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Final Report

Contract No. DAHA90-94-D-0005
Delivery Order No. 0501

Preliminary Assessment/Site Investigation at the Savoonga Federal Scout Armory Savoonga, Alaska

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Alaska Army National Guard

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FINAL REPORT
FOR
PRELIMINARY ASSESSMENT/SITE INVESTIGATION
AT THE SAVOONGA FEDERAL SCOUT ARMORY
SAVOONGA, ALASKA

Contract No. DAHA90-94-D-0005
Delivery Order No. 0501
Alaska Army National Guard (AKARNG)

PREPARED FOR:

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LIST OF ACRONYMS

ACL	Alternative Cleanup Levels
ADEC	Alaska Department of Environmental Conservation
AKARNG	Alaska Army National Guard
Analytica	Analytica Alaska, Inc.
AOC	Areas of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
BTEX	Benzene, Toluene, Ethylbenzene, and total Xylenes
DCRA	Alaska Department of Community and Regional Affairs
DRO	Diesel Range Organics
EPA	Environmental Protection Agency
FSA	Federal Scout Armory
GRO	Gasoline Range Organics
GWSI	Ground Water Sites Inventory
HASP	Health and Safety Plan
IR	Infrared Spectrometry
MCL	Maximum Contaminant Levels
mg/kg	milligram/kilogram
NFA	No Further Action
Ogden	Ogden Environmental and Energy Services, Co., Inc.
PA/SI	Preliminary Assessment/Site Investigation
PMP	Project Management Plans
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SOW	Scope of Work
TPH	Total Petroleum Hydrocarbons

EXECUTIVE SUMMARY

This report presents the purpose, scope, objectives, methods, and findings of a Preliminary Assessment/Site Investigation (PA/SI) conducted for the Alaska Army National Guard (AKARNG) at the Savoonga Federal Scout Armory (FSA). The purpose of the investigation was to collect information on current site conditions and historical activities in order to assess the potential threat posed to human health and the environment. Information review and development of Work Plans were conducted during March and April of 1996 and resulted in a site Sampling and Analysis Plan (SAP), Health and Safety Plan (HASP), Quality Assurance Project Plan (QAPP), and a Project Management Plan (PMP). These documents were reviewed by the AKARNG prior to implementing the field investigation.

Savoonga is located on the northeast coast of St. Lawrence Island in the Bering Sea, approximately 39 miles south of Gambell, and 164 miles west of Nome. The Savoonga ARNG FSA is located on the northwestern edge of the village of Savoonga.

During the Savoonga FSA PA/SI, a total of 12 locations were sampled. These locations were comprised of seven field screening soil samples and five analytical soil samples. The samples were analyzed for diesel range organics (DRO) and total petroleum hydrocarbons (TPH). The laboratory analysis were performed by Analytica Alaska, Inc. (Analytica).

The analytical results were compared to State of Alaska petroleum hydrocarbon cleanup guidelines to determine if any of the contaminant concentrations had exceeded these limits.

MAJOR FINDINGS

DRO contamination was detected in all five analytical samples at concentrations ranging from 12 to 160 mg/kg. The highest concentration detected was at location SV051 at a depth of 0.5 feet.

TPH contamination was detected in one of the five samples analyzed at a concentration of 26 mg/kg. The TPH contamination was detected at location SV051 at a depth of 0.5 feet.

CONCLUSIONS

The following conclusions are based on the information obtained during this investigation:

- The soil contamination present appears to be the result of minor spills or leaks from fuel handling operations.
- The volume of contaminated soil was conservatively estimated to be no greater than 4 cubic yards. This estimate was based on an approximate area of contamination of 36 square feet and a depth of 3 feet (depth to permafrost).

The soil analytical results indicate that DRO is present at concentrations well below ADEC regulatory guidelines for cleanup.

RECOMMENDATIONS

Because current contamination levels are below applicable ADEC cleanup criteria, we recommend no further action at the AKARNG Savoonga FSA.

1.0 INTRODUCTION

The project was performed for the AKARNG under contract to the Army National Guard. This report was prepared by Ogden Environmental and Energy Services (Ogden) in accordance to the SOW authorized by Contract No. DAHA90-94-D-0005, Delivery Order No. 0501. The investigations was conducted following the requirements and guidelines outlined in the PMP, SAP, QAPP, and HASP prepared for this project.

The information provided in this report is in support of PA/SI for the AKARNG at the Savoonga FSA located in Savoonga, Alaska (Figure 1-1). The purpose of this investigation was to collect information on current site conditions and historical activities in order to assess the potential threat posed to human health and the environment. The results of the investigation will be used to categorize the site for further action.

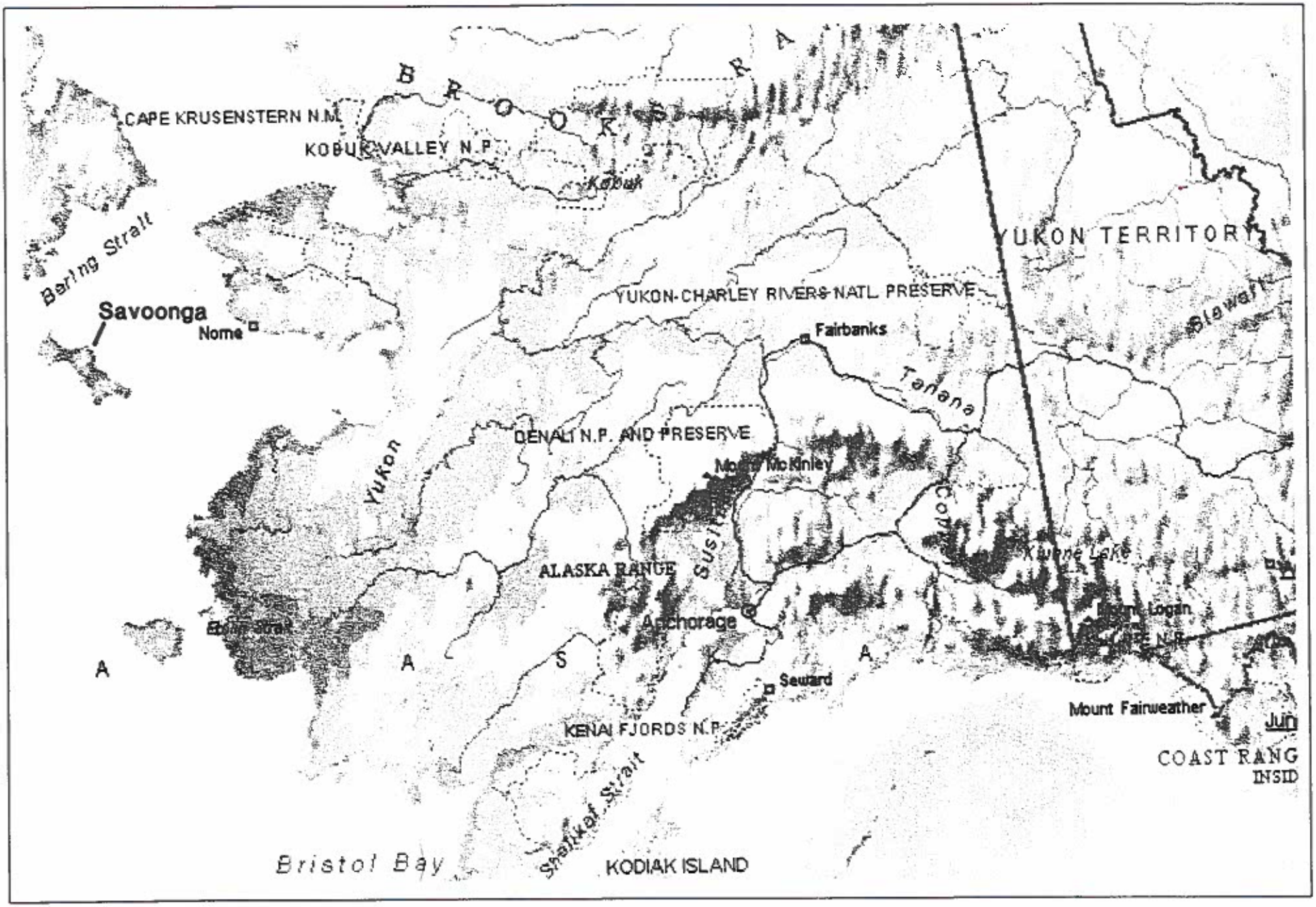
Based on this investigation, the site was classified in one of the following categories:

1. **No Further Action.** The no further action alternative may be recommended if investigation results indicated that a site meets all of the following criteria:

   - The source of contamination has been removed (such as a storage tank) or fixed (such as a leaking valve).

   - After a reasonable field effort and visual inspection, a suspected contamination area cannot be found.

2. **No Further Action with Limited Monitoring.** This alternative may be recommended if investigation results indicate that site remediation goals can be met either through natural attenuation or through alternative cleanup levels (ACLs) negotiated with Alaska Department of Environmental Conservation (ADEC).



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Project Location Map

FIGURE
1-1

Natural attenuation (also called intrinsic remediation) entails, allowing natural subsurface processes such as dilution, volatilization, biodegradation, and chemical reactions to reduce petroleum hydrocarbon contaminant concentrations to acceptable levels.

Alternative cleanup levels are based on interim guidance established by ADEC that specifies soil cleanup levels for aboveground storage tank (AST) petroleum-contaminated Soils (ADEC, 1991). ADEC believes that these levels, albeit conservative, are protective of surface water and ground water quality and consider site-specific conditions.

Natural attenuation and/or ACLs may be selected it can be demonstrated to ADEC's satisfaction that degradation is proceeding at rates consistent with cleanup levels. All of the following criteria must also be met for both natural attenuation and ACLs.

- The source of contamination has been removed (such as a storage tank) or fixed (such as a leaking valve).
- Screening and sampling results confirm that most of the contaminated soil is generally below applicable ADEC cleanup levels, with limited quantities above cleanup levels.
- There will be no impact on potential receptors.
- The contaminants are either immobilized (by sorbing onto soil particles) or have limited migration before degradation occurs.
- Alternative remedial technologies are not technically or economically feasible, may not significantly speed up remediation time frames, and may cause more damage than benefit.
- Enough site characterization and information exists to recommend natural attenuation and/or propose ACLs, and a very strong scientific case can be made in predicting their success and protectiveness.

Using natural attenuation or ACLs also entails monitoring throughout the process; the monitoring will consist of sampling and sample analysis. Monitoring will verify that degradation is proceeding at rates consistent with cleanup objectives.

3. **Additional Investigation Required**. This alternative may be selected if enough information cannot be collected to recommend a remedial technology, or additional information is required to recommend natural attenuation or ACLs.

4. **Follow-up Remedial Action**. The follow-up remedial action alternative may be recommended if investigation results indicate that a site meets any of the following criteria:

   - The source of contamination has not been removed or fixed, and is not a de minimis release.
   - Screening and sampling results confirm that most of the contaminated soil is above applicable ADEC cleanup levels.
   - There is impact on potential receptors, and data indicate a need for action to reduce real or potential risk to human health or the environment.
   - The contaminants are highly mobile and have potential for significant off-site impact before realizing an acceptable decrease in observed concentration.
   - Alternative remedial technologies are technically and/or economically feasible, may significantly speed up remediation time frames, and may not cause more damage than benefit.
   - Site information suggests that a very strong scientific case cannot be made in predicting the success and protectiveness of natural attenuation or ACLs.

2.0 PROJECT APPROACH

The scope of this investigation included a review of file information and interviews with current and past employees and to conduct a site investigation to characterize potential petroleum contamination at the Savoonga FSA.

The scope of services for this project included the tasks described below:

Task A: Determine through interview and literature searches the areas suspected of being contaminated by petroleum products.

Task B: Confirm through a field investigation the presence or absence of suspected contamination.

Task C: Provide information that characterizes the site to such an extent that the potential for off-site contamination migration may be identified.

Task D: Compare results to cleanup standards and guidelines for either non-UST or UST-related petroleum releases and recommend future investigations and action required at the site.

2.1 OVERALL PURPOSE AND OBJECTIVES

This report provide the AKARNG about the type and level of contamination at the Savoonga FSA. This information will be used to determine if contamination exists in concentrations greater than ADEC cleanup standards, and to help recommend appropriate actions.

