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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT FOR SOLID WASTE MANAGEMENT UNIT 18 MILLINGTON SUPPACT TN

10/8/1998

ENSAFE INC

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY
NAVAL SUPPORT ACTIVITY MID-SOUTH
MILLINGTON, TENNESSEE

SWMU 18
RCRA FACILITY INVESTIGATION REPORT

Revision: 1

CTO-094
Contract No.: N62467-89-D-0318

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

Prepared by:

EnSafe Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134
(901) 372-7962

October 8, 1998

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY
NAVAL SUPPORT ACTIVITY MID-SOUTH
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The Contractor, EnSafe, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0318 is complete, accurate, and complies with all requirements of the contract.

Date: October 8, 1998
Signature:
Name: Lawson Anderson
Title: Task Order Manager

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List of Acronyms

AOC	Area of Concern
bls	Below land surface
BRAC	Base Realignment and Closure
CMS	Corrective measures study
COPC	Chemical of potential concern
CSI	Confirmatory Sampling Investigation
DCE	Dichloroethene
DNAPL	Dense non-aqueous phase liquid
DPT	Direct push technology
DQO	data quality objective
DRO	Diesel range organics
E/A&H	EnSafe/Allen & Hoshall
ERA	Ecological risk assessment
FOSL	Finding of Suitability to Lease
GRO	Gasoline range organics
HI	Hazard Index
HQ	Hazard quotient
ILCR	Incidental lifetime cancer risk
MCL	Maximum contaminant level
MEK	Methyl ethyl ketone
mg/kg	Milligram per kilogram
MS/MSD	Matrix spike/matrix spike duplicate
NSA	Naval Support Activity
OSWER	Office of Solid Waste and Emergency Response
PCB	Polychlorinated biphenyls
PCE	Perchloroethene or tetrachloroethene
ppb	Parts per billion
PRE	Preliminary risk evaluation
QA/QC	Quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-based concentration
RCs	Reference concentrations
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SSL	Soil screening level
SWMU	Solid Waste Management Unit
SVOC	Semivolatile organic compound
TCE	Trichloroethene
TDEC	Tennessee Department of Environment and Conservation
TPH	Total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
UWT	Underground Waste Tank

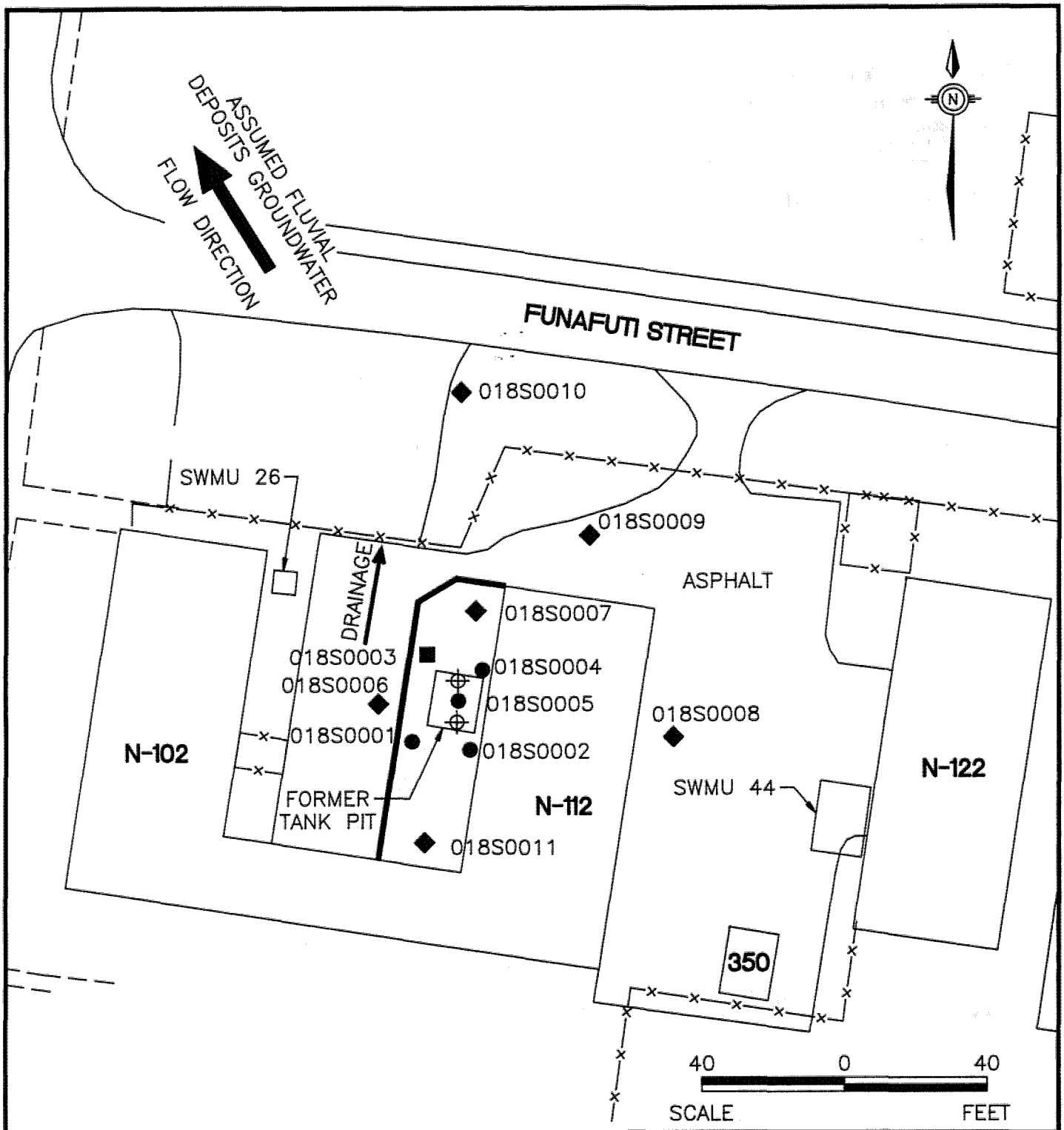
1.0 INTRODUCTION

As part of the U.S. Navy's Installation Restoration Program, the following Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) report has been prepared by EnSafe for Solid Waste Management Unit (SWMU) 18, the N-112 Underground Waste Tank (UWT) from the Building N-112 (Ground Support Equipment Shop) area at Naval Support Activity (NAVSUPPACT [NSA]) Mid-South (formerly NSA Memphis), Millington, Tennessee (Figure 1).

SWMU 18 is included in the group of SWMUs known as Assembly C, but was not included in the Assembly C Confirmatory Sampling Investigation (CSI) because a voluntary corrective action (VCA) tank removal planned for the site might have met the needs of a CSI.

The N-112 UWT and contaminated soil were removed on September 26, 1996 by Omega Environmental Services. The VCA provided evidence of a past release at SWMU 18, so an RFI was conducted to determine the nature and extent of contamination, including the extent of soil requiring removal for the VCA Phase II. A technical memorandum, *Request for Expedited Approval — SWMU 18 UWT Geoprobe Investigation* (EnSafe, 1998a), was submitted to the Base Closure and Realignment (BRAC) Cleanup Team (BCT) January 21, 1998 and approved, allowing the investigation of SWMU 18 soil and groundwater to proceed.

Based on results of the initial VCA and this RFI, further soil removal for the VCA Phase II was completed in April 1998 by the U.S. Army Corps of Engineers. An additional approximately 100 cubic yards of contaminated soil were removed. Trichloroethene (TCE) exceeding the risk-based concentration (RBC) was detected in two of three groundwater samples collected during the RFI Geoprobe effort. Reported concentrations warranted further investigation of groundwater at SWMU 18. To facilitate the followup effort, a technical memorandum *Request for Expedited Approval — SWMU 18 VCA Soil Removal and Followup Geoprobe Investigation (EnSafe, 1998b)*



LEGEND

- ● – LOESS SOIL–SAMPLE LOCATION
- ■ – LOESS SOIL AND FLUVIAL DEPOSITS GW SAMPLE
- ◆ – FLUVIAL DEPOSITS GW SAMPLE
- ⊕ – VCA CONFIRMATION SOIL SAMPLE

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FIGURE 1
SWMU 18
SAMPLE LOCATION MAP

DWG DATE: 10/08/98 | DWG NAME: 0094G018

2.0 ENVIRONMENTAL SETTING

SWMU 18 is approximately 150 feet south of Funafuti Street on the NSA Mid-South Northside in the Building N-112 complex, which was used for vehicle and ground support equipment maintenance. SWMU 44 (the former N-102 Hazardous Waste Accumulation Point) and SWMU 26 (the former N-102 Battery Acid Neutralization Unit) are also in the Building N-112 complex.

SWMU 26 was investigated in the spring of 1995, the results of which were presented in the *Assembly C Confirmatory Sampling Investigation (CSI) Report* (E/A&H, 1996a). SWMU 44 was investigated in the fall of 1995, the results of which were presented in the *Assembly D CSI Report* (E/A&H, 1996b). No further action was approved for SWMU 26. No further action was approved for SWMU 44 contingent on implementation of a VCA. The VCA has been completed and results are presented in the technical memorandum *Removal of TPH-contaminated Soil at SWMU 44 —the N-102 Hazardous Waste Accumulation Point* (EnSafe, 1998c). This VCA report is currently awaiting BCT approval.

