

**UNITED STATES AIR FORCE
ELMENDORF AIR FORCE BASE,
ALASKA**

ENVIRONMENTAL COMPLIANCE PROGRAM

**SERA PHASE IV
UST CLOSURES INVESTIGATION REPORT**

DRAFT

DECEMBER 1996

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LIST OF ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFID	Air Force Identification Number
ASTM	American Society for Testing and Materials
ATH	Ambient Temperature Headspace
bgs	Below ground surface
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DRO	Diesel Range Organics
EB	Equipment Blank
ENSR	ENSR Corporation
EPA	U.S. Environmental Protection Agency
FD	Field Duplicate
GRO	Gasoline Range Organics
MAP	Management Action Plan
MRL	Method Reporting Limit
Mogas	Motor Vehicle Gasoline
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MW	Monitoring Well
OU	Operable Unit
OWS	Oil-water separator
PID	Photoionization Detector
POL	Petroleum, Oils, and Lubricants
ppm	Parts per million
PVC	Polyvinyl Chloride
PZ	Piezometer
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Compensation and Recovery Act
RRO	Residual Range Organics

LIST OF ACRONYMS AND ABBREVIATIONS
(Cont'd)

SAP	Sampling and Analysis Plan
SD	Laboratory Matrix Spike Duplicate
SERA	State-Elmendorf Environmental Restoration Agreement
SO	Soil
SQ	Soil/Solid Quality Control Matrix
SSHP	Site Safety and Health Plan
SVOC	Semivolatile Organic Compounds
TPH	Total petroleum hydrocarbons
TSDF	Treatment, Storage, and Disposal Facility
USAF	United States Air Force
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WL	Well
WQ	Water Quality Control Matrix

EXECUTIVE SUMMARY

This report presents release investigations and treatability studies conducted at 21 former underground storage tank (UST) sites on Elmendorf Air Force Base (AFB), Alaska, known or suspected to be contaminated with petroleum, oil, and lubricants (POL) products. These sites include:

<u>Site No.</u>	<u>AFID</u>	<u>Site Name</u>
ST401	96-104	9 USTs at Building 22-013
ST402	150	UST at Building 32-127
ST403	209, 229	2 USTs at Building 22-009
ST404	324	UST at Building 33-324
ST405	335	UST at Building 42-335
ST407	575, 576, 578	3 USTs at Building 43-575
ST408	290A, 290B	2 USTs at Building 11-290
ST409	805	UST at Building 24-804
ST410	165	UST at New Hush House
ST419	51, 52	2 USTs at Building 41-659
ST420	60	UST at Building 43-410
ST421	425A, B, C, and D	4 USTs at Building 42-425
ST422	471	UST at Building 41-701
ST423	755	UST at Building 41-755
ST424	189	UST at Building 32-189
ST425	775	UST at Building 44-775
ST426	785	UST at Building 44-785
ST427	136 and 137	2 USTs at Building 11-160
ST428	130	UST at Building 1-836
ST429	325	UST at Building 63-325
ST430	410A and 410B	2 USTs at Building 43-410

The work presented was completed as Phase IV of a cooperative agreement with the State of Alaska Department of Environmental Conservation (ADEC) signed in October 1992, known as the State-Elmendorf Environmental Restoration Agreement (SERA; ADEC and USAF 1992). The objectives of the release investigations were to estimate the extent of soil contamination, evaluate the potential for the site to be a source of groundwater contamination, and conduct preliminary bioventing treatability studies as appropriate as an initial screening in the SERA process.

This report presents the release investigation and treatability study results and provides preliminary remediation/closure recommendations for each site. Corrective action plan preparation was not within the scope of this project. Table E-1 summarizes the results and conclusions for each site.

Table E-1. SERA IV UST Sites Summary and Preliminary Recommendations.