The objective of the site investigation was to evaluate the environmental conditions of the Savoonga FSA facility, with respect to petroleum hydrocarbon contamination, and to evaluate potential petroleum hydrocarbon contamination by collecting soil samples for field screening and analytical laboratory analysis. During the site investigation, field personnel verified site conditions, surrounding land uses, and potential off-site sources or receptors.

2.2 PROJECT ORGANIZATION AND PERSONNEL RESPONSIBILITIES

2.2.1 Organization Chart

The organization of the project team is outlined in Figure 2-1.

Figure 2-1. Project Organization Chart

2.2.2 Key Personnel Responsibilities

The key personnel positions responsible for assuring that the Savoonga PA/SI was conducted in accordance with standard and accepted operating procedures are shown in Figure 2-1. The duties of each position are described in the following text.

Army National Guard, Contract Officer: The Contract Officer is David Hunt. Mr. Hunt is responsible for the overall contract direction.

AKARNG, Project Manager: The AKARNG Project Manager is Norman Straub. He is responsible for the final review and approval of all reports and chemical analysis data.

Ogden, Project Manager: The Ogden Project Manager is David Bufo. Mr. Bufo is responsible for all field activities and deliverables under this SOW. No changes to the SOW were implemented without coordination with the Ogden Project Manager and prior approval by the AKARNG Contract Officer.

Ogden, Field Team Members: The Ogden Field Team included Archer Bishop and David Bufo. They were responsible for conducting sampling, to include all field quality control, instrument calibration, and field documentation. They have knowledge of standards and regulations applying to soil sampling.

No contact with the ADEC, the U.S. Environmental Protection Agency (EPA), other regulatory entities, or the press was made by Ogden personnel.

3.0 SITE CHARACTERIZATION

3.1 GENERAL SITE CHARACTERISTICS

3.1.1 Location

Savoonga is located on a bluff above the Bering Sea, approximately 39 miles south of Gambell, and 164 miles west of Nome. Coordinates for the facility are Township 21 South, Range 61 West, Section 5, Kateel River Meridian at 63° 42' north latitude, 170° 29' west longitude (Figure 3-1). The Savoonga FSA is located on the northwestern edge of the village of Savoonga, which is located on the northeast coast of St. Lawrence Island in the Bering Sea.

3.1.2 Geographical and Topographical Setting

Savoonga lies on the north coast of St. Lawrence Island. The village is situated on a bluff above the Bering Sea and the land south of the village is hilly. Atuk Mountain rises to a height of 2,207 feet only eight miles south of Savoonga. To the east and west of the village, the land is flat and has many bogs. Most development lies above the area identified as the 100-year flood zone.

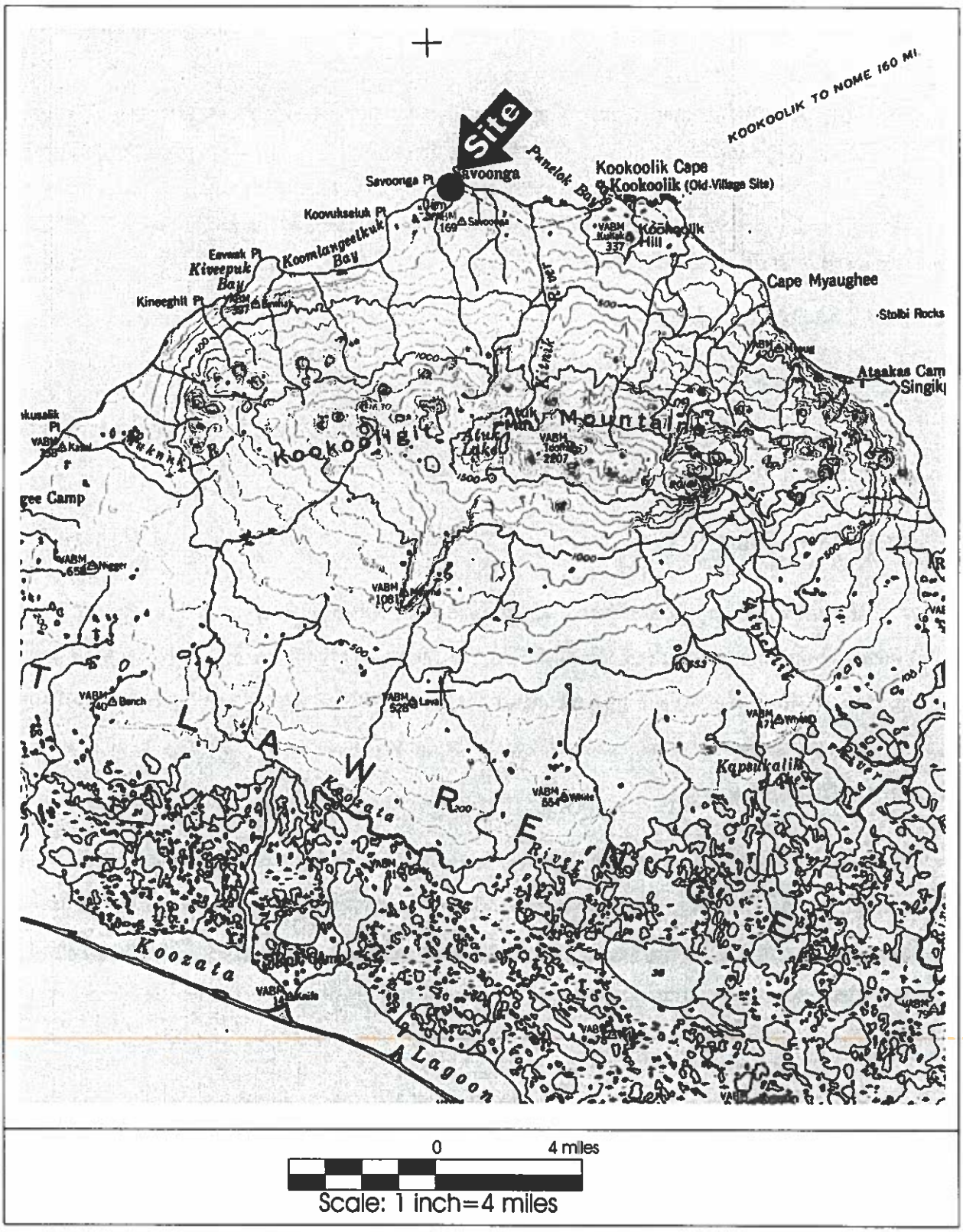
The facility yard is generally level, and the entire FSA is constructed on a gravel pad that is surrounded by wet tundra. No vegetation reportedly grows on the gravel pad of the FSA, and the surrounding tundra is vegetated by low grass species. Surface drainage trends to the north toward the Bering sea. Vegetation consists primarily of sedges, berries, and mosses.

3.1.3 Environmental Setting

3.1.3.1 Ecosystems

Wildlife populations in the vicinity of Savoonga are large and varied; however, they are subject to substantial fluctuations through time. These fluctuations may be seasonal because of migration, or of longer duration if changes in the population base occurs.

From U.S.G.S. Quadrangle:St Lawrence (1:250 000)



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Project Location - Village of Savoonga

FIGURE

3-1

Savoonga is hailed as the "Walrus Capitol of the World." Residents hunt walrus and whales (bowhead, grey) in the spring and fall. During the summer, the people fish, crab, hunt birds, gather eggs and harvest various seafoods, greens, blackberries, salmonberries and cranberries. Seal, fish, and crab are harvested through the winter. Arctic fox is also found on the island. Some reindeer also roam freely on the island.

3.1.3.2 Socioeconomics

The residents of Savoonga are primarily Yupik Eskimos whose lifestyle consists primarily of subsistence supplemented with cash income. Census data from 1996 indicated a village population of just over 600 persons (DCRA, 1996).

3.1.3.3 Infrastructure

The present water supply for the village comes from a 195-foot deep well (installed in 1972) located about one-half mile south of the FSA at the end of the airstrip. Based on the direction of surface flow, the well is upgradient of the FSA. Water is pumped from the well into a 100,000 gallon storage tank in the village. Residents obtain water from two central watering points within the village.

Savoonga operates its own sewage system. Honeybuckets are used by residents and community hauling service is provided. A central sewage lagoon provides for disposal and treatment. The FSA utilizes a composting toilet system. Garbage collection services are provided and a local landfill is available.

3.1.4 Geology and Hydrogeology

The village is built on clayey silt that contains basalt boulders overlain by a one-foot thick layer of black peat, roots, and organic material. Bedrock, possibly basalt, occurs at a depth of approximately 12 feet below ground surface. Permafrost is continuous under the village, with a two to three foot thick surface-thaw layer (DCRA, 1996). Permafrost impedes the downward and lateral movement of water.

3.1.5 Climate

The climate at Savoonga is considered to be subarctic maritime with continental influences during the winter. Winter lows can reach -7°F, and summer highs generally reach only around 50°F. Average precipitation is 16 inches annually, with 80 inches of snowfall. The island is subject to prevailing winds, averaging 12 to 23 miles per hour (DCRA, 1996).

3.2 FACILITY BACKGROUND INFORMATION AND HISTORY

3.2.1 Facility Mission

Since its formation during World War II, the AKARNG's Federal Scouts have been tasked with providing defense for Alaska. In the late 1950s, the Scout mission was expanded to include search and rescue operations. With the expansion has come the construction and operation of Army Aviation Operations Facilities, FSAs, and Organizational Maintenance Shops.

The military mission of the Savoonga FSA is reconnaissance, surveillance, and screening. The civilian mission of the FSA includes responding to disasters and search and rescue. The AKARNG is mobilized for these missions by direction of the Governor of the State of Alaska and operations are integrated with Emergency Services, Department of Military and Veterans Affairs.

3.2.2 Facility Description

The Savoonga FSA facility consists of a 20 x 60 foot wood-framed building constructed in 1960 ("Old" Armory) and a 30 x 40 foot wood framed building ("New" Armory) constructed in approximately 1985 (1990 and 1995 SPCC Plan data). The two Armory buildings are connected to each other by a breezeway. The facility also includes a 3,000-gallon, double-walled aboveground fuel tank located adjacent to the New Armory building, two 1,500-gallon double-walled aboveground storage tanks adjacent to the Old Armory building, drum storage areas, a drum storage shed, and a conex storage van.

Land uses surrounding the FSA include undeveloped tundra to the north, west, and southeast, a northeast-southwest trending roadway immediately south of the site; a store to the northeast; maintenance garage to the south; and a warehouse to the southwest. An aboveground power transmission line trends in a generally east-west direction south of the FSA. Residential dwellings are reportedly located within 50-feet of the FSA property. A 4,600 foot gravel airstrip is located southwest of the village.