2.1 Topography and Drainage

The SWMU 18 site is on an elevated, paved area between Buildings N-102 and N-112 with a retaining wall facing Funafuti Street to the north. The street is approximately 3 feet below the paved area. The site drains to the southwest into the SWMU 4 storm sewer via a drainage ditch that parallels Funafuti Street. SWMU 4 ultimately empties into the North Fork Creek.

2.2 Hydrogeologic Information

Hydrogeology

Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Section 5.1 of the *Assembly C CSI Report — SWMUs 15 and 21* (EnSafe, 1998d) provides updated information, as available in *Hydrogeology*

The borings for the monitoring wells installed at SWMU 21 were advanced to approximately 95 feet bls to verify the depth to the top of the Cockfield Formation in this area. The Cockfield Formation, which overlies the Cook Mountain Formation, consists of very fine silty sand interbedded with clay and silt lenses, or clay with interbedded fine sand lenses, and underlies the fluvial deposits to a depth of approximately 190 feet bls.

2.3 Climatological Data

Regional climatological data are provided in Section 2.8 of the *Comprehensive RFI Work Plan* (E/A&H, 1994).

3.0 CHARACTERIZATION OF HAZARDOUS CONSTITUENT RELEASES

3.1 Source Characterization

The SWMU 18 UWT, a 550-gallon steel tank, reportedly received waste engine oil and hydraulic fluid generated during ground support equipment maintenance at Building N-112. Neither the installation date nor the period of use are known.

3.2 Previous Investigations

No previous investigations have been conducted at the UWT. However, a VCA was conducted in September 1996 to remove the tank and excavate any contaminated soil. It was discovered that the steel tank had already been removed and replaced with a comparably-sized fiberglass tank, and the tank pit had been lined with plastic. The soil beneath the plastic and around the fill pipe was stained and had a strong petroleum odor. The top and bottom of the tank were at approximately 3 and 7 feet bls, respectively. The bottom of the excavation was at approximately 8 feet bls.

Approximately 45 cubic yards of soil were excavated from both sides of the liner during removal of the fiberglass tank. Before backfilling the excavation with pea gravel, two confirmation soil samples were collected from the floor of the excavation (Figure 1). These samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), Appendix IX metals, pesticides/polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) (418.1), TPH-gasoline range organics (GRO), and TPH-diesel range organics (DRO). Significant detections included maximum concentrations of 1,300 milligrams per kilogram (mg/kg) TPH and 660 mg/kg TPH-DRO. Chlorinated solvents, a common groundwater contaminant at many NSA Mid-South sites, were not detected in the soil samples. No groundwater was reported to have accumulated in the excavation during tank closure.

4.0 SAMPLING RATIONALE

Sampling for the RFI at SWMU 18 was conducted in two phases. The first phase was conducted in January 1998, and the second phase in April 1998. Rationales for both phases are discussed below.

4.1 RFI Sampling Rationale

Because the source of contamination was a buried tank, it is more likely that soil from lower loess intervals would be contaminated rather than surface soils. Impacts to fluvial deposits groundwater were also thought possible. For the RFI Phase I, four soil-sample locations were proposed around the excavation and one within the excavation (Figure 1). At each of the four sample locations outside the excavation (0018S0001 through 018S0004), a subsurface-soil sample was collected from 6 to 8 feet bls, and a second soil sample was collected from 12 to 15 feet bls in the saturated zone in the loess, because the loess typically has a low hydraulic conductivity and does not produce sufficient amounts of groundwater for sampling.

The fifth location (018S0005; Figure 1) was inside the excavated area. Soil-sample intervals were chosen differently because of the pea-gravel backfill. A soil sample was collected from 10 to 12 feet bls in the unsaturated zone below the center of the pit to provide an estimate of the depth of TPH contamination that might require removal. The second soil sample was collected from saturated loess at 12 to 15 feet bls. All soil samples were collected with a Geoprobe.

All the soil samples were analyzed for VOCs, TPH, TPH-GRO, and TPH-DRO, except the unsaturated soil sample collected just below the center of the excavation. That sample was analyzed for TPH and TPH-DRO because high concentrations of these parameters were detected at 8 feet bls. The VOC analysis provided data about solvents or volatile fuel constituents that could threaten groundwater. The TPH analyses provided an indication of the extent of contamination.

directions to estimate the extent of VOC contamination in fluvial deposits groundwater. The samples were collected as close as possible to the same depth (60 feet) as the highest previous TCE detection. All four samples were collected with a Geoprobe and were analyzed for VOCs. Two of these samples were collected at 60 feet bls, and two at 56 feet bls. QA/QC procedures were performed in accordance with Section 4.14.2 of the *Comprehensive RFI Work Plan* (E/A&H, 1994). One trip blank and one groundwater duplicate were collected as QA/QC samples for the followup RFI investigation (see Appendix B).

5.0 FINDINGS AND CONCLUSIONS

5.1 Methods

Tables 1, 2, and 3 present sample summaries of soil and groundwater contaminant detections for both phases of the RFI effort. Table 3 is also used to support a preliminary risk evaluation (PRE) screening for groundwater at SWMU 18. The PRE is presented in detail in Section 5.4 of this report. Analytical data are presented in Appendix A and the data validation report is presented in Appendix B.

Subsurface soil VOC data were compared to state cleanup levels for petroleum in soil and to generic soil screening levels (SSL) for the migration to groundwater pathway from the *May 1996 USEPA/OSWER Soil Screening Technical Guidance Document EPA/540/R-95/128*. A dilution-attenuation factor of 1 was applied to the SSLs. They were also compared to surface soil RBCs to determine the need for evaluating risk for a subsurface soil, construction worker scenario.

The groundwater VOC data generated during the field investigation have been compared to the screening levels listed in the *Risk-Based Concentration (RBC) Table* (U.S. Environmental Protection Agency [USEPA] Region III, December 22, 1997), which is used as a guideline to determine whether further site assessment is warranted, and also to Maximum Contaminant Levels (MCLs) for drinking water.

The PRE compares the maximum detected concentrations to USEPA Region III RBCs in order to identify chemicals of potential concern (COPCs). COPCs are used to derive a risk estimate in accordance with the *Amended Guidance on Preliminary Risk Evaluations (PREs) for the Purpose of Reaching a Finding of Suitability to Lease (FOSL)* (USEPA, 1994).

Noncarcinogenic compound RBCs shown in these tables are adjusted values for screening purposes. The published RBC values have been multiplied by 0.1 in accordance with

Table 2
SWMU 18 — Hydrocarbon Detections in Subsurface Soil (mg/kg)

Sample ID	Contaminant	Result[a]
018S000108	TPH	52 J
018S000115	TPH - DRO	1.2 J
018S000208	TPH	37 J
018S000215	TPH - DRO	21
	TPH - GRO	0.24
	TPH	190 J
018S000408	TPH - DRO	11
	TPH	65 J
018S000512	TPH - DRO	9
	TPH	250 J
018S000515	TPH - DRO	26 J
	TPH	84 J

Notes:

a — Tennessee Department of Environment and Conservation (TDEC) TPH cleanup level is 500 mg/kg based on a soil permeability $< 10^{-4}$ cm/sec and no drinking-water aquifer present.

J — Compound was detected in concentrations less than the method reporting limit; value estimated.

mg/kg — milligrams per kilogram

construction-worker scenario. No RBC was exceeded, so no subsurface-soil construction-worker PRE calculation was performed. Surface-soil samples were not collected at SWMU 18 because the source area was an UWT.

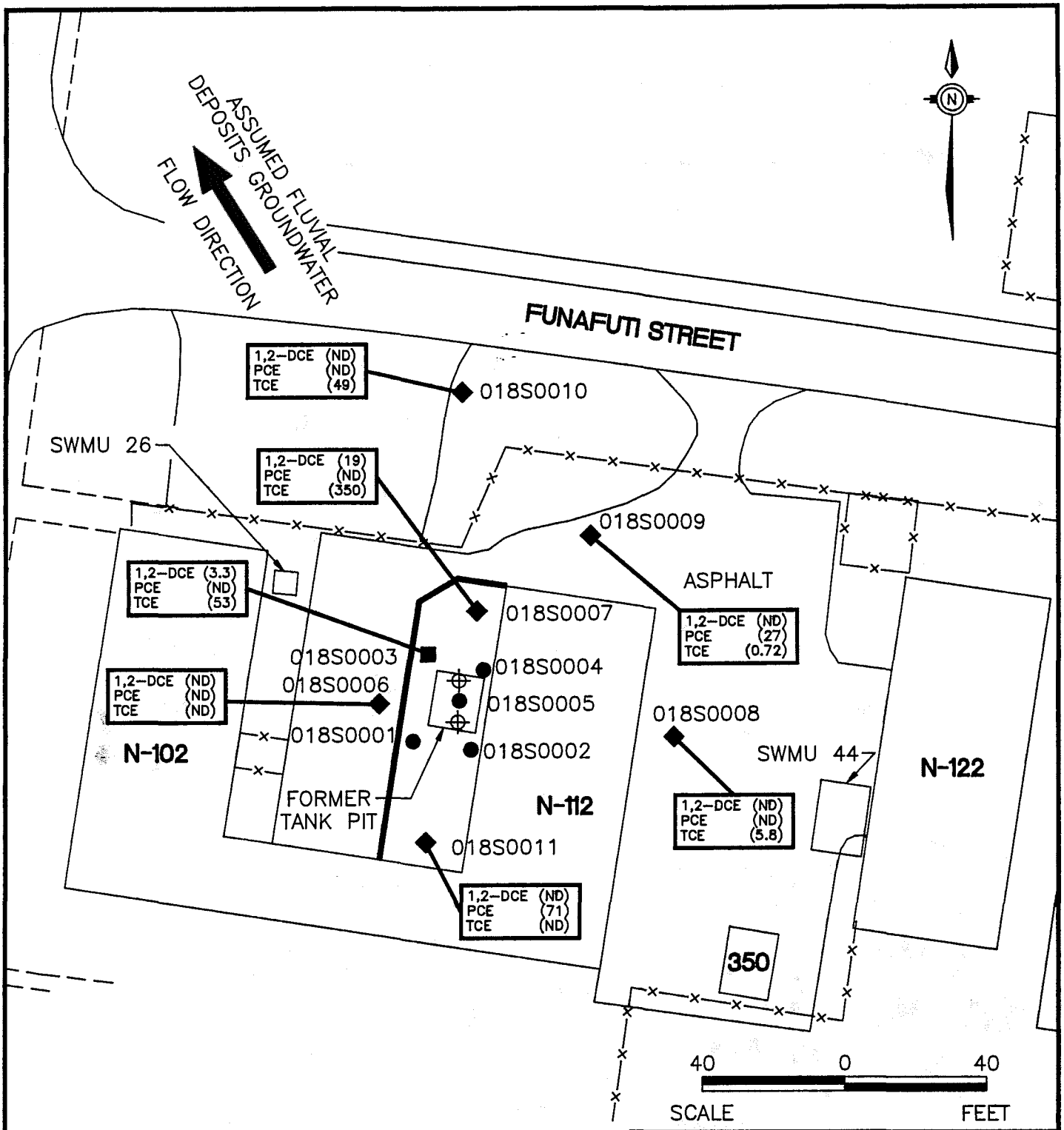
Several VOCs were detected in subsurface soil but not in excess of SSLs. Minor concentrations of PCE, MEK, carbon disulfide, and acetone were detected sporadically. The concentrations reported were all less than corresponding SSLs.