Site	Matrix Score	Soil Contamination	Recommendation	Groundwater Contamination	Recommendation
ST401	A	Yes	Biovent	Suspected	OU-5
ST402	A	Yes	To be determined	Suspected	OU-5
ST403	A	Yes	To be determined	Suspected	OU-5
ST404	A*	No	Close	Not Suspected	NFA
ST405	A	Yes	Biovent	Suspected	OU-5
ST407	A	Yes	Biovent	Suspected	OU-5
ST408	B	Yes	Close	Not Suspected	NFA
ST409	A	Yes	Biovent	Suspected	OU-5
ST410	A	Yes	Biovent	Suspected	OU-5
ST419	A	Yes	Biovent	Suspected	OU-5
ST420	B	No	Close	Not Suspected	NFA
ST421	A	Yes	Biovent	Suspected	OU-5
ST422	A	Yes	Biovent/Include with ST419	Suspected	Include with ST419
ST423	A	Yes	Natural Attenuation	Free Product	Product Recovery
ST424	A	Yes	Biovent	Suspected	OU-5
ST425	C	No	Close	Not Suspected	NFA
ST426	A	Yes	Excavate/Alternate Cleanup Level	Suspected	Remove/ACL
ST427	A	No	Close	Suspected	Include with ST410
ST428	A	Yes	Biovent	Suspected	OU-5
ST429	B	Yes	Biovent	Not Suspected	NFA
ST430	C	No	Close	Not Suspected	NFA

* No ADEC Matrix Score was calculated. All results were below Level A cleanup standards.
 ACL = Alternate cleanup level.
 NFA = No further action.
 OU-5 = Operable Unit 5.

16.0 ST423 - UST AT BUILDING 41-755

16.1 ST423 Site Background

ST423 consists of UST AFID 775, a former 3000-gallon steel UST located west of Building 41-755. The 3000-gallon UST had been used to store diesel fuel for the emergency generator at Building 41-755. The installation date is unknown. UST 775 and a 12,000-gallon heating oil UST located immediately to the northeast are displayed on as-built drawings dating back to 1951.

ST423 is located on the northwestern portion of the Elmendorf moraine. The hydraulic gradient is assumed to approximate surface contours and flow to the northwest. There are no known downgradient water supply wells. The closest known downgradient groundwater receptor is Knik Arm, which is over 0.5 mile northwest of the site. Wetlands are intermittently present between the Elmendorf moraine and Knik Arm. It is possible that groundwater from ST423 surfaces prior to Knik Arm.

UST 755 was replaced in August 1995 (USAF 1995k). Piping attached to Building 41-755 was abandoned in place by crimping and taping the ends. An undocumented pipe was discovered during the tank removal. The pipe crossed above the UST and was removed. A new 4000-gallon UST was installed in the excavation, and clean fill was used to bring the site back to grade. A matrix score cleanup level of B was determined for the site. DRO contamination levels exceed the ADEC cleanup Level B of 200 mg/Kg. Approximately 65 cubic yards of contaminated soil was removed for off-site remediation. Three of the four samples collected from the excavation and analyzed for DRO exceeded ADEC Level B cleanup standards, with concentrations ranging between 42 mg/Kg and 9700 mg/Kg.

16.2 ST423 Release Investigation Field Program and Results

The ST423 release investigation was conducted between July and November 1996.