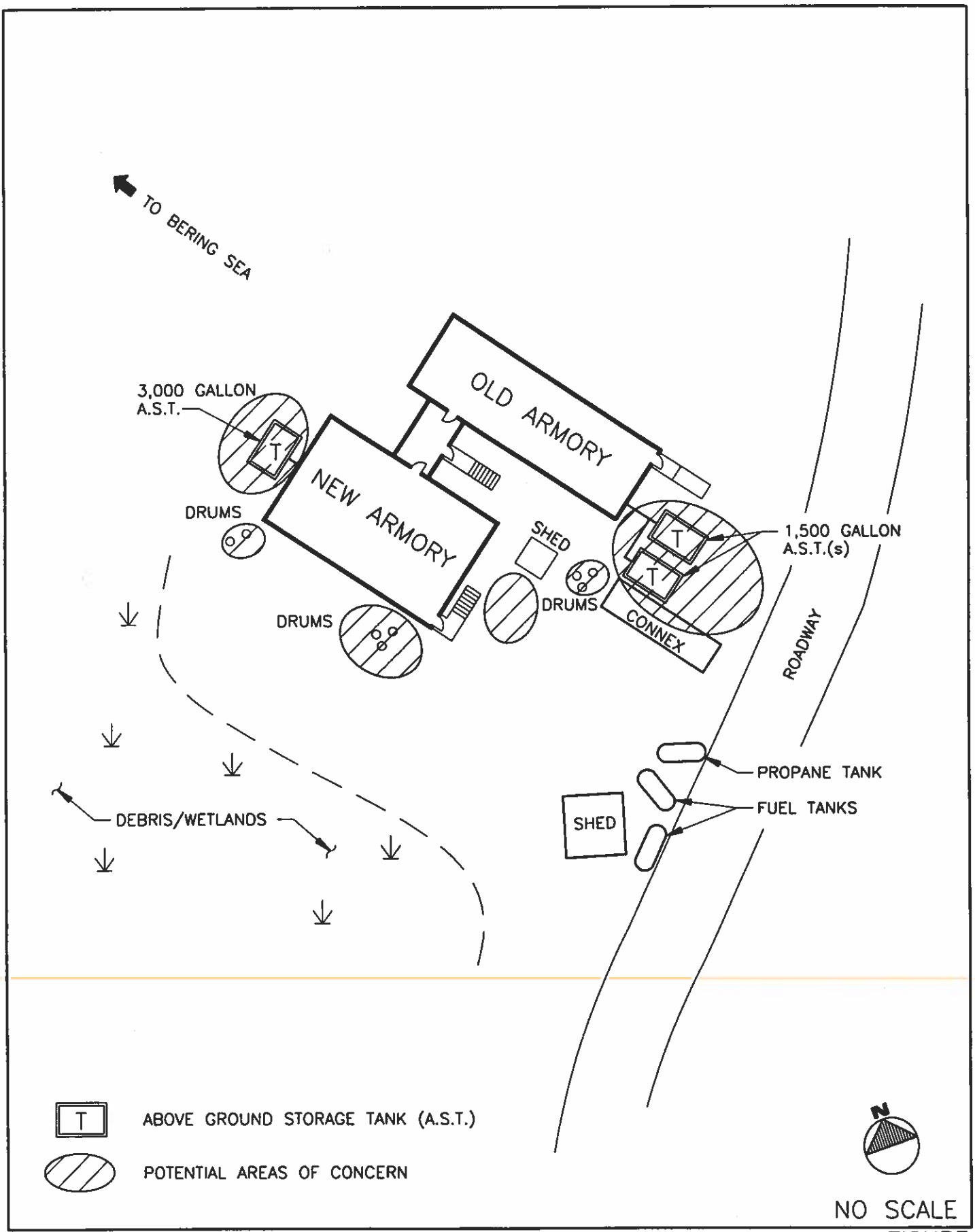
3.2.3 Areas of Concern

Four areas of concern (AOC) were identified during the records search. These AOCs are described as follows and their approximate locations are shown in Figure 3-2.

Fuel Spill: A reported spill of 500 to 3,000 gallons of fuel oil from a broken fuel line, and 200 gallons of Jet A50 fuel from leaking drums was reported at the site in 1985. The spill was reportedly cleaned up by Alaska Offshore, Inc. in July 1985. No record of confirmation sampling or sampling results to determine if residual contamination was left in the ground were observed in the AKARNG files. The spill is assumed to have been associated with the tanks next to the Old Armory building since the New Armory was not constructed at this time. The 1985 spill left a visible stain and noticeable odor still detectable in 1990 (SPCC 1990).

Fuel Spill: Another fuel line leak 'from the fuel tank to the furnace' was reported in June 1992 during an Environmental Compliance Assessment Survey investigation. The release was reported in a Spill Notification Report filed with the ADEC in May 1994. It is unknown which fuel tank was involved in the reported release, and no information regarding cleanup or remediation was observed in the files.

Aboveground Fuel Storage Tanks: The area surrounding the three existing aboveground fuel storage tanks and associated piping are areas of potential concern.



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SAVOONGA ARMORY - AREAS OF CONCERN

FIGURE

3-2

Drum Storage Areas: The drum storage shed, conex storage van, and areas of current and former drum storage are areas of concern. Drum storage areas have been documented next to the New Armory AST (Mogas), between the conex storage van and the New Armory building (Mogas, Jet A1, Jet A50, and unknown petroleum, oil, and lubricant products), and south of the New Armory building (Mogas).

4.0 FIELD INVESTIGATION PROGRAM

4.1 FIELD PROGRAM

A site investigation was conducted at the Savoonga FSA on August 6, 1996. The site investigation included performing a soil survey utilizing Infrared (IR) Spectrophotometry field screening as a tool to delineate the general area of suspected contamination. Data presented in the Work Plan and onsite visual inspections were used to guide selection of screening and sampling locations. Once the zone of soil contamination was estimated by this screening methodology, select samples were collected and submitted for off-site analytical analyses of petroleum contaminants.

4.1.1 Field Sampling Program

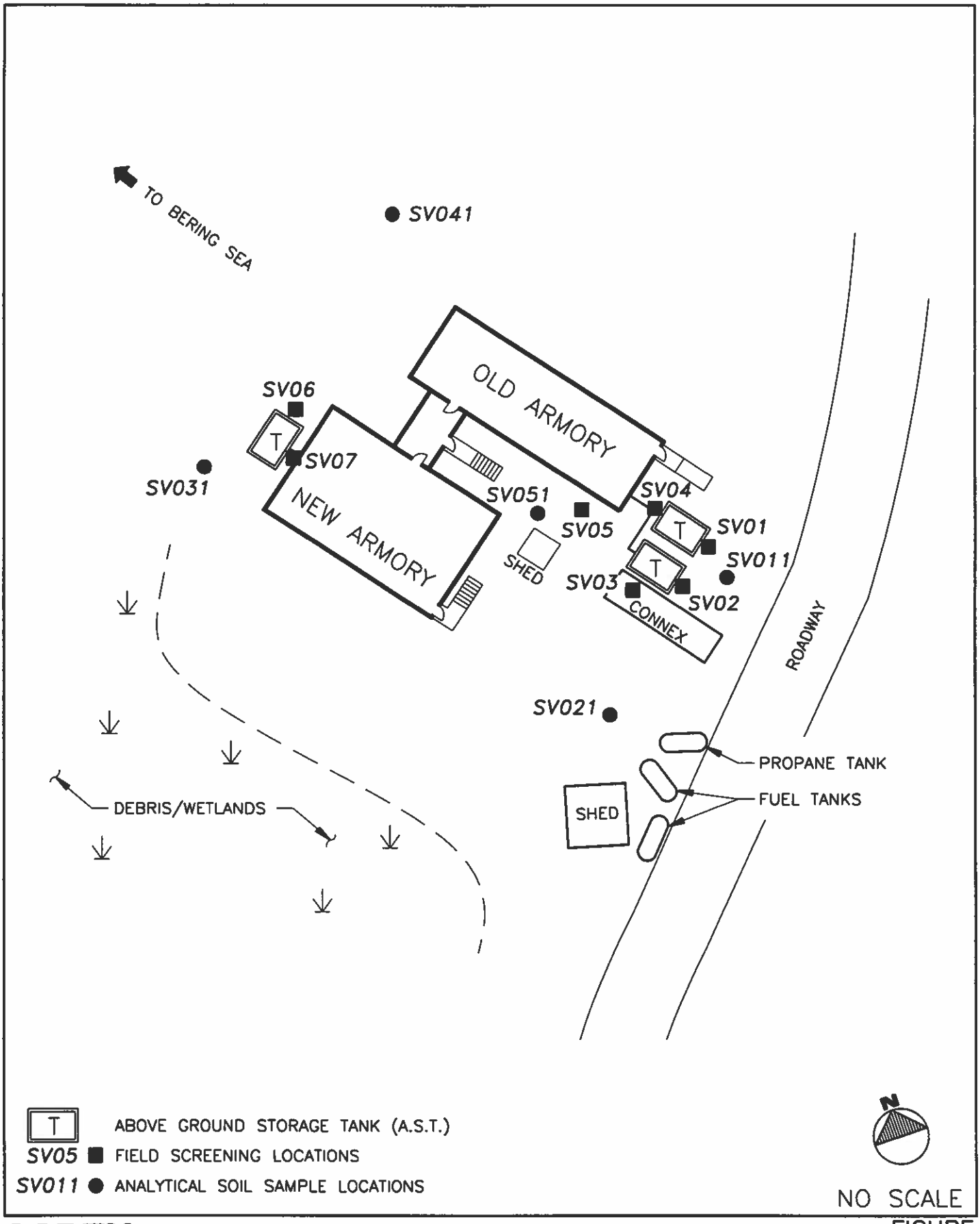
Ogden collected seven field screening samples and five analytical samples from this site. Soil samples were collected from the AOCs and from areas of obvious contamination observed during the site visit. The sample locations are shown on Figure 4-1.

4.1.2 Sampling Approach

The field sampling program was designed to evaluate potential petroleum release areas and the extent of contamination. The sampling strategy included field screening and analytical sampling.

Field screening of soils was performed utilizing IR spectrophotometry as a tool. Field screening samples were collected from AOCs and areas of suspected contamination based on visual observation. Field screening was used to identify specific locations for sampling.

Analytical soil samples were collected at each AOC described and areas of potential concern. The soil samples were submitted for laboratory analysis.



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SAVOONGA ARMORY - FIELD SCREENING AND SOIL SAMPLE LOCATIONS

FIGURE 4-1

4.1.3 Sample Collection

Soil samples were collected at each location as follows:

- Most soil samples were screened for TPH to help delineate the horizontal extent of contamination. Soil samples to be submitted for off-site laboratory analysis were collected form the sites which IR indicated as having the highest TPH levels of those samples collected for field screening.
- Soil samples for off-site analysis were collected using a decontaminated stainless steel hand trowel or shovel and placed into sample jars. Subsurface soil samples were collected to a maximum depth of 0.5 feet.
- Appropriate amber or colorless glass containers with Teflon®-lined lids, provided by the laboratory, were used for sample collection.

4.2 LABORATORY PROGRAM

Laboratory analyses for the Savoonga FSA PA/SI were performed by Analytica located in Anchorage, Alaska. Results are included in Appendix A.

4.2.1 Summary of Analytical Methods

Laboratory analytical procedures are outlined in the laboratory's QA plan. All analytical methods were performed in accordance with applicable EPA SW-846 publication protocol or standard methods (EPA, 1987) and ADEC-approved methods (AK101 and AK102).

A summary of the analytical methods used for the Savoonga Armory PA/SI are provided in Table 4-1.

Table 4-1. Analytical Program Summary

Parameter	EP Method
Diesel Range Organics (DRO)	AK 102
Total Petroleum Hydrocarbons (TPH)	EPA 418.1

4.2.2 Database Management

Ogden managed the data collection through field notebooks, sample labels, custody seals, photographs, and chain-of-custody forms. Appendix A includes laboratory results; Appendix B includes chain-of-custody forms; Appendix C includes photographs; Appendix D includes all field notes; and Appendix E includes the IR field screening procedure.

4.2.3 QA/QC Program

Sampling efforts for this project was conducted in accordance with EPA and ADEC guidelines for QA/QC, as described in the Project Manage Plan QAPP (Ogden, 1998). Sample duplicates are included in the sampling program.

