaluation of the potential for site closure. There were two major objectives of the SERA IX investigation at this site:

- Delineate the extent of soil contamination in the vertical and lateral directions in the vicinity of the dispenser island.
- Fill the following specific analytical data gaps: 1) no polycyclic aromatic hydrocarbon (PAH) data for soil had been collected to date at this site; and 2) previous non-detect benzene results were obtained at method recording limits that are in excess of the Alaska Department of Environmental Conservation Method Two migration-to-groundwater soil cleanup level of 0.02 milligrams per kilogram (mg/kg) and therefore did not allow for determination of whether the Method Two benzene cleanup level has been exceeded.

Major findings of the SERA IX investigation included the following:

[1] Also referred to as Storage Tank Management Plan (STMP) Nos. 419, 420, and 424.

- Soil analytical data indicate that no soil samples collected from the tank excavation, dispenser island, or downgradient of these two potential source areas exceed the most stringent Method I, Level A, soil cleanup standards for diesel range organics, residual range organics, or gasoline range organics.
- Soil samples did not exceed Method II cleanup standards for PAHs.

Based on the results of the SERA IX RI and the UST Site Assessment, and the fact that the site falls into the OU5 model area, this site is recommended for closure.

1.0 INTRODUCTION

This report presents the findings of the State-Elmendorf Environmental Restoration Agreement (SERA) Phase IX Release Investigation (RI) at ST505/9 Airborne Warning and Control Squadron (AWACS) Hangar, on Elmendorf Air Force Base (EAFB: see Figure 1–1). SERA is a cooperative agreement signed in October 1992 between the U.S. Air Force (USAF) and Alaska Department of Environmental Conservation (ADEC).

SERA addresses EAFB's solid waste; underground storage tank (UST); and petroleum, oil, and lubricant (POL) spill program areas, and does not include sites already addressed in EAFB's Federal Facility Agreement (FFA). FFA sites are subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

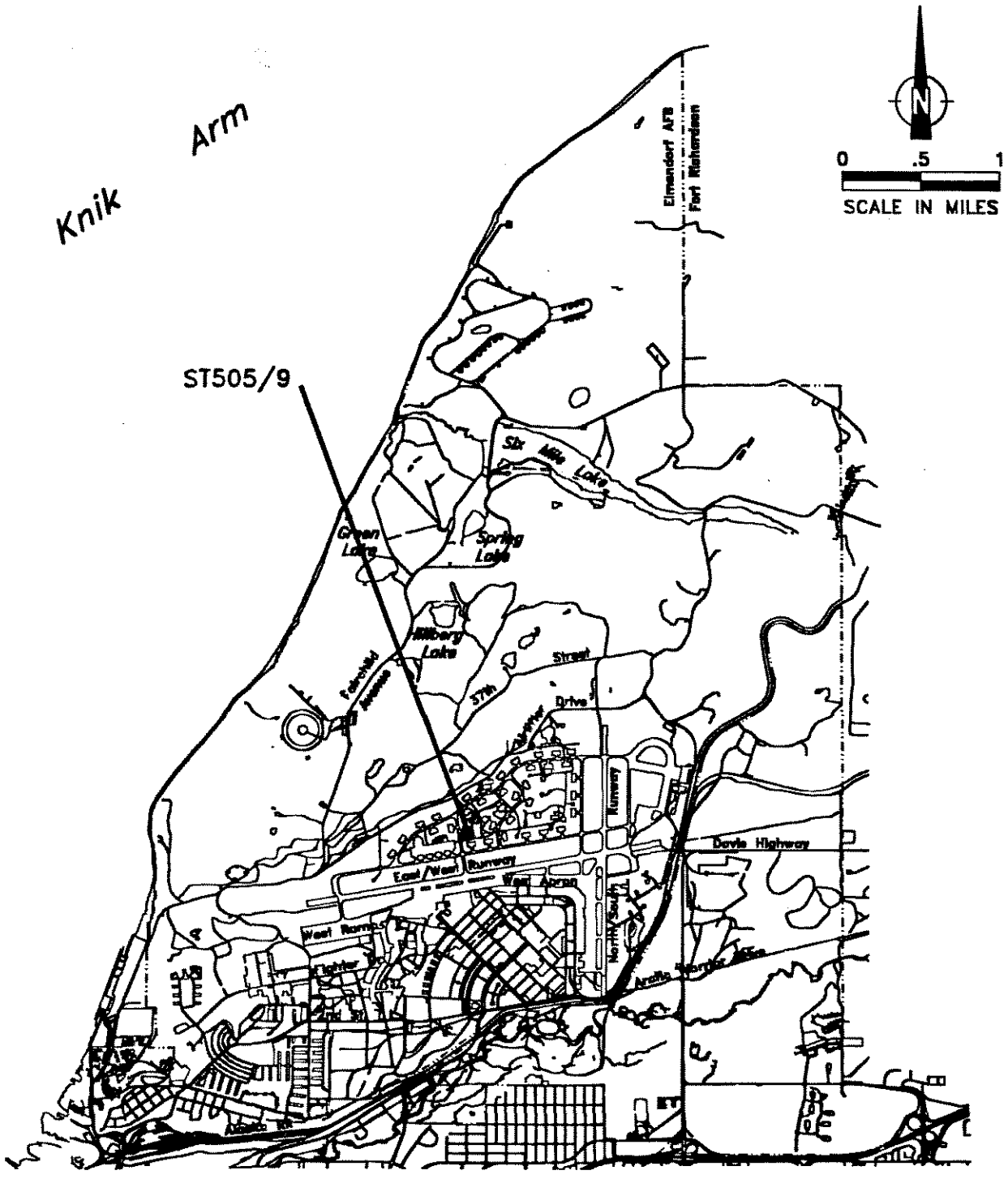
SERA requires EAFB to perform any necessary assessment, monitoring, remediation, and closure of solid waste, UST, and POL spill sites identified under SERA, as well as new sites identified subsequent to the issuance of SERA. For all sites in SERA Phase IX, it has been established through previous environmental investigations that a discharge or release has occurred from a known source of contamination (e.g., leaking UST or surface spill).

The goal of the 2001 field program at ST505/9, which was investigated previously during the UST Site Assessment, is to gather additional data that will address data gaps identified by EAFB and allow for evaluation of the potential for site closure.

1.1 Report Outline

This report is divided into the following sections:

- Section 1.0 introduces the report and describes the SERA program, the regional setting, applicable ADEC regulatory requirements, site background, previous investigations, and site objectives.
- Section 2.0 summarizes field methods employed in the RI. This section also discusses methods and standards used in data interpretation.
- Section 3.0 describes 2001 fieldwork and discusses all findings to date for the site.
- Section 4.0 provides conclusions of the RI, identifies any remaining data gaps, and provides disposition recommendations for the site.
- Section 5.0 is a list of documents cited in this report.



FILE: F3605/A-D	DRAWN: SSR	FIGURE 1-1 ST505/9 SITE LOCATION MAP	3 CES/CEVR SERA PHASE IX ELMENDORF AFB, ALASKA ENSR PROJECT #9000-268
C/SC: 1:5500	ZIP: 47/01		
DATE: 10/23/01	CHECK: J.D.		

Analytical results and figures for the previous investigation are presented in Appendix A. Boring exploration logs for SERA IX are in Appendix B. Appendix C contains the completed ADEC Matrix Score Sheet for the UST investigation. The SERA IX data assessment report for ST505/9 includes a discussion of data quality and chromatogram interpretations and is provided in Appendix D.

1.2 SERA Phase IX

The approach to SERA fieldwork was based on whether or not a site is located within the groundwater modeled area (Operable Unit 5 [OU5] Model Area) of the EAFB outwash plain (Figure 1-2). Because groundwater quality in the model area is being monitored actively under the terms used to establish OU5, SERA sites within the model area typically do not address dissolved-phase contamination. ST505/9 is within the model area, and therefore the investigation did not focus on the presence of dissolved-phase contaminants in groundwater.

1.3 ADEC Regulatory Requirements

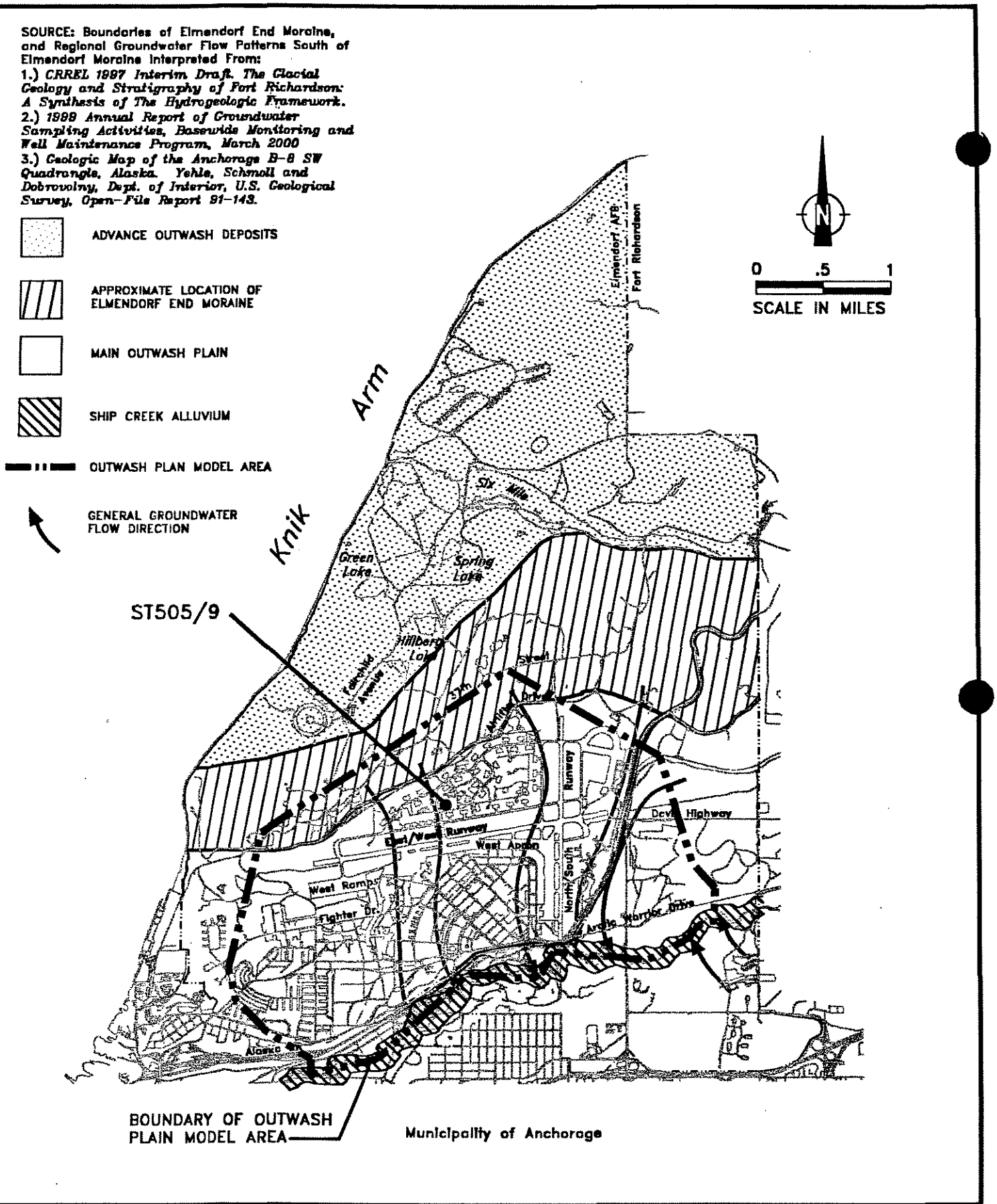
State of Alaska regulations pertinent to the SERA IX RI for ST505/9 include the site characterization/RI and corrective action requirements of Title 18 of the *Alaska Administrative Code* (AAC), Sections 75 and 78.

1.4 ADEC Underground Storage Tank Regulations

For UST sites with a confirmed release of petroleum product, an RI must be performed in accordance with 18 AAC 78.234. ST505/9 is subject to the RI requirements of 18 AAC 78 (UST Regulations), including the soil cleanup levels published in 18 AAC 75 and commonly known as the Contaminated Sites Remediation Program (CSRP).

The RI regulations require that after initial release abatement is complete, an RI is conducted to characterize the release and the actual or potential threat to human health and safety, and to the environment. If applicable to the site, the RI must include the following (with the applicability to the SERA program also noted):

- *Soil samples must be taken to adequately characterize the horizontal and vertical distribution of the release in the soil and to identify soil properties that are likely to influence the type and rate of migration.* The UST Site Assessment and the SERA IX investigation were conducted at the site to satisfy this requirement.



FILE: RGFP/A-D	DRAWN: SSR	FIGURE 1-2. REGIONAL GROUNDWATER FLOW PATTERNS
C/SC: 1:5500	ZIP: 47/01	3 CES/CEVR SERA PHASE IX ELMENDORF AFB, ALASKA ENSR PROJECT #9000-268
DATE: 10/23/01	CHECK: J.D.	

- *Investigation of the site geology and hydrogeology must be conducted to adequately characterize the horizontal and vertical distribution of the release in groundwater and to identify the features that affect the fate and transport of the release.* The UST Site Assessment and the SERA IX investigation were conducted at the site to satisfy this requirement.
- *Investigation of any surface waters must be conducted to adequately characterize significant hydrologic features such as surface drainage patterns and quantities, surface waters, floodplains, and actual or potential contaminant migration routes toward or within these features.* The release site is not located near any significant hydrologic feature.
- *A hazard ranking evaluation must be conducted to measure the potential risk to human health and safety and to the environment.* ADEC Preliminary Risk Evaluation form completed during the SERA Phase V RI.

1.5 Regional Geology

EAFB lies within the Cook Inlet-Susitna Lowlands, which is bordered on the west by the Alaska Range and on the east by the Kenai, Chugach, and Talkeetna mountain ranges. The Elmendorf Moraine traverses the base from northeast to southwest and consists of discontinuous, unconsolidated glacial till comprising gravel, sand, and silt deposits. The southern boundary of the Elmendorf Moraine is a ridgeline running along the north side of the east-west runway. Underlying the glacial deposits of the Elmendorf Moraine are the shallow marine deposits of the Bootlegger Cove Formation.

The shallow aquifer within the Elmendorf Moraine occurs from 1 to 60 feet below ground surface (bgs). The greatest depth to groundwater is along the moraine crest, which also acts as a groundwater divide with groundwater becoming shallower along the limbs of the moraine (USAF 2000a). Groundwater flow is divided by the Elmendorf Moraine. Groundwater flow direction in the Elmendorf Moraine closely matches the slope of the surface topography, with flow to the northwest along the north edge and to the southeast along the south edge of the moraine (USAF 2000a).

South of the moraine are sediments associated with the glaciofluvial deposits of an outwash plain (herein called "Main Outwash Plain"), consisting of mainly unconsolidated, poorly sorted sand and gravel with a thin overlying layer of loess present locally. Underlying the glacial outwash deposits are fine-grained silt and clay deposits of the Bootlegger Cove Formation. The Bootlegger Cove Formation beneath the Elmendorf Moraine is encountered between 50 and 100 feet bgs. Depth to the shallow aquifer in the Main Outwash Plain is between 5 and 50 feet bgs. The general flow direction of the shallow aquifer in the Main Outwash Plain is to the south and southwest, toward Ship Creek. ST505/9 is located within the Main Outwash Plain.

South of the Main Outwash Plain is the Ship Creek Alluvium. The Ship Creek Alluvium is comprised of unconsolidated, fine- to medium-grained sands, with lesser amounts of fine-grained gravel. The Bootlegger Cove Formation is believed to underlie the Ship Creek Alluvium, although the Bootlegger Cove Formation is exposed only in downstream locations (USAF 2000). Depth to the shallow aquifer in the Ship Creek Alluvium varies from zero to 10 feet bgs. The general flow direction of the shallow aquifer in the Ship Creek Alluvium closely matches that of Ship Creek.

North of the Elmendorf Moraine are advance outwash deposits consisting of stratified sand and pebble-and-cobble gravel. The Bootlegger Cove Formation underlies the advance outwash deposits and is exposed along the Knik Arm bluff. The thickness of the advance outwash deposit ranges from 5 to 42 feet along Knik Arm. Groundwater occurs in the advance outwash deposits above the Bootlegger Cove Formation.

Overall, the regional groundwater flow direction north of the moraine is to the northwest toward Knik Arm of Cook Inlet, while the regional groundwater flow direction south of the moraine is to the south and west toward Ship Creek (Figure 1-2). The local groundwater flow direction at the site is to the southwest toward Ship Creek.

1.6 Site Background

Building 14410 (formerly Building 42-300) is associated with the AWACS Hangar and is situated near the aircraft hardstands north of the East-West Runway. The site is a former fueling station for Air-to-Ground Equipment (AGE). The fueling station was located on the south side of the building and included three 2,500-gallon, single-walled USTs (Air Force Identification [AFID] Numbers 306, 307 and 308; also referred to as Storage Tank Management Plan [STMP] Nos. 419, 420, and 424) and an associated fuel dispenser island approximately 15 feet to the west. Tank 419 stored diesel, Tank 420 stored mogas, and Tank 424 stored JP-4. The site remained active for approximately 10 years. The tanks, associated piping, and dispensers were removed in May 1994. During tank removal, no leaks from the tanks were observed, and the tanks appeared to be in good condition, with uniform surface corrosion. The tank excavation was backfilled with stockpiled soils and approximately 25 yards of clean soils. Soil from the dispenser island area was not excavated (USAF 1994b). Previous investigation analytical results and figures are presented in Appendix A.