Hydrocarbon Analysis

Hydrocarbon analyses at SWMU 18 consisted of TPH, TPH-DRO, and TPH-GRO. Total petroleum hydrocarbon (TPH) concentrations are compared to the Tennessee Department of Environment and Conservation's (TDEC) soil-cleanup levels, established by the Division of Underground Storage Tanks, and adopted by the Division of Solid Waste. The TDEC soil-cleanup level for TPH at SWMU 18 is 500 mg/kg based on an expected maximum soil permeability of 10^{-4} cm/sec and no drinking-water aquifer present. Soil permeabilities measured in the loess at other SWMUs and sites across NSA Mid-South have never exceeded 10^{-4} cm/sec.

TPH concentrations ranged from not detected to 250 mg/kg in 10 sample results. There were no exceedances. TPH-DRO ranged from not detected to 26 mg/kg in 10 sample results. TPH-GRO was only detected in one of nine samples at a concentration of 0.24 mg/kg.

The highest concentration of TPH of 250 mg/kg occurred in the loess sample collected from 10 to 12 feet bls (018S000512) in the center of the pit (Figure 1). Sample 018S000515, taken from the interval below 018S000512, had a detected TPH concentration of 84 mg/kg. Both results are less than the site-specific TDEC soil-cleanup level for TPH (500 mg/kg).



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NOTE: ND – NOT DETECTED

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FIGURE 2
SWMU 18
CHLORINATED SOLVENT CONCENTRATIONS IN FLUVIAL DEPOSITS GROUNDWATER (μg/L)

DWG DATE: 10/08/98 | DWG NAME: 0094G019

groundwater investigation then shifted from the dry well to the entire airfield apron area, and ultimately to the entire NSA Mid-South Northside, as scattered pockets of contaminated groundwater were identified. As a result, the BCT decided to take a holistic approach to the Northside groundwater investigation and any subsequent corrective measures study (CMS), creating Area of Concern (AOC) A, the Northside Fluvial Groundwater, to be evaluated as one unit rather than as individual sites.

The conceptual model of groundwater contamination, developed from the ongoing investigation, theorizes that there is a very complex network of multiple plumes of varying widths, lengths, depth intervals, and contaminant concentrations in the airfield apron area. This model suggests that the plumes are likely a result of multiple small releases of spent solvents from various sources (e.g., different shops, buildings, and work or training activities). Spent solvents were reportedly poured on the ground, into storm sewers, etc., in small quantities (less than 5 gallons at a time). Based on the maximum solvent concentration detected to date (3,300 μg/L TCE in monitoring well 007G04LF) and the biased sampling strategies employed, the presence of DNAPL is not suspected. An AOC A RFI report describing the SWMU 7 and Northside groundwater investigations is currently under review by the BCT. An AOC A CMS work plan also has been prepared to describe the planned approach for evaluating potential remedies for the groundwater contamination. BCT comments on the CMS work plan are currently being addressed.

5.4 PRE Calculations

A PRE was conducted for SWMU 18 to determine if any human-health risk could result from contaminants released at the site. Risk was estimated using data from the groundwater samples collected.

In accordance with *Supplemental Guidance to RAGS Bulletin 1, Data Collection and Evaluation* (USEPA, November 1995), COPCs were identified by comparing the maximum concentration of

The risk ratios for each chemical are summed separately for both residential and industrial scenarios to determine the overall site risk. Cumulative risk (for carcinogens) and cumulative HI (for noncarcinogens) are calculated separately, and the cumulative risk and HI are compared to the corresponding cumulative thresholds in accordance with the November 1994 USEPA Region IV Memorandum, the USEPA Region IV November 1995 Supplemental Guidance to RAGS, and the E/A&H August 1996 technical memorandum. Risk estimates for both land-use scenarios include the following assumptions.

A residential scenario includes exposure during childhood and adulthood, and assumes exposure for 350 days per year for at least 30 total years. The future site-resident scenario assumed dwellings would be constructed onsite. Site workers are presumed to contact the affected medium for 8 hours each day, 250 days per year for 25 years. Current site workers' exposure would be less than that assumed for the hypothetical future site-worker scenario because of their limited soil contact and the fact that groundwater from the loess or fluvial deposits is not currently used onsite as drinking or process water. Construction or maintenance-worker exposure would be considered less than the hypothetical future-worker exposure assumed in this PRE because construction or maintenance workers would be exposed less frequently and for shorter durations. Consequently, future-worker assessment is considered protective of both current site use and future construction/maintenance events. As previously mentioned, an ILCR greater than 1E-04 (the USEPA cumulative upper-bound acceptable risk threshold) or an HI greater than 1.0 (the USEPA cumulative HI threshold) indicates the site may require additional investigation for the corresponding land-use scenario (USEPA Region IV Memorandum, November 1994). In accordance with this memorandum, the property is considered suitable for lease for the specified land-use scenario if neither threshold is exceeded.

The groundwater residential HI is the maximum concentration of 1,2-DCE (19 μg/L) divided by the tap-water RBC (55 μg/L). Therefore the residential HI for groundwater is 0.35. The industrial HI is the maximum concentration of 1,2-DCE (19 μg/L) divided by an adjusted tap-water RBC. The industrial RBC value is the residential RBC (55 μg/L) divided by 0.25, or 220 μg/L. Therefore the industrial HI for groundwater is 0.09 (19 divided by 220).

The HI for groundwater is less than 1.0 for both the residential and industrial scenarios. Therefore, based on the HI, groundwater at SWMU 18 is suitable for residential or industrial use.

The groundwater cancer risk for TCE is the maximum concentration of TCE (350 μg/L) divided by the tap-water RBC (1.6 μg/L) multiplied by 1E-6. Therefore, the cancer risk for TCE in groundwater is 2.2E-4 for the residential scenario.

The groundwater cancer risk for PCE is the maximum concentration of PCE (71 μg/L) divided by the tap water RBC (1.1 μg/L) multiplied by 1E-6. Therefore, the cancer risk for PCE in groundwater is 6.5E-5 for the residential scenario.

The groundwater cumulative cancer risk for the residential scenario is the sum of the risks for TCE and PCE, or 2.8E-4.

The groundwater cumulative cancer risk for the industrial scenario is based on the same calculations as the residential scenario, but using RBC values that have been adjusted by dividing by 0.25 (in accordance with *USEPA Region IV Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* [USEPA, November 22, 1994]).

5.6 Conclusions and Recommendations

Soils

No TPH or VOCs were detected in subsurface soil or saturated loess at concentrations exceeding screening or action levels. One purpose of this RFI was to identify the extent of soil requiring removal for the VCA Phase II. The highest result detected in this RFI, TPH at 250 mg/kg, occurred in the loess sample collected from 10 to 12 feet bls (018S000512) in the center of the pit (Figure 1). The sample collected from the interval below this one (018S000515), had a detected TPH concentration of 84 mg/kg. Both results are less than the site-specific TDEC soil-cleanup level for TPH (500 mg/kg).

No further soil investigation is recommended at SWMU 18.

Groundwater

Seven groundwater samples were collected from the fluvial deposits. The chlorinated solvents TCE, 1,2-DCE, and/or PCE were detected in six of the groundwater samples. Xylene and acetone were also detected in three groundwater samples. Because the detected concentrations were relatively low (maximum detection was TCE at 350 μg/L) and did not suggest the presence of a DNAPL source area, it is recommended that the data from and further evaluation of SWMU 18 groundwater be incorporated into the AOC A CMS.