5.0 INVESTIGATION RESULTS

5.1 SUMMARY OF SITE CONDITIONS AND OBSERVATIONS

Site conditions and observations are as follows:

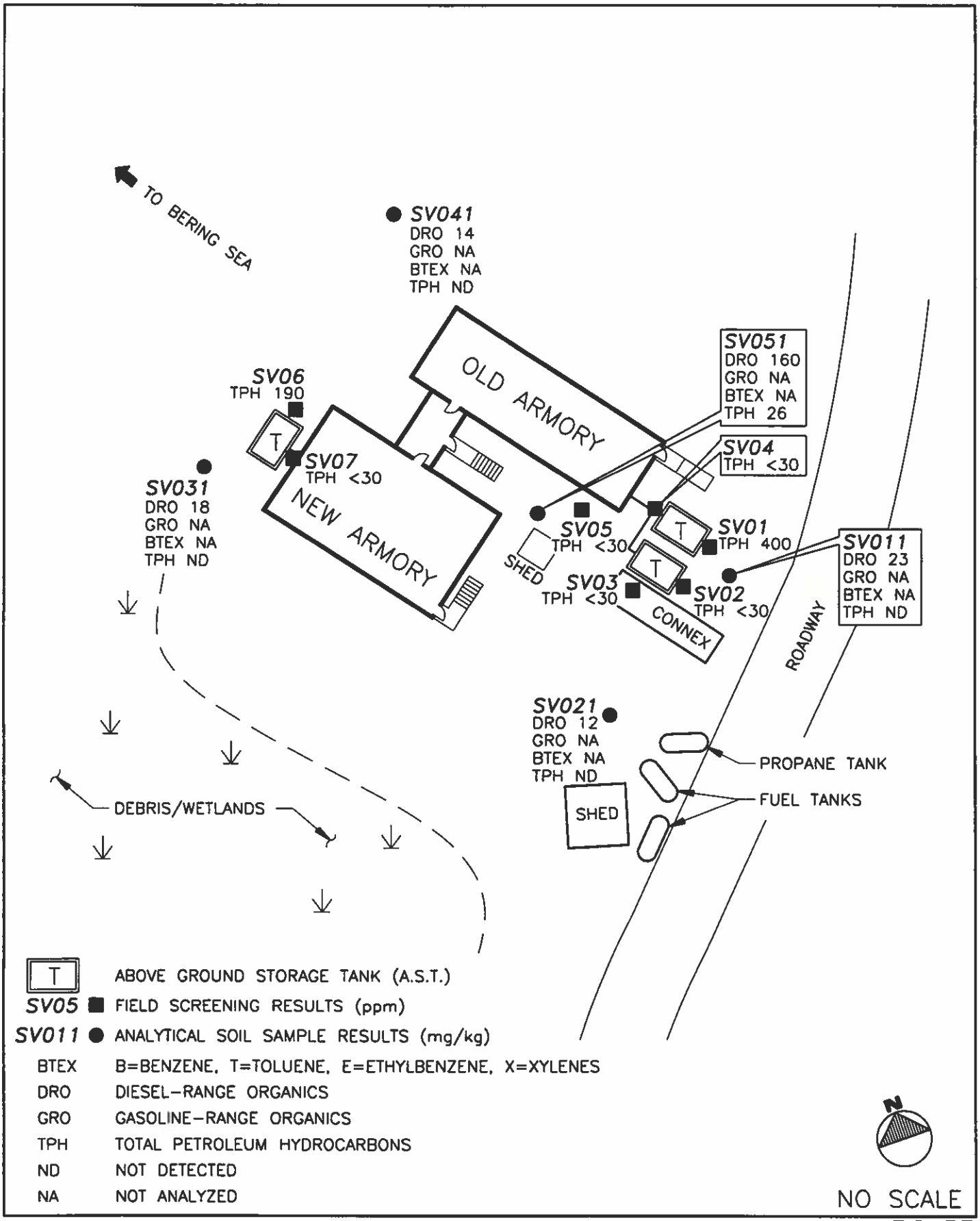
- Soil is gravelly with little fines.
- General housekeeping is poor. Debris is scattered about and swampy area to southwest of Armory has metal debris in it.
- South of FSA near road is a rusted propane tank and two rusted fuel tanks (empty) and a shed.
- Snow machines on southwest side of conex storage van.
- Two overturned drums between the shed and tank. No other drums are observed onsite.

5.2 SUMMARY OF FIELD SCREENING DATA

Field screening of soils was performed by using a field-portable IR spectrophotometer to measure TPH by EPA Method 418.1. Experience has shown that the IR-measured TPH concentration in a soil sample is generally greater than the corresponding diesel and gasoline concentrations. This difference was used to conservatively estimate the level of contamination. Table 5-1 presents the results from the field screening. Figure 5-1 shows field screening and soil sample locations and results.

5.3 Summary of Soil Analytical Results

Because of the petroleum hydrocarbon contaminants released at the site, all samples were analyzed for DRO and TPH compounds. Soil samples were submitted to Analytica for analyses. A summary of the soil quality results which shows only the analytes detected is provided in Table 5-2. Figure 5-1 presents the soil sample locations and results.



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SAVOONGA ARMORY - FIELD SCREENING AND ANALYTICAL SOIL SAMPLE RESULTS

FIGURE 5-1

Table 5-1
IR Field Screening Results at the Savoonga FSA

Sample Number	Depth (feet)	Result (mg/kg)
SA1	0.5	400
SA2	0.5	<30
SA3	0.5	<30
SA4	0.5	<30
SA5	0.5	<30
SA6	0.5	190
SA7	0.5	<30

5.3.1 Nature and Extent of Contamination.

DRO contamination was detected in all five samples analyzed at concentrations ranging from 12 to 160 mg/kg. The highest concentration detected was at location SV051 at a depth of 0.5 feet.

TPH contamination was detected in one of the five samples analyzed at a concentration of 26 mg/kg. The TPH contamination was detected at location SV051 at a depth of 0.5 feet.

5.3.2 Contaminant Migration Pathway

Potential pathways for contaminant migration from this site include air, soil, surface water, and ground water. One primary pathway for migration of contaminants contained in the subsurface soil is by infiltration through soils to ground water and subsequent transport via ground water movement as a dissolved constituent. A secondary migration pathway includes volatilization of contaminants from the subsurface soil and release to the atmosphere. A third migration pathway includes transportation of contaminated surface soil by erosion processes and possible dissolution into surface runoff. The relative importance of each of the migration pathways is dependent on several factors, including the contaminant properties (i.e., solubility, volatility, sorptivity) and physical site characteristics.

TABLE 5-2 Summary of Laboratory Detections for Soil Analytical Data
Savoonga Federal Scout Armory
Savoonga, Alaska
August 1996

Sample Location	Sample ID	Depth (ft.)	Analyte	Method	Results (mg/Kg)*	Detection Limit (mg/Kg)
Diesel Range Organics						
SV011	96SV011SL	0.5	DRO	AK102	23	4.6
SV021	96SV021SL	0.5	DRO	AK102	12	4.4
SV031	96SV031SL	0.5	DRO	AK102	18	4.9
SV041	96SV041SL	0.5	DRO	AK102	14	4.6
SV051	96SV051SL	0.5	DRO	AK102	160	4.7
Total Petroleum Hydrocarbons						
SV051	96SV051SL	0.5	TPH	E418.1	26	19

***Bold** type indicates detections above Level C cleanup levels.

5.3.3 Regulatory Requirements

Target regulatory clean-up levels for soils at this site are based on the ADEC Soil Matrix Score Sheet for non-UST sites. The soil matrix determination is taken from Table I of ADEC guidance document entitled "Interim Guidance for Non-UST Contaminated Soil Cleanup Levels", dated July 17, 1991. The matrix score sheet determines the clean-up category based on five criteria:

- Depth to Ground water,
- Mean Annual Precipitation,
- Soil Type (Unified Soil Classification)
- Potential Receptors, and
- Volume of Contaminated Soil.

Each matrix score sheet category has its associated clean-up levels for GRO, DRO, benzene, and Total BTEX.

When the petroleum contaminant is known, such as diesel, aviation gas, motor vehicle gas, or JP-4, GRO or DRO analysis is preferred. Occasionally EPA Method 418.1 is not suitable for the analysis of volatile organic hydrocarbon compounds since this method also detects biogenic hydrocarbons.

5.3.4 Summary of Results

Soil contamination appears to be a result of spills or leaks from fuel handling operations. The soil quality results indicate that DRO and TPH are not present at concentrations in excess of ADEC regulatory guidelines for cleanup. The soil matrix score sheet for the Savoonga FSA is based on the following criteria determinations:

Depth to Ground water: The site's close proximity to wetlands and evidence of standing water indicate the depth to water is less than five feet below ground surface. Based on contamination present to a depth of 0.5 feet and an estimated ground water

level less than five feet below ground surface, the depth to ground water is less than 4.5 feet.

Mean Annual Precipitation: The average precipitation for Savoonga is ten inches per year.

Soil Type (Unified Soil Classification): Based on soil samples taken, the soil on site is classified as fine-grained soil with high organic content.

Potential Receptors: The present water supply for Savoonga comes from a 195-foot deep well located about one-half mile from the village at the south end of the airstrip. The airstrip is approximately 1.5 miles from the FSA.

Volume of Contaminated Soil: Based on an approximate area of 36 square feet and an estimated average thickness of 3 feet, based an estimated depth to permafrost of 3 feet, the volume of contaminated soil is 4 cubic yards or de minimus (<25 cubic yards).

Based on the above criteria the matrix score for the Savoong FSA is Category C. This requires the following soil cleanup levels:

DRO	1,000 mg/kg
GRO	500 mg/kg
TPH	2,000 mg/kg
Benzene	0.5 mg/kg
BTEX	50 mg/kg

Table 5-3 presents the Non-UST matrix score sheet for the Savoonga FSA.

Table 5-3
Matrix Score Sheet
Savoonga Federal Scout Armory

1.	Depth to Subsurface Water		Parameter Matrix Score
	<5 feet	(10)	10
	5-15 feet	(8)	
	15-25 feet	(6)	
	25-50 feet	(4)	
	>50 feet	(1)	
2.	Mean Annual Precipitation		Parameter Matrix Score
	>40 inches	(10)	3
	25-40 inches	(5)	
	15-25 inches	(3)	
	<15 inches	(1)	
3.	Soil Type (Unified Soil Classification)		Parameter Matrix Score
	Clean, coarse-grained soils	(10)	1
	Coarse-grained soils with fines	(8)	
	Fine-grained soils (low organic content)	(3)	
	Fine grained soils (high organic content)	(1)	
4.	Potential Receptors		Parameter Matrix Score
	Public well within 1,000 feet, or		8
	Private well 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 ground water	(1)	
5.	Volume of Contaminated Soil		Parameter Matrix Score
	>500 cubic yards	(10)	0
	100-500 cubic yards	(8)	
	25-100 cubic yards	(5)	
	>De Minimis-25 cubic yards	(2)	
	De Minimis	(0)	
Total Matrix Score			22

Cleanup Level in mg/kg

Matrix Score		Diesel	Gasoline/Unknown		
		Diesel-Range Petroleum Hydrocarbon	Gasoline-Range Petroleum Hydrocarbon	Benzene	BTEX
Level A	>40	100	50	0.1	10
Level B	27-40	200	100	0.5	15
Level C	21-26	1,000	500	0.5	50
Level D	<20	2,000	1,000	0.5	100

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Based on the soil quality results, petroleum hydrocarbons are not present at concentrations in excess of ADEC cleanup levels. The soil contamination that is present appears to be the result of minor spills or leaks from fuel handling operations. The volume of contaminated soil was conservatively estimated to be no greater than 4 cubic yards. This estimate was based on an approximate area of contamination of 36 square feet and a depth of 3 feet (depth to permafrost).

Ground water was not investigated at this site. The potential for ground water migration of contaminants is moderate to low, primarily due to permafrost impeding downward and lateral movement of ground water and possibly acting as an aquitard. The data on ground water movement is not available for this site. A community well is located approximately 0.5 miles south of the village at the end of the airstrip. No information on the depth of the well or ground water is available at this time.

Based on the information obtained during this investigation, the following conclusions were identified.

- Evidence suggests that the areas of contamination are a result of spills and leaks during fueling handling operations. The areas of contamination were from DRO and TPH in the soil.
- The volume of contaminated soil was conservatively estimated to be no greater than 4 cubic yards.
- The soil quality results indicate that DRO is present at concentrations well below ADEC regulatory guidelines for cleanup.

6.2 RECOMMENDATIONS

Because current contamination levels are below applicable ADEC cleanup criteria, we recommend no further action at the AKARNG Savoonga FSA.

7.0 REFERENCES

Alaska Department of Community and Regional Affairs (DCRA), *Community Profile, Savoonga*. March 14, 1996.

Alaska Department of Environmental Conservation (ADEC) *Interim Guidance for Non-UST Contaminated Soil Cleanup Levels*, July 17, 1991.

Alaska Ground-Water Site Inventory (GWSI) October 21, 1996.

ENSR, *Spill Prevention, Control, and Countermeasure Plan and Installation Spill Contingency Plan for the Savoonga Armory.* Prepared for the Alaska Army Nation Guard. January 1995.