16.2.1 ST423 Soil Sampling and Analysis

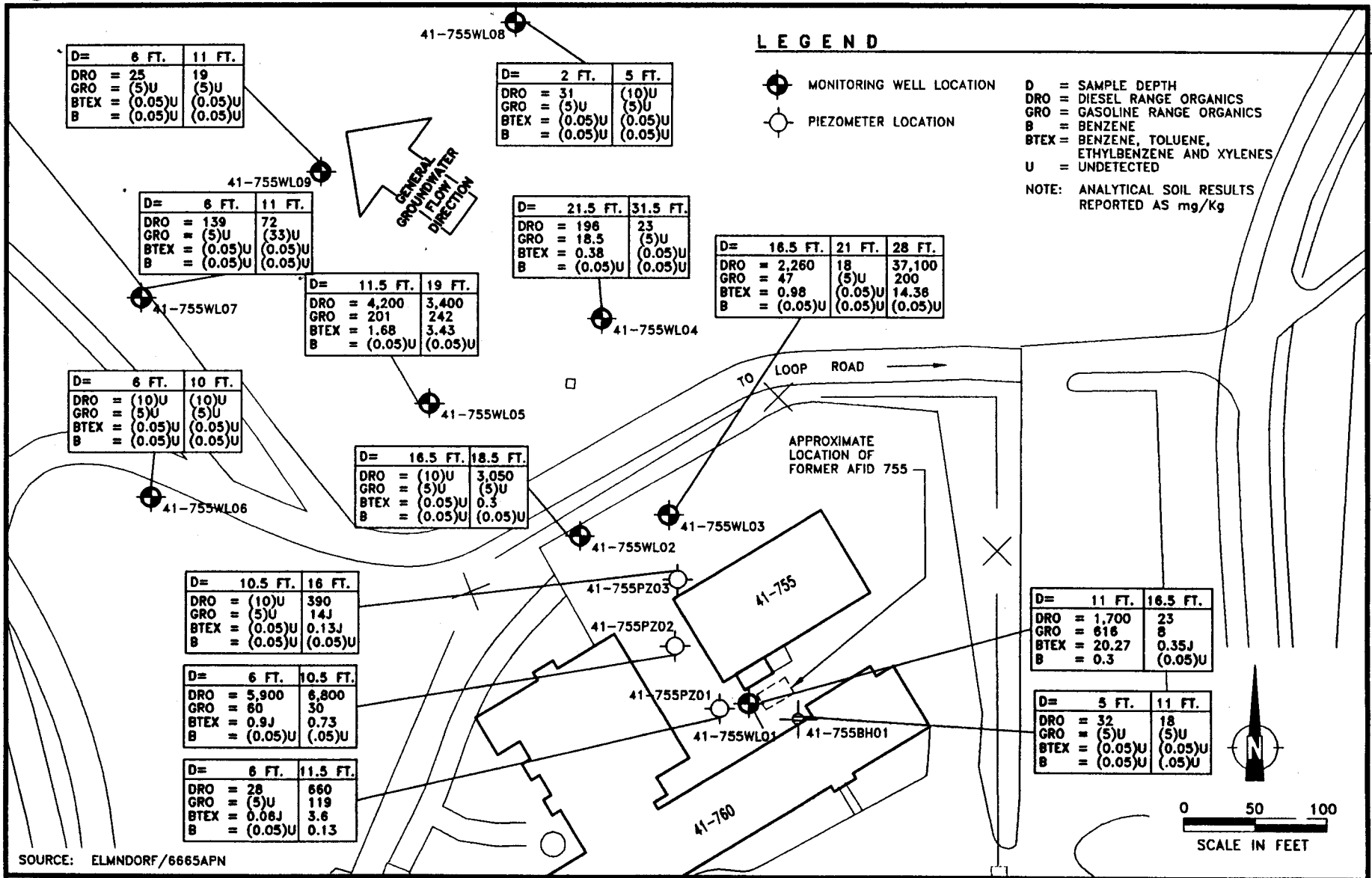
Thirteen borings were drilled at ST423, including nine groundwater monitoring/air injection wells (41-755WL01 through -09), three soil gas monitoring arrays (41-755PZ01 through -03, and one boring that was grouted following sampling. Boring locations and analytical results are displayed in Figure 16-1. Boring details are provided on boring logs in Attachment 16.4 (see Section 16.4). Site soils consist of complexly interbedded silts, sands, and gravels. Multiple confined and perched aquifers were encountered.

Soil samples contained elevated ATH/PID readings and smelled of petroleum in wells 41-755WL01 through -05 and in all three soil gas monitoring arrays. Soil petroleum hydrocarbon analytical results are summarized on Table 16-1 and Figure 16-1, and fully reported in Attachment 16.5 (see Section 16.5). Results from 41-755WL08 and -09 are preliminary due to the recent sampling date. Soil contamination above ADEC Level A cleanup standards was detected in 12 of the 27 normal soil samples. DRO chromatograms were interpreted as weathered to very weathered middle distillate fuel. The soil sample collected at 11.0 feet bgs in 417PZ03 was interpreted as biogenic hydrocarbons. Other soil physical and chemical results are presented on Table 16-2.