APPENDIX A

ANALYTICAL DATA

SOIL ANALYTICAL DATA

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

SW846-VOA															
	SAMPLE ID ------->	018-S-0001-08		018-C-0001-08		018-S-0001-15		018-S-0002-08		018-S-0002-15		018-S-0003-08	
	ORIGINAL ID ----->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	LAB SAMPLE ID --->	S880378*1		S880378A*1		S880378*2		S880378*3		S880378*4		S880378*5	
	ID FROM REPORT -->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98		01/21/98		01/21/98	
	DATE ANALYZED --->	01/29/98		01/30/98		01/30/98		01/29/98		01/30/98		01/30/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	EM9G07	VAL	EM9G08	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL
74-87-3	Chloromethane	13.	U	13.	U	12.	U	13.	U	12.	U	12.	U
74-83-9	Bromomethane	13.	U	13.	U	12.	U	13.	U	12.	U	12.	U
75-01-4	Vinyl chloride	13.	U	13.	U	12.	U	13.	U	12.	U	12.	U
75-00-3	Chloroethane	13.	U	13.	U	12.	UJ	13.	U	12.	U	12.	UJ
75-35-4	1,1-Dichloroethene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
75-09-2	Methylene chloride	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
75-34-3	1,1-Dichloroethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
67-66-3	Chloroform	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
71-55-6	1,1,1-Trichloroethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
56-23-5	Carbon tetrachloride	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
71-43-2	Benzene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
107-06-2	1,2-Dichloroethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
79-01-6	Trichloroethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
78-87-5	1,2-Dichloropropane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
75-27-4	Bromodichloromethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
108-88-3	Toluene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
79-00-5	1,1,2-Trichloroethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
127-18-4	Tetrachloroethene	6.5	U	6.4	U	0.96	J	6.4	U	6.2	U	6.2	U
124-48-1	Dibromochloromethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
108-90-7	Chlorobenzene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
100-41-4	Ethylbenzene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
100-42-5	Styrene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
75-25-2	Bromoform	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
79-34-5	1,1,2,2-Tetrachloroethane	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
67-64-1	Acetone	65.	U	64.	U	62.	U	64.	U	62.	U	62.	U
75-15-0	Carbon disulfide	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
78-93-3	2-Butanone (MEK)	32.	U	32.	U	31.	U	52.	J	55.	J	31.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	32.	U	32.	U	31.	U	32.	U	31.	U	31.	U
10061-01-5	cis-1,3-Dichloropropene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
10061-02-6	trans-1,3-Dichloropropene	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
591-78-6	2-Hexanone	32.	U	32.	U	31.	U	32.	U	31.	U	31.	U
1330-20-7	Xylene (Total)	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U
540-59-0	1,2-Dichloroethene (total)	6.5	U	6.4	U	6.2	U	6.4	U	6.2	U	6.2	U

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

SW846-VOA									
	SAMPLE ID ------->	018-S-0003-15		018-S-0004-08		018-S-0004-15		018-S-0005-15	
	ORIGINAL ID ----->	018S000315		018S000408		018S000415		018S000515	
	LAB SAMPLE ID --->	S880378*6		S880378*7		S880378*8		S880378*9	
	ID FROM REPORT -->	018S000315		018S000408		018S000415		018S000515	
	SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98	
	DATE ANALYZED --->	01/30/98		01/30/98		01/30/98		01/30/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil	
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL
74-87-3	Chloromethane	13.	U	13.	U	13.	U	12.	U
74-83-9	Bromomethane	13.	U	13.	U	13.	U	12.	U
75-01-4	Vinyl chloride	13.	U	13.	U	13.	U	12.	U
75-00-3	Chloroethane	13.	U	13.	U	13.	U	12.	U
75-35-4	1,1-Dichloroethene	6.3	U	6.3	U	6.3	U	6.2	U
75-09-2	Methylene chloride	6.3	U	6.3	U	6.3	U	6.2	U
75-34-3	1,1-Dichloroethane	6.3	U	6.3	U	6.3	U	6.2	U
67-66-3	Chloroform	6.3	U	6.3	U	6.3	U	6.2	U
71-55-6	1,1,1-Trichloroethane	6.3	U	6.3	U	6.3	U	6.2	U
56-23-5	Carbon tetrachloride	6.3	U	6.3	U	6.3	U	6.2	U
71-43-2	Benzene	6.3	U	6.3	U	6.3	U	6.2	U
107-06-2	1,2-Dichloroethane	6.3	U	6.3	U	6.3	U	6.2	U
79-01-6	Trichloroethene	6.3	U	6.3	U	6.3	U	6.2	U
78-87-5	1,2-Dichloropropane	6.3	U	6.3	U	6.3	U	6.2	U
75-27-4	Bromodichloromethane	6.3	U	6.3	U	6.3	U	6.2	U
108-88-3	Toluene	6.3	U	6.3	U	6.3	U	6.2	U
79-00-5	1,1,2-Trichloroethane	6.3	U	6.3	U	6.3	U	6.2	U
127-18-4	Tetrachloroethene	6.3	U	6.3	U	6.3	U	6.2	U
124-48-1	Dibromochloromethane	6.3	U	6.3	U	6.3	U	6.2	U
108-90-7	Chlorobenzene	6.3	U	6.3	U	6.3	U	6.2	U
100-41-4	Ethylbenzene	6.3	U	6.3	U	6.3	U	6.2	U
100-42-5	Styrene	6.3	U	6.3	U	6.3	U	6.2	U
75-25-2	Bromoform	6.3	U	6.3	U	6.3	U	6.2	U
79-34-5	1,1,2,2-Tetrachloroethane	6.3	U	6.3	U	6.3	U	6.2	U
67-64-1	Acetone	63.	U	63.	U	63.	U	32.	J
75-15-0	Carbon disulfide	6.3	U	6.3	U	3.4	J	6.2	U
78-93-3	2-Butanone (MEK)	32.	U	32.	U	32.	U	31.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	32.	U	32.	U	32.	U	31.	U
10061-01-5	cis-1,3-Dichloropropene	6.3	U	6.3	U	6.3	U	6.2	U
10061-02-6	trans-1,3-Dichloropropene	6.3	U	6.3	U	6.3	U	6.2	U
591-78-6	2-Hexanone	32.	U	32.	U	32.	U	31.	U
1330-20-7	Xylene (Total)	6.3	U	6.3	U	6.3	U	6.2	U
540-59-0	1,2-Dichloroethene (total)	6.3	U	6.3	U	6.3	U	6.2	U

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

TPH													
	SAMPLE ID ------->	018-S-0001-08		018-C-0001-08		018-S-0001-15		018-S-0002-08		018-S-0002-15		018-S-0003-08	
	ORIGINAL ID ----->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	LAB SAMPLE ID --->	S880378*1		S880378A*1		S880378*2		S880378*3		S880378*4		S880378*5	
	ID FROM REPORT -->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98		01/21/98		01/21/98	
	DATE EXTRACTED -->	02/11/98		02/11/98		02/11/98		02/11/98		02/11/98		02/11/98	
	DATE ANALYZED --->	02/12/98		02/12/98		02/12/98		02/12/98		02/12/98		02/12/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM9G07	VAL	EM9G08	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	52.	J	13.	U	13.	UJ	37.	J	190.	J	13.	UJ

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

TPH											
	SAMPLE ID ------->	018-S-0003-15		018-S-0004-08		018-S-0004-15		018-S-0005-12		018-S-0005-15	
	ORIGINAL ID ----->	018S000315		018S000408		018S000415		018S000512		018S000515	
	LAB SAMPLE ID --->	S880378*6		S880378*7		S880378*8		S880378*10		S880378*9	
	ID FROM REPORT -->	018S000315		018S000408		018S000415		018S000512		018S000515	
	SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98		01/21/98	
	DATE EXTRACTED -->	02/11/98		02/11/98		02/11/98		02/11/98		02/11/98	
	DATE ANALYZED --->	02/12/98		02/12/98		02/12/98		02/12/98		02/12/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	13.	UJ	65.	J	13.	UJ	250.	J	84.	J

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

TPH-DRO													
	SAMPLE ID ------->	018-S-0001-08		018-C-0001-08		018-S-0001-15		018-S-0002-08		018-S-0002-15		018-S-0003-08	
	ORIGINAL ID ----->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	LAB SAMPLE ID --->	S880378*1		S880378A*1		S880378*2		S880378*3		S880378*4		S880378*5	
	ID FROM REPORT -->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98		01/21/98		01/21/98	
	DATE EXTRACTED -->	01/29/98		01/29/98		01/29/98		01/29/98		01/29/98		01/29/98	
	DATE ANALYZED --->	02/02/98		02/04/98		02/02/98		02/02/98		02/02/98		02/02/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM9G07	VAL	EM9G08	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL
9999900-02-6	TPH - Diesel Range Organics	5.2	U	5.1	U	1.2	J	5.1	U	21.		5.	U

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

TPH-DRO											
	SAMPLE ID ------->	018-S-0003-15		018-S-0004-08		018-S-0004-15		018-S-0005-12		018-S-0005-15	
	ORIGINAL ID ----->	018S000315		018S000408		018S000415		018S000512		018S000515	
	LAB SAMPLE ID --->	S880378*6		S880378*7		S880378*8		S880378*10		S880378*9	
	ID FROM REPORT -->	018S000315		018S000408		018S000415		018S000512		018S000515	
	SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98		01/21/98	
	DATE EXTRACTED -->	01/29/98		01/29/98		01/29/98		01/29/98		01/29/98	
	DATE ANALYZED --->	02/02/98		02/04/98		02/04/98		02/04/98		02/04/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL
9999900-02-6	TPH - Diesel Range Organics	5.1	UJ	11.		5.1	U	8.8		26.	J