Ogden Environmental and Energy Services, *Final Project Management Plans, Preliminary Assessment/Site Investigation at 14 Various Sites in Alaska.* Prepared for State of Alaska, Department of Military and Veteran Affairs, Army National Guard, Environmental Office. January, 1998

Ogden Environmental and Energy Services, *Final Work Plan, Preliminary Assessment/Site Investigation at 14 Various Sites, Alaska.* Prepared for Army National Guard, Alaska District. December, 1997.

Preparer Unknown, *Savoonga AKARNG Scout Armory Spill Prevention Control and Countermeasure Plan and Installation Spill Contingency Plan.* September 1990.

U.S. Environmental Protection Agency, *Methods for Chemical Analysis for Water and Wastes, EPA 600/4-7-020, revised March 1983*, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268.

> *Method for the Determination of Diesel Range Organics*, American Petroleum Institute/U.S. Environmental Protection Agency, Consensus Method, 1992.
>
> *Method for the Determination of Gasoline Range Organics*, American Petroleum Institute/U.S. Environmental Protection Agency, Consensus Method, 1992.

Test Methods for Evaluating Solid Waste, SW-846, 2nd Edition, revised April 1985; 3rd Edition, September 1986.

US Environmental Protection Agency, Office of Emergency and Remedial Response, *A Compendium of Superfund Field Operations Methods*, EPA/5010/P-87/001, December 1987.

APPENDIX A
ANALYTICAL LABORATORY RESULTS

AK ARNG PA/SI
1996 Analytical Results
SAVOONGA FSA Locations

	Location	SV011		SV021		SV031		SV041		SV051	
	Sample Number	96SV011SL		96SV021SL		96SV031SL		96SV041SL		96SV051SL	
	Sample Date	8/6/96		8/6/96		8/6/96		8/6/96		8/6/96	
	Matrix	SL		SL		SL		SL		SL	
	Depth	0.5'		0.5'		0.5'		0.5'		0.5'	
	Sample Type										
Analyte	**Method**	**Units**									
DRO											
DIESEL RANGE ORGANICS	AK102	mg/Kg	23	[4.6]	12	[4.4]	18	[4.9]	14	[4.6]	160	[4.7]
GRO											
GASOLINE RANGE ORGANICS	AK101	mg/Kg	NA		NA		NA		NA		NA	
BTEX											
BENZENE	SW8020	mg/Kg	NA		NA		NA		NA		NA	
TOLUENE	SW8020	mg/Kg	NA		NA		NA		NA		NA	
ETHYLBENZENE	SW8020	mg/Kg	NA		NA		NA		NA		NA	
XYLENES, TOTAL	SW8020	mg/Kg	NA		NA		NA		NA		NA	
TPH												
PETROLEUM HYDROCARBONS	E418.1	mg/Kg	ND	[19]	ND	[18]	ND	[20]	ND	[19]	26	[19]

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OGDEN ENVIRONMENTAL & ENERGY
4040 B STREET
ANCHORAGE, AK. 99503-5999

Attn: MR. ARCHER BISHOP

Order #: A6-08-030
Date Reported: 08/27/96 11:53
Project Name: PA/SI 14 SITES
Date Received: 08/08/96
Date Completed: 08/27/96

SAMPLE IDENTIFICATION

Sample Number	Client Description
01	96WA011SL
02	96WA012SL
03	96WA021SL
04	96WA031SL
05	96WA041SL
06	96WA051SL
07	96WA061SL
08	96WA071SL
09	ST96011SL
10	ST96012SL
11	ST96021SL
12	ST96031SL
13	ST96041SL
14	ST96051SL
15	ST96061SL
16	96SM011SL
17	96SM012SL
18	96SM021SL
19	96SM031SL
20	96SM041SL
21	96SV011SL
22	96SV021SL
23	96SV031SL
24	96SV041SL
25	96SV051SL

Enclosed are the analytical results for the submitted samples. All analyses met quality assurance objectives, except where noted in the case narratives. If you have any questions regarding the analyses, please feel free to call.

Steven E. Bonde
Technical Director

ADEC Laboratory Approval Number: UST-014

The DRO samples were extracted on 08/14/96 and 08/13/96.

The TPH samples were extracted on 08/14/96 and 08/13/96.

All results are reported on a dry weight basis.

The samples were received properly packed in one cooler at 1.7°C and were refrigerated upon receipt.

Sample dilutions are listed in the matrix/dilution field. For example, a 50x dilution for DRO and 20x dilution for TPH will be listed as DRO50X TPH20X.

Data Flag Definitions:

U - Indicates the analyte was analyzed for but not detected (ND). The reported value is the practical quantitation limit.

J - Indicates an estimated value for the detected analyte. The analyte result is greater than zero but less than the sample practical quantitaion limit.

CU - The DRO surrogate (OTP) recoveries that are outside of the acceptable limits (50-150%) are due to the required extract dilutions and to co-elution with sample analytes of similar boiling points. Therefore these recoveries are reported as not calculated (CU).

NC - The BTEX/VPH surrogate (p-bromofluorobenzene) recoveries that are outside of the acceptable limits (50-150%) are due to the required extract dilutions and to co-elution with sample analytes of similar boiling points. Therefore these recoveries are reported as not calculated (NC).

Analyst: _____ Date: 8/28/96

Analyst: _____ Date: 8/28/96

Analyst: _____ Date: 8/28/96

Sample: 21A 96SV011SL Collected: 08/06/96 Matrix: SOIL

Test Description	Method	Result	Limit	Units	Analyzed
DRO in solids by AK102.	3550\AK102				
Diesel Range Organics	3550\AK102	23	4.6	mg/Kg	08/19/96
Surrogates, % Recovery					
o-Terphenyl		125	Min: 50	Max: 150	
TPH in solids by EPA 418.1	3550\418.1	U	19	mg/Kg	08/14/96

Sample: 22A 96SV021SL Collected: 08/06/96 Matrix: SOIL

Test Description	Method	Result	Limit	Units	Analyzed
DRO in solids by AK102.	3550\AK102				
Diesel Range Organics	3550\AK102	12	4.4	mg/Kg	08/19/96
Surrogates, % Recovery					
o-Terphenyl		128	Min: 50	Max: 150	
TPH in solids by EPA 418.1	3550\418.1	U	18	mg/Kg	08/14/96

Sample: 23A 96SV031SL Collected: 08/06/96 Matrix: SOIL

Test Description	Method	Result	Limit	Units	Analyzed
DRO in solids by AK102.	3550\AK102				
Diesel Range Organics	3550\AK102	18	4.9	mg/Kg	08/19/96
Surrogates, % Recovery					
o-Terphenyl		124	Min: 50	Max: 150	
TPH in solids by EPA 418.1	3550\418.1	U	20	mg/Kg	08/14/96

Sample: 24A 96SV041SL Collected: 08/06/96 Matrix: SOIL

Test Description	Method	Result	Limit	Units	Analyzed
DRO in solids by AK102.	3550\AK102				
Diesel Range Organics	3550\AK102	14	4.6	mg/Kg	08/19/96
Surrogates, % Recovery					
o-Terphenyl		114	Min: 50	Max: 150	
TPH in solids by EPA 418.1	3550\418.1	U	19	mg/Kg	08/14/96

Sample: 25A 96SV051SL Collected: 08/06/96 Matrix: SOIL

Test Description	Method	Result	Limit	Units	Analyzed
DRO in solids by AK102.	3550\AK102				
Diesel Range Organics	3550\AK102	160	4.7	mg/Kg	08/19/96
Surrogates, % Recovery					
o-Terphenyl		125	Min: 50	Max: 150	
TPH in solids by EPA 418.1	3550\418.1	26	19	mg/Kg	08/14/96

Method 418.1 from Methods for Chemical Analysis of Water and Wastes, USEPA-600/4-79-020, March 1983, is used for the analysis of total petroleum hydrocarbons (TPH).

Solids are prepared according to method 3550 (sonication) per USEPA SW-846.

Method AK102 from the State of Alaska, Department of Environmental Conservation (ADEC), Storage Tank Program, Underground Storage Tanks Procedures Manual, 18 AAC 78, as amended through January 31, 1996; is referenced for the analysis of diesel range organics (DRO), calibrating with diesel fuel #1, #2, and kerosene and a quantitation range of C10-C24.

Solids are prepared via sonication per AK102 and U.S. EPA SW-846 method 3550.

QC Evaluation Summary

Analytica
Alaska, Inc.

Client:	Ogden Environmental and Energy Systems
Method:	AK 102
Criteria:	ADEC
AAI Project #:	A6-08-030
Client Project #:	PA/SI 14 Sites
Matrix:	Soil
Number of Samples:	25

QC Parameter	Method Criteria Acceptance	Comments/Actions
Holding Times	☒Pass ☐Fail	
Initial Calibration	☒Pass ☐Fail	
Continuing Calibration	☒Pass ☐Fail	
Method Blanks	☒Pass ☐Fail	
QC Spike Samples	☒Pass ☐Fail	
MS/MSD	☒Pass ☐Fail	
Calculations	☒Pass ☐Fail	
Surrogate Recoveries	☒Pass ☐Fail	Surrogates for samples 9 & 10 were diluted out due to high levels of organics native to the samples.
Retention Times	☒Pass ☐Fail	

Comments/ Identification	
	Samples 1, 2, 5, 9 - 11, 16, & 17 exhibit an organic envelope consistent with a middle diesel range distillate, e.g. DF2 or JP-8. The DRO result from sample 3 is due to the light ends of a residual range hydrocarbon envelopes resembling a lubricating oil. Samples 4, 12 - 15, & 21 - 24 contain unknown organic compounds most consistent with biogenic material. The DRO results from samples 6 - 8, & 25 appear to be from a combination of a middle diesel range distillate, a lubricating oil, and biomass.

Reviewed By: Steven Erik Bouda Approved:

The Science of Analysis, The Art of Service
Analytica Alaska Inc. 811 W 8th Avenue, Anchorage, AK 99501 • (907) 258-2155 • FAX (907)258-6634

QA/QC:

Data meets guidelines established within the SOP for the Analytica Alaska, Inc. Data Reporting Level 3.

Reviewed By: Steve Kirk Bouble Approved:

The Science of Analysis, The Art of Service
Analytica Alaska Inc. 811 W 8th Avenue, Anchorage, AK 99501 • (907) 258-2155 • FAX (907)258-6634

QC Evaluation Summary

Analytica
Alaska, Inc.

Client:	Ogden Environmental and Energy Systems
Method:	EPA 418.1
Criteria:	ADEC
AAI Project #:	A6-08-030
Client Project #:	PA/SI 14 Sites
Matrix:	Soil
Number of Samples:	25

QC Parameter	Method Criteria Acceptance	Comments/Actions
Holding Times	☒Pass ☐Fail	
Initial Calibration	☒Pass ☐Fail	
Continuing Calibration	☒Pass ☐Fail	
Method Blanks	☒Pass ☐Fail	
QC Spike Samples	☒Pass ☐Fail	
MS/MSD	☒Pass ☐Fail	
Calculations	☒Pass ☐Fail	

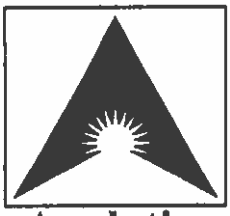
Comments	Samples 5, 8, 12, 13, 15 - 18, & 20 - 24 are below reporting limits. All other samples contain aliphatic hydrocarbons.