The depth to groundwater at ST505/9 is 21.9 feet to 22.5 feet bgs. Basewide groundwater monitoring indicates that this aquifer flows to the south-southwest in this area (USAF 1994b). An open drainage ditch and open drain gate were located directly south of the former tanks before the tank excavation. The nearest monitoring well included in the 1999 Groundwater Sampling Event is OU4W-04 located approximately 300 feet east-southeast. The nearest downgradient active well, Base Well 16, is approximately 3,750 feet southwest of the site.

There is a small stream approximately 1.25 miles south of the site. ST505/9 is located in the Outwash Plain Groundwater Model Area.

1.6.1 Previous Investigations

UST Site Assessment. At the time of tank removal, nine laboratory soil samples were collected from the site (including three from the dispenser island area). Excavation samples were collected within 2 feet of the bottom of the tanks and less than 5 feet from either end. Dispenser island samples were collected within 2 feet below the piping at each dispenser. The soil samples were submitted for analysis of total petroleum hydrocarbons-gasoline (TPH-G), extractable petroleum hydrocarbons-diesel (EPH-D), and BTEX. Appendix A contains a figure showing sample locations and analytical results from the UST Site Assessment.

EPH-D was detected at 14 and 146 mg/kg in the excavation beneath the JP-4 and diesel tanks in the southern half of the pit. TPH-G was detected at 7 mg/kg in one sample collected from beneath the diesel tank. The mogas fuel line traversed the diesel tank at this location. Xylene was detected at 0.07 mg/kg in this same southern corner location.

Significantly higher levels of hydrocarbon concentrations were detected from beneath the fuel dispensers. TPH-G ranged from 16 to 3,200 mg/kg, and EPH-D ranged from 193 to 4,160 mg/kg. Benzene was detected beneath the mogas dispenser at 57 mg/kg. Toluene was detected beneath the JP-4 and diesel dispensers at a range from 0.06 to 0.09 mg/kg, but at 510 mg/kg beneath the mogas dispenser. Ethylbenzene was detected (140 mg/kg) only beneath the mogas dispenser. Xylenes were detected at 0.06 mg/kg beneath the diesel dispenser and at 720 mg/kg beneath the mogas dispenser (USAF 1994b). It was noted that the UST Site Assessment report inconsistently identified dispenser island samples 42-300-D-2 and 42-300-D-1. However, it is assumed that the sample location map prepared for the report correctly identified the location of the GRO result of 3,200 mg/kg from beneath the mogas dispenser.

SERA Release Investigation. An RI was planned for this site during SERA Phase V (USAF 1996a) but was never completed (USAF 1999b).

1.6.2 Exceedances of Cleanup Levels

Soil. Data from the UST site assessment report (USAF 1994b) were compared to ADEC Method One soil cleanup levels (18 AAC 75.341). The site was scored as Level D in the UST Site Assessment report but probably should have been scored Level B, based on additional soil type information and more accurate estimate of volume of contaminated soil. Soil samples collected from beneath the fuel storage tanks during tank removal do not exceed ADEC Method One, Level B soil cleanup levels. However, elevated levels of DRO and GRO exist near the dispenser island, in excess of Method One, Level B, and Method Two cleanup levels. In addition, these soils exceed Method Two cleanup levels for BTEX. Tank excavation samples did not contain reportable concentrations of benzene, however the

maximum reporting limit (MRL) of 0.05 mg/kg achieved at that time was greater than the current Method Two benzene cleanup level.

1.7 Objectives of SERA IX Investigation

Based on a review of general site plans and the results of the UST site assessment, the objectives of the SERA IX investigation at ST505/9 were to:

- Delineate the extent of soil contamination in the vertical and lateral directions in the vicinity of the dispenser island.
- Fill the following specific analytical data gaps: 1) no PAH data for soil has been collected to date at this site; and 2) previous non-detect benzene results were obtained at a MRL in excess of the Method Two migration-to-groundwater soil cleanup level of 0.02 mg/kg and therefore do not allow for determination of whether the Method Two benzene cleanup level has been exceeded.

2.0 FIELD METHODS

This section summarizes the field methods that were used in the 2001 SERA IX RI. The Work Plan (USAF 2001) was prepared following the guidelines of SERA, ADEC regulations in 18 AAC 75 and 18 AAC 78, and basewide policies and procedures for fieldwork at EAFB as applicable to environmental compliance projects. Any deviations from the Work Plan and rationale behind sample locations are discussed in this section.

2.1 Initial Activities

The field program was designed to address data gaps identified during the UST Site Assessment. The primary data gap was whether contaminated soil above regulatory cleanup levels exist beneath the former dispenser island and associated piping. Utility clearances were obtained for the site before drilling was conducted, and the building custodian was contacted before work began on site.

Visual inspection of the site was not conducted before drilling activities because of security issues at the AWACS Hangar. Drilling locations were moved slightly from those proposed in the Work Plan because to avoid buried utilities.

2.2 Borings

A total of four soil borings were advanced to groundwater during the 2001 investigation in the vicinity of the dispenser island. Two borings (01505BH01 and 01505BH02) were placed as close to the two former diesel and mogas dispensers as possible. The intent of 01505BH01 and 01505BH02 placement was to better characterize any past fuel releases from the dispenser island and piping, as documented during the UST removal. Borings 01505BH01 and 01505BH02 were placed within 4 feet of the dispensers that exhibited elevated concentrations of DRO (4,160 mg/kg) and GRO (3,200 mg/kg) during the UST removal. Boring 01505BH02 was located hydraulically downgradient of the former mogas dispenser. Boring 01505BH01 could not be placed hydraulically downgradient of the former diesel dispenser due to active underground POL fuel lines. Boring 01505BH01 was placed as close as possible to the diesel dispenser island.

The third soil boring, 01505BH03, was placed hydraulically downgradient of both the former dispenser island and the former UST. This location was selected to aid in verifying whether the contamination observed at the dispenser island should be attributed to the island itself, or whether the tanks were additional sources of contaminants.

The fourth soil boring, 01505BH04, was placed between the former dispenser island and the former diesel tank. This placement was selected because a soil sample collected during the UST site assessment from the southern end of the former diesel tank contained DRO at a

concentration of 146 mg/kg (USAF 1994). Boring 01505BH04 was placed within 5 feet of this UST removal sample location.

All borings were grouted to 2 feet bgs with Volclay grout slurry. The surface completion of 01505BH01, 01505BH02, and 01505BH03 consisted of placing bentonite chips from 1 to 2 feet bgs and a cement patch from 1 foot bgs to original grade. Boring 01505BH04 was completed with 2 feet of bentonite chips at the ground surface.

Soil boring logs are presented in Appendix B. Groundwater was encountered during drilling between 21.9 feet and 22.5 feet bgs.

Field screening measurements were made and documented for each split-spoon sample collected: the field screening procedure is further described in Section 2.3.1. The soil borings were advanced using a truck-mounted, hollow-stem auger drill rig. Drilling fluids were not used during soil boring installation. The cuttings from the soil borings were placed in 55-gallon drums and disposed of as outlined in Section 2.8, Investigation-Derived Waste Management.

2.3 Sampling Procedures

All soil samples were collected with decontaminated tools (stainless steel spoons, bowls, and split-spoon samplers). Disposable gloves were worn and changed between sample collections. All samples were collected by a "Qualified Person" for environmental sampling, as defined by ADEC under 18 AAC 78.995. Only laboratory certified-clean sample containers were used.

2.3.1 Soil Sampling

Soil samples were collected from boreholes with a split-spoon sampler 2.5 inches in inner diameter, advanced ahead of the auger flights. In general, samples were collected at 5-foot intervals to groundwater. Borings were terminated at groundwater. All soil samples were field screened by using the heated headspace (HHS) method, as follows: A clean 250-milliliter (mL) or larger resealable plastic bag was partially filled (one-third to one-half) with soil immediately after the split-spoon sampler was opened. Headspace vapors were allowed to develop in the bag for at least 10 minutes but less than 1 hour. The container was agitated for 15 seconds at the beginning and end of the headspace development to assist volatilization. The container was maintained at a minimum temperature of approximately 40°F. The field screening instrument, a photoionization detector (PID) was then side-punched into the bag, to a point about one-half the headspace depth. Care was taken to avoid uptake of water or soil. The highest meter reading was recorded in the field logbook at the appropriate depth.

HHS samples were collected from all sample intervals. Typically, the following samples were selected for laboratory analysis:

1) The sample at or just above the water table,

2) The sample with the highest HHS screening result, and

3) The sample where it appears, based on HHS screening, that the contamination ends.

Samples not chosen for laboratory analysis were placed with the soil cuttings awaiting final disposition. Table 2-1 summarizes sample analyses and laboratory methods.

Soil samples were placed in containers in the following order: 1) GRO/BTEX, 2) DRO/RRO, 3) PAHs, and 4) total organic carbon (TOC).

Samples collected for volatile organic analysis (VOA) of GRO and BTEX were collected directly from the sampling device by transferring approximately 25 to 40 mL of core sample into a preweighed, tared sample container, and then immediately field preserved with methanol. Percent moisture determinations for DRO samples were used for the corresponding GRO/BTEX samples. Samples collected for non-volatile organic analysis (e.g., DRO, RRO, PAHs, and TOC) were homogenized before placement in sample jars. Homogenization involved placing soil in a stainless steel bowl and mixing with a stainless steel spoon. All samples (excluding samples for soil classification) were immediately placed in a cooler with freeze packs and maintained at approximately 4°C.

Table 2-1. Sample Analytical Summary for ST505/9.

Analyte	Method	Number of Samples[a]
Soil		
Diesel Range Organics/Residual Range Organics	AK102/AK103	12
Gasoline Range Organics/BTEX	AK101/8021B	12
Polycyclic Aromatic Hydrocarbons	EPA Method 8270C	3
Total Organic Carbon	EPA Method 9060	2

Note:
[a]Number of samples does not include quality assurance, quality control, or blank samples.
Key:
BTEX = Benzene, toluene, ethylbenzene, and total xylenes.
EPA = U.S. Environmental Protection Agency.

2.3.2 Field Quality Control Samples

All field quality control (QC) samples were collected, handled, documented, preserved, packaged, and shipped by the same techniques that were used for all other samples. The following field QC samples were collected:

- Field duplicates were collected at a rate of 10 percent for the entire SERA IX field program. Field duplicates were submitted "blind" to the laboratory.
- During field mobilization, one sample of deionized/distilled water was collected to represent the entire SERA IX project. This sample was collected as a quality control measure for the decontamination water source. This sample was collected by pouring directly from the original deionized/distilled water container.
- Laboratory-prepared trip (transfer) blanks of analyte-free media accompanied each batch of aqueous samples submitted for GRO/BTEX analysis.
- Matrix spike/matrix spike duplicate (MS/MSD) samples were collected at an overall rate of 5 percent for the entire project.

2.4 Field Sample Identification

Samples collected during this field investigation were each assigned a unique field sample identification code and labeled accordingly. This system was developed to allow for sample control of the large number of samples that would be collected during this and any following investigations. Each sample identification number consisted of a five-segment, alphanumeric code that identifies the site, the location designation, the matrix of the sample, the sample depth, and the QC identifier.

Sample numbers were assigned as described below.

1) Site Designation. The first segment of the sample identification number is the site designation number (3 to 5 digits).

   ST505/9 = 505

2) Location Designation. The next four characters represent the location within the site where the samples are obtained, namely: AANN, where A = alpha code designating the type of sample, and N = the sequential number assigned. The following alpha codes were used during this investigation:

   BH = Borehole

3) Matrix Code. The next two characters indicate the sample matrix. The following are some of the codes that were used during this investigation:

SO = Soil

WQ = Water quality control matrix

4) Sample Depth. For soil samples only, the next set of numerals indicate the depth below the surface to the top of the soil sample collection interval in feet and tenths of feet (e.g., 4.0 or 11.5; this part of the code is used only for soil samples). Field duplicate samples and trip blanks were given fictitious depths so that laboratory personnel were unaware of which primary sample was being duplicated, or whether the sample was a trip blank.

5) Sample Type. The next set of characters represents the field sample type. The following are some of the codes that were used during this investigation:

EB# = Equipment blank

FD# = Field duplicate

N# = Normal environmental sample

TB# = Trip blank

The # symbol represents a numeral that was sequentially assigned by additional sample types collected from one location. Laboratory matrix spike (MS) and matrix spike duplicate (MSD) samples were identified together as MS/MSD sample types.

For a soil sample collected from boring BH01 at site ST505, from 5 to 7.5 feet bgs, the sample number would be: **505BH01SO5.0N1**

The following information was included on each sample label for samples submitted for laboratory analysis:

- Project site
- Project number
- Sample collector name or initials
- Date and time of collection
- Field sample identification codes
- Analyses requested
- Preservation

2.5 Sample Packaging and Shipping

Plastic bubble wrap was used to line the bottom of shipping coolers. A thin layer of vermiculite was also placed at the bottom of the coolers to absorb condensation and liquids in the event of bottle breakage. The samples were placed in individual, resealable plastic bags and wrapped in plastic bubble wrap before placement in the coolers. Samples were placed upright in coolers. Chemical ice (blue-ice) cold packs used for cooling preservation

were additionally placed and isolated in plastic bags. These cold packs were placed around and on top of the samples to maintain the temperature goal of 4°C. A temperature blank consisting of at least 500 mL water in a high-density polyethylene (HDPE) bottle accompanied every cooler transporting project samples to the laboratory for chemical analysis. Space between samples in the coolers was filled with packing material so that samples were protected and movement was limited.

Completed chain-of-custody records were placed inside a resealable plastic bag and secured to the inside of coolers. Coolers were sealed with chain-of-custody tape on the front right and back left corners. Custody seals were signed by the individual relinquishing the sample, and date and time were recorded. Additionally, the chain-of-custody tape number was recorded on the chain-of-custody record. Packaging tape was placed around the cooler, with a minimum of two full wraps. "This End Up" labels were placed on all four sides, and "Fragile" labels were placed on two sides.

When a transfer of samples occurred, the chain-of-custody record was completed with the name of the person relinquishing the samples, and the person receiving the samples signed and dated the form. Copies of any shipping documentation were retained for the project files.

Sample coolers were shipped by Alaska Airlines Goldstreak delivery to:

Sound Analytical Services, Inc.
4813 Pacific Hwy East
Tacoma, WA 98424

2.6 Field and Sample Custody Documentation

Field documentation contains information pertinent to the field sampling program and the equipment preparation efforts. Field documentation was recorded in bound logbooks, and entries were made in indelible ink. Corrections to any documentation were made by drawing a single line through the incorrect entry and initialing the correction. No documentation pages were removed from any field logbooks.

Field documentation was maintained by the field team leader during field activities and transferred to the project files for a record of sampling.

Field and sample custody documentation consisted of the following:

- *Field activity logbooks.* These logbooks were assigned to the field team leader to summarize daily field activities and to document required field briefings (such as health and safety briefings); the field team's activities and observations; the identifiers of the locations of samples collected that day, any unusual occurrences affecting the overall project, weather conditions, etc.; equipment calibration; decontamination; health and safety monitoring (e.g., ambient air monitoring,

explosive level monitoring, and other monitoring by field instruments); and subcontractor activities (including performance, downtime, etc.).

- *Boring log.* The boring log (Appendix B) includes the following documentation: the name of the drilling subcontractor; drilling method; rig type and size; equipment diameter; boring number; blow counts; boring diameter; sampling depths; descriptions of lithology; well construction material and diameter; screen type, depth, and size; boring annulus completion material and depth of placement; water levels; well head completion and well security information; collection date; method of collection; headspace screening results; and any other observation relevant to the investigation. Soil samples were classified by the Unified Soil Classification System (USCS) and were described as indicated in ASTM D-2488, including color, texture, moisture content, grain texture, sedimentary features, staining, and odors noted during field activities.
- *Electronic sample log.* The sample log accounts for all samples collected and provides a basis for sample tracking.
- *Chain-of-custody records.* Chain-of-custody record forms were completed to document each sample sent for laboratory analysis. The chain-of-custody forms summarized sample information (project, sample location, date and time of sampling, sample identifier, and analyses required) and provided a complete record of sample custody, from the point of sampling through receipt by the analytical laboratory. Samples not submitted to the laboratory were not included on the chain-of-custody forms and were managed in the same manner as the soil cuttings, as described in Section 2.7, Investigation-Derived Waste Management.
- *Photography.* For base security reasons, no photographs were permitted by EAFB military personnel to be taken around the AWACS Hangar.
- Decontamination Procedures

All field equipment coming in contact with potentially contaminated soil or used for sampling was decontaminated before and after use. Clean, chemical-resistant gloves were worn by persons decontaminating tools and equipment. Soil sampling tools, including split-spoon samplers, were cleaned by the following process:

1) scrub with a brush in a solution of Alconox or Liquinox and water,
2) rinse twice in clean water, and
3) rinse with deionized or distilled water.

Auger flights, rods, and bits were decontaminated by cleaning with high-pressure hot water at the beginning of the project, between boreholes, and before moving off site at the end of the field investigation.

Specific decontamination procedures for various types of field equipment were as follows:

- Well sounders, steel tapes, and water quality probes were washed with a Liquinox and potable water solution, then rinsed with deionized water, and allowed to air dry.
- Personnel decontamination procedures followed the procedures presented in the Site-Specific Health and Safety Plan (SSHP), Appendix B of the Work Plan (USAF 2001).

2.7 Investigation-Derived Waste Management

Soil cuttings generated during this investigation were containerized in drums at the time of drilling. Investigation-derived waste (IDW) soil drums were labeled with permanent marker and labels to show the date and time of sampling, associated soil boring, contents, a drum identification number, and the EAFB point of contact. The containers of soil were transported to the Environmental Staging Facility (ESF) for storage until analytical data for the soil from the borings or wells were received.