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

TPH-GRO													
	SAMPLE ID ------->	018-S-0001-08		018-C-0001-08		018-S-0001-15		018-S-0002-08		018-S-0002-15		018-S-0003-08	
	ORIGINAL ID ----->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	LAB SAMPLE ID --->	S880378*1		S880378A*1		S880378*2		S880378*3		S880378*4		S880378*5	
	ID FROM REPORT -->	018S000108		018C000108		018S000115		018S000208		018S000215		018S000308	
	SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98		01/21/98		01/21/98	
	DATE ANALYZED --->	02/03/98		02/04/98		02/02/98		02/02/98		02/04/98		02/02/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM9G07	VAL	EM9G08	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL
9999900-02-5	TPH - Gasoline Range Organics	0.23	U	0.23	U	0.22	U	0.23	U	0.24		0.22	U

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Soil Samples

TPH-GRO													
		SAMPLE ID ------->	018-S-0003-15		018-S-0004-08		018-S-0004-15		018-S-0005-15				
		ORIGINAL ID ----->	018S000315		018S000408		018S000415		018S000515				
		LAB SAMPLE ID --->	S880378*6		S880378*7		S880378*8		S880378*9				
		ID FROM REPORT -->	018S000315		018S000408		018S000415		018S000515				
		SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98				
		DATE ANALYZED --->	02/04/98		02/03/98		02/03/98		02/04/98				
		MATRIX ---------->	Soil		Soil		Soil		Soil				
		UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG				
CAS #	Parameter		EM9G07	VAL	EM9G07	VAL	EM9G07	VAL	EM9G07	VAL			
9999900-02-5	TPH - Gasoline Range Organics		0.23	U	0.23	U	0.23	U	0.22	U			

*** Validation Complete ***

GROUNDWATER ANALYTICAL DATA

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Groundwater Samples

SW846-VOA

SAMPLE ID ------->	018-G-0003-53		018-G-0006-60		018-H-0006-60		018-G-0007-60		018-G-0008-60		018-H-0008-60	
ORIGINAL ID ----->	018G000353		018G000660		018H000660		018G000760		018G000860		018H000860	
LAB SAMPLE ID --->	S8803788*3		S8803788*1		S880378C*1		S8803788*4		S882284*2		S882284*3	
ID FROM REPORT -->	018G000353		018G000660		018H000660		018G000760		018G000860		018H000860	
SAMPLE DATE ----->	01/21/98		01/21/98		01/21/98		01/21/98		04/22/98		04/22/98	
DATE ANALYZED --->	01/31/98		01/31/98		02/02/98		01/31/98		04/24/98		04/24/98	
MATRIX ---------->	Water		Water		Water		Water		Water		Water	
UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS # Parameter	EM9G09	VAL	EM9G09	VAL	EM9G10	VAL	EM9G09	VAL	MEM47	VAL	MEM47	VAL
74-87-3 Chloromethane	10.	UJ	10.	UJ	10.	U	10.	UJ	10.	U	10.	UJ
74-83-9 Bromomethane	10.	UJ	10.	UJ	10.	U	10.	UJ	10.	UJ	10.	UJ
75-01-4 Vinyl chloride	10.	U	10.	U	10.	U	10.	U	10.	U	10.	UJ
75-00-3 Chloroethane	10.	U	10.	U	10.	U	10.	U	10.	U	10.	UJ
75-35-4 1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
75-09-2 Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
75-34-3 1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
67-66-3 Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
71-55-6 1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
56-23-5 Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
71-43-2 Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
107-06-2 1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
79-01-6 Trichloroethene	53.		5.	U	5.	U	350.		5.8		4.8	J
78-87-5 1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
75-27-4 Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
108-88-3 Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
79-00-5 1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
127-18-4 Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
124-48-1 Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
108-90-7 Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
100-41-4 Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
100-42-5 Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
75-25-2 Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
79-34-5 1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
67-64-1 Acetone	50.	U	50.	U	50.	U	50.	U	50.	U	50.	UJ
75-15-0 Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
78-93-3 2-Butanone (MEK)	25.	U	25.	U	25.	U	25.	U	25.	U	25.	UJ
108-10-1 4-Methyl-2-Pentanone (MIBK)	25.	U	25.	U	25.	U	25.	U	25.	U	25.	UJ
10061-01-5 cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
10061-02-6 trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	UJ
591-78-6 2-Hexanone	25.	U	25.	U	25.	U	25.	U	25.	U	25.	UJ
1330-20-7 Xylene (Total)	9.5		11.		8.		5.	U	5.	U	5.	UJ
540-59-0 1,2-Dichloroethene (total)	3.3	J	5.	U	5.	U	19.		5.	U	5.	UJ

*** Validation Complete ***

NSA MEMPHIS
SWMU 18 UWT GEOPROBE INVESTIGATION
Groundwater Samples

SW846-VOA											
		SAMPLE ID ------->	018-G-0009-60		018-G-0010-56		018-G-0011-56				
		ORIGINAL ID ----->	018G000960		018G001056		018G001156				
		LAB SAMPLE ID --->	S882284*4		S882284*5		S882284*6				
		ID FROM REPORT -->	018G000960		018G001056		018G001156				
		SAMPLE DATE ----->	04/22/98		04/22/98		04/22/98				
		DATE ANALYZED --->	04/25/98		04/25/98		04/25/98				
		MATRIX ---------->	Water		Water		Water				
		UNITS ---------->	UG/L		UG/L		UG/L				
CAS #	Parameter		MEM47	VAL	MEM47	VAL	MEM47	VAL			
74-87-3	Chloromethane		10.	U	10.	U	10.	U			
74-83-9	Bromomethane		10.	UJ	10.	UJ	10.	UJ			
75-01-4	Vinyl chloride		10.	U	10.	U	10.	U			
75-00-3	Chloroethane		10.	U	10.	U	10.	U			
75-35-4	1,1-Dichloroethene		5.	U	5.	U	5.	U			
75-09-2	Methylene chloride		5.	U	5.	U	5.	U			
75-34-3	1,1-Dichloroethane		5.	U	5.	U	5.	U			
67-66-3	Chloroform		5.	U	5.	U	5.	U			
71-55-6	1,1,1-Trichloroethane		5.	U	5.	U	5.	U			
56-23-5	Carbon tetrachloride		5.	U	5.	U	5.	U			
71-43-2	Benzene		5.	U	5.	U	5.	U			
107-06-2	1,2-Dichloroethane		5.	U	5.	U	5.	U			
79-01-6	Trichloroethene		0.72	J	44.		5.	U			
78-87-5	1,2-Dichloropropane		5.	U	5.	U	5.	U			
75-27-4	Bromodichloromethane		5.	U	5.	U	5.	U			
108-88-3	Toluene		5.	U	5.	U	5.	U			
79-00-5	1,1,2-Trichloroethane		5.	U	5.	U	5.	U			
127-18-4	Tetrachloroethene		27.		5.	U	71.				
124-48-1	Dibromochloromethane		5.	U	5.	U	5.	U			
108-90-7	Chlorobenzene		5.	U	5.	U	5.	U			
100-41-4	Ethylbenzene		5.	U	5.	U	5.	U			
100-42-5	Styrene		5.	U	5.	U	5.	U			
75-25-2	Bromoform		5.	U	5.	U	5.	U			
79-34-5	1,1,2,2-Tetrachloroethane		5.	U	5.	U	5.	U			
67-64-1	Acetone		50.	U	36.	J	50.	U			
75-15-0	Carbon disulfide		5.	U	5.	U	5.	U			
78-93-3	2-Butanone (MEK)		25.	U	25.	U	25.	U			
108-10-1	4-Methyl-2-Pentanone (MIBK)		25.	U	25.	U	25.	U			
10061-01-5	cis-1,3-Dichloropropene		5.	U	5.	U	5.	U			
10061-02-6	trans-1,3-Dichloropropene		5.	U	5.	U	5.	U			
591-78-6	2-Hexanone		25.	U	25.	U	25.	U			
1330-20-7	Xylene (Total)		5.	U	5.	U	5.	U			
540-59-0	1,2-Dichloroethene (total)		5.	U	5.	U	5.	U			

*** Validation Complete ***

APPENDIX B

DATA VALIDATION REPORT

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1.0 INTRODUCTION

This report presents the analytical data collected during a Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) at Naval Support Activity (NSA) Mid-South (formerly NSA Memphis) and their quality assurance/quality control (QA/QC) evaluation of those data. The data were evaluated to verify that the QC requirements of the data set have been met and to characterize the weakness of any questionable data.

Soil and groundwater samples were collected in January and April 1998 during a geoprobe investigation of Solid Waste Management Unit (SWMU) 18, the Building N-112 Underground Waste Tank. All investigative samples were submitted to Savannah Laboratory and Environmental Services Inc. in Savannah, Georgia, and reported using U.S. Environmental Protection Agency (USEPA) data deliverable levels III and IV. Level III data consist of case narratives, sample results, analytical sequences, preparation logs, gas chromatography/mass spectrometry (GC/MS) tuning data, calibration information [including percent relative standard deviation (%RSD) or percent difference (%D) from calibration], method blanks, matrix spikes/matrix spike duplicates (MS/MSDs), GC/MS internal standard areas and retention times, laboratory control samples, and laboratory duplicate relative percent differences (RPDs). Level IV data consist of all level III QC information, plus all raw data, bench sheets, and instrument printouts. The analytical methods and laboratory deliverables for this phase of the RFI are summarized in Table 1-1.