QA/QC:

Data meets guidelines established within the SOP for the Analytica Alaska, Inc. Data Reporting Level **3.**

Reviewed By: Steve Strike Bonde Approved:

The Science of Analysis, The Art of Service
Analytica Alaska Inc. 811 W 8th Avenue, Anchorage, AK 99501 • (907) 258-2155 • FAX (907)258-6634



QA Summary

Work Order: A608030 Client: OGDEN

BLANK

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
2	MB 0814	AK102S	B P	S			1.0	50.397	1.0	1.0		PWS

Analytes	Result		Detection Limit			Specs Low	Specs High					V
Diesel Range Organics	U		3.97									Y
o-Terphenyl	4.553		0.099	4.961	91.8	60	120					Y

BLANK

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
3	MB 0813	AK102S	B P	S			1.0	50.989	1.0	1.0		PWS

Analytes	Result		Detection Limit			Specs Low	Specs High					V
DIESEL RANGE ORGANICS	U		3.92									Y
O-TERPHENYL	5.858		0.098	4.903	119	60	120					Y

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
22	K608030-13A	AK102S	K M	S	13		1.0	50.374	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
Diesel Range Organics	60.56	5.59	4.93	61.57	89.3	50	150					Y
o-Terphenyl	5.702	5.372	0.123	6.157	92.6	50	150					Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
23	K608030-13A	AK102S	K M D	S	13	22	1.0	50.150	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	RPD	V
Diesel Range Organics	56.30	5.59	4.95	61.85	82.0	50	150		20	89.3	8.52	Y
o-Terphenyl	5.798	5.372	0.124	6.185	93.7	50	150		20	92.6	1.18	Y

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
30	K608030-21K	AK102S	K M	S	6		1.0	50.743	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
DIESEL RANGE ORGANICS	75.48	22.77	4.52	56.50	93.3	50	150					Y
O-TERPHENYL	6.384	7.167	0.113	5.650	113	50	150					Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
31	K608030-21K	AK102S	K M D	S	6	30	1.0	50.479	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	Reference RPD	V
DIESEL RANGE ORGANICS	69.38	22.77	4.54	56.80	82.1	50	150		20	93.3	12.8	Y
O-TERPHENYL	6.328	7.167	0.114	5.680	111	50	150		20	113	1.79	Y

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
3	LCS 0814	AK102S	K S	S	2		1.0	50.971	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	V
Diesel Range Organics	49.94	U	3.92	49.05	102	60	120	Y
o-Terphenyl	4.852	4.553	0.098	4.905	98.9	50	150	Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
4	LCSD 0814	AK102S	K S D	S	2	3	1.0	50.901	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	Reference RPD	V
Diesel Range Organics	41.34	U	3.93	49.11	84.2	60	120		20	102	19.1	Y
o-Terphenyl	4.578	4.553	0.098	4.911	93.2	50	150		20	98.9	5.93	Y

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
4	LCS 0813	AK102S	K S	S	3		1.0	50.156	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	V
DIESEL RANGE ORGANICS	46.71	U	3.99	49.84	93.7	60	120	Y
O-TERPHENYL	6.963	6.457	0.100	4.984	140	50	150	Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
5	LCSD 0813	AK102S	K S D	S	3	4	1.0	50.652	1.0	1.0		PWS

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	Reference RPD	V
DIESEL RANGE ORGANICS	44.15	U	3.95	49.36	89.4	60	120		20	93.7	4.70	Y
O-TERPHENYL	6.951	6.457	0.099	4.936	141	50	150		20	140	0.712	Y

Work Order: A608030 Client: OGDEN

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
1	CCVSD1 0816	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec- overy	Specs Low	Specs High					V
Diesel Range Organics	447.85	500	40.00	500.00	89.6	75	125					Y
o-Terphenyl	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
11	CCVSD2 0816	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec- overy	Specs Low	Specs High					V
Diesel Range Organics	449.35	500	40.00	500.00	89.9	75	125					Y
o-Terphenyl	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
18	CCVSD3 0816	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec- overy	Specs Low	Specs High					V
Diesel Range Organics	448.43	500	40.00	500.00	89.7	75	125					Y
o-Terphenyl	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
24	CCVSD4 0816	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec- overy	Specs Low	Specs High					V
Diesel Range Organics	405.84	500	40.00	500.00	81.2	75	125					Y
o-Terphenyl	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
25	CCVSD3 0823	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec- overy	Specs Low	Specs High					V
Diesel Range Organics	481.95	500	40.00	500.00	96.4	75	125					Y
o-Terphenyl	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Spk Seq	Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
26	CCVSD4 0823	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
Diesel Range Organics	483.78	500.00	40.00	500.00	96.8	75	125					Y
o-Terphenyl	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Spk Seq	Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
1	CCVSD1 0815	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
Diesel Range Organics	471.65	500	40.00	500.00	94.3	75	125					Y
o-Terphenyl	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Spk Seq	Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
13	CCVSD2 0815	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
DIESEL RANGE ORGANICS	464.85	500	40.00	500.00	93.0	75	125					Y
O-TERPHENYL	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Spk Seq	Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
24	CCVSD3 0815	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
DIESEL RANGE ORGANICS	403.63	500	40.00	500.00	80.7	75	125					Y
O-TERPHENYL	U		1.000	50.000	0	50	150					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Spk Seq	Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
32	CCVSD4 0815	AK102S	T I	S			1.0	1.0	1.0	1.0		PWS

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
DIESEL RANGE ORGANICS	504.47	500	40.00	500.00	101	75	125					Y
O-TERPHENYL	U		1.000	50.000	0	50	150					Y

Work Order: A608030 Client: OGDEN

BLANK

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
2	MB 081396	TPH_S	B P	S			1.0	15.521	1.0	1.0		BCO

Analytes	Result	Detection Limit	Specs Low	Specs High	V
TPH	U	16			Y

BLANK

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
2	MB 081496	TPH_S	B P	S			1.0	15.815	1.0	1.0		BCO

Analytes	Result	Detection Limit	Specs Low	Specs High	V
TPH	U	16			Y

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
6	K608030-05A	TPH_S	K M	S	5		1.0	15.751	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	V
TPH	312	U	17	347	89.9	60	120	Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
7	K608030-05A	TPH_S	K M D	S	5	6	1.0	15.186	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	RPD	V
TPH	327	U	18	360	90.8	60	120		20	89.9	0.996	Y

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
10	K608030-25A	TPH_S	K M	S	9		1.0	15.097	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	V
TPH	318	22	17	331	89.4	60	120	Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
11	K608030-25A	TPH_S	K M D	S	9	10	1.0	15.082	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	RPD	V
TPH	312	26	17	332	86.1	60	120		20	89.4	3.76	Y

Work Order: A608030 Client: OGDEN

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
3	LCS 081396	TPH_S	K S	S	2		1.0	15.203	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
TPH	312	U	16	329	94.8	60	120					Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
4	LCSD 081396	TPH_S	K S D	S	2	3	1.0	15.833	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	Reference RPD	V
TPH	297	U	16	316	94.0	60	120		20	94.8	0.847	Y

SPIKE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
3	LCS 081496	TPH_S	K S	S	2		1.0	15.918	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
TPH	292	U	16	314	93.0	60	120					Y

SPIKE DUPLICATE

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
4	LCSD 081496	TPH_S	K S D	S	2	3	1.0	15.506	1.0	1.0		BCO

Analytes	Result	Unspiked Result	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High	RPD Specs Low	RPD Specs High	Reference Recovery	Reference RPD	V
TPH	303	U	16	322	94.1	60	120		20	93.0	1.18	Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
1	ICV	TPH_S	T I	S			1.0	1.0	1.0	1.0		BCO

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
TPH	97	100	5		97.0	75	125					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
27	ICV	TPH_S	T I	S			1.0	1.0	1.0	1.0		BCO

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
TPH	94	100	5		94.0	75	125					Y

Work Order: A608030 Client: OGDEN

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
1	ICV	TPH_S	T I	S			1.0	1.0	1.0	1.0		BCO

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
TPH	97	100	5		97.0	75	125					Y

CONTROL

Seq.	Sample ID	Test Code	Class/ Sub/Dup	Matrix/ Sub	Ref Seq	Spk Seq	Dilution	Weight	Volume	Conv. Factor	Flag	Ver
12	ICV	TPH_S	T I	S			1.0	1.0	1.0	1.0		BCO

Analytes	Result	Theoretical Value	Detection Limit	Spike Value	Rec-overy	Specs Low	Specs High					V
TPH	96	100	5		96.0	75	125					Y

Analytica
Alaska, Inc.

Support Documentation

Page

PERCENT MOISTURE WORKSHEET
ANALYTICA ALASKA, INC.

Date: 08/14/96

Sample \ LGN Number	Boat Weight	Boat + Wet Sample Wt.	Wet Sample Weight	Boat + Dry Sample Wt.	Sample Water Wt.	Percent Moist. (%)
BLANK	1.092	11.515	10.423	11.513	0.002	0.0
A608030-21	1.096	12.466	11.370	11.009	1.457	12.8
A608030-22	1.079	12.777	11.698	11.677	1.100	9.4
A608030-23	1.076	12.991	11.915	10.761	2.230	18.7
A608030-24	1.078	12.749	11.671	11.130	1.619	13.9
A608030-25	1.089	13.600	12.511	11.716	1.884	15.1
A608024-12	1.083	12.629	11.546	10.979	1.650	14.3
A608024-13	1.080	13.198	12.118	11.965	1.233	10.2
A608024-14	1.085	12.723	11.638	10.320	2.403	20.6
A608024-14DUP	1.071	12.160	11.089	9.811	2.349	21.2

NOTE: All Items Listed Below Must be Kept on File for at Least 3 Years After Analysis:

- ✓ Laboratory File Identification Number
- ✓ Original Data Package (With Analyst's Initial)
- ✓ Sample Queue
- ✓ Chromatograms Included
- ✓ Chromatograms Clearly Labeled
- ✓ Chromatograms Baseline-Baseline Integrated
- ✓ Integration Report Included (Clearly Labeled)
- ✓ Calibration Report (With Analyst's Initials)
- ✓ Date/Time of Initial Calibration
- ✓ Concentration Range Clearly Indicated
- ✓ Composition of Calibration Standard(s)
- ✓ Lab Control Standard Analyzed, Date/Time
- ✓ Continuing Calibration Standard Analyzed, Date/Time
- ✓ Surrogate Used
- ✓ Surrogate Properly Identified
- ✓ Percent Recovery for Each Sample
- ✓ Acceptable Range Indicated
- ✓ Outliers Explained
- ✓ Alkane/Window Retention Time Standard Analyzed
- ✓ Components Properly Indentified
- __ Column Performance/Separation Number__ Date Determined
- ✓ Analyst's Initials
- ✓ Spike/Spike Duplicate Analyzed ✓ Recoveries ✓ Relative % Difference
- ✓ Acceptable range Clearly Indicated ✓ Outliers Explained
- ✓ Blank Data (No Blank Correction of Field Samples!)
- __ Reagent Blank ✓ Method Blank __ Bottle Blank
- __ References (Library) Sample Included
- ✓ Pattern Match/Narrative Summary

hgw: A0080--

ANALYTICA ALASKA INC

Cooler Receipt Form

Project: 14 PA/SI

Cooler received on 8/8/96 and opened on 8/8/96 by [illegible]

1.	Were custody seals on outside of cooler?	YES (NO)
	If yes, how many and where? _____	
	Were signature and date correct?	YES NO
2.	Were custody papers taped to lid inside cooler?	(YES) NO
3.	Were custody papers properly filled out (ink, signed, etc.)?	(YES) NO
4.	Did you sign custody papers in the appropriate place?	(YES) NO
5..	Did you attach shipper's packing slip to this form?	YES (NO)
6.	What kind of packing material was used? NONE	
7.	Was sufficient ice used (if appropriate)?	(YES) NO
8.	Were all bottles sealed in separate plastic bags	(YES) (NO)
9.	Did all bottles arrive in good condition (unbroken)?	YES (NO)
10.	Were all bottle labels complete (No., date, signed, analysis, pres., etc)?	(YES) NO
11.	Did all bottle labels and tags agree with custody papers?	(YES) NO
12.	Were correct bottles used for the tests indicated?	(YES) NO
13.	Were VOA vials checked for absence of air bubbles, and noted if so?	NA YES NO
14.	Was sufficient amount of sample sent in each bottle?	(YES) NO

15.	Temperature of cooler(s) upon receipt:	1.7°C				
	Identification number of thermometer:	35065				
	Is the temperature within 4 ± 2° C?:	Yes ☐ No ☒	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

Explain any discrepancies Cooler HAND Delivered, ONE Broken VOA sample # 96SV0215Z, REMAINDER OF sample DUMPED into New VOA by A. Bishop.