16.2.2 ST423 Groundwater Sampling and Analysis

All six wells at 41-755 were gauged with an interface probe on October 8, 1996. Hydraulic contours are shown on Figure 16-2. The gradient is estimated at 250 feet/mile and is to the north/northwest. Approximately 0.56 feet of product were observed with an interface probe in WL01, 0.04 feet in WL03, and WL02 had a detectable sheen.

All monitoring wells, except for 41-755WL01 and 41-755WL03, were developed and groundwater samples were analyzed for DRO, GRO, and BTEX. 41-755WL02, and -05 recharged slowly, indicating low groundwater conductivity. Analytical results are not yet available and will be provided in the final report. No bioventing treatability study was conducted at the site due to the presence of free product on the groundwater and the site silty soils with low apparant air permeability.



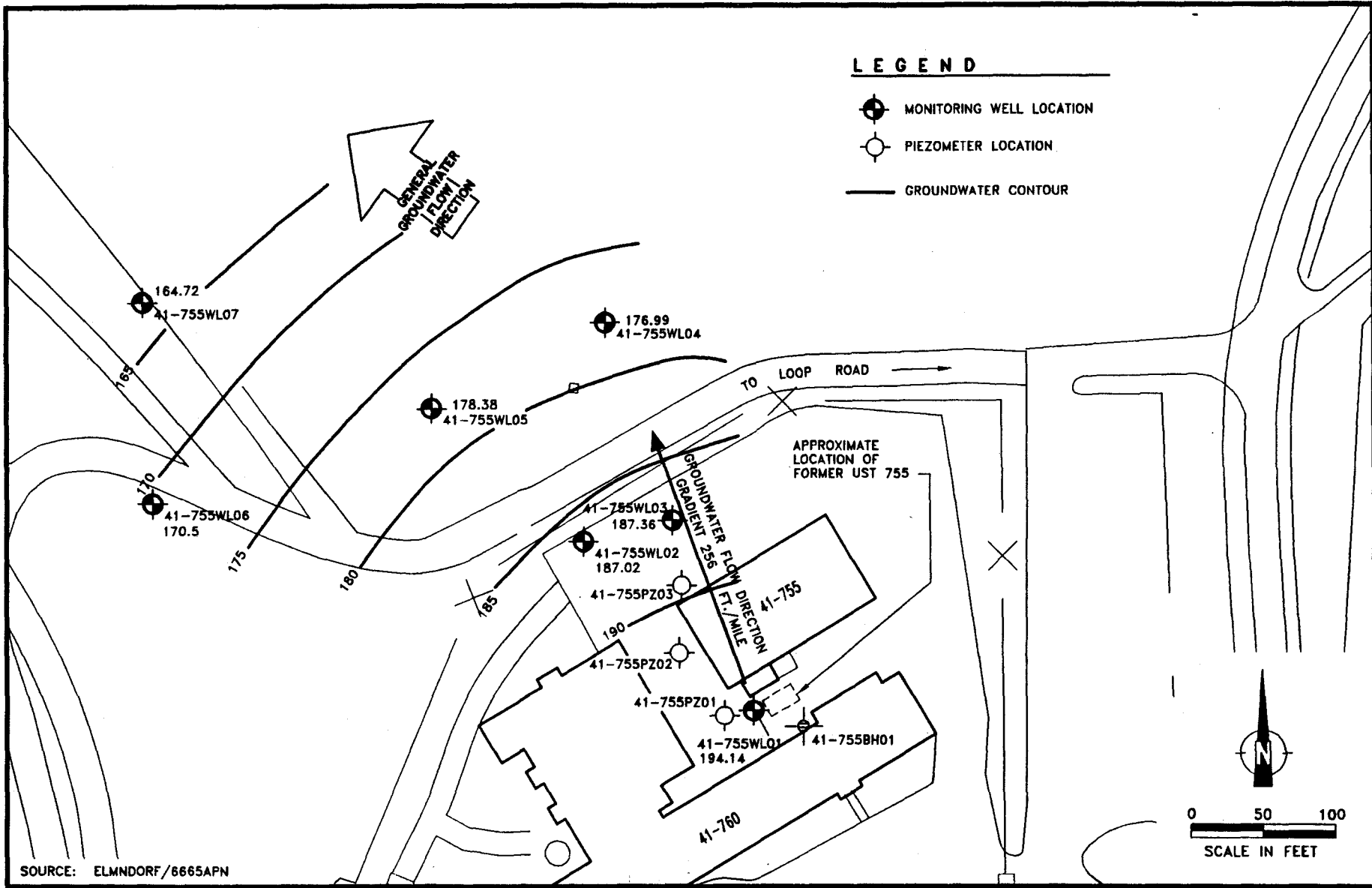
SOURCE: ELMNDORF/6665APN

DRAWING: ST423_1
 C/SC: 1:100
 DATE: 12/13/96

DRAWN: SSR
 DISK: Z 6/96
 CHECK: P.R

FIGURE 16-1
 ST423
 SITE MAP SHOWING
 SOIL SAMPLE RESULTS

3RD SPTG/CEVC
 ELMENDORF AFB, ALASKA
 PROJECT 9000-080/068



SOURCE: ELMENDORF/6665APN

DRAWING: 41-755GW
 C/SC: 1:100
 DATE: 12/13/96

DRAWN: SSR
 DISK: Z 6/96
 CHECK: P.R

FIGURE 16-2
 ST423
 GROUNDWATER CONTOURS
 AND ELEVATIONS

3RD SPTG/CEVC