Table 1-1
NSA Mid-South Analytical Program

Analytical Method	Data Deliverable Level Equivalents	USEPA Method Reference
Volatile Organic Compounds	IV	SW-846 8240
Total Petroleum Hydrocarbons	III	USEPA 418.1
Gasoline Range Organics	IV	Modified 8015/TN GRO

Table 1-1
NSA Mid-South Analytical Program

Analytical Method	Data Deliverable Level Equivalents	USEPA Method Reference
Diesel Range Organics	IV	Modified 8015/TN DRO

Note:
TN GRO/DRO = Tennessee Method for Gasoline Range Organics and Diesel Range Organics

The references for the methods listed in Table 1-1 were obtained from the following sources:

- USEPA Office of Solid Waste and Emergency Response (OSWER), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846), Third Edition, revised July 1992.

- USEPA Environmental Monitoring and Support Laboratory, *Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-79-020, revised March 1983.

- Data Quality Objectives for data deliverables as cited in: *USEPA Data Quality Objectives for Remedial Response Activities,* EPA-540/G-87/003, March 1987.

Data were validated using the following documents (as appropriate):

- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, OSWER, February 1994 (EPA-540/R-94/012). (Organic Functional Guidelines).

- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, OSWER, February 1994 (EPA-540/R-94/013). (Inorganic Functional Guidelines).

The NSA Mid-South data were validated by either EnSafe personnel or EnSafe's subcontractor, Heartland Environmental Services Inc. (Heartland) of St. Charles, Missouri. Of the samples submitted to Savannah, 95% of the data was validated at level III while 5% was validated at level IV. The data validation findings were summarized separately for each individual sample delivery group (SDG). Each SDG usually contained 20 investigative samples of one matrix type, i.e., either solid (soil and/or sediment) or water (groundwater and/or surface water) samples; except for QC samples, which were not counted as investigative samples. All validation summary reports are included in Attachment A to this appendix. All data summary tables are included in Appendix A of this document.

Samples collected at NSA Mid-South were evaluated for volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), diesel range organics (DRO), and gasoline range organics (GRO).

1.1 Organic Evaluation Criteria

The USEPA methods listed in Table 1-1 define QC criteria that the laboratory must meet, although they do not address data evaluation from a user's perspective. Evaluation criteria available in the Organic Functional Guidelines (February 1994) were used throughout the data evaluation process when the analytical methods did not address data usability.

Data evaluation for samples collected at NSA Memphis included the following parameters:

- Holding times

- GC/MS instrument performance checks
- Surrogate spike recoveries
- Instrument calibration
- Matrix spike and matrix spike duplicates
- Laboratory control and duplicate samples
- Blank analysis
- Internal standard performance
- Field duplicate precision

According to the Organic Functional Guidelines, when the QC parameters do not fall within the specific method guidelines, the data evaluator annotates or "flags" the corresponding deficient compounds. The data from SWMU 18 were evaluated using this approach. The following flags were used to annotate data with laboratory and/or field deficiencies or problems:

Validation Qualifiers

U **Undetected** — The analyte was found in a sample, but at a concentration less than 10 times the blank concentration for common organic constituents (methylene chloride, acetone, and 2-butanone), or five times the blank concentration for other constituents; the associated value shown is the quantitation limit after evaluation of the blank.

J **Estimated Value** — At least one QC parameter was outside control limits.

UJ **Undetected and Estimated** — The target analyte was analyzed for, but not detected above the listed estimated quantitation limit; the quantitation limit is estimated because one or more QC parameters were outside control limits.

D **Diluted Result** — The result was obtained from a diluted sample.

R/UR **Unusable Data** — At least one QC parameter grossly exceeded control limits.

These flags were applied to data where deficiencies were noted during validation. Because the laboratory uses some of the same qualifiers during analyses, laboratory qualifiers "U" and "J" remained on the data, unless superseded by a validation qualifier (e.g., "UJ," "UR"). Laboratory qualifiers that remained on the data after validation are described below:

Laboratory Qualifiers

U **Undetected** — The target analyte was not detected above the Practical Quantitation Limit (PQL).

J **Estimated Value Below PQL** — The analyte was detected below the PQL and is estimated.

Appendix A includes tables of all qualified data.

1.2 Holding Times

Acceptable technical holding times are specified in the analytical methods. The sample holding time depends on the type of analysis and whether the sample was preserved. The holding time for preserved volatile organic compound (VOC) and gasoline range organic (GRO) analysis is 14 days from the collection date. DRO samples must be extracted within 14 days and analyzed within 40 days of extraction. TPH (by USEPA Method 418.1) samples have a holding time of 28 days from the collection date.

1.3 GC/MS Mass Calibration (Instrument Performance Checks)

Tuning and performance criteria are established to ensure that the data produced by the instrument can be correctly interpreted according to method requirements. These criteria are not sample-specific; conformance is determined using standard materials, and therefore must be met in all circumstances. The performance standard for VOC [bromofluorobenzene (BFB)] is analyzed to determine if the data produced by the instrument can be correctly interpreted according to the method requirements. The performance standard must be analyzed within 12 hours of sample analysis, and the results must be within the established criteria.

1.4 Surrogate Spike Recoveries

Surrogate compounds are added to samples and laboratory blanks prior to extraction and sample preparation to evaluate the effect of the sample matrix on extraction and measurement procedures. Surrogates are organic compounds chemically similar to analytes of interest, but those not normally found in environmental samples. Three surrogate compounds are added to samples for VOC analysis, and one is added to both GRO and DRO analyses. Percent recovery (%R) of the surrogates is calculated by comparing the amount of the compound recovered by the analysis to the amount added to the sample.

The following surrogate compounds are recommended by the SW-846 methods:

VOC Surrogates	GRO Surrogate	DRO Surrogate
Toluene-d8	f3-Toluene	o-Terphenyl
Bromofluorobenzene		
1,2-Dichloroethane-d4		

1.5 Instrument Calibration

Instruments are initially and continually calibrated with standard solutions to verify that they are capable of producing acceptable quantitative data for the compounds.

Initial calibration (GC/MS): The instrument is initially calibrated at the beginning of the analytical run to check its performance and to establish a linear five-point calibration curve. The initial calibration is verified by calculating the relative response factor (RRF) and the %RSD for each compound. An RRF less than 0.05 or a %RSD greater than 30% is outside the QC limits for the initial calibration.

Continuing calibration (GC/MS): Standard solutions are run periodically to check the instrument's daily performance and to establish the 12-hour RRF on which the sample quantitations are based. The continuing calibration is verified by calculating the RRF and the %D for each compound. An RRF less than 0.05 or a %D or %drift greater than 25% is outside the QC limits for the continuing calibration.

Initial calibration (GC): A five-point initial calibration is analyzed for GRO, DRO, and TPH. Two calibration methods may be used: response factor or linear regression methods. For the response factor method, the initial calibration may be verified by calculating the RRF and the %RSD for each compound. An RRF less than 0.05 or a %RSD greater than 20% is outside the QC limits for the initial calibration. If linear regression is used, the correlation coefficient must meet or exceed 0.995 before the samples can be analyzed.

Continuing calibration (GC): For GRO and DRO, the continuing calibration is verified by calculating the RRF and the %D or %drift for each compound. An RRF less than 0.05 or a %D greater than 15% is outside the QC limits for the continuing calibration.

1.6 Matrix Spikes/Matrix Spike Duplicates

The MS, which is used to determine the accuracy of the analysis for a given matrix, consists of adding a known quantity of stock solution to the sample before its preparation and analysis.

Evaluating the MS data involves two calculations. First, the %R is calculated by comparing the amount of the compound recovered by the analysis to the amount added to the sample. In addition, the RPD between the MS and the MSD samples is calculated and assessed. No specific requirements have been established for qualifying MS/MSD data. However, guidelines to aid in applying professional judgment are discussed in Organic Functional Guidelines.

1.7 Laboratory Control and Duplicate Samples

TPH and GC methods may require that a laboratory control sample (LCS) and laboratory duplicate be analyzed with each SDG. The LCS monitors the overall performance of each step during analysis, including sample preparation. All aqueous LCS %R results must fall within the control limits established by the laboratory. Laboratory duplicate samples are used to demonstrate acceptable method precision at the time of analysis. The RPD between the sample and the duplicate sample is calculated. Although no guidelines are established for organic laboratory duplicates, sample qualification is left to professional judgment.

1.8 Blank Analysis

Laboratory Method Blanks

Method blanks are used to assess the presence and magnitude of potential contamination introduced during analysis. Additionally, *field blanks* may be collected to assess any contamination introduced during sample collection, as well as ambient field conditions. When chemicals are present in both samples and laboratory blanks analyzed within the same 12-hour period, **and/or** field-derived blanks, the usability of the data depends on the reviewer's judgment and the blank's origin. According to Organic Functional Guidelines, a sample result should not be considered positive unless the concentration of the compound in the sample exceeds 10 times the amount in **any** blank for common laboratory contaminants (i.e., methylene chloride, acetone, 2-butanone, and common phthalate esters), or five times the amount for other constituents. These

amounts are referred to as *action levels* (ALs). Sample weight, volume, and dilution should be considered when calculating ALs because blank samples may not be prepared using the same weight, dilution, or volume of sample. The specific actions to be taken are as follows:

- If a chemical is found in the blank but not the sample, no action is taken.