Seven drums containing soil cuttings were generated during the SERA IX investigation. Analytical results indicate that no samples collected contain petroleum hydrocarbons above Method One Level A soil cleanup levels. All drums containing soil cuttings from ST505/9 are considered clean (petroleum hydrocarbon contaminant concentrations are below Category A cleanup levels) and will be spread onto the ground in an area approved by the 3 CES/CEVR.

Water produced during decontamination was containerized in two 55-gallon drums. The containerized decontamination fluid will be processed through the on-site conditioning system at the ESF by the EAFB IDW management contractor. Details on how the conditioning system works are presented in the *Basewide Environmental Staging Facility Operation and Maintenance Plan* (USAF 1994). After conditioning, the system will discharge the water to the sanitary sewer system for treatment in the Anchorage wastewater treatment system.

Disposable protective clothing, disposable bailers, and other similar supplies were presumed to be nonhazardous and disposed of in dumpsters at EAFB.

2.8 Field Equipment Calibration

A PID with a minimum 10.2-eV (electron volt) lamp (Minirae) was used to field screen soil for volatile compounds. The PID was calibrated each day before use and recalibrated during the day, as needed (e.g., if PID drift was noted). The PID was calibrated in accordance with the owner's manual using a 100-mg/kg (parts per million) isobutylene reference gas and clean ambient air as the zero reference gas. Other field instruments (e.g., Explosimeter) were maintained according to the manufacturer's recommended procedures. The date, time, and results of all calibrations were recorded in the field logbook.

2.9 Survey

Due to heightened security on EAFB, no preliminary survey data for this site is available. Once access is obtained by ENSR's surveying subcontractor, horizontal and vertical data will be obtained and included in the final report. All borings installed during this investigation will be surveyed by an Alaska-registered surveyor. All survey data established will be relative to the Municipality of Anchorage datum and the USAF identified benchmark (TTAN7) located at EAFB. The vertical datum for this survey will be based on the Alaska State Plan coordinates. The control is the same datum used for the SERA Phase I, II, IV, VII, and VIII investigations.

2.10 Data Interpretation

2.10.1 Field Screening Data

HHS/PID results are considered qualitative data and were used in selecting samples for laboratory analysis and for evaluating whether contamination was present. HHS/PID values in combination with odor and elevated analytical results from associated samples were generally interpreted as positive indicators of petroleum hydrocarbons. Elevated HHS/PID values not accompanied by odor or positive results from laboratory analyses were considered potentially suspect and possibly attributable to interference from natural organic content, moisture, or equipment malfunction.

2.10.2 Comparison to ADEC Soil Cleanup Levels – Method One

Soil petroleum hydrocarbon concentrations were initially compared to cleanup levels provided in 18 AAC 75.340, Table A1, Method One (ADEC 2000b). Method One provides petroleum hydrocarbon soil cleanup levels based on a site-specific matrix score and can be used to estimate the cleanup action necessary at a site. For example, if Method One, Category A, soil cleanup levels are achieved before groundwater is encountered, the remedial goals for the site can be considered met (subject to ADEC concurrence).

The completed matrix score sheet, provided in Appendix C, indicates a total matrix score of 27 (Category B cleanup levels).

2.10.3 Comparison to ADEC Soil Cleanup Levels – Method Two

Soil analytical results were also compared to the chemical-specific, risk-based Method Two soil cleanup levels under 18 AAC 75.340 (ADEC 2000b). Under Method Two, bulk petroleum hydrocarbon (e.g., GRO, DRO, and RRO) and chemical-specific (e.g., BTEX and PAH) cleanup levels are determined based on contaminant exposure pathways and the amount of precipitation the site receives. The applicable Method Two cleanup levels proposed for the ST505/9 site (less than 40 inches of precipitation per year) are the ingestion-based and migration-to-groundwater levels which are considered the most

stringent of the Table B1 and Table B2 levels. These cleanup levels are provided for comparison purposes in the sample results table in Section 3.2.

3.0 RESULTS

3.1 2001 SERA IX Field Program

3.1.1 Soil Boring Installation

Three soil borings were installed at former pump islands, and one soil boring was installed at the former diesel UST excavation. No fuel odor was observed in any split-spoon samples collected from soil borings. Elevated HHS readings were, however, obtained from every boring. The highest HHS reading, 847 mg/kg, was obtained from the 5-to-7-foot bgs sample interval in 01505BH03.

Elevated HHS readings were obtained from 01505BH02 at 10 to 12 feet bgs (263 mg/kg), and from 01505BH01 at 15 to 17 feet bgs (210 mg/kg), 20 to 22 feet bgs (220 mg/kg), and 25 to 27 feet bgs (500 mg/kg). These elevated readings were unusual in that the PID exhibited a gradual rise over several minutes to achieve these readings.

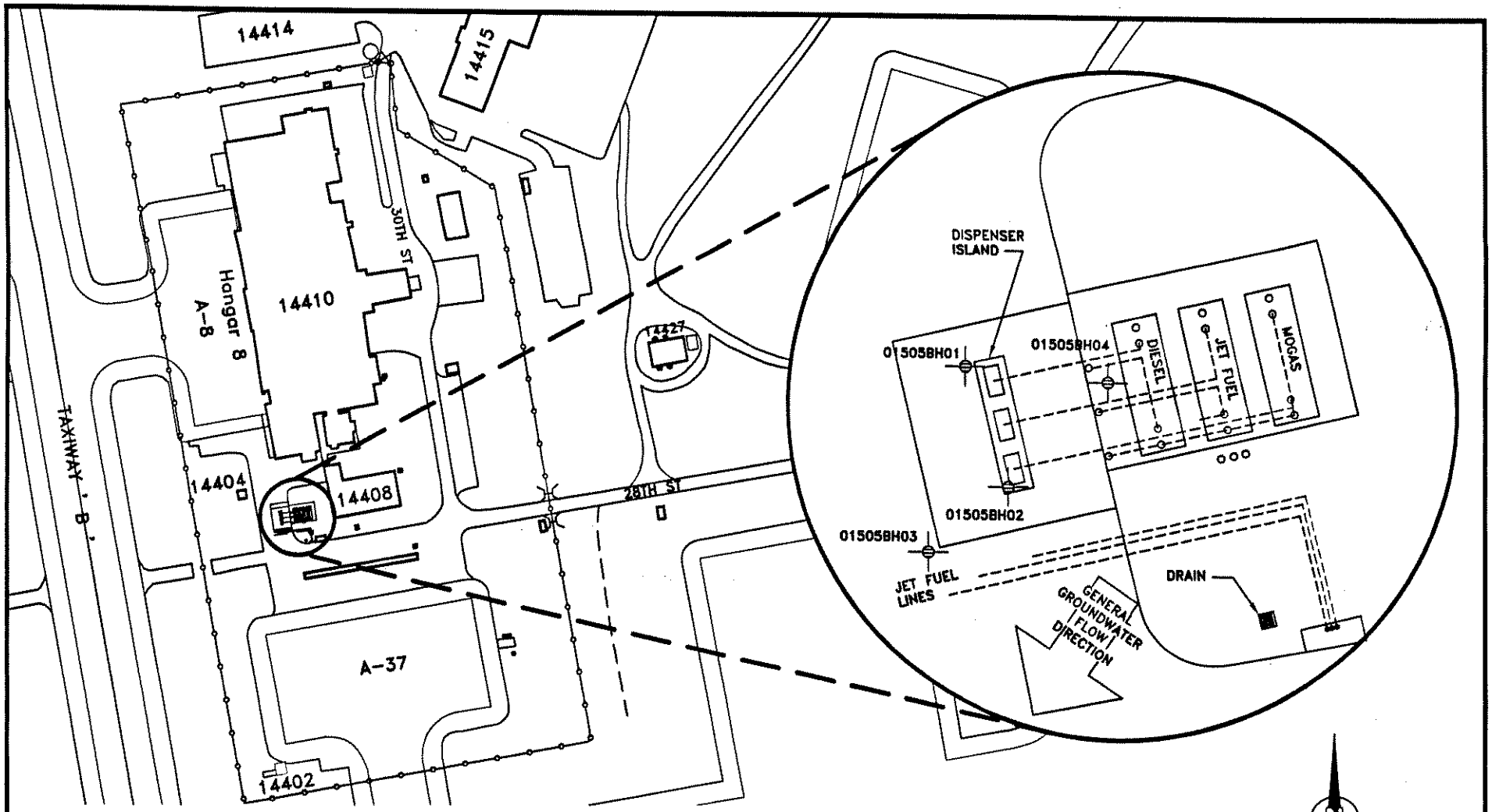
All soil borings were abandoned at groundwater. Soils encountered throughout the site were generally sands and gravels.

Figure 3-1 and Figure 3–2 are site layout maps showing the locations of the soil borings.

3.2 Discussion of Findings

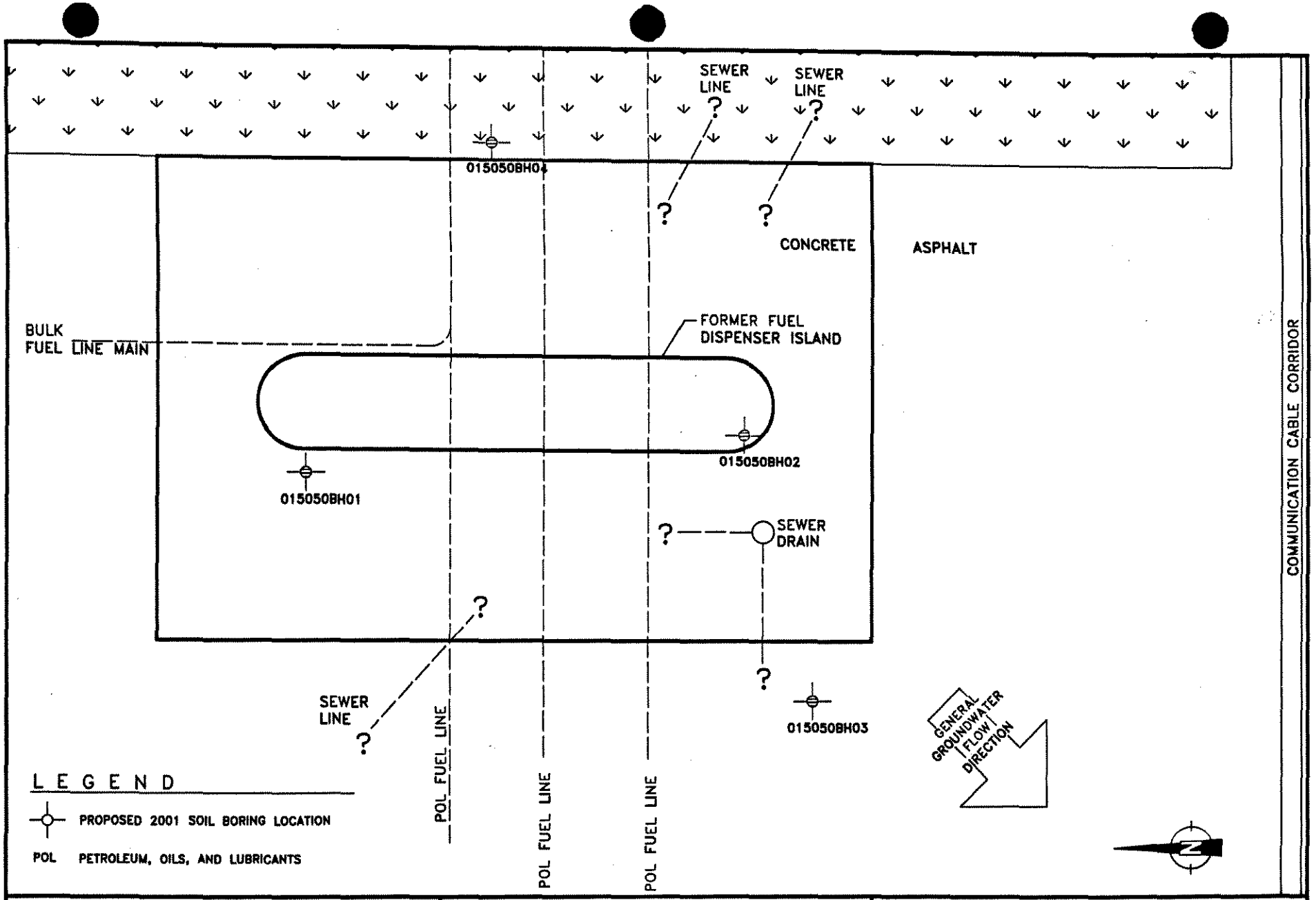
3.2.1 Soil Findings

Twelve primary and one duplicate soil samples were collected and submitted for laboratory analysis from the soil borings installed at ST505/9. DRO and PAH analytes were not detected above their respective MRLs for any soil sample submitted for analysis. RRO was detected at a concentration of 29 mg/kg in one sample, below the most stringent Method One, Level A cleanup level of 2,000 mg/kg. For all other samples, reported RRO concentrations were below MRLs. GRO was detected in three soil samples collected from two borings. One soil sample collected from 01505BH02 at 10 feet bgs exhibited a GRO concentration of 1.2 mg/kg, below the most stringent Method One, Level A, cleanup level of 50 mg/kg. GRO was detected in two soil samples collected from 01505BH04 at 10 and 15 feet bgs at concentrations of 1.0 and 1.3 mg/kg respectively. These concentrations are well below the Method One, Level A cleanup level of 50 mg/kg.



SOURCE: ELMENDORF BASE MAP 2000

FILE: 505SL01	DRAWN: SSR	FIGURE 3-1 ST505/9 AWACS HANGAR SITE LAYOUT AND BORING LOCATIONS
C/SC: 1:1PS	ZIP: 47/01	3 CES/CEVR SERA PHASE IX ELMENDORF AFB, ALASKA PROJECT #9000-268
DATE: 03/30/01	CHECK: J.D.	



FILE: FLM	DRAWN: MNS	FIGURE 3-2 AWACS HANGAR DETAIL OF SOIL BORING LOCATIONS
C/SC: 1:80	ZIP: NA	3 CES/CEVR SERA PHASE IX ELMENDORF AFB, ALASKA PROJECT #9000-268
DATE: 12/19/01	CHECK: M. JONES	

BTEX analytes were not detected in any samples submitted for laboratory analysis from 01505BH01 and 01505BH03. In the soil sample from the 10-foot interval in 01505BH02, ethylbenzene, toluene, and xylenes were detected at concentrations of 0.032 mg/kg, 0.15 mg/kg, and 0.058 mg/kg, respectively. None of these concentrations exceeds the Method Two migration-to-groundwater cleanup levels.

Xylenes and toluene were detected in the 10- and 15-foot bgs samples collected from 01505BH04, at concentrations ranging from 0.03 to 0.054 mg/kg. These results are below the xylene Method Two cleanup level. Toluene was detected at range of 0.066 to 0.14 mg/kg, also below the Method Two cleanup level.

Table 3-1 shows the SERA IX soil analytical results.

Table 3-1. Soil Analytical Results: Site 505/9, SERA IX Release Investigation, 2001.

Location:			01505BH01		
Sample Depth:			6 Feet	16 Feet	25 Feet
Sample ID:		Soil	505BH01SO6.0N1	505BH01SO16.0N1	505BH01SO25.0N1
Sample Date:		Cleanup	7/13/01	7/13/01	7/13/01
Sample QC Type:		Level*			
Laboratory ID(s):			99595-07, 99595-08	99595-01, 99595-02	99595-03, 99595-04
Parameter	**Unit**				
Petroleum Hydrocarbons [AK101, 102, 103]					
Gasoline Range Organics	mg/kg	300	ND [2.1]	ND [2.1]	ND [2.3]
Diesel Range Organics	mg/kg	250	ND [34]	ND [35]	ND [38]
Residual Range Organics	mg/kg	11,000	ND [34]	ND [35]	ND [38]
BTEX [8021B]					
Benzene	mg/kg	0.02	ND [0.021]	ND [0.021]	ND [0.023]
Ethylbenzene	mg/kg	5.5	ND [0.042]	ND [0.043]	ND [0.047]
m,p-Xylene (Sum of Isomers)	mg/kg	NA	ND [0.084]	ND [0.086]	ND [0.093]
o-Xylene	mg/kg	NA	ND [0.042]	ND [0.043]	ND [0.047]
Total Xylenes[1]	mg/kg	78	ND --	ND --	ND --
Toluene	mg/kg	5.4	ND [0.042]	ND [0.043]	ND [0.047]
Polycyclic Aromatic Hydrocarbons (PAHs) [8270C]					
2-Chloronaphthalene	µg/kg	NA	ND [1.2]	--	--
2-Methylnaphthalene	µg/kg	NA	ND [1.2]	--	--
Acenaphthene	µg/kg	210,000	ND [1.2]	--	--
Acenaphthylene	µg/kg	NA	ND [1.2]	--	--
Anthracene	µg/kg	4,300,000	ND [1.2]	--	--
Benzo(a)anthracene	µg/kg	6,000	ND [2.3]	--	--
Benzo(a)pyrene	µg/kg	1,000	ND [1.2]	--	--
Benzo(b)fluoranthene	µg/kg	11,000	ND [1.2]	--	--
Benzo(g,h,i)perylene	µg/kg	NA	ND [1.2]	--	--
Benzo(k)fluoranthene	µg/kg	110,000	ND [1.2]	--	--
Chrysene	µg/kg	620,000	ND [2.3]	--	--
Dibenzo(a,h)anthracene	µg/kg	1,000	ND [1.2]	--	--
Fluoranthene	µg/kg	2,100,000	ND [1.2]	--	--
Fluorene	µg/kg	270,000	ND [1.2]	--	--
Indeno(1,2,3-cd)pyrene	µg/kg	11,000	ND [1.2]	--	--
Naphthalene	µg/kg	43,000	ND [1.2]	--	--
Phenanthrene	µg/kg	NA	ND [1.2]	--	--
Pyrene	µg/kg	1,500,000	ND [1.2]	--	--
Total Organic Carbon [9060]					
Total Organic Carbon (TOC)	mg/kg	NA	1100 [100]	--	--
Percent Solids [E160.3]					
Solids, Percent	percent	NA	96.07 [0.1]	94.27 [0.1]	85.44 [0.1]

Notes:

Values in boldface exceed ADEC cleanup levels

Values in brackets ([xxx.xx]) are MQLs.