 ELMENDORF AFB, ALASKA
 PROJECT 9000-080/068

Table 16-1. ST423 Soil Contaminant Results.*

Sample ID	Benzene EPA 8020a	BTEX EPA 8020a	GRO AK101.0	DRO AK102.0
41-755BH01SO11.ON	(0.05) U	(0.05) U	(5) U	18
41-755BH01SO11.ON DUP	(0.05) U	(0.05) U	(5) U	13
41-755BH01SO5.0N	(0.05) U	(0.05) U	(5) U	32
41-755PZ01SO11.5N	0.13	3.6	119	660
41-755PZ01SO6.0N	(0.05) U	0.06	(5) U	28
41-755PZ02SO10.5N	(0.05) U	0.73	30	6800
41-755PZ02SO10.5N DUP	(0.5) U	7.8	270	4750
41-755PZ02SO6.0N	(0.05) U	0.9	60	5900
41-755PZ03SO10.5N	(0.05) U	(0.05) U	(5) U	(10) U
41-755PZ03SO16.0N	(0.05) U	0.13	14	390
41-755WL01SO11.0N	0.3	20.27	616	1700
41-755WL01SO16.5N	(0.05) U	0.35	8	23
41-755WL02SO16.5N	(0.05) U	(0.05) U	(5) U	(10) U
41-755WL02SO18.5N	(0.05) U	0.3	(5) U	3050
41-755WL03SO16.5N	(0.05) U	0.98	47	2260
41-755WL03SO21.0N	(0.05) U	(0.05) U	(5) U	18
41-755WL03SO28.0N	(0.5) U	14.36	200	37100
41-755WL04S021.5N	(0.05) U	0.38	18.5	196
41-755WL04S031.5N	(0.05) U	(0.05) U	(5) U	23
41-755WL05S011.5N	(0.05) U	1.68	201	4200
41-755WL05S019.0N	(0.05) U	3.43	242	3400
41-755WL06SO10.N	(0.05) U	(0.05) U	(5) U	(10) U
41-755WL06SO6.0N	(0.05) U	(0.05) U	(5) U	(10) U
41-755WL07SO11.0N	(0.05) U	(0.05) U	(33) U	72
41-755WL07SO6.0N	(0.05) U	(0.05) U	(5) U	139

* All results in mg/Kg.

DUP = Duplicate sample.

U = Not detected (detection limit).