APPENDIX B
CHAIN-OF-CUSTODY

ANALYTICA
ALASKA INC

811 W. 8th Ave.
Anchorage, AK 99501
(907) 258-2155
FAX: (907) 258-6634

325 Interlocken Parkway, Suite 200
Broomfield, Colorado 80021
(303) 469-8868
FAX: (303) 469-5254

LGN: A608032
CSN:

Chain of Custody Record / Analysis Request

Company Name: Ogden
Company Address: 4040 B St Anchorage Ak
Telephone: 563 6436
FAX: 561 8945
Project Name: 14 PAHs
Report To:
Sampler: D. Burd
P.O. Number:

Sample ID	Date Collected	Time Collected	Matrix	# Containers/Preservation: 8 oz Glass	4 oz Glass	40 ml. VOA/HCl	1 L Glass /	1 L Poly /	BTEX by 5030/8020 or 602 (specify)	GRPH by 5030/8015M	DRPH by 3550/8100M	TPH by 3540/418.1	GRO by AK101	DRO by AK102	RRO by AK103	Volatiles by EPA 8240 or 624	Semi-Volatiles by EPA 8270 or 625	PCB by EPA 8080 or 608	Metals (specify)					PH<2	Tare Weight	Hold for Further Analysis	RUSH (see below)	LAB ID
STG6 ø 4 SL	8/6/96	1050		1								✓		✓													13
STG6 ø 5 SL		1055		1								✓		✓													14
ST 96 ø 6 1 SL		1100		1								✓		✓													15
96 SM ø 11 SL		1310		1								✓		✓													16
96 SM ø 12 SL		1312		1								✓		✓													17
96 SM ø 21 SL		1315		1								✓		✓													18
96 SM ø 31 SL		1320		1								✓		✓													19
96 SM ø 41 SL		1323		1								✓		✓													20
96 SV ø 11 SL		1750		1								✓		✓													21
96 SV ø 21 SL		1755		1								✓		✓													22
96 SV ø 31 SL		1800		1								✓		✓													23
96 SV ø 41 SL		1805		1								✓		✓													24
COMMENTS 96 SV ø 51 SL		1810		1								✓	X	✓													25
96 SV ø 21 SL				1																							
96 SV ø 31 SL				1																							

No

QA/QC LEVEL
- ☐ ACOE Deliverables
- ☐ Standard

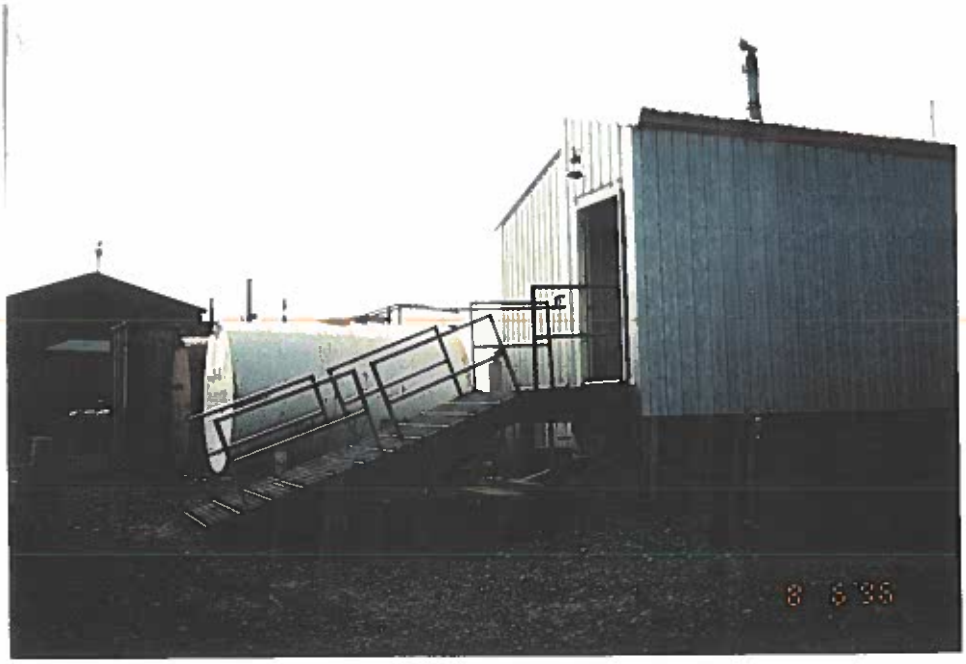
TURNAROUND
- ☐ 2 business days
- ☐ 5 business days
- ☐ 10 business days
- ☐ other ___ (#) business day

RELINQUISHED BY SAMPLER:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	Signature:	Signature:	Signature:
Printed Name: David Burd	Printed Name: L. Bishop	Printed Name: A. Bishop	Printed Name: Pat Murphy
Firm: Ogden	Firm: Ogden	Firm: Ogden	Firm: Analytica AK
Date/Time: 7 Aug 3pm	Date/Time: 7 Aug 3pm	Date/Time: 8.8.96 11:40am	Date/Time: 8/8/96 11:40

ANALYTICA USE ONLY:
Airbill / Freight #:
Condition of Sample Containers:
Temp Received: 1.7 °C
# of Coolers: 1
Seals: NO

APPENDIX C
PHOTOGRAPHS

Road in Front of Armory. Looking North. **Photo No** 1



Front of Old Armory. Looking Southwest. **Photo No** 2

North Side of Armory. Looking West. **Photo No 3**

Back of Armory. Looking Southeast at Heating Oil AST. **Photo No 4**

Southwest Side of Armory. Looking North. **Photo No 5**

Front of New Armory. Looking Northeast. **Photo No 6**

APPENDIX D
FIELD NOTES

6 AUG 96 SAVOONGA

A AS SOIL VERY GRAVELLY · NOT MUCH LOOSE FINE MATERIAL

GENERAL HOUSEKEEPING IS POOR. DEBRIS SCATTERED ABOUT.

OLD SNOW MACHINES ON SW SIDE OF CONNEX STORAGE VAN.

TWO OVERTURNED DRUMS W/ BUNDS IN BETWEEN SHED & TANK FARM.

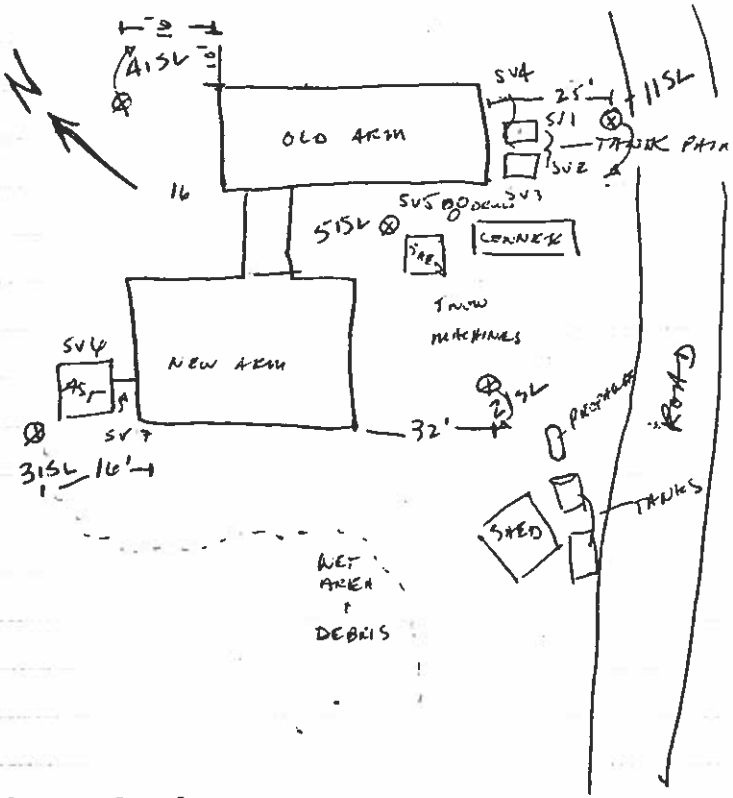
OTHER DRUMS IN SITE FIGURE ARE NOT PRESENT

SWAMPY AREA TO SW OF NEW ARMORY HAS METAL DEBRIS IN IT - LOADER BUCKET & OTHER PARTS.

ALSO SOUTH OF COMPLEX NEAR ROAD IS A RUSTED PROPANE TANK AND TWO RUSTED (DISCARDED ?) FUEL TANKS AND A SHED.

PMW 6 AUG 96

6 AUG 96 SAVOONGA



OFFSITE SAMPLES

	TIME	DEPTH	LOCATION
96SV011SL	5:50	6"	25' SSE of S Corner of OLD ARM
96SV021SL	5:55		32' SSE of S Corner of NEW ARM
96SV031SL	6:00		16' WNW of SW corner of NEW ARM
96SV041SL	6:05		10' NE & 16' NW of N Corner of OLD ARM
96SV051SL	6:10		NEXT to overturned drums @ Center of COMPLEX

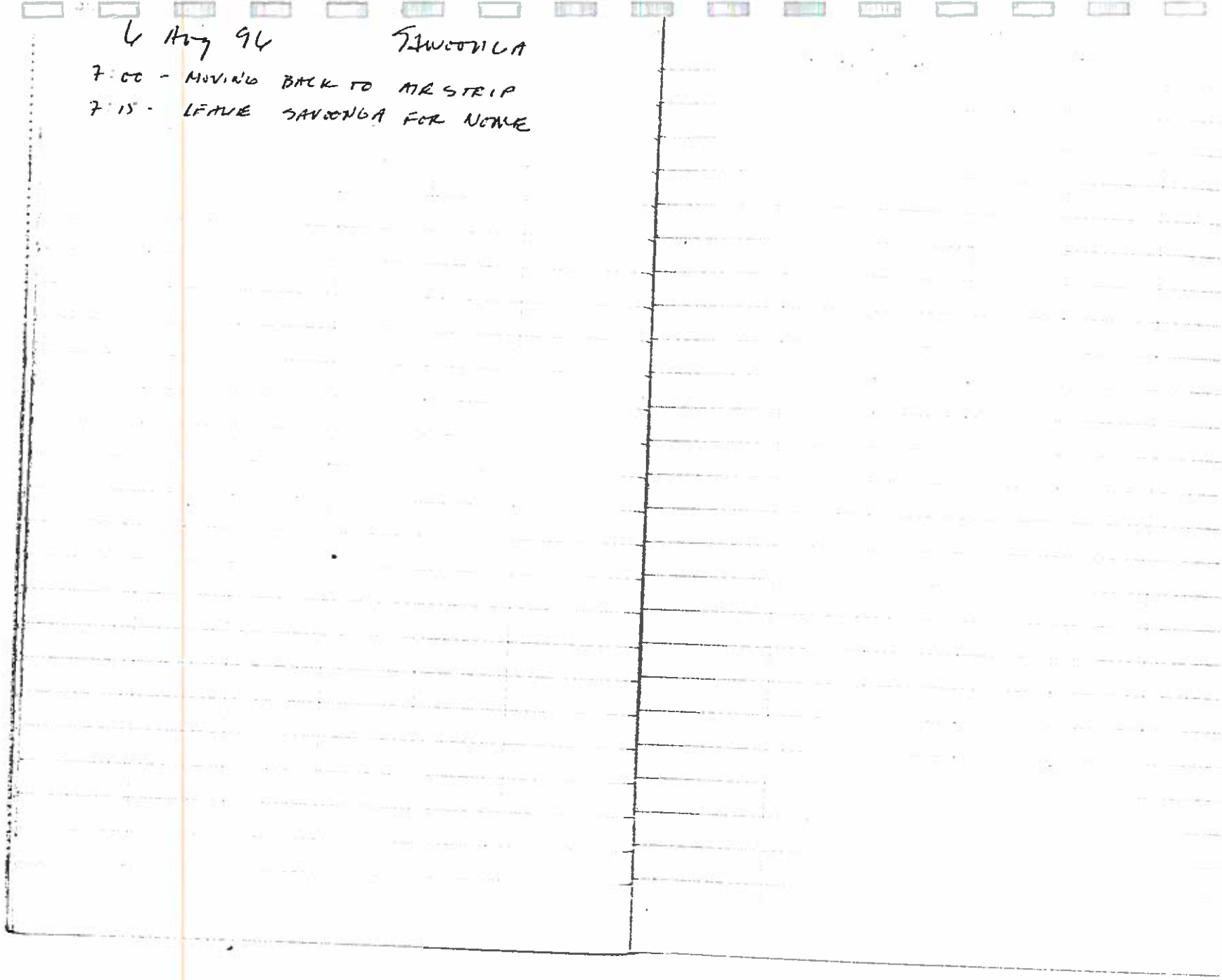
6:30 CLEANING UP @ SITE

PMW 6 AUG 96

6 Aug 96 SAVOONGA

7:00 - MOVING BACK TO AIRSTRIP

7:15 - LEAVE SAVOONGA FOR NOME



APPENDIX E
IR FIELD SCREENING PROCEDURES

PROCEDURES FOR FIELD ANALYSIS OF TOTAL PETROLEUM HYDROCARGONS BY INFRARED SPECTROPHOTOMETRY

Target Constituents

Petroleum Hydrocarbons

Sample Matrix

Soils or Sediments

Sample Preparation

Chemical Drying, Freon Extraction

Instrumental Method

Infrared Spectrophotometry

Detection Level

The method detection limit (MDL) for total petroleum hydrocarbons is estimated to be 20.0 mg/kg (ppm). In general, the detection level of this method is a function of sample matrix, sample preparation, and instrument performance, and can vary significantly from the stated MDL.