[1] Total xylenes represent the sum of m, p, and o-Xylenes.

* The most stringent soil cleanup level listed in Method Two Tables B1 and B2 (Under 40-inch zone; ADEC 2000b)

Key:

-- = Analysis not performed on this sample.

J = Result is considered an estimate.

NA = Not available.

ND = Parameter not detected above the method quantitation limit (MQL).

Table 3-1. Soil Analytical Results: Site 505/9, SERA IX Release Investigation, 2001 (Continued).

Location:			01505BH01	01505BH02	
Sample Depth:			25 Feet	10 Feet	21 Feet
Sample ID:		Soil	505BH01SO30.0N1	505BH02SO10.0N1	505BH02SO21.0N1
Sample Date:		Cleanup	7/13/01	7/13/01	7/13/01
Sample QC Type:		Level*	Field Duplicate		
Laboratory ID(s):			99595-05, 99595-06	99595-09, 99595-10	99595-11, 99595-12
Parameter	**Unit**				
Petroleum Hydrocarbons [AK101, 102, 103]					
Gasoline Range Organics	mg/kg	300	ND [2.3]	1.2 [2] J	ND [2.2]
Diesel Range Organics	mg/kg	250	ND [38]	ND [35]	ND [33]
Residual Range Organics	mg/kg	11,000	ND [38]	ND [35]	29 [33] J
BTEX [8021B]					
Benzene	mg/kg	0.02	ND [0.023]	ND [0.02]	ND [0.022]
Ethylbenzene	mg/kg	5.5	ND [0.046]	0.032 [0.041] J	ND [0.044]
m,p-Xylene (Sum of Isomers)	mg/kg	NA	ND [0.092]	0.058 [0.082] J	ND [0.087]
o-Xylene	mg/kg	NA	ND [0.046]	ND [0.041]	ND [0.044]
Total Xylenes[1]	mg/kg	78	ND --	ND --	ND --
Toluene	mg/kg	5.4	ND [0.046]	0.15 [0.041]	ND [0.044]
Polycyclic Aromatic Hydrocarbons (PAHs) [8270C]					
2-Chloronaphthalene	µg/kg	NA	--	ND [1.2]	--
2-Methylnaphthalene	µg/kg	NA	--	ND [1.2]	--
Acenaphthene	µg/kg	210,000	--	ND [1.2]	--
Acenaphthylene	µg/kg	NA	--	ND [1.2]	--
Anthracene	µg/kg	4,300,000	--	ND [1.2]	--
Benzo(a)anthracene	µg/kg	6,000	--	ND [2.5]	--
Benzo(a)pyrene	µg/kg	1,000	--	ND [1.2]	--
Benzo(b)fluoranthene	µg/kg	11,000	--	ND [1.2]	--
Benzo(g,h,i)perylene	µg/kg	NA	--	ND [1.2]	--
Benzo(k)fluoranthene	µg/kg	110,000	--	ND [1.2]	--
Chrysene	µg/kg	620,000	--	ND [2.5]	--
Dibenzo(a,h)anthracene	µg/kg	1,000	--	ND [1.2]	--
Fluoranthene	µg/kg	2,100,000	--	ND [1.2]	--
Fluorene	µg/kg	270,000	--	ND [1.2]	--
Indeno(1,2,3-cd)pyrene	µg/kg	11,000	--	ND [1.2]	--
Naphthalene	µg/kg	43,000	--	ND [1.2]	--
Phenanthrene	µg/kg	NA	--	ND [1.2]	--
Pyrene	µg/kg	1,500,000	--	ND [1.2]	--
Total Organic Carbon [9060]					
Total Organic Carbon (TOC)	mg/kg	NA	--	3400 [100]	--
Percent Solids [E160.3]					
Solids, Percent	percent	NA	84.69 [0.1]	95.67 [0.1]	95.87 [0.1]

Notes:

Values in boldface exceed ADEC cleanup levels

Values in brackets ([xxx.xx]) are MQLs.

[1] Total xylenes represent the sum of m, p, and o-Xylenes.

* The most stringent soil cleanup level listed in Method Two Tables B1 and B2 (Under 40-inch zone; ADEC 2000b)

Key:

-- = Analysis not performed on this sample.

J = Result is considered an estimate.

NA = Not available.

ND = Parameter not detected above the method quantitation limit (MQL).

Table 3-1. Soil Analytical Results: Site 505/9, SERA IX Release Investigation, 2001 (Continued).

Location:			01505BH02	01505BH03	
Sample Depth:			23 Feet	10 Feet	23 Feet
Sample ID:		Soil	505BH02SO23.0N1	505BH03SO10.0N1	505BH03SO23.0N1
Sample Date:		Cleanup	7/13/01	7/13/01	7/13/01
Sample QC Type:		Level*			
Laboratory ID(s):			99595-13, 99595-14	99595-15, 99595-16	99595-18, 99595-19
Parameter	**Unit**				
Petroleum Hydrocarbons [AK101, 102, 103]					
Gasoline Range Organics	mg/kg	300	ND [2.2]	ND [2.1]	ND [2.2]
Diesel Range Organics	mg/kg	250	ND [36]	ND [35]	ND [37]
Residual Range Organics	mg/kg	11,000	ND [36]	ND [35]	ND [37]
BTEX [8021B]					
Benzene	mg/kg	0.02	ND [0.022]	ND [0.021]	ND [0.022]
Ethylbenzene	mg/kg	5.5	ND [0.045]	ND [0.043]	ND [0.044]
m,p-Xylene (Sum of Isomers)	mg/kg	NA	ND [0.09]	ND [0.086]	ND [0.089]
o-Xylene	mg/kg	NA	ND [0.045]	ND [0.043]	ND [0.044]
Total Xylenes[1]	mg/kg	78	ND --	ND --	ND --
Toluene	mg/kg	5.4	ND [0.045]	ND [0.043]	ND [0.044]
Polycyclic Aromatic Hydrocarbons (PAHs) [8270C]					
2-Chloronaphthalene	µg/kg	NA	--	--	--
2-Methylnaphthalene	µg/kg	NA	--	--	--
Acenaphthene	µg/kg	210,000	--	--	--
Acenaphthylene	µg/kg	NA	--	--	--
Anthracene	µg/kg	4,300,000	--	--	--
Benzo(a)anthracene	µg/kg	6,000	--	--	--
Benzo(a)pyrene	µg/kg	1,000	--	--	--
Benzo(b)fluoranthene	µg/kg	11,000	--	--	--
Benzo(g,h,i)perylene	µg/kg	NA	--	--	--
Benzo(k)fluoranthene	µg/kg	110,000	--	--	--
Chrysene	µg/kg	620,000	--	--	--
Dibenzo(a,h)anthracene	µg/kg	1,000	--	--	--
Fluoranthene	µg/kg	2,100,000	--	--	--
Fluorene	µg/kg	270,000	--	--	--
Indeno(1,2,3-cd)pyrene	µg/kg	11,000	--	--	--
Naphthalene	µg/kg	43,000	--	--	--
Phenanthrene	µg/kg	NA	--	--	--
Pyrene	µg/kg	1,500,000	--	--	--
Total Organic Carbon [9060]					
Total Organic Carbon (TOC)	mg/kg	NA	--	--	--
Percent Solids [E160.3]					
Solids, Percent	percent	NA	89.15 [0.1]	95.55 [0.1]	86.22 [0.1]

Notes:

Values in boldface exceed ADEC cleanup levels

Values in brackets ([xxx.xx]) are MQLs.

[1] Total xylenes represent the sum of m, p, and o-Xylenes.

* The most stringent soil cleanup level listed in Method Two Tables B1 and B2 (Under 40-inch zone; ADEC 2000b)

Key:

-- = Analysis not performed on this sample.

J = Result is considered an estimate.

NA = Not available.

Table 3-1. Soil Analytical Results: Site 505/9, SERA IX Release Investigation, 2001 (Continued).

Parameter	Unit	Soil Cleanup Level*	01505BH03 5 Feet 505BH03SO5.0N1 7/13/01 99595-20, 99595-21, 99595R21	01505BH04 10 Feet 505BH04SO10.0N1 7/16/01 99619-01, 99619-02	01505BH04 15 Feet 505BH04SO15.0N1 7/16/01 99619-03, 99619-04
Petroleum Hydrocarbons [AK101, 102, 103]					
Gasoline Range Organics	mg/kg	300	ND [2]	1 [2] J	1.3 [2.1] J
Diesel Range Organics	mg/kg	250	ND [33]	ND [34]	ND [34]
Residual Range Organics	mg/kg	11,000	ND [33]	ND [34]	ND [34]
BTEX [8021B]					
Benzene	mg/kg	0.02	ND [0.02]	ND [0.02]	ND [0.021]
Ethylbenzene	mg/kg	5.5	ND [0.041]	ND [0.041]	ND [0.043]
m,p-Xylene (Sum of Isomers)	mg/kg	NA	ND [0.081]	0.03 [0.082] J	0.054 [0.086] J
o-Xylene	mg/kg	NA	ND [0.041]	ND [0.041]	ND [0.043]
Total Xylenes[1]	mg/kg	78	ND --	0.03 --	0.054 --
Toluene	mg/kg	5.4	ND [0.041]	0.066 [0.041]	0.14 [0.043]
Polycyclic Aromatic Hydrocarbons (PAHs) [8270C]					
2-Chloronaphthalene	µg/kg	NA	--	--	--
2-Methylnaphthalene	µg/kg	NA	--	--	--
Acenaphthene	µg/kg	210,000	--	--	--
Acenaphthylene	µg/kg	NA	--	--	--
Anthracene	µg/kg	4,300,000	--	--	--
Benzo(a)anthracene	µg/kg	6,000	--	--	--
Benzo(a)pyrene	µg/kg	1,000	--	--	--
Benzo(b)fluoranthene	µg/kg	11,000	--	--	--
Benzo(g,h,i)perylene	µg/kg	NA	--	--	--
Benzo(k)fluoranthene	µg/kg	110,000	--	--	--
Chrysene	µg/kg	620,000	--	--	--
Dibenzo(a,h)anthracene	µg/kg	1,000	--	--	--
Fluoranthene	µg/kg	2,100,000	--	--	--
Fluorene	µg/kg	270,000	--	--	--
Indeno(1,2,3-cd)pyrene	µg/kg	11,000	--	--	--
Naphthalene	µg/kg	43,000	--	--	--
Phenanthrene	µg/kg	NA	--	--	--
Pyrene	µg/kg	1,500,000	--	--	--
Total Organic Carbon [9060]					
Total Organic Carbon (TOC)	mg/kg	NA	--	--	--
Percent Solids [E160.3]					
Solids, Percent	percent	NA	96.33 [0.1]	96.77 [0.1]	95.43 [0.1]

Notes:

Values in boldface exceed ADEC cleanup levels

Values in brackets ([xxx.xx]) are MQLs.

[1] Total xylenes represent the sum of m, p, and o-Xylenes.

* The most stringent soil cleanup level listed in Method Two Tables B1 and B2 (Under 40-inch zone; ADEC 2000b)

Key:

-- = Analysis not performed on this sample.

J = Result is considered an estimate.

NA = Not available.

Table 3-1. Soil Analytical Results: Site 505/9, SERA IX Release Investigation, 2001 (Continued).

Parameter	Unit	Soil Cleanup Level*	01505BH04	Trip Blank
Location:			01505BH04	Trip Blank
Sample Depth:			23 Feet	--
Sample ID:			505BH04SO23.0N1	505BH03SO15.0N1
Sample Date:			7/16/01	7/13/01
Sample QC Type:				Trip Blank
Laboratory ID(s):			99619-05, 99619-06	99595-17
Petroleum Hydrocarbons [AK101, 102, 103]				
Gasoline Range Organics	mg/kg	300	ND [2.3]	ND [2.3]
Diesel Range Organics	mg/kg	250	ND [37]	--
Residual Range Organics	mg/kg	11,000	ND [37]	--
BTEX [8021B]				
Benzene	mg/kg	0.02	ND [0.023]	ND [0.023]
Ethylbenzene	mg/kg	5.5	ND [0.046]	ND [0.047]
m,p-Xylene (Sum of Isomers)	mg/kg	NA	ND [0.093]	ND [0.094]
o-Xylene	mg/kg	NA	ND [0.046]	ND [0.047]
Total Xylenes[1]	mg/kg	78	ND --	ND --
Toluene	mg/kg	5.4	ND [0.046]	ND [0.047]
Polycyclic Aromatic Hydrocarbons (PAHs) [8270C]				
2-Chloronaphthalene	µg/kg	NA	ND [1.3]	--
2-Methylnaphthalene	µg/kg	NA	ND [1.3]	--
Acenaphthene	µg/kg	210,000	ND [1.3]	--
Acenaphthylene	µg/kg	NA	ND [1.3]	--
Anthracene	µg/kg	4,300,000	ND [1.3]	--
Benzo(a)anthracene	µg/kg	6,000	ND [2.6]	--
Benzo(a)pyrene	µg/kg	1,000	ND [1.3]	--
Benzo(b)fluoranthene	µg/kg	11,000	ND [1.3]	--
Benzo(g,h,i)perylene	µg/kg	NA	ND [1.3]	--
Benzo(k)fluoranthene	µg/kg	110,000	ND [1.3]	--
Chrysene	µg/kg	620,000	ND [2.6]	--
Dibenzo(a,h)anthracene	µg/kg	1,000	ND [1.3]	--
Fluoranthene	µg/kg	2,100,000	ND [1.3]	--
Fluorene	µg/kg	270,000	ND [1.3]	--
Indeno(1,2,3-cd)pyrene	µg/kg	11,000	ND [1.3]	--
Naphthalene	µg/kg	43,000	ND [1.3]	--
Phenanthrene	µg/kg	NA	ND [1.3]	--
Pyrene	µg/kg	1,500,000	ND [1.3]	--
Total Organic Carbon [9060]				
Total Organic Carbon (TOC)	mg/kg	NA	--	--
Percent Solids [E160.3]				
Solids, Percent	percent	NA	86.56 [0.1]	--

Notes:

Values in boldface exceed ADEC cleanup levels

Values in brackets ([xxx.xx]) are MQLs.

[1] Total xylenes represent the sum of m, p, and o-Xylenes.

* The most stringent soil cleanup level listed in Method Two Tables B1 and B2 (Under 40-inch zone; ADEC 2000b)

Key:

-- = Analysis not performed on this sample.

J = Result is considered an estimate.

NA = Not available.

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4.0 CONCLUSIONS

4.1 Summary

Soil samples collected from beneath the fuel storage tanks during the UST removal action were determined not to exceed ADEC Method One, Category B soil cleanup levels. However, elevated levels of DRO and GRO were determined to exist near the dispenser island, in excess of Method One, Level B, and Method Two cleanup levels. Tank excavation samples collected during the UST Site Assessment did not contain reportable concentrations of benzene, but the MRL achieved at that time was greater than the current Method Two benzene cleanup level.

SERA IX analytical results indicate that no soil samples collected from either the tank excavation, dispenser island, or downgradient of these two potential source areas exceed the most stringent Method I, Level A, soil cleanup standards for DRO, RRO, or GRO. SERA IX soil borings around the dispenser island were placed within 4 feet of locations where DRO and GRO had been detected previously. The SERA IX boring at the DRO UST was placed within 5 feet of former DRO detection.

Additionally, no soil samples exceeded their respective Method II cleanup standards for PAH or BTEX constituents. BTEX MRLs were achieved at or below the applicable Method Two cleanup standards. Since groundwater is being monitored in the OU5 model area, groundwater is not addressed under this RI.