Table 16-2. ST430 Soil Nutrient, TOP, and pH Results.*

Sample ID	Nitrate-Nitrite 353.2	TKN 351.3	Ammonium 350.3	Phosphate 365.3	TOC D4129	pH 150.1
41-755PZ02SO10.5N	(0.4) U	171	0.7	(20) U	0.58	6.9
41-755WL01SO16.5N	(0.4) U	386	1	(20) U	0.26	6.5

* All units mg/Kg except pH.

16.2.3 ST423 Free Product Recovery Evaluation

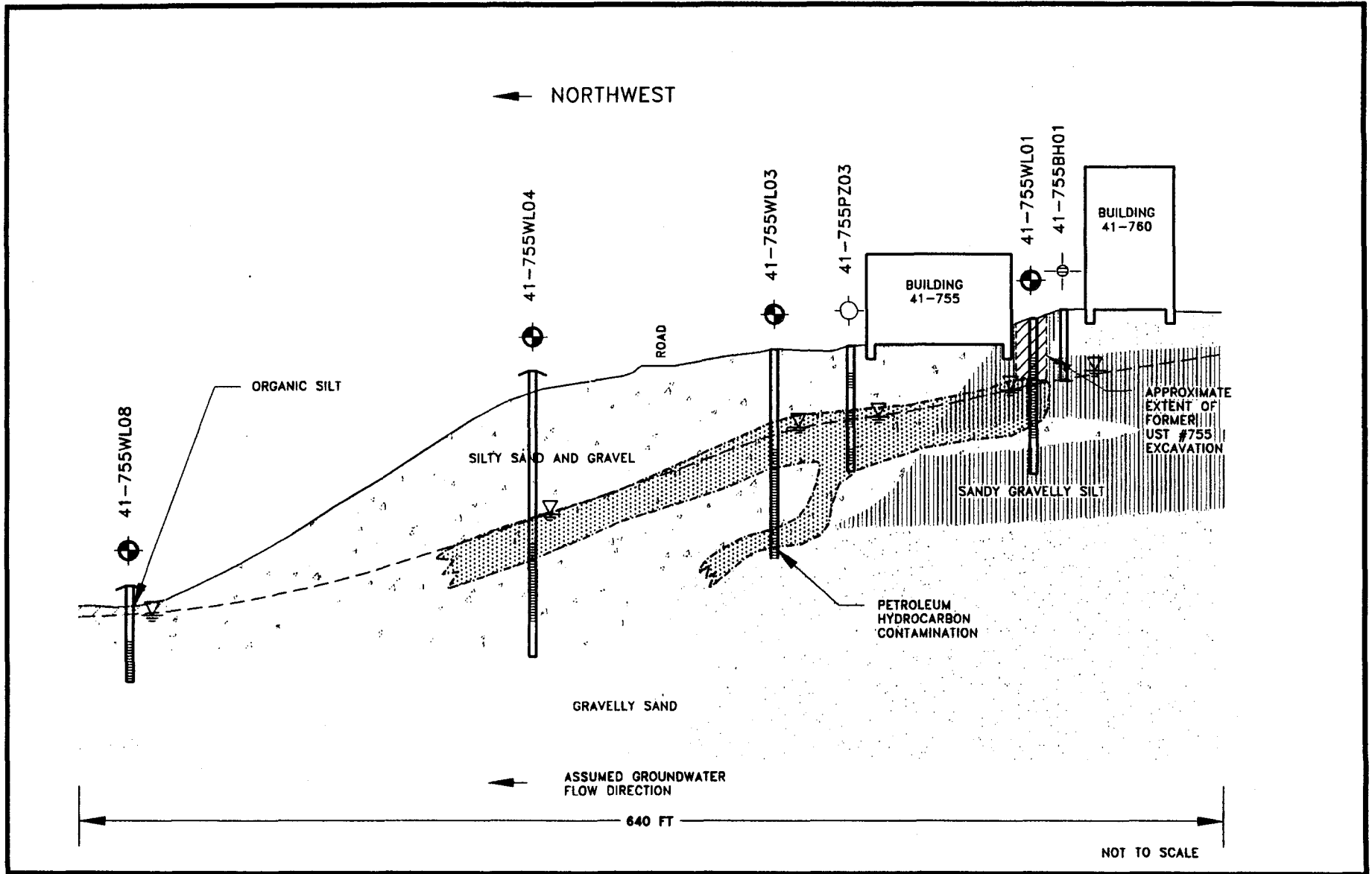
A free-product recovery evaluation was conducted on October 1996 at monitoring well 41-755WL01. The initial evaluation was conducted by handbailing product using a disposable bailer. Due to the favorable recovery rates, a passive product recovery filter (Petropore™) was installed to determine if extraction of the free product can be sustained at an acceptable rate. The test consisted of using a Petropore™ filter without the automatic bailing apparatus. Free product was bailed from the well using a 36 by 1.5-inch PVC bailer before the initial installation of the filter. The filter was then placed in the well for a given time interval. After the time interval, the filter was pulled from the well, the captured product was drained from the filter, and recovered product volume measured. Before reinstalling the emptied filter, any excessive product in the well was bailed using the PVC bailer.