- If the sample concentration is greater than the AL, the concentration may be used unqualified.

- If the sample concentration is less than the quantitation limit and less than the AL, then the sample is reported as nondetect at the quantitation limit.

  Example (using 10X rule):

Water Sample		**Diluted Water Sample**	
Blank result	1	Blank result	1
Blank AL	10	Dilution Factor	5
PQL	5	Blank AL	50
Sample result	4J	Diluted PQL	25
Final result	5U	Sample result	4J
		Final result	25U

  In this example, data are not reported as 4U because they are less than the PQL. The dilution factor is used to calculate an AL of 50 (1 x 5 x 10).

- If the sample concentration is greater than the quantitation limit, but less than the AL, then the concentration is reported as nondetect "U."

Example (using 10X rule):

Water Sample		**Soil Sample**		**Diluted Soil Sample**	
Blank result	6	Blank result	6	Blank result	6
Blank AL	60	% Solids	80	% Solids	80
PQL	5	Blank AL	75	Dilution Factor	5
Sample result	50	PQL	5	Blank AL	375
Final result	50U	Sample result	50	PQL	25
		Final result	50U	Sample result	250
				Final result	250U

In this example, water sample results less than 60 (or 10 x 6) would be qualified as nondetect. Soil results of less than 75 would be qualified as nondetect because percent solids are used to calculate the AL: [(6 ÷ 0.8) x 10]. In the diluted soil sample, results less than 375 would be qualified as nondetect because dilution factors and percent solids are used to calculate the AL: [(6 ÷ 0.8) x 10 x 5].

Field-Derived Blanks

For this project, three types of field-derived blanks were collected: the *field blank*, the *equipment rinsate blank* (also called a *rinsate blank*), and the *trip blank*. The field blank is a sample of the source water used onsite, primarily to decontaminate equipment. The equipment rinsate blank is a sample of runoff water from one or more pieces of the decontaminated equipment used to collect samples. The trip blank is a 40-milliliter volatile organic analysis vial filled at the laboratory with certifiable water to assess cross-contamination during VOC sample container shipment and handling, both before and after the sample collection.

The frequencies for collecting these QC samples were defined in Section 4 of the NSA Memphis *Comprehensive RFI Work Plan* (EnSafe/Allen & Hoshall, October 1994) as follows:

- *Field blanks* — one per source of water per sampling event
- *Rinsate blank* — one per week
- *Trip blank* — one per shipment containing VOC samples

For data validation, each trip blank is associated only with the samples from the same shipment/cooler. The field blanks and rinsate blanks apply to a larger number of samples because only one is collected per source of water per sampling event. Because field-derived blanks are used with method blanks to assess potential cross-contamination of field investigative samples, no action is taken if contamination is detected in the method blanks associated with the field-derived blanks.

1.9 Internal Standard Performance

GC/MS internal standards are added to samples to ensure the stability of the instrument's sensitivity and response during each analytical VOC run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (-50% to +100%) from the associated calibration standard. If an internal standard area count is outside this window, action should be taken. 1,4-Dichlorobenzene-d4, 1,2-dichloroethane-d4, 1,4-difluorobenzene, and chlorobenzene-d5 are the internal standard (IS) compounds used by the analytical laboratory.

1.10 Field Duplicate Precision

One field duplicate was collected at NSA Mid-South for each 10 water and/or soil or sediment samples collected. Field duplicate samples are analyzed to evaluate data precision, which measures the reproducibility of the analysis.

For the NSA Mid-South RFI, RPDs between the samples and duplicates were calculated during the validation processes for sample results exceeding the PQL. If the results for any compounds did not meet RPD criteria of less than 30% for water and less than 50% for soil or sediment, the

positive results for that compound were flagged as estimated for the sample and duplicate only. If one value was nondetected and the other value exceeded the PQL, the positive result was flagged as estimated "J," and the nondetected result as estimated "UJ."

2.0 DATA VALIDATION RESULTS — SWMU 18

All samples were received by the laboratory intact and with the proper documentation. Table 2-1 summarizes the samples that were included in SWMU 18.

Table 2-1
SWMU 18 Sample IDs

Sample ID	SDG	8260 VOCs	418.1 TPH	TPH-DRO	TPH-GRO
018S000108	EM9G07	X	X	X	X
018C000108	EM9G08	X	X	X	X
018S000115	EM9G07	X	X	X	X
018S000208	EM9G07	X	X	X	X
018S000215	EM9G07	X	X	X	X
018S000308	EM9G07	X	X	X	X
018S000315	EM9G07	X	X	X	X
018G000353	EM9G09	X			
018S000408	EM9G07	X	X	X	X
018S000415	EM9G07	X	X	X	X
018S000512	EM9G07		X	X	
018S000515	EM9G07	X	X	X	X
018G000660	EM9G09	X			
018H000660	EM9G10	X			
018G000760	EM9G09	X			
018G000860	MEM47	X			
018H000860	MEM47	X			
018G000960	MEM47	X			
018G001056	MEM47	X			
018G001156	MEM47	X			

Twenty investigative samples were analyzed in five SDGs for SWMU 18. Full validation reports of this SDG can be found in Attachment A, while data tables can be found in Appendix A of this document.

2.1 Data Quality

The overall data quality of the analytical work performed for SWMU 18 was considered satisfactory and usable for site remediation and risk assessment. Results outside QA/QC requirements were flagged as estimated "J." This qualification indicates that the data could be biased either high or low. Although the data are qualified as estimated, they remain acceptable for use in risk assessment and site remediation.

2.2 Blanks

The blanks were examined during validation. No detections were made in any blanks associated with SWMU 18.

Attachment A

Data Validation Summary Narratives

SWMU 18

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	EM9G07
Date:	March 12, 1998
Client Name:	EnSafe
Project/Site Name:	NSA Memphis
Date Sampled:	January 21, 1998
Number of Samples:	10 Non-aqueous Sample(s) with 0 MS/MSD(s)
Laboratory:	Savannah Laboratories
Validation Guidance:	National Functional Guidelines for Organic and Inorganic Data, February, 1994
QA/QC Level:	EPA DQO Level III
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Volatiles, Gasoline Range Organics, Diesel Range Organics, Total Petroleum Hydrocarbons

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

Craig G. Swanson
Paul B. Humburg, President

3/13/98.
Date

4127 Plaza 94 South • St. Charles, MO 63304
(314) 936-1332 • Fax (314) 936-1335

SDG# EM9G07

Samples and Fractions Reviewed

Sample Identifications — Analytical Fractions

ENSAFE ID	MATRIX	VOA		GRO		DRO		TPH	
018S000108	SOIL		X		X		X		X
018S000115	SOIL		X		X		X		X
018S000208	SOIL		X		X		X		X
018S000215	SOIL		X		X		X		X
018S000308	SOIL		X		X		X		X
018S000315	SOIL		X		X		X		X
018S000408	SOIL		X		X		X		X
018S000415	SOIL		X		X		X		X
018S000515	SOIL		X		X		X		X
018S000512	SOIL						X		X
Total Billable Samples	(Water/Soil)	0	9	0	9	0	10	0	10

VOA = SW846 Volatiles
GRO = SW846 Gasoline Range Organics
DRO = SW846 Diesel Range Organics
TPH = SW846 Petroleum Hydrocarbons 418.1

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846 8260; the National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results.

SDG # EM9G07

A validation was performed on the Volatile Data from SDG EM9G07. The data was evaluated based on the following parameters.

* Data Completeness
* Holding Times
* GC/MS Tuning
  Calibrations
* Internal Standard Performance
* Blanks
* Surrogate Recoveries
* Laboratory Control Samples
* Field Duplicates
* Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing Calibration

The continuing calibration, MQ377, contained compounds with %Ds greater than 25% and less than 50%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J).

018S000415	carbon disulfide (29.6)
018S000208 018S000215	2-butanone (31.6)

The continuing calibration, MQ380, contained compounds with %Ds greater than 50% and less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and non detects as estimated (UJ).

018S000115 018S000308	chloroethane (55.1)

System Performance and Overall Assessment

The data as presented requires qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL =	The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.
U =	The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.
No Action =	The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL
018S000415	carbon disulfide	+	J
018S000208 018S000215	2-butanone	+	J
018S000115 018S000308	chloroethane	+/-	J/UJ

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

TPH - PURGEABLE (GRO)

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, calibration results, surrogate and matrix spike recoveries, and GC performance. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the Tennessee TPH Method; the National Functional Guidelines for Organic Data Review, where applicable; and EPA DQO Level III requirements. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG# EM9G07

A validation was performed on the TPH (GRO) data from SDG EM9G07. The data was evaluated based on the following parameters.

*	•	Data Completeness
*	•	Holding Times
*	•	GC/MS Tuning
*	•	Calibrations
*	•	Internal Standard Performance
*	•	Blanks
*	•	Surrogate Recoveries
*	•	Matrix Spike/Matrix Spike Duplicate
*	•	Field Duplicates
*	•	Identification/Quantitation

* - All criteria were met for this parameter.

Overall Performance

The data did not require qualification.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL

NO QUALIFICATIONS WERE REQUIRED

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

TPH - EXTRACTABLES (DRO)

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, calibration results, surrogate and matrix spike recoveries, and GC performance. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the Tennessee TPH Method; the National Functional Guidelines for Organic Data Review, where applicable; and EPA DQO Level III requirements. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG# EM9G07

A validation was performed on the TPH (DRO) data from SDG EM9G07. The data was evaluated based on the following parameters.