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5.0 REFERENCES

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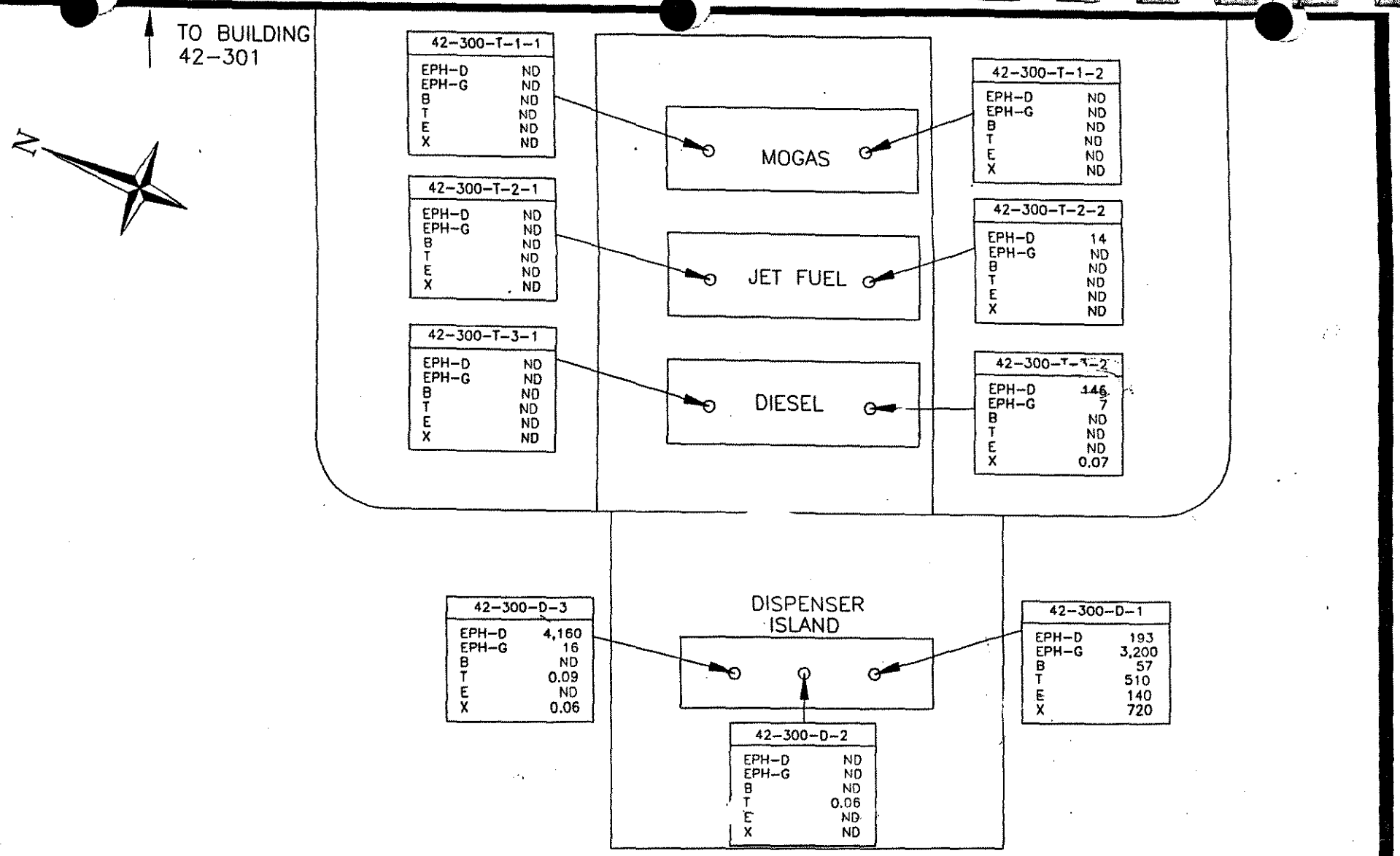
APPENDIX A

ANALYTICAL RESULTS AND FIGURES FOR PREVIOUS INVESTIGATIONS



TITLE:

SAMPLING LOCATIONS FIGURE 2

NOTES:

SAMPLES TAKEN AT 2FT BELOW THE BOTTOMS OF THE TANKS

TANK PIT SAMPLES TAKEN ON 17 MAY 1994
DISPENSER SAMPLES TAKEN ON 19 MAY 1994

DESCRIPTION: **UNDERGROUND STORAGE TANKS**
AFID NUMBERS 306, 307, & 308

SCALE 1" = 10 FT

THIRD WING

APPENDIX B

SERA PHASE IX BORING EXPLORATION LOGS

EXPLORATION LOG

Project: *SERA IX* — *Elmendorf AFB*

Date: *13 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,421* Easting: *1,672,145*

Top of Hole Elevation: *178.6 ft*

Hole Number, Field: *ST505 BH01* Permanent: *01505BH01*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *22.4 ft WD*

Depth Drilled: *25.0 ft*

Total Depth: *27.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
														0'-0.8' Cement
2														
			20		6 11 13	SW-SM	Well-graded SAND with Silt and Gravel	20	60	20	2.0	7.3		3'-4.5' Brown, gravelly SAND,max.>2", avg.=1', rounded, loose, poorly sorted, dry, no fuel odor.
4														
			22		3 8 6 9	SW	Well-graded SAND with Gravel	20	70	10	2.0	9.3		5'-7' Brown, gravelly SAND, max.>2", avg.=1", loose, poorly sorted, no fuel odor.
6	505BH01SO6.0													
8														
10			24		4 11 10 12	SP-SM	Poorly graded SAND with Silt	1	80	19	2.0	50.0		10'-12' Gray, interbedded sand and silt, medium sand, gravel 1"-2", well sorted, moist, no fuel odor. 11.5'-11.7' Laminated silt bed.
12														
14			22		7 8 8 15	GW-GM	Well-graded Sandy GRAVEL with Silt	70	20	10	2.0	210.0		15'-17' Brown, sandy GRAVEL, graded gravel, fining upward, max.>2", avg.=1/2 cm, subangular to angular, medium to coarse sand, loose, poorly sorted, moist, no fuel odor. Gradual rise in PID reading.
16	505BH01SO16.0													
18														

EXPLORATION LOG

Project: *SERA IX* — *Elmendorf AFB*

Date: *13 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,421* Easting: *1,672,145*

Top of Hole Elevation: *178.6 ft*

Hole Number, Field: *ST505 BH01* Permanent: *01505BH01*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *22.4 ft WD*

Depth Drilled: *25.0 ft*

Total Depth: *27.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
22			24		7 15 21 25	SP	Poorly graded SAND	4	90	5	2.0	220.0		20'-22' Gray, SAND, 1% 1cm-2cm angular coal pieces, gravel max.>2", loose, moist, well sorted, no fuel odor.
24														
26	505BH01SO25.0, SO30.0				4 9 12 12	SP	Poorly graded SAND	20	80		0.3	500.0		25'-27' Gray, SAND, minor silt, bedded with 1 cm angular gravel, loose, well sorted, saturated, no fuel odor.
28														Bottom of Exploration 27.0 ft Groundwater Encountered While Drilling: at depth 22.43 ft PID = Photo Ionization Detector
30														
32														
34														
36														
38														

EXPLORATION LOG

Project: *SERA IX*
Elmendorf AFB

Date: *13 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,399* Easting: *1,672,153*

Top of Hole Elevation: *178.6 ft*

Hole Number, Field: *ST505 BH02* Permanent: *01505BH02*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other _____
☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *22.3 ft WD*

Depth Drilled: *23.0 ft*

Total Depth: *25.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
														0'-0.8' Cement
2			10		2 2 4 2	SW-SM	Well-graded SAND with Silt and Gravel	20	50	30	1.0	48.4		3'-5' Brown, gravelly silty SAND, max.=1", rounded, loose, moist, poorly sorted, no fuel odor.
4														
6			18		5 5 4 3	SW-SM	Well-graded SAND with Silt and Gravel	20	50	30	1.0	205.0		5'-7' Brown, soil as above, moist, loose, no fuel odor.
8														
10		505BH02SO10.0	22		8 11 12 13	SW	Well-graded Gravelly SAND	20	70	10	1.5	263.0		10'-12' Brownish-gray, gravelly SAND, max.=1.5", avg=2 cm, subangular, moist, loose, poorly sorted, no fuel odor.
12														
14			22		6 14 15 18	SW	Well-graded Gravelly SAND	20	70	10	2.0	62.9		15'-17' Soil as above, max.>2", loose, moist, poorly sorted, no fuel odor.
16														
18														

EXPLORATION LOG

Project: *SERA IX* — *Elmendorf AFB*

Date: *13 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,399* Easting: *1,672,153*

Top of Hole Elevation: *178.6 ft*

Hole Number, Field: *ST505 BH02* Permanent: *01505BH02*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *22.3 ft WD*

Depth Drilled: *23.0 ft*

Total Depth: *25.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
22		505BH02SO21.0	24		6 16 25 25	SW	Well-graded Gravelly SAND	20	70	10	2.0	31.7		20'-22' Soil as above, loose, moist, no fuel odor.
24		505BH02SO23.0	24		8 7 12 12	GW-GM	Well-graded GRAVEL with Silt and Sand	60	20	20		36.4		23'-25' Brown, sandy GRAVEL, subangular to angular, loose, poorly sorted, no fuel odor.
26														Bottom of Exploration 25.0 ft Groundwater Encountered While Drilling: depth 22.30 ft PID = Photo Ionization Detector
28														
30														
32														
34														
36														
38														

EXPLORATION LOG

Project: *SERA IX*
Elmendorf AFB

Date: *13 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,391* Easting: *1,672,140*

Top of Hole Elevation: *178.3 ft*

Hole Number, Field: *ST505 BH03* Permanent: *01505BH03*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *21.9 ft WD*

Depth Drilled: *23.0 ft*

Total Depth: *25.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
														0'-0.8' Asphalt
2														
4														
			20		2 3 6 5	SW-SM	Well-graded Gravelly SAND with Silt	20	60	20	2.0	847.0		5'-7' Brown, gravelly SAND, max.>2", subrounded, moist, loose, poorly sorted.
6		505BH03SO5.0												
8														
			24		4 16 15 11	SW	Well-graded Gravelly SAND	20	70	10	2.0	10.1		10'-12' Gravelly SAND, max>2", avg.=1", subrounded, loose, moist, poorly sorted, no fuel odor.
10		505BH03SO10.0												
12														
14														
			24		7 6 11 16	SW	Well-graded Gravelly SAND	20	70	10	2.0	5.8		15'-17' Soil as above, coarse sand, angular gravel, moist, poorly sorted, no fuel odor.
16														
18														

EXPLORATION LOG

Project: *SERA IX* — *Elmendorf AFB*

Date: *13 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,391* Easting: *1,672,140*

Top of Hole Elevation: *178.3 ft*

Hole Number, Field: *ST505 BH03* Permanent: *01505BH03*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *21.9 ft WD*

Depth Drilled: *23.0 ft*

Total Depth: *25.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
22			24		9 23 26 26	SW	Well-graded Gravelly SAND	20	70	10	2.0	13.2		20'-22' Soil as above, loose, moist, poorly sorted, no fuel odor.
24	505BH03SO23.0		24		5 8 10 12	SW	Well-graded Gravelly SAND	20	70	10	1.0	12.3		23'-25' Gravelly SAND, angular, max.=1", avg.=1/2 cm, loose, moderate sorting, saturated, no fuel odor.
26														Bottom of Exploration 25.0 ft Groundwater Encountered While Drilling: at depth 21.90 ft PID = Photo Ionization Detector
28														
30														
32														
34														
36														
38														

EXPLORATION LOG

Project: *SERA IX* — *Elmendorf AFB*

Date: *17 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,419* Easting: *1,672,196*

Top of Hole Elevation: *178.4 ft*

Hole Number, Field: *ST505 BH04* Permanent: *01505BH04*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other _____

☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *22.5 ft WD*

Depth Drilled: *23.0 ft*

Total Depth: *25.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
2														
4														
6			22		7 9 11 14	SW	Well-graded Gravelly SAND	30	60	10	2.0	2.7		5'-7' Brownish gray, gravelly SAND, max.>2", avg.=1", subrounded, loose, dry, poorly sorted, no fuel odor.
8														
10			24		5 9 13 13	SW	Well-graded Gravelly SAND	20	70	10	1.5	8.0		10'-12' Brown, gravelly SAND, max.=1.5", subangular, loose, moist, moderate sorting, no fuel odor.
12														
14														
16			20		8 23 19 41	SW	Well-graded Gravelly SAND	20	70	10	1.5	9.0		15'-17' Brown, soil as above, loose, moist, mod. sorted, no fuel odor.
18														

EXPLORATION LOG

Project: *SERA IX* — *Elmendorf AFB*

Date: *17 Jul 2001*

Drilling Agency: ☐ Alaska District ☒ Other *Hughes Drilling*

Elevation Datum: ☒ MSL ☐ other

Location: Northing: *2,650,419* Easting: *1,672,196*

Top of Hole Elevation: *178.4 ft*

Hole Number, Field: *ST505 BH04* Permanent: *01505BH04*

Driller: *Gary Wilson*

Inspector: *Jackie Donley*

Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: *22.5 ft WD*

Depth Drilled: *23.0 ft*

Total Depth: *25.0 ft*

Hammer Weight: *340 lbs*

Split Spoon I.D.: *2.0 in*

Size and Type of Bit: *6.0 in*

Type of Equipment: *Truck Mounted CME-75*

Type of Samples: *Split Spoon*

Depth (ft)	Lithology	Sample	Recovery (in)	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	Grain Size %Sand	Grain Size %Fines	Max Size (in)	PID (ppm)	% Water	Description and Remarks
22			22		10 22 30 32	SW	Well-graded Gravelly SAND	20	70	10	1.0	4.0		20'-22' Soil as above, max.=1", avg.=4 cm, loose, moist, no fuel odor.
24			24		7 11 13 17	SW	Well-graded Gravelly SAND	20	70	10	1.0	0.8		23'-25' Soil as above, saturated, no fuel odor.
26														Bottom of Exploration 25.0 ft Groundwater Encountered While Drilling: at depth 22.45 ft PID = Photo Ionization Detector
28														
30														
32														
34														
36														
38														

APPENDIX C

ADEC MATRIX SCORE SHEETS

TABLE A1. METHOD ONE – PETROLEUM HYDROCARBON SOIL CLEANUP LEVELS IN NONARCTIC ZONES

(See notes to table for further requirements)

Part A: Determine score for each item*

1. Depth to Groundwater		
Less than 5 feet	(10)	
5 feet to 15 feet	(8)	
More than 15 feet to 25 feet	(6)	
More than 25 feet to 50 feet	(4)	**6**
More than 50 feet	(1)	
2. Mean Annual Precipitation		
More than 40 inches	(10)	
More than 25 inches to 40 inches	(5)	
15 inches to 25 inches	(3)	**3**
Less than 15 inches	(1)	
3. Soil Type (Unified Soil Classification)		
Clean, coarse-grained soils	(10)	
Coarse-grained soils with fines	(8)	
Fine-grained soils (low organic carbon)	(3)	**8**
Fine-grained soils (high organic carbon)	(1)	
4. Potential Receptors		
(Select the most applicable category)		
a. Public water system within 1000 feet, or private water system within 500 feet	(15)	
b. Public/private water system within 1/2 mile	(12)	
c. Public/private water system within one mile	(8)	
d. No water system within one mile	(4)	**8**
e. Nonpotable groundwater	(1)	
5. Volume of Contaminated Soil		
More than 500 cubic yards	(10)	
More than 100 cubic yards to 500 cubic yards	(8)	
More than 25 cubic yards to 100 cubic yards	(5)	**2**
10 cubic yards to 25 cubic yards	(2)	
Less than 10 cubic yards	(0)	

*The items to be scored are defined in note 1 to this table.

Part B: Add scores from Part A to determine matrix score and cleanup level

Score: 27 **Matrix Score for Each Category**	**Cleanup Level in mg/kg**		
	Gasoline Range Organics	**Diesel Range Organics**	**Residual Range Organics**
Category A: More than 40	50	100	2000
Category B: More than 26 to 40	100	200	2000
Category C: 21-26	500	1000	2000
Category D: Less than 21	1000	2000	2000

Tanks AFID#'s 306, 307, 308 **MATRIX SCORE SHEET**

1. Depth to Subsurface Water		
< 5 feet	(10)	
5 - 15 feet	(8)	
15 - 25 feet	(6)	
25 - 50 feet	(4)	
> 50 feet	(1)	6
2. Mean Annual Precipitation		
> 40 inches	(10)	
25 - 40 inches	(5)	
15 - 25 inches	(3)	
< 15 inches	(1)	3
3. Soil Type (Unified Soil Classification)		
Clean, coarse-grained soils	(10)	
Coarse-grained soils with fines	(8)	
Fine-grained soils (low OC)	(3)	
Fine-grained soils (high OC)	(1)	3
4. Potential Receptors		
Public Well within 1000 feet, or		
Private Well(s) within 500 feet	(15)	
Municipal/priv well w/i 1/2 mi	(12)	
Municipal/priv well w/i 1 mile	(8)	
No known well within 1/2 mile	(6)	8
No known well within 1 mile	(4)	
Non-potable groundwater	(1)	
5. Volume of Contaminated Soil		
> 500 cubic yards	(10)	
100 - 500 cubic yards	(8)	
25 - 100 cubic yards	(5)	
>De Minimis - 25 cubic yards	(2)	0
De Minimis	(0)	

Matrix Score TOTAL = 20 LEVEL D		Cleanup Level in mg/kg			
		Diesel	Gasoline/Unknown		
		diesel range pet. hydro.	gasoline range pet. hydro.	Benzene	BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1000	500	0.5	50
XXLevel D	<20	2000	1000	0.5	100

APPENDIX D

SERA PHASE IX DATA ASSESSMENT REPORT

DATA ASSESSMENT REPORT

To: FILE/Anchorage
Date: December 2001
From: Data Quality Services Manager
File: ST505_SERA IX_DAR
Re: SERA IX – ST505/9 Former Fueling Facility
cc: Project Manager

LIST OF TABLES

ATTACHMENT A: Field QC Sample Results

ATTACHMENT B: Data Assessment Summary – 99595, and 99619

LIST OF ACRONYMS

ADEC	Alaska Department of Environmental Conservation
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
C	Celsius
DAR	Data Assessment Report
DRO	Diesel range organic
EDF	Electronic deliverable format
EDFIT	Electronic Data Format Import Tool
EDMS	Environmental Data Management System
ENSR	ENSR Corporation
EPA	U.S. Environmental Protection Agency
FID	Flame ionization detector
GRO	Gasoline range organic
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LGN	Laboratory group number
MECL	Method-established control limits
MQL	Method quantitation limit
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
ND	Non-detected
QA	Quality assurance
QAO	Quality assurance objective
QAPP	Quality Assurance Project Plan
QC	Quality control
RPD	Relative percent difference
SAS	Sound Analytical Services, Inc.
USAED-AK	U.S. Army Engineer District-Alaska

1.0 SUMMARY

This Data Assessment Report (DAR) has been prepared for 2001 data collection activities supporting SERA IX Release Investigations at Elmendorf Air Force Base (EAFB), Alaska. Sampling was conducted at the Former Fueling Facility, EAFB, identified as Site 505/9 (ST505/9). Project samples included soil samples collected July 13 and July 16, 2001.