The filter was emptied and product bailed at successively shorter intervals. For 4 days the filter was emptied two times per day. On the fifth day, the filter was emptied three times. Results from these tests showed that the filter could be emptied more frequently and a more intensive test was necessary. Thus, the filter was emptied nine times over a 28 hour period. As with the longer test intervals, the filter had filled to capacity during each time interval. Table 16-3 summarizes product removal at the site.

16.3 ST423 Conclusions

Petroleum hydrocarbons, principally diesel range, were detected in the soil at ST423. Groundwater contamination was identified. The spatial extent of the soil and groundwater contamination has been delineated. Contamination appears to have migrated along zones of high hydraulic conductivity. The downgradient extent of the contamination does not extend beyond wells 41-755WL06 through -09. Free product was identified on aquifers at the site. Figure 16-3 displays a conceptual diagram for the site.

DP98000078



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DRAWN: SSR

FIGURE 16-3

3RD SPTG/CEVC

C/SC: 1:1

DISK: Z 6/96

ST423

ELMENDORF AFB, ALASKA

DATE: 12/13/96

CHECK: PR

CONCEPTUAL SITE MODEL

PROJECT 9000-068/080

Table 16-3. Product Recovery Evaluation Results.

Date Product Removed	Quantity Product Removed (liter)
10/10/96	1
10/11/96	1
10/21/96	3
10/21/96	0.35
10/22/96	0.75
10/22/96	0.35
10/23/96	0.35
10/23/96	0.35
10/24/96	1
10/24/96	0.35
10/25/96	1
10/25/96	0.35
10/25/96	0.35
10/28/96	1
10/28/96	1
10/28/96	0.35
10/28/96	0.35
10/28/96	0.35
10/28/96	0.25
10/28/96	0.25
10/29/96	0.35
10/29/96	0.25
Total	14.35

The initially determined ADEC Level B cleanup goal for ST423 is not supported by the SERA IV release investigation as groundwater contamination was identified. No matrix score was calculated for ST423 as Level A cleanup is required for sites at which groundwater contamination is detected.

It is recommended that USAF consider alternate remedial strategies for the soil and groundwater contamination detected at ST423. Bioventing is not likely to be successful due to the presence of free product, fine-grained soils, and extensive subsurface preferential airflow pathways. The following actions may be successful components to the ST423 corrective action plan:

- Implement a free product recovery system. Sustainable product recovery was demonstrated by the product recovery evaluation. Installing additional larger-diameter wells may increase recovery rates.
- Implement a natural attenuation program for the identified groundwater contamination, which may included additional site groundwater monitoring.
- Re-evaluate vadose contamination cleanup options following termination of the product recovery system. It may be possible to establish alternate cleanup levels at the site.
- Evaluate the adjacent 12,000-gallon fuel oil UST as a potential additional source of contamination.

16.4 Boring Logs

Borings logs for ST423 are included as Attachment 16.5 at the end of this section.

16.5 Analytical Data

Analytical data for the ST423 investigation are included as Attachment 16.6 at the end of this section.

16.6 ADEC Forms

The ADEC Oil and Hazardous Materials Incident Report, Preliminary Risk Evaluation, and Release Investigation Summary Form (draft) are provided in Attachment 16.7.