Comments

It is recommended that conditions of sampling, sample pretreatment, and analysis be standardized to ensure comparability of the final results.

1.0 Scope and Application

1.1 This method is used for field analysis of soils and sediments for total petroleum hydrocarbons, such as fuels and oils. It is presented as a means to rapidly characterize contamination in site investigation-derived samples. The method is sensitive to petroleum-based hydrocarbons and can be cross sensitive to other hydrocarbons.

Target Contaminants

Gasoline
Diesel
Fuel Oil
Stoddard Solvent
Mineral Spirits

1.2 Application of this method is limited to the analysis of soil and sediments for TPH. Results are reported as TPH in milligrams per kilograms (ppm) based on quantification against a reference oil.

1.3 This TPH method utilizes a silica gel cleanup of the sample extract. Silica gel removes constituents such as animal greases and vegetable oils.

1.4 The method detection limit (MDL) for TPH is estimated to be 15.0 mg/kg (ppm). This estimate is the result of previous method development work and may vary in response to the complexity of the sample matrix.

2.0 Summary of Method

2.1 The method presented here is a modification of EPA Method 418.1, "Petroleum Hydrocarbons, Total Recoverable," found in EPA-600/4-79-020, Methods of Chemical Analysis of Water and Wastes. A modification of Method 418.1 is required to process soil samples. Specifically the sample extraction steps described by Method 418.1 are appropriate for water samples; this method requires modification for processing of soil samples. In brief, an aliquot of samples is immersed with Freon, chemically dried with sodium sulfate, extracted by manual shaking or sonification, and a portion of the extract is passed through silica gel and then analyzed by infrared spectrophotometry.

3.0 Interferences and Limitations

3.1 This method will measure only Freon extractables.

3.2 Heavy molecular weight petroleum hydrocarbons, such as asphalt oils, are not reliably extracted by Freon, and therefore, will not be reliably quantified by the TPH analysis.

3.3 To the extent possible, sampling techniques, sample pretreatment, and analysis should be standardized to ensure comparability in the final results.

4.0 Safety

4.1 Samples contaminated with TPH constituents may be hazardous. Samples may include flammables, explosives, and potentially carcinogenic compounds. All samples are assumed to be hazardous and should be handled as such. All stock and working calibration standards, as well as all samples, shall be handled with the utmost care using good laboratory techniques in order to avoid harmful exposures.

4.2 Lab analysts shall wear lab coast, safety glasses, and surgical gloves at all times when preparing and handling standards and samples.

4.3 Freon 113 (1,1,2-trichloro-1,2,2-triflouoethane) is regulated by OSHA. The permissible exposure limit is 1,000 ppm. Primary routes of exposure are: inhalation, skin or eye contact, and oral. Effects of short-term exposure are light-headedness, giddiness, shortness of breath, and may lead to narcosis and cardiac irregularities.

First Aid Measures

If inhales: Remove to fresh air.

In case of eye contact: Immediately flush eye with copious quantities of water for 15 minutes.

In case of skin contact: Immediately wash skin with copious quantities of soap and water.

4.4 Sample preparation should be performed in a ventilated area with adequate skin and eye protection.

4.5 All of the target compounds have "good warning properties." Any situation that leads to or causes noticeable odors or produces any physical symptoms in the worker shall be investigated immediately followed by appropriate corrective actions.

4.6 First aid kit, eye wash, and chemical spill cleanup kit shall be available for use at all times.

5.0 Apparatus and Materials

A. Buck Scientific HC-404 IR Analyzer
B. mm quartz cuvettes (2 minimum) with stopper
C. Electronic balance with 1,500 g capacity and 0.01g sensitivity
D. Pipettes - Volumetric or automatic to deliver Freon (10 mL)
E. Beakers - 2-150 mL (minimum), more beakers may be useful
F. Pasteur pipettes and bulbs
G. Stainless steel sample spatula ("scupula") - 2 minimum
H. 40mL VOA vials
I. Sample reservoirs with particulate filters (GAC)
J. Silica gel filter cartridges (GAC)
K. mL gas-tight syringe with luer lock tip
L. Sample reservoir sealer
M. Sample Rack
N. Volumetric flasks for dilution
O. Scientific calculator with linear regression capability

6.0 Chemicals and Reagents

A. Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)
B. Sodium sulfate, anhydrous, reagent grade, powdered
C. Complete set of calibration standards (made up in advance of site visit)

7.0 Calibration (Performed prior to field visits.)

7.1 Reference Oil (Provided by Laboratory)—Pipette 15.0 ml n-hexadecane, 15.0 isooctane, and 10.0 ml chlorobenzene into a 50-ml glass stoppered bottle. This reference oil mixture is considered as TPH at a neat concentration (pure form). Maintain the integrity of the mixture by keeping stoppered, except with withdrawing aliquots.

7.2 Stock Standard—Pipette 1.0 ml referenced oil (7.1) into a tared 200-ml volumetric flask and immediately stoppered. Weigh and dilute to volume with

fluorocarbon-113. Calculate TPH stock standard solution concentration as milligrams per liter (mg/l).

7.3 Work Standards—Pipette appropriate volumes of stock standard (7.2) into 100-ml volumetric flasks according to the cell path length to be used. Dilute to volume with fluorocarbon-113. Calculate concentration of the TPH working standards from the stock standard, mg/l.

7.4 Using the linear regression function of a scientific calculator, calculate the correlation coefficient (r) derived from standard concentration versus IR absorbance reading. The value of r must be greater than or equal to 0.995.

8.0 Instrument Set-up

Let standards warm to ambient temperature during the instrument warm-up (should only take 10-15 minutes). REMEBER TO KEEP STANDARDS TIGHTLY CAPPED WHEN NOT IN USE. Cap immediately after filling cuvette. As soon as you are done calibrating, get them back into the cooler.

A. Locate IR on a level, vibration free table, protected from wind and moisture.

B. Switch IR on and let warm up for 30 minutes or more WITH DOOR OPEN. IR is designated to operate with the door open (the door is only a dust cover for storage).

C. "Unlock" the Coarse and Fine controls by turning the locking dials counterclockwise.

D. In ABS mode adjust the Coarse and Fine controls for .000 on the display (this is normally between 9 and 10 on the Coarse setting dial. Relock these dials when settings are finished.

E. In %T (T for Transmittance) mode use the %T calibration dial on back panel to get 100.0 on the display.

F. Block the beam by pulling up on the sample rack inside the IR sample chamber. Adjust the 0%T control (front panel) for .000 on the display. This is also a "locking" dial.

G. Change to ABS mode (.000 on display).

H. TOUCHING ONLY THE GLAZED SIDE WALLS OF THE CUVETTE AT ALL TIMES, add clean Freon to a cuvette (equipment blank). Put cuvette in sample rack with black line showing (the cuvettes are directional and need to be placed in the IR the same way each time).

I. Let the display stabilize (10-30 seconds). The Freon we are using generally gives a reading of about 0.130. If the reading is mush higher (0.145), double check the zero settings then recheck the equipment blank reading. If still high, the Freon may have become contaminated. Check a blank from the second bottle of Freon if you suspect contamination.

J. Leaving the equipment blank in the IR, "unlock" the Coarse and Fine controls and adjust for .000 on the display. Relock the controls when finished.

K. Switch to CONC. X 1 mode. This will give sample readings in concentration.

L. Take out the equipment blank cuvette. Discard the Freon and allow cuvette to briefly air dry. Fill cuvette with 300 ppm standard. Place in IR.

Let reading stabilize. If reading is not 300 (209 to 301), unlock CONC CAL dial and adjust until reading is 300. Relock dial.

M. Remove cuvette and rinse with clean Freon. Allow cuvette to briefly air dry. Using a new pasteur pipette, fill with 60 or 120 ppm standard. Record reading in data notebook and discard standard.

N. Repeat step M with a more concentrated standard (120 or 210 ppm). Record reading and discard standard.

O. Compare readings of both standards to the expected readings. Both should be within 15% of the actual value. If not, double check the equipment blank, 300 ppm standard, whether the cuvette is clean, etc. If this doesn't fix the problem, try the other vial of standard at the same concentration.

P. When ready to proceed with samples, rinse cuvette with Freon and check equipment blank reading. If higher than first equipment blank of the day, rinse cuvette again. Use the same cuvette for all samples, rinsing with clean Freon between each reading.

9.0 Sample Extraction and Analysis

For a single sample, complete the eight steps listed below without pausing. If analyzing many samples, complete steps 1,2, and 3 together for each sample before going to step 4 (in other words, you can pause after step 3 before going to step 4). Steps 4 through 8 can be completed as there is time.

1. Zero the balance with an uncapped, LABELED VOA vial. Weigh ≅ 5 (± 0.2g) of sample and record weight in 0.0g.
2. Add sodium sulfate and mix with spatula. Sample should have a dry, grainy appearance when enough sodium sulfate has been added. Several grams may be needed if sample is very wet. If extracting several samples at once, perform this step and the next before going to the next sample.
3. Volumetrically add 10.0 mL of Freon to the sample vial and cap the vial. Set aside at this point if extracting several samples and go back to step 1 for the next sample.
4. Shake vigorously for 5 minutes. (Note on sample dryness: Sample is not dry enough if it sticks substantially to side walls of VOA vial when shaking with Freon. If this happens, open the vial and use a spatula to loosen the sample from the side walls, breaking it up as best you can. Recap and continue shaking.
5. Pour several millimeters of the samples into a sample (filtering) reservoir with filter disk and filter cartridge in place. Reserve a few millimeters of sample in the capped VOA vial in case you forgot to record the reading or need to take another reading of the sample for some reason.
6. Attach the metal pressure seal to the filter reservoir and twist into place. Attach the 25 mL syringe to the pressure seal. Slowly pressurize the filter reservoir, pushing sample dropwise through the filters. Discard the first ≈ 10 drops of filtered sample. Collect the next 2.5 to 3 mL of sample in a cuvette. Do not try to force the sample through too fast. This will cause channeling in the silica gel filter which will lead to inadequate filtering.
7. Record sample reading. If reading is above 300, record as >300. Be sure to rinse the cuvette with clean Freon at least twice after a "hot" sample.

8. If there are samples remaining, return to step 4.

10.0 Calculations

Convert sample IR readings from mg/L (of TPH in extract) to mg/kg (of TPH in original sample) wet weight. Use calculation below:

Concentration of TPH, kg = {MxV}÷(ERxWS)

Where:

M=miligrams/liter (mg/L) of TPH (conversion from absorbance reading)
V=original volume, in mL, of the original sample added to the VOA vial
WS=weight, in grams, of the original sample added to the VOA vial

For samples that were recorded as >300, record the sample concentration as >600. For samples with an instrument reading of less than 15, record the sample concentration as <30.

11.0 Quality Assurance

Analysis of equipment blanks at the beginning of each day's analysis, and after every 10 samples.

Daily calibration checks performed prior to analysis of each day's lot of samples, after each lot of 10 samples, and after the last sample for the day is analyzed. Extraction Blank analysis once per day or with every 20 samples. Use "blank sand" and carry through the entire extraction and analysis procedure.

Analysis of field duplicate samples at a frequency of 1 in 20 samples.