A Quality Assurance Project Plan (QAPP) was submitted (ENSR 2000) prior to data collection activities to outline the analytical program, data quality assurance (QA) objectives, quality control (QC) procedures, and level of effort for data quality assessment.

The objective of this DAR is to determine, through assessment of the data quality assessment samples, as to whether the QA objectives (i.e., goals) outlined in the QAPP were met.

ENSR data management services performed data validation procedures on the analytical results for a systematic and independent verification of method compliance and data quality. As a result of the data validation procedures, validation data qualifier codes are appended to the analytical data when applicable, to describe the bias or any limitations in use of the data. Validation efforts have been documented in the Data Assessment Summaries in Attachment B.

Overall the precision and accuracy of measurement were considered acceptable based upon the evaluation of data quality assessment sample results (field duplicate samples (Attachment A), laboratory control samples, and matrix spike samples) included into the project sampling and analysis scheme. The data quality assessment samples were considered to have met the project QA objectives for accuracy and precision. In summary:

- The data are considered valid as qualified and acceptable for use.
- The completeness objective goal of 95 percent is considered met for the site.

1.1 Data Recommended for Qualification

As a result of data validation procedures, validation data qualifier codes (flags) are appended to the analytical data to help describe the limitations in use of the data.

Data which are recommended to be flagged "J" for target compounds reported between the method detection limit (MDL) and the method quantitation limit (MQL), and are considered estimated values include:

- GRO sample 505BH02SO10.0N1 (99595-09) result at 1.2 mg/Kg.
- RRO sample 505BH02SO21.0N1 (99595-12) result at 29 mg/Kg.
- BTEX sample 505BH02SO10.0N1 (99595-09) results for ethylbenzene at 0.032 mg/Kg, and m,p-xylene at 0.058 mg/Kg.
- GRO sample 505BH04SO10.0N1 (99619-01) result at 1.0 mg/Kg.

- GRO sample 505BH04SO15.0N1 (99619-03) result at 1.3 mg/Kg.
- BTEX sample 505BH04SO10.0N1 (99619-01) result for m,p-xylene at 0.03 mg/Kg.
- BTEX sample 505BH04SO15.0N1 (99619-03) result for m,p-xylene at 0.054 mg/Kg.

These results should be viewed with caution for the possibility of false-positive identification and estimated quantitative value results. BETX target analytes detected were confirmed by second-column chromatography analysis, which enhances a determination of a qualitative presence. Petroleum hydrocarbon gas chromatography analysis (GRO, DRO, RRO), however, has a large possibility in false-positive identifications at values between the MDL and the MQL from inherent identifications made solely on chemical retention time in the analytical system.

1.2 Hydrocarbon Qualitative Interpretation

Gas chromatography traces obtained from the DRO/RRO analysis were reviewed to facilitate hydrocarbon interpretations and define the specific hydrocarbon range of contamination present. Project soil samples were reported as non-detected at the reporting limit.

2.0 SAMPLE MANAGEMENT AND ANALYTICAL PROGRAM

2.1 Field Sample Management

Primary project samples collected were analyzed by Sound Analytical Services, Inc. (SAS) located in Tacoma, Washington. At the request of USAED-AK, QA referee samples identified in the QAPP, were not collected.

Samples received at the laboratory were organized as "batches" of samples and are referred to as laboratory group numbers (LGNs). LGNs included batch-specific QC elements to assess the precision and accuracy of analysis.

Laboratory QC samples – consisting of laboratory control samples (LCS), laboratory control sample duplicates (LCSD), matrix spike (MS) samples, and matrix spike duplicate (MSD) samples – were incorporated into the analytical scheme to assess data quality.

Field QC samples were collected during the sampling activities to evaluate field sample handling, transportation, analytical procedures, and total field and analytical variability. The field QC samples consisted of a field duplicate sample, and a trip blank sample for volatiles analysis. Field QC samples were submitted to SAS as "blind" samples to mask their identity and were analyzed as project samples.

2.2 Analytical Methodology

Analysis methods are defined by U.S. Environmental Protection Agency (EPA) SW-846 (1994, 1996), and Alaska Department of Environmental Conservation (ADEC; 1999) methodology.

- Analysis of samples for petroleum hydrocarbons were performed by gas chromatography (GC) technique with flame ionization detector (FID). Methodology is defined by State of Alaska (ADEC 1999) as "Method for the Determination of Gasoline Range Organics" (GRO: AK101), "Method for the Determination of Diesel Range Organics" (DRO: AK102), and "Method for the Determination of Residual Range Organics" (RRO: AK103).
- Volatile aromatic compounds benzene, toluene, ethylbenzene, and xylenes (collectively known as the BTEX compounds) were analyzed by applying SW-846 Method 8021B (EPA 1996) to GRO analysis utilizing in-series photoionization detection before GRO FID analysis. BTEX compounds reported by SW-846 Method 8021B were confirmed with second column chromatography in analysis. BTEX soil samples were collected in the field by the high concentration soil method described in EPA SW-846 Method 5035. A representative soil sample (minimum 25 grams) was placed in a pre-weighed jar with a septum-sealed screw-cap. A 25-milliliter volume of methanol (provided in a glass-sealed container) was immediately added to

the sample to maintain hydrocarbon integrity and minimize analyte volatilization prior to analysis.

- Polycyclic aromatic hydrocarbons (PAHs) were assessed by EPA SW-846 (1996) Method 8270C. The gas chromatography/mass spectrometry (GC/MS) instrument was operated with an ion trap (IT) detector to increase the sensitivity of the method for PAH target analytes.
- The general chemistry parameter of total organic carbon (TOC) was assessed by EPA SW-826 Method 9060.

3.0 QUALITY ASSURANCE OBJECTIVES

All analytical data for the SERA IX Release Investigations were generated as definitive data as described by EPA (1993). Rigorous SW-846 analytical procedures (EPA 1994, 1996) and ADEC methods (1999) were utilized.

3.1 Quantitative QA Objectives

Quantitative quality assurance objectives (QAOs) of measurement data are determined by assessment of the data quality indicators of precision, accuracy, completeness, and sensitivity of reported results. The fundamental QAO – with respect to accuracy, precision, and sensitivity of laboratory analytical data – is to achieve the QC acceptance criteria of the analytical protocols.

Quantitative QAOs of measurement data for hydrocarbon methodology (GRO, DRO, RRO) were compared to method-established control limits (MECL) referenced from the Alaska Series Laboratory Methods within the Underground Storage Tank Procedures Manual (ADEC 1999). Quantitative QAOs for EPA methodology were adapted from the USACE Shell for Analytical Chemistry Requirements (USACE 2001). The quantitative QAOs are summarized in Table 3-1.

Table 3-1. Quantitative QA Objectives

Parameter	Methods	MQL	Precision Goal RPD	Accuracy Goal % Recovery
Soils				
Gasoline Range Organics	AK101	2 mg/kg	50	60 – 140
Aromatic Volatile Compounds (BTEX)[a]	5035/8021B	20 µg/kg	50	70-130
Diesel Range Organics	AK102	33 mg/kg	50	60 – 140
Residual Range Organics	AK103	40 mg/kg	50	60 – 140
PAH	8270C	10 µg/kg	60	45 – 135
Total Organic Carbon	9060	100 mg/kg	50	75 –125

Key:
µg/Kg = Micrograms per kilogram; BTEX = Benzene, toluene, ethylbenzene, and xylenes; mg/Kg = Milligrams per kilogram; MQL = Method quantitation limit; PAH = Polycyclic aromatic hydrocarbons; RPD = Relative percent difference calculated from duplicate measurement.

4.0 DATA QUALITY EVALUATION

Project investigative samples for ST505/9 were received and analyzed by SAS under the LGNs identified as 99595, and 99619. Data assessment summaries for each LGN are presented in Attachment B.

4.1 Data Verification Procedures

Data verification procedures were performed on each LGN to ensure the competency of the data reported and electronic data archived in the Environmental Data Management System (EDMS). A complete cross-check of laboratory identification numbers with field identification numbers was performed to ensure that analyses had been performed as specified in the chain-of-custody documentation. Missing information regarding samples was noted and resolved with laboratory personnel.

SAS supplied the analytical results in the U.S. Army Corps of Engineers North Pacific Division Electronic Deliverable Format (EDF) Version 1.2a for inclusion in the EDMS. ENSR data quality management services used Microsoft® Access 98 and Excel 98 to extract data from the verified final EDF for generation of tabulated sampling results. Additional data verification procedures were performed by ENSR comparing the tabulated sampling result tables to the hardcopy analytical report.

4.2 Data Validation Procedures

ENSR data quality management services performed limited data assessment procedures for a systematic and independent verification to determine method compliance and assess data quality. Data assessment was performed from the laboratory-provided sample result sheets and summary QC sheets, and was aided with the data software tools EDFIT (ENSR 2001) and Datastream™ (Arsenault & Associates 1997) for the additional generation of QC results summary reports (Attachment A).

4.3 Field Quality Control Sample Results

Field QC samples were collected during the sampling activities to evaluate field sample handling, transportation, analytical procedures, and analytical variability. The field QC samples consisted of field duplicate samples and a trip-transfer blank sample for volatile analysis.

4.3.1 Field Duplicate Sample Results

Field duplicate samples were collected and analyzed at the primary laboratory to evaluate both the sample matrix variability and variability in sampling and analytical procedures. Field duplicate samples were submitted as "blind" samples to mask their identity and were analyzed as primary samples.

Field duplicate samples included:

- 505BH01SO30.0N1 (99595-05) was submitted as a soil "blind" field duplicate of primary sample 505BH01SO25.0N1 (99595-03).

Field duplicate sample results are presented in Attachment A.

Field duplicate samples were compared to the USACE (1997) criteria for the comparability of field duplicate results summarized in Table 4-1.

Table 4-1. Criteria for Comparing Field QC and QA Sample Data

Matrix	Parameter	Disagreement	Major Disagreement
Water and Soil	GRO, DRO, RRO	Arbitrary (suggest > 3-times difference)	Arbitrary (suggest > 5-times difference)
Soil	BTEX	Arbitrary (suggest > 5-times difference)	Arbitrary (suggest > 10-times difference)
Water	BTEX, PAH	> 2-times difference	> 3-times difference
Soil	PAH	> 4-times difference	> 5-times difference
Water	BTEX	> 2-times difference	> 3-times difference
Water and Soil	All	> 5-times difference when one result is less than detection limit	> 10-times difference when one result is less than detection limit
Water and Soil	All	> 3-times difference when one result is less than reporting limit	> 5-times difference when one result is less than reporting limit

Project samples met the USACE comparability criteria.

4.3.2 Methanol Trip Blank Sample

A methanol trip (transfer) blank sample was included with the volatiles analysis analytical scheme to evaluate potential field- and/or laboratory-introduced contamination from sample handling, transportation, and storage of samples.

- Methanol trip blank sample 505BH03SO15.0N1 (99595-17) reported BTEX target analytes by SW-8021B as non-detected (ND) at the method quantitation limit (MQL). GRO by AK101 was reported as ND at the MQL.

The absence of target analytes indicates that sample handling and transportation procedures were considered acceptable and did not contribute any contamination effect to data collection activities.

5.0 REFERENCES

Alaska Department Environmental Conservation (ADEC). 1999. Underground Storage Tanks Procedures Manual – Guidance for Remediation of Petroleum-Contaminated Soil and Water and Standard Operating Procedures. March 1.

Arsenault & Associates, Inc. 1997. Datastream. Version 1.2. September.

ENSR International (ENSR). 2000. Sampling and Analysis Plan, Part Two: Quality Assurance Project Plan for Release Investigations SERA IX Elmendorf Air Force Base, Alaska. June.

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U.S. Army Corps of Engineers (USACE). 1990. *Chemical Data Quality Management for Hazardous Waste Remedial Activities.*

_____. 1997. Chemical *Quality Assurance for HTRW Projects.* Engineer Manual, EM 200-1-6. October.

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U.S. Environmental Protection Agency (EPA). 1996. *SW-846 Test Methods for Evaluating Solid Waste* Final Update III, December.

_____. 1993. *Data Quality Objective Process for Superfund.* Office of Solid Waste and Emergency Response (OSWER), EPA540-R-93-071, September.

_____. 1994. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. Office of Emergency and Remedial Response. EPA 540/R-94/012. February.

_____. 1996. SW-846 Test Methods for Evaluating Solid Waste. Final Update III, December.

ATTACHMENT A

Field QC Sample Results

The U.S. Army Corps of Engineers (USACE) North Pacific Division Electronic Deliverable Format (EDF) Version 1.2a was supplied as ASCII text files containing comma-delimited fields. The EDF was compiled in Microsoft Access® and extracted by Microsoft EXCEL® 8.0 for generation of tabulated analytical results. A description of the column headings and USACE valid value codes are provided as:

Field_ID	Field sample identification number.
Lab_ID	Laboratory sample identification number.
Analysis	Analysis Method Designation / Extraction Method Designation.
Basis	D = Dry, W = Wet, N = Not Filtered, F = Field-Filtered.
Parameter	Target analyte, target compound.
Result	Analysis result.
Units	Units of measure.
ND	Not detected at the method quantitation limit (MQL).
NC	Not calculated, duplicate results reported as ND.
Dilfac	Dilution factor of analysis.

FIELD DUPLICATE SAMPLE SUMMARY

	Primary Sample	Duplicate Sample	Laboratory
Field ID:	505BH01SO25.0N1	505BH01SO30.0N1	Sound Analytical Services, Inc., Tacoma, WA
Lab ID:	99595-03	99595-05	

Parameter	Basis	Duplicate Pair Results: Primary (RL/DL/Dil)	Duplicate Pair Results: Duplicate (RL/DL/Dil)	Units	RPD	Comment
AK101 / METHOD						
Gasoline Range Organics	D	ND (2.3 / 1.2 / 1)	ND (2.3 / 1.2 / 1)	mg/kg	NC	ND
AK102 / METHOD						
Diesel Range Organics	D	ND (38 / 19 / 1)	ND (38 / 19 / 1)	mg/kg	NC	ND
AK103 / METHOD						
Residual Range Organics	D	ND (38 / 20 / 1)	ND (38 / 20 / 1)	mg/kg	NC	ND
SW8021B / SW5030B						
Benzene	D	ND (0.023 / 0.0093 / 1)	ND (0.023 / 0.0092 / 1)	mg/kg	NC	ND
Ethylbenzene	D	ND (0.047 / 0.0093 / 1)	ND (0.046 / 0.0092 / 1)	mg/kg	NC	ND
m,p-Xylene (Sum of Isomers)	D	ND (0.093 / 0.019 / 1)	ND (0.092 / 0.018 / 1)	mg/kg	NC	ND
o-Xylene	D	ND (0.047 / 0.0093 / 1)	ND (0.046 / 0.0092 / 1)	mg/kg	NC	ND
Toluene	D	ND (0.047 / 0.0093 / 1)	ND (0.046 / 0.0092 / 1)	mg/kg	NC	ND

RL = reporting limit, DL = dection limit, Dil = dilution Factor, RPD = relative percent difference.

ATTACHMENT B

Data Assessment Summary

Data Assessment Summary

Lab Report #:	99595	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000011

1.1 Sample Receipt and Integrity

Twenty-one soil samples were received at SAS on 7/18/01 for analysis.

The temperature of the temperature blank representative of project sample temperatures within the cooler received at the laboratory were recorded as:

- 99595 @ 2.8 °C.

1.2 Corrective Actions

- None

1.3 Data Recommended for Qualification

Sample results reported below the MQL has been recommended to be flagged "J" and be considered an estimated values for:

- GRO sample 505BH02SO10.0N1 (99595-09) result at 1.2 mg/Kg.
- RRO sample 505BH02SO21.0N1 (99595-12) result at 29 mg/Kg.
- BTEX sample 505BH02SO10.0N1 (99595-09) results for ethylbenzene at 0.032 mg/Kg, and m,p-xylene at 0.058 mg/Kg.

Lab Report #:	99595	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000011

1.4 Diesel Range Organics / Residual Range Organics Analysis

RRO sample results reported below the method quantitation limit (MQL or reporting limit), and above the method detection limit (MDL) have been recommended to be flagged "J" and be considered an estimated values in samples:

- RRO sample 505BH02SO21.0N1 (99595-12) result at 29 mg/Kg.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *DRO and RRO method blank results were reported as non-detected at the reporting limit (MQL) of 33 mg/Kg.*

Laboratory Control Samples: *DRO analyte recovery in LCS analysis were compared to the method-established control limit (MECL) of 75 to 125 percent and 20 percent RPD in measurement. RRO analyte recovery in LCS analysis were compared to the LECL of 60 to 120 percent and 20 percent RPD in measurement.*

Lab_ID	Analyte	% Rec LCS	% Rec LCSD	RPD	Notes
SDS0359	DRO	99	105	5.9	
SDS0359	RRO	93.5	96.7	3.4	

Matrix Spike / Matrix Spike Duplicates: *DRO analyte recovery in MS and MSD analysis were compared to the MECL of 75 to 125 percent recovery and 30 percent RPD in measurement. RRO analyte recovery in MS and MSD analysis were compared to the MECL of 50 to 150 percent recovery and 50 percent RPD in measurement.*

Matrix spike sample was performed on site-specific sample 505BH03SO10.0N1 (99595-16).

Lab_ID	Field_ID	Analyte	% Rec MS	% Rec MSD	RPD	Notes
99595-16	505BH03SO10.0N1	DRO	109	1112	2.7	
99595-16	505BH03SO10.0N1	RRO	104	108	3.8	

Matrix Duplicates: *DRO and RRO results in matrix duplicate (MD) analysis were reported for an relative assessment of sample homogeneity.*

Lab_ID	Field_ID	Analyte	Result	Result	RPD	Notes
99595-04	505BH01SO25.0N1	DRO	ND	ND	NC	
99595-04	505BH01SO25.0N1	RRO	ND	ND	NC	

Surrogate Compounds: *DRO surrogate compound (o-terphenyl) and RRO surrogate compound (n-triacontane-d62) recovery in analysis were compared to the MECL of 50 to 150 percent. Surrogate compounds in project samples met the LECL in recovery.*

Lab Report #:	99595	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000011

1.5 Volatile Aromatic Hydrocarbons Analysis

The BTEX target analytes were assessed by EPA SW-846 method 8021B in conjunction with GRO AK101 analysis. Soil samples were field-preserved with methanol following AK101 guidance.

BTEX sample results reported below the method quantitation limit (MQL or reporting limit), and above the method detection limit (MDL) have been recommended to be flagged "J" and be considered an estimated values in samples:

- BTEX sample 505BH02SO10.0N1 (99595-09) results for ethylbenzene at 0.032 mg/Kg, and m,p-xylene at 0.058 mg/Kg.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *Method blank results were reported as non-detected at the reporting limit (MQL) of 2 mg/Kg.*

Laboratory Control Samples: *BTEX analyte recovery in LCS analysis were compared to the LECL of recovery and relative percent difference (RPD) in measurement of: Benzene (69 - 113%) <21% RPD; Toluene (71 - 131%) <20% RPD; Ethylbenzene (63 - 133%) <19% RPD; M&p-Xylene (74 - 137%) <20% RPD; o-Xylene (65 - 137%) <16% RPD.*

Lab ID	Analyte	% Recovery Range	RPD Range	Notes
SGB2763	BTEX	91 - 105	0 - 7.4	

Matrix Spike / Matrix Spike Duplicates: *BETX analyte recovery in MS and MSD analysis were compared to the quantitative QA objective (QAO) goal of 70 to 130 percent recovery and 50 percent RPD in measurement.*

Matrix spike sample was performed on site-specific sample 505BH03SO10.0N1 (99595-15).

Lab_ID	Field_ID	Analyte	% Recovery Range MS	RPD Range	Notes
99595-15	505BH03SO10.0N1	BETX	89.3 - 121	9.2 - 26	

Surrogate Compounds: *Surrogate compounds bromofluorobenzene (BFB) and triflourotoluene (TFT)recovery in analysis was compared to LECL of 70 to 130 percent recovery. Surrogate compounds in project samples met the LECL with the exception:*

- BTEX sample 505BH03SO5.0N1 (99595-20) surrogate compound 4BFB was reported at 134 percent which slightly exceeded the MECL. The additional surrogate compound TFT was within MECL. No data are recommended for qualification.

Lab Report #:	99595	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000011

1.6 Gasoline Range Organics Analysis

GRO sample results reported below the method quantitation limit (MQL or reporting limit), and above the method detection limit (MDL) have been recommended to be flagged "J" and be considered an estimated values in samples:

- GRO sample 505BH02SO10.0N1 (99595-09) result at 1.2 mg/Kg.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *Method blank results were reported as non-detected at the reporting limit (MQL) of 2 mg/Kg.*

Laboratory Control Samples: *GRO analyte recovery in LCS analysis were compared to the MECL of 70 to 120 percent and 20 percent relative percent difference (RPD) in measurement.*

Lab_ID	Analyte	% Rec MS	% Rec MSD	RPD	Notes
SGB2763	GRO	84	88	4.7	

Matrix Spike / Matrix Spike Duplicates: *GRO analyte recovery in MS and MSD analysis were compared to the LECL of 50 to 150 percent recovery and 50 percent RPD in measurement.*

Matrix spike sample was performed on site-specific sample 505BH03SO10.0N1 (99595-15).

Lab_ID	Field_ID	Analyte	% Rec MS	% Rec MSD	RPD	Notes
99595-15	505BH03SO10.0N1	GRO	85.6	85.6	0	

Surrogate Compound: *Surrogate compounds bromofluorobenzene, and trifluorotoluene recovery in analysis was compared to MECL of 50 to 150 percent recovery. Surrogate compounds in project samples met the MECL in recovery with the exception:*

- GRO sample 702BH14SO13.0N1 (99542-03) surrogate compound 4BFB exceeded the MECL. Significant GRO at 110 mg/Kg was reported in the sample which hindered an accurate determination of the surrogate compound. The additional surrogate TFT was within MECL. No data are recommended for qualification.

Lab Report #:	99595	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000011

1.7 Polycyclic Aromatic Hydrocarbons

The PAH target analytes were assessed by EPA SW-846 method 8270, utilizing mass spectroscopy with ion-trap detection.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *Method blank results were reported as non-detected at the reporting limit (MQL).*

Laboratory Control Samples: *PAH analyte recovery in LCS analysis were compared to LECL.*

Lab ID	Analyte	% Recovery Range	RPD Range	Notes
SS0328	PAH			

- PAH target analyte acenaphthylene recovery in LCS was reported at 164 percent which is slightly greater than the LECL. Target analyte dibenzo(a,h)anthracene recovery in LCS was reported at 51 percent which is slightly below the LECL. PAH target analytes in the associated samples were reported as ND at the MQL. No data are recommended for qualification.

Matrix Spike / Matrix Spike Duplicates: *PAH analyte recovery in MS and MSD analysis were compared to LECL.*

Matrix spike sample was performed on site-specific sample 505BH02SO10.0N1 (99595-10).

- PAH target analyte acenaphthylene recovery in LCS and LCSD was reported at 175 percent and 161 percent which is slightly greater than the LECL. PAH target analytes in the associated samples were reported as ND at the MQL. No data are recommended for qualification.

Surrogate Compounds: *Surrogate compounds 2-fluorobiphenyl (55 – 148), nitrobenzene-d5 (51 – 159), and p-terphenyl-d14 (43 – 148) recovery in analysis was compared to LECL (in parenthesis). Surrogate compounds in project samples met the LECL.*

Data Assessment Summary

Lab Report #:	99619	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000012

1.1 Sample Receipt and Integrity

Twenty-seven soil samples were received at SAS on 7/19/01 for analysis.

The temperature of the temperature blank representative of project sample temperatures within the cooler received at the laboratory were recorded as:

- 99619 @ 2.1 °C.

1.2 Corrective Actions

- None

1.3 Data Recommended for Qualification

Sample results reported below the MQL has been recommended to be flagged "J" and be considered an estimated values for:

- GRO sample 505BH04SO10.0N1 (99619-01) result at 1.0 mg/kg.
- GRO sample 505BH04SO15.0N1 (99619-03) result at 1.3 mg/kg.
- GRO sample 532BH02SO45.5N1 (99619-11) result at 1.8 mg/kg.
- RRO sample 532BH02SO45.5N1 (99619-12) result at 27 mg/kg.
- RRO sample 906H01SO6.0N1 (99619-20) result at 30 mg/kg.
- BTEX sample 505BH04SO10.0N1 (99619-01) result for m,p-xylene at 0.03 mg/kg.
- BTEX sample 505BH04SO15.0N1 (99619-03) result for m,p-xylene at 0.054 mg/kg.

Lab Report #:	99619	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000012

1.4 Diesel Range Organics / Residual Range Organics Analysis

RRO sample results reported below the method quantitation limit (MQL or reporting limit), and above the method detection limit (MDL) have been recommended to be flagged "J" and be considered an estimated values in samples:

- RRO sample 532BH02SO45.5N1 (99619-12) result at 27 mg/kg.
- RRO sample 906H01SO6.0N1 (99619-20) result at 30 mg/kg.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *DRO and RRO method blank results were reported as non-detected at the reporting limit (MQL) of 33 mg/Kg.*

Laboratory Control Samples: *DRO analyte recovery in LCS analysis were compared to the method-established control limit (MECL) of 75 to 125 percent and 20 percent RPD in measurement. RRO analyte recovery in LCS analysis were compared to the LECL of 60 to 120 percent and 20 percent RPD in measurement.*

Lab_ID	Analyte	% Rec LCS	% Rec LCSD	RPD	Notes
SDS0360	DRO	102	105	2.9	
SDS0360	RRO	93.5	93.5	0	
SDS0369	DRO	111	117	5.3	

Matrix Spike / Matrix Spike Duplicates: *DRO analyte recovery in MS and MSD analysis were compared to the MECL of 75 to 125 percent recovery and 30 percent RPD in measurement. RRO analyte recovery in MS and MSD analysis were compared to the MECL of 50 to 150 percent recovery and 50 percent RPD in measurement.*

Matrix spike sample was performed on site-specific sample 505BH04SO10.0N1 (99619-02), and 906BH02SO6.0 (99619-27).

Lab_ID	Field_ID	Analyte	% Rec MS	% Rec MSD	RPD	Notes
99619-02	505BH04SO10.0N1	DRO	125	127	1,6	
99619-02	505BH04SO10.0N1	RRO	95.7	92.1	3.8	
99619-27	906BH02SO6.0N1	DRO	114	115	0.87	

Lab Report #:	99619	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000012

Matrix Duplicates: *DRO and RRO results in matrix duplicate (MD) analysis were reported for an relative assessment of sample homogeneity.*

Lab ID	Field ID	Analyte	Result	Result	RPD	Notes
99619-04	505BH04SO15.0N1	DRO	ND	ND	NC	
99619-04	505BH04SO15.0N1	RRO	ND	ND	NC	
99619-25	906BH02SO3.5N1	DRO	ND	ND	NC	
99619-25	906BH02SO3.5N1	RRO	ND	ND	NC	
99619-27	906BH02SO6.0N1	DRO	ND	ND	NC	

Surrogate Compounds: *DRO surrogate compound (o-terphenyl) and RRO surrogate compound (n-triacontane-d62) recovery in analysis were compared to the MECL of 50 to 150 percent. Surrogate compounds in project samples met the LECL in recovery with the exception:*

- DRO sample 532BH02SO30.0N1 (99619-10) did not report the surrogate compound OTP recovery due to a 10-times dilution in analysis. Significant DRO was reported in the sample at 7000 mg/Kg that hindered an accurate determination of surrogate recovery. RRO surrogate compound was within LECL. No data is recommended for qualification.

Lab Report #:	99619	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000012

1.5 Volatile Aromatic Hydrocarbons Analysis

The BTEX target analytes were assessed by EPA SW-846 method 8021B in conjunction with GRO AK101 analysis. Soil samples were field-preserved with methanol following AK101 guidance.

BTEX sample results reported below the method quantitation limit (MQL or reporting limit), and above the method detection limit (MDL) have been recommended to be flagged "J" and be considered an estimated values in samples:

- BTEX sample 505BH04SO10.0N1 (99619-01) result for m,p-xylene at 0.03 mg/kg.
- BTEX sample 505BH04SO15.0N1 (99619-03) result for m,p-xylene at 0.054 mg/kg.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *Method blank results were reported as non-detected at the reporting limit (MQL) of 2 mg/Kg.*

Laboratory Control Samples: *BTEX analyte recovery in LCS analysis were compared to the LECL of recovery and relative percent difference (RPD) in measurement of: Benzene (69 - 113%) <21% RPD; Toluene (71 - 131%) <20% RPD; Ethylbenzene (63 - 133%) <19% RPD; M&p-Xylene (74 - 137%) <20% RPD; o-Xylene (65 - 137%) <16% RPD.*

Lab_ID	Analyte	% Recovery Range	RPD Range	Notes
SGB2763	BTEX	91 - 105	0 - 7.4	

Matrix Spike / Matrix Spike Duplicates: *BETX analyte recovery in MS and MSD analysis were compared to the quantitative QA objective (QAO) goal of 70 to 130 percent recovery and 50 percent RPD in measurement.*

Matrix spike sample was performed on site-specific sample 505BH04SO10.0N1 (99619-01).

Lab_ID	Field_ID	Analyte	% Recovery Range MS	RPD Range	Notes
99619-01	505BH04SO10.0N1	BETX	93 - 127	13 - 19	

Surrogate Compounds: *Surrogate compounds bromofluorobenzene (BFB) and triflourotoluene (TFT)recovery in analysis was compared to LECL of 70 to 130 percent recovery. Surrogate compounds in project samples met the LECL with the exception:*

- BTEX sample 505BH03SO5.0N1 (99595-20) surrogate compound 4BFB was reported at 134 percent which slightly exceeded the MECL. The additional surrogate compound TFT was within MECL. No data are recommended for qualification.

Lab Report #:	99619	**Laboratory:**	SAS
Location	SERA IX Release Investigations	**COC#:**	E000012

1.6 Gasoline Range Organics Analysis

GRO sample results reported below the method quantitation limit (MQL or reporting limit), and above the method detection limit (MDL) have been recommended to be flagged "J" and be considered an estimated values in samples:

- GRO sample 505BH04SO10.0N1 (99619-01) result at 1.0 mg/kg.
- GRO sample 505BH04SO15.0N1 (99619-03) result at 1.3 mg/kg.
- GRO sample 532BH02SO45.5N1 (99619-11) result at 1.8 mg/kg.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *Method blank results were reported as non-detected at the reporting limit (MQL) of 2 mg/Kg.*

Laboratory Control Samples: *GRO analyte recovery in LCS analysis were compared to the MECL of 70 to 120 percent and 20 percent relative percent difference (RPD) in measurement.*

Lab_ID	Analyte	% Rec MS	% Rec MSD	RPD	Notes
SGB2764	GRO	84	84	0	

Matrix Spike / Matrix Spike Duplicates: *GRO analyte recovery in MS and MSD analysis were compared to the LECL of 50 to 150 percent recovery and 50 percent RPD in measurement.*

Matrix spike sample was performed on site-specific sample 505BH04SO10.0N1 (99619-01).

Lab_ID	Field_ID	Analyte	% Rec MS	% Rec MSD	RPD	Notes
99619-01	505BH04SO10.0N1	GRO	78.3	78.3	0	

Surrogate Compound: *Surrogate compounds bromofluorobenzene, and trifluorotoluene recovery in analysis was compared to MECL of 50 to 150 percent recovery. Surrogate compounds in project samples met the MECL in recovery with the exception:*

- GRO sample 702BH14SO13.0N1 (99542-03) surrogate compound 4BFB exceeded the MECL. Significant GRO at 110 mg/Kg was reported in the sample which hindered an accurate determination of the surrogate compound. The additional surrogate TFT was within MECL. No data are recommended for qualification.

1.7 Polycyclic Aromatic Hydrocarbons

The PAH target analytes were assessed by EPA SW-846 method 8270, utilizing mass spectroscopy with ion-trap detection.

Holding Times: *Analytical holding times were met in sample analysis.*

Method Blanks: *Method blank results were reported as non-detected at the reporting limit (MQL).*

Laboratory Control Samples: *PAH analyte recovery in LCS analysis were compared to LECL.*

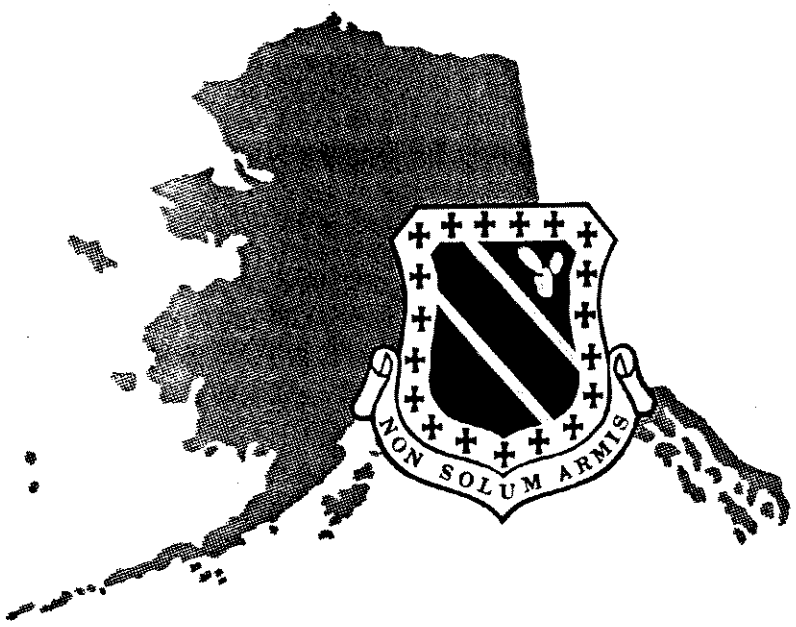
- PAH target analyte acenaphthylene recovery in LCS analysis (SSS0329) was reported at 165 percent which is slightly greater than the LECL. PAH target analytes in the associated samples were reported as ND at the MQL. No data are recommended for qualification.

Matrix Spike / Matrix Spike Duplicates: *PAH analyte recovery in MS and MSD analysis were compared to LECL.*

Matrix spike sample was performed on site-specific sample 505BH04SO23.0N1 (99619-06).

- PAH target analyte acenaphthylene, and anthracene in MSD was reported slightly greater than the LECL. MS recovery met LECL. PAH target analytes in the associated samples were reported as ND at the MQL. No data are recommended for qualification.

Surrogate Compounds: *Surrogate compounds 2-fluorobiphenyl (55 – 148), nitrobenzene-d5 (51 – 159), and p-terphenyl-d14 (43 – 148) recovery in analysis was compared to LECL (in parenthesis). Surrogate compounds in project samples met the LECL.*



UNITED STATES AIR FORCE
ELMENDORF AIR FORCE BASE, ALASKA

ENVIRONMENTAL COMPLIANCE PROGRAM

SITE EVALUATION AND BIOVENTING STUDIES FOR SERA PHASE V SITES, WORKPLAN

FINAL

AUGUST 1996

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On the basis of the small distance (approximately 4 ft) between the bottom of the tank and the water table, and the large seasonal groundwater level fluctuations observed at Elmendorf AFB, bioventing may not be recommended for ST 504. Bioventing is primarily designed to deliver oxygen to soils in the unsaturated zone; therefore, it is not an effective technology to remediate water-saturated soils.

Because the extent of contamination beneath this site is unknown, a limited field investigation will be conducted. Section 3 details the decision-making process that will be used during the investigation to determine the appropriateness of bioventing, or an alternative remedy at the site.

2.5 ST 505 (UST Sites 306, 307, and 308)

ST 505 contains three USTs 306, 307 and 308 that contained diesel, MOGAS, and JP-4, respectively. These tanks were located near Buildings 42-300 and 42-301, north of the runway, and were removed in 1994, during which environmental samples were taken. The results of the excavation and sampling are presented in the *UST Site Assessment, State of Alaska Underground Storage Tank Register Numbers: 306, 307, & 308, Near Building 42-301* (USAF, August 1994). The following sections summarize the tank removal and investigation, and present recommendations for additional work.

2.5.1 Site Location and Description

The USTs were located south of Building 42-300 and west of Building 42-301, and were used to store fuel for operations support vehicles and equipment. The associated fuel pumps were located approximately 10 ft to the east of the tanks. Figure 1.2-1 shows the approximate former location of the tanks at Elmendorf AFB; Figure 2.5-1 presents a more detailed location map.

The area surrounding the location of the four tanks is level and vegetated with grass; the area surrounding the fuel pumps is level and paved with concrete. A drainage ditch is located to the east and a small stream is located approximately 1.25 miles to the south.

Soils encountered during excavation of the tanks were classified as very fine sands, according to the Unified Soil Classification System. The shallow aquifer is estimated to be 35 ft below grade in the vicinity of the tanks, approximately 24 ft below the base of the tanks. Shallow groundwater flows to the west in this area (USAF, August 1994).

2.5.2 Tank Removal Results

All three tanks were excavated and removed in May 1994 and appeared to be in good condition (USAF, August 1994). A PID was used to screen soils during excavation, but no volatile organic compounds (VOCs) were detected. Two soil samples were collected from the base of each tank excavation, within 2 ft of the tank bottoms. The results of the sampling are shown in Figure 2.5-1. DRO, GRO, and benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in four of the six samples collected from beneath the fuel tanks. A sample collected from beneath the south end of the diesel tank contained 146-mg/kg DRO, 7-mg/kg GRO, and 0.07-mg/kg xylenes. The remaining sample, collected beneath the south end of the JP-4 tank, contained only a minor amount of DRO (14 mg/kg).

An additional sample was taken at each of the three associated fuel pumps (diesel, MOGAS, and JP-4). These samples were taken approximately 2 ft below the pipes leading from the fuel tanks to the pumps. Samples collected from near the fuel pumps contained significantly higher concentrations of contaminants than those collected beneath the tanks. The sample collected near the pipe to the diesel pump contained 4160 mg/kg DRO, and the sample collected near the pipe to the MOGAS pump

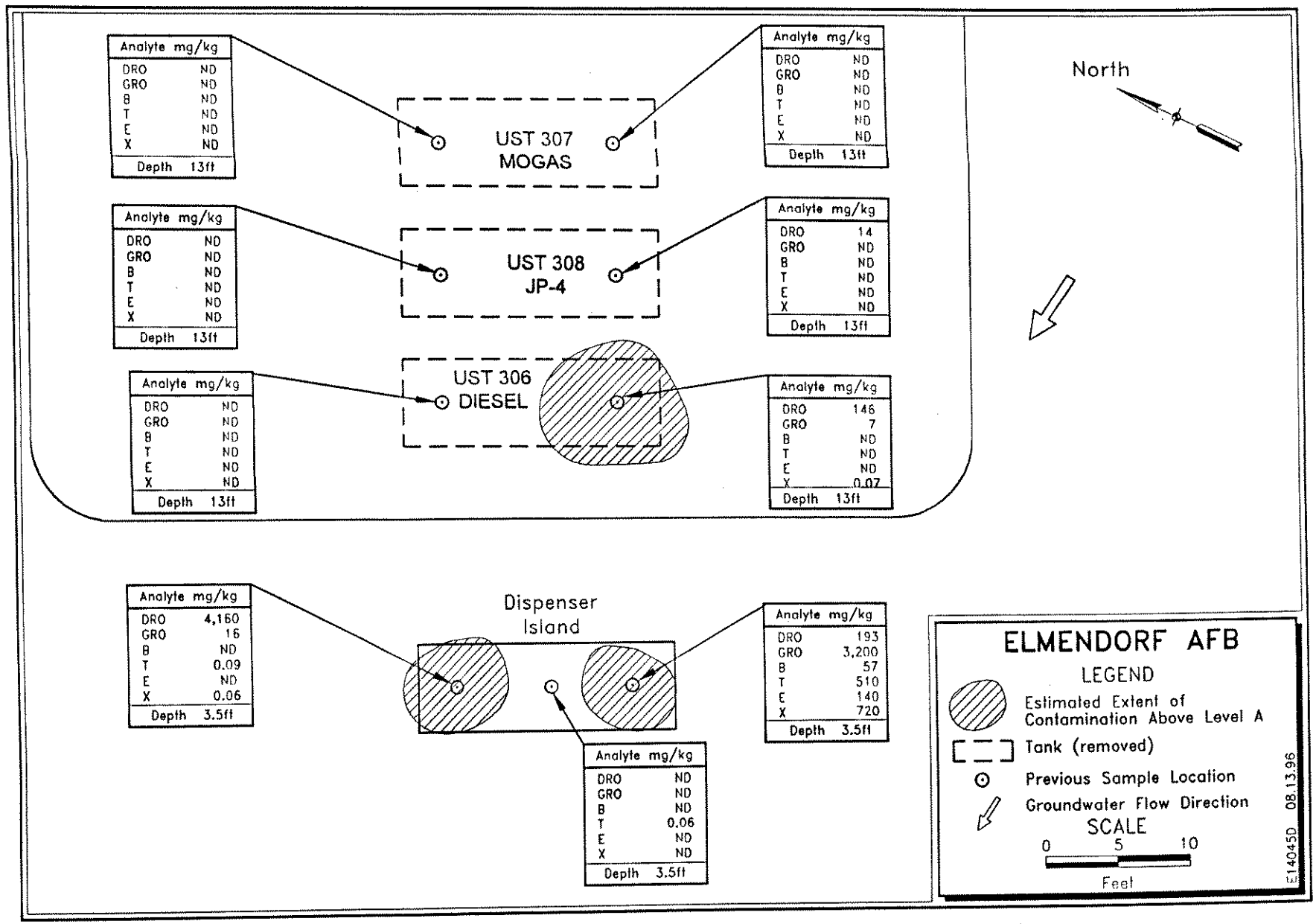

Figure 2.5-1. Location of Site ST 505

contained 3200-mg/kg GRO and significant concentrations of BTEX. These results are also shown in Figure 2.5-1.

Following excavation of the three USTs, the excavated soils plus some clean soil were used as backfill. The soils around the fuel pumps were not excavated (USAF, August 1994).

2.5.3 Conclusions and Recommendations

The original ACM score calculated for this site was 20, corresponding to Level D cleanup criteria (USAF, August 1994). This score did not take into account the contamination associated with the fuel pumps; therefore, the ACM score was recalculated using a conservative estimate of the volume of soil contamination, and assuming that the groundwater in the shallow aquifer is not used for consumption within the Base boundaries. Figure 2.5-2 shows the recalculated ACM score of 24, which corresponds to Level C cleanup criteria. DRO and GRO exceeded the Level C cleanup criteria near the fuel pumps.

Because the extent of contamination beneath this site is unknown, a limited field investigation will be conducted. If, during the course of this investigation, the vertical extent of contamination is found to be significant, this site may be recommended for bioventing as the presumptive remedy for the remediation of the soils above the water table. Section 3 details the decision-making process that will be used during the investigation to determine whether this site warrants bioventing, an alternative removal action, or no further action.

2.6 ST 506 (UST Sites 395A, 395B, 395C, and 395D)

ST 506 contains four former USTs which were 10,000-gal. tanks that contained unleaded and premium unleaded gasoline. These tanks were located near Building 33-395, a retail gasoline station on the Davis Highway on the eastern part of the Base. These tanks were removed in 1994, and environmental samples were taken during excavation. The results of the excavation and sampling are presented in the *UST Site Assessment, State of Alaska Underground Storage Tank Register Numbers: 395A, 395B, 395C, & 395D, Near Building 33-395* (USAF, September 1994). The following sections summarize the tank removal and investigation, and present recommendations for additional work.

2.6.1 Site Location and Description

All four USTs were located east of Building 33-395 and west of the Davis Highway, and were used to store fuel for the retail fuel operation. The four associated fuel pumps were located immediately east of the tanks. Figure 1.2-1 shows the approximate location of the fuel tanks and gasoline station at Elmendorf AFB; Figure 2.6-1 presents a more detailed location map.

The area surrounding the location of the four tanks is paved and slopes gently to the east; the area surrounding the fuel pumps is level and paved with concrete. A drainage ditch is located to the east of the tanks, and Ship Creek is located approximately one-third mile to the south.

Soils encountered during excavation of the tanks were classified as very fine sands, according to the Unified Soil Classification System, and did not appear to be native. The shallow aquifer is estimated to be 35 ft below grade in the vicinity of the gasoline station, approximately 19 ft below the base of the tanks. Shallow groundwater flows to the west in this area (USAF, September 1994).

I. Matrix Score Sheet		Score
1. Depth to Subsurface Water		
< 5 feet	(10)	
5 - 15 feet	(8)	
15 - 25 feet	(6)	
25 - 50 feet	(4)	
> 50 feet	(1)	6
2. Mean Annual Precipitation		
> 40 inches	(10)	
25 - 40 inches	(5)	
15 - 25 inches	(3)	
< 15 inches	(1)	3
3. Soil Type (Unified Soil Classification)		
Clean, coarse-grained soils	(10	
Coarse-grained soils with fines	(8)	
Fine-grained soils (low OC)	(3)	
Fine-grained soils (high OC)	(1)	3
4. Potential Receptors		
Public well within 1000 feet, or private well(s) within 500 feet	(15)	
Municipal/private well within ½ mile	(12)	
Municipal/private well within 1 mile	(8)	
No known well within ½ mile	(6)	
No known well within 1 mile	(4)	
Non-potable groundwater	(1)	4
5. Volume of Contaminated Soil		
> 500 cubic yards	(10)	
100 - 500 cubic yards	(8)	
25 - 100 cubic yards	(5)	
>De Minimis - 25 cubic yards	(2)	
De Minimis	(0)	8
	TOTAL	24

		Cleanup Level in mg/kg				
		Diesel	Gasoline/Unknown			
Matrix Score		Diesel Range Petroleum Hydrocarbons	Gasoline Range Petroleum Hydrocarbons	Residual Range Organics	Benzene	BTEX
Level A	> 40	100	50	2000	0.1	10
Level B	27 - 40	200	100	2000	0.5	15
Level C	**21 - 26**	**1000**	**500**	**2000**	**0.5**	**50**
Level D	< 20	2000	1000	2000	0.5	100

Figure 2.5-2. Recalculated Matrix Score Sheet for Site ST 505

3.5.5 Sampling Plan for ST 505

ST 505 contains USTs 306, 307, and 308 which were 2500-gal. fuel tanks located near Buildings 42-300 and 42-301. These tanks, which were removed in 1994, have three small areas of DRO and GRO contamination, near UST 306 and the dispenser island. The site has an ACM score of 24. The limited sampling conducted at the site during tank removal indicates that GRO and DRO contamination exceed the Level C ACM cleanup criteria of 500 and 1000 mg/kg, respectively.

Figure 3.5-5 shows the location of the initial boring, in the area of greatest contamination, and the additional soil borings, both on a circle 10 ft out from the estimated extent of contamination and within the area of contamination. If the field investigation indicates that bioventing is warranted, a bioventing well will be installed in the initial boring. Monitoring implants will be installed in three of the additional borings. One implant will be located on the circle surrounding the estimated plume, and the other two may be placed within the circle in areas of contamination, as shown in Figure 3.5-5, depending on the extent of contamination.

Table 3.5-5 outlines the confirmation sampling proposed for ST 505. The QAP (Appendix B) outlines the laboratory QA/QC samples for the field investigation.

Table 3.5-5

Sampling Plan for ST 505

	Depth to Tank Bottom (ft)	Estimated Depth to Pipe (ft)	Depth to Groundwater [a] (ft)	No. of Laboratory Samples	Analytical Method
Initial boring/ potential bioventing well.	11	1.5	35	2	AK101, AK102, AK103, 8020, Nitrate/nitrite[b], total phosphate[b], TOC[b].
Additional borings/ potential monitoring implants.				2 per boring	AK101, AK102, AK103, 8020.

[a]Borings will be drilled and sampled to groundwater.
[b]These analyses will be conducted only on the most contaminated sample from the boring.
AK101 = State of Alaska method for GRO.
AK102 = State of Alaska method for DRO.
AK103 = State of Alaska method for RRO.
8020 = EPA method for BTEX.
TOC = Total organic carbon.

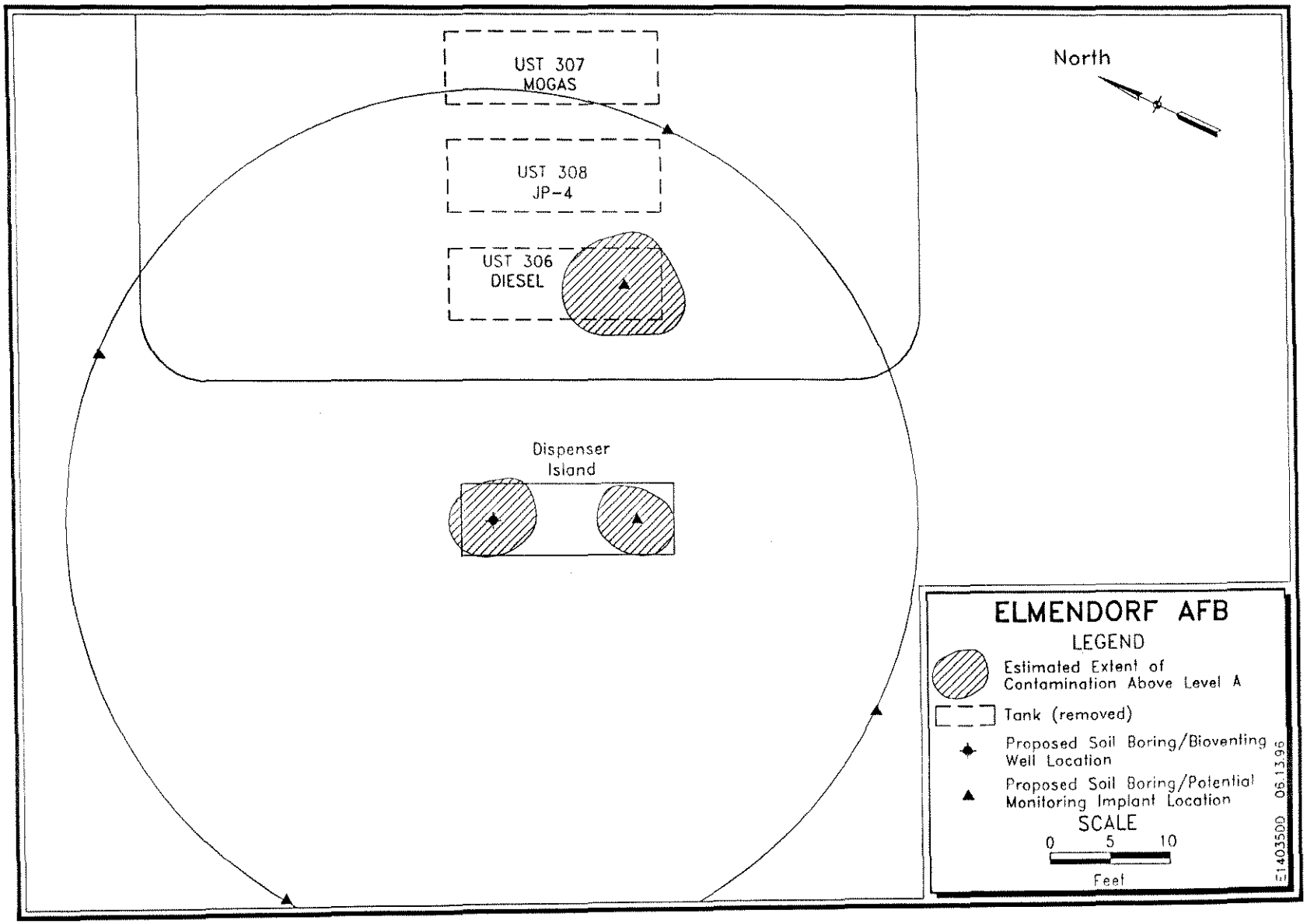

Figure 3.5-5. Sampling Plan for ST 505