*	•	Data Completeness
*	•	Holding Times
*	•	GC/MS Tuning
*	•	Calibrations
*	•	Internal Standard Performance
*	•	Blanks
	•	Surrogate Recoveries
*	•	Matrix Spike/Matrix Spike Duplicate
*	•	Field Duplicates
*	•	Identification/Quantitation

* - All criteria were met for this parameter.

Surrogate Recoveries

The following samples exhibited low surrogate recoveries for the DRO compound. Qualify all positive results as estimated, J, and all non-detect results as estimated, UJ.

018S000315	44%
018S000515	32%

Overall Performance

The data required qualification.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL
018S000315	DRO	+/-	J/UJ
018S000515			

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE
TPH

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW 846 Methods; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # EM9G07

A validation was performed on the TPH Data from SDG EM9G07. The data was evaluated based on the following parameters.

*	•	Data Completeness
*	•	Holding Times
*	•	Calibrations
*	•	Blanks
	•	Matrix Spike Recovery
*	•	Matrix Duplicates
*	•	Field Duplicates
*	•	Laboratory Control Samples

* - All criteria were met for this parameter.

Matrix Spike recovery results

The Matrix Spike recovery for soils for TPH (45%) was below the lower control limits (>30% but <75%). All positive and non-detect results are qualified as estimated, "J" or "UJ".

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
all soil samples	TPH.	+/U	J/UJ

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	EM9G08
Date:	March 12, 1998
Client Name:	EnSafe
Project/Site Name:	NSA Memphis
Date Sampled:	January 21, 1998
Number of Samples:	1 Non-aqueous Sample(s) with 0 MS/MSD(s)
Laboratory:	Savannah Laboratories
Validation Guidance:	National Functional Guidelines for Organic and Inorganic Data, February, 1994
QA/QC Level:	EPA DQO Level IV
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Volatiles, Gasoline Range Organics, Diesel Range Organics, Total Petroleum Hydrocarbons

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

Craig G. Scarpos
for Paul B. Humburg, President

3/13/98.
Date

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SDG# EM9G08

Samples and Fractions Reviewed

Sample Identifications | Analytical Fractions

ENSAFE ID	MATRIX	VOA		GRO		DRO		TPH	
018C000108	SOIL		X		X		X		X
Total Billable Samples	(Water/Soil)	0	1	0	1	0	1	0	1

VOA = SW846 Volatiles
GRO = SW846 Gasoline Range Organics
DRO = SW846 Diesel Range Organics
TPH = SW846 Petroleum Hydrocarbons 418.1

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846 8260; the National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results.

SDG # EM9G08

A validation was performed on the Volatile Data from SDG EM9G08. The data was evaluated based on the following parameters.

* Data Completeness
* Holding Times
* GC/MS Tuning
* Calibrations
* Internal Standard Performance
* Blanks
* Surrogate Recoveries
* Laboratory Control Samples
* Field Duplicates
* Compound Identification /Quantitation

* - All criteria were met for this parameter

System Performance and Overall Assessment

The data as presented requires no qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL

No qualifications required.

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

TPH - PURGEABLE (GRO)

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, calibration results, surrogate and matrix spike recoveries, and GC performance. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the Tennessee TPH Method; the National Functional Guidelines for Organic Data Review, where applicable; and EPA DQO Level IV requirements. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG# EM9G08

A validation was performed on the TPH (GRO) data from SDG EM9G08. The data was evaluated based on the following parameters.

*	•	Data Completeness
*	•	Holding Times
*	•	GC/MS Tuning
*	•	Calibrations
*	•	Internal Standard Performance
*	•	Blanks
*	•	Surrogate Recoveries
*	•	Matrix Spike/Matrix Spike Duplicate
*	•	Field Duplicates
*	•	Identification/Quantitation

* - All criteria were met for this parameter.

Overall Performance

The data did not require qualification.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL

NO QUALIFICATIONS WERE REQUIRED

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

TPH - EXTRACTABLES (DRO)

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, calibration results, surrogate and matrix spike recoveries, and GC performance. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the Tennessee TPH Method; the National Functional Guidelines for Organic Data Review, where applicable; and EPA DQO Level IV requirements. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG# EM9G08

A validation was performed on the TPH (DRO) data from SDG EM9G08. The data was evaluated based on the following parameters.

*	•	Data Completeness
*	•	Holding Times
*	•	GC/MS Tuning
*	•	Calibrations
*	•	Internal Standard Performance
*	•	Blanks
*	•	Surrogate Recoveries
*	•	Matrix Spike/Matrix Spike Duplicate
*	•	Field Duplicates
*	•	Identification/Quantitation

* - All criteria were met for this parameter.

Overall Performance

The data did not require qualification.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL

NO QUALIFICATIONS WERE REQUIRED

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE
TPH

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW 846 Methods; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # EM9G08

A validation was performed on the TPH Data from SDG EM9G08. The data was evaluated based on the following parameters.

*	•	Data Completeness
*	•	Holding Times
*	•	Calibrations
*	•	Blanks
*	•	Matrix Spike Recovery
*	•	Matrix Duplicates
*	•	Field Duplicates
*	•	Laboratory Control Samples

* - All criteria were met for this parameter.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL

Data stands as reported without qualification.

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	EM9G09
Date:	March 12, 1998
Client Name:	EnSafe
Project/Site Name:	NSA Memphis
Date Sampled:	January 21, 1998
Number of Samples:	4 Aqueous Sample(s) with 0 MS/MSD(s)
Laboratory:	Savannah Laboratories
Validation Guidance:	National Functional Guidelines for Organic and Inorganic Data, February, 1994
QA/QC Level:	EPA DQO Level III
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Volatiles

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

Craig G. Searson
for Paul B. Humburg, President

3/13/98
Date

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SDG# EM9G09

Samples and Fractions Reviewed

Sample Identifications Analytical Fractions

ENSAFE ID	MATRIX	VOA	
000T012198	WATER	X	
018G000353	WATER	X	
018G000660	WATER	X	
018G000760	WATER	X	
Total Billable Samples (Water/Soil)		4	0

VOA= SW846 Volatiles

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846 8260; the National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results.

SDG # EM9G09

A validation was performed on the Volatile Data from SDG EM9G09. The data was evaluated based on the following parameters.

* Data Completeness
* Holding Times
* GC/MS Tuning
  Calibrations
* Internal Standard Performance
* Blanks
* Surrogate Recoveries
* Laboratory Control Samples
* Field Duplicates
* Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing Calibration

The continuing calibration, AQ742, contained compounds with %Ds greater than 50% and less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and non detects as estimated (UJ).

018G000660	chloromethane (77.9)
018G000353	bromomethane (61.1)
018G000760	

System Performance and Overall Assessment

The data as presented requires qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

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UJ = Reported quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL
018G000660	chloromethane	+/-	J/UJ
018G000353	bromomethane		
018G000760			

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	EM9G10
Date:	March 12, 1998
Client Name:	EnSafe
Project/Site Name:	NSA Memphis
Date Sampled:	January 21, 1998
Number of Samples:	1 Aqueous Sample(s) with 0 MS/MSD(s)
Laboratory:	Savannah Laboratories
Validation Guidance:	National Functional Guidelines for Organic and Inorganic Data, February, 1994
QA/QC Level:	EPA DQO Level IV
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Volatiles

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

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3/13/98.
Date

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SDG# EM9G10

Samples and Fractions Reviewed

Sample Identifications Analytical Fractions

ENSAFE ID	MATRIX	VOA	
018H000660	WATER	X	
Total Billable Samples (Water/Soil)		1	0

VOA= SW846 Volatiles

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846 8260; the National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results.

SDG # EM9G10

A validation was performed on the Volatile Data from SDG EM9G10. The data was evaluated based on the following parameters.

* Data Completeness
* Holding Times
* GC/MS Tuning
* Calibrations
* Internal Standard Performance
* Blanks
* Surrogate Recoveries
* Laboratory Control Samples
* Field Duplicates
* Compound Identification /Quantitation

* - All criteria were met for this parameter

System Performance and Overall Assessment

The data as presented requires no qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

UR = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that compound is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the compound value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	COMPOUND ID	DL	QL

No qualifications required.

* DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

ENSAFE VALIDATION SUMMARY REPORT

Site Name:	NSA Memphis, Millington, Tennessee
CTO and Subtask No.:	0094-001-04-730-00
Laboratory:	Savannah Laboratory and Environmental Services, Savannah, Georgia
Sample Delivery Group:	MEM47
Matrix:	Water
DQO Level:	III

Table 1
SDG MEM47 Sample IDs and Analyses

Sample ID	8260-Volatile Organic Compounds
0.18G000860	X
018H000860	X
018G000960	X
018G001056	X
018G001156	X

VALIDATION RESULTS

All samples were received by the laboratory intact and with the proper documentation on April 23, 1998. The following section summarizes the data validation results. Tentatively identified compounds (TICs) have not been discussed in great detail because most compounds are quantitatively uncertain (many TICs are unidentifiable and are reported as unknowns).

Volatile Organic Compound Fraction

1. All holding times, GC/MS instrument performance check standard, continuing calibration, internal standard, blank spike/blank spike duplicate, method and trip blank, and field duplicate results were acceptable. No problems were encountered during review of sample result verification.

2. Bromomethane was calibrated by linear regression for this SDG. The correlation coefficient for bromomethane (0.983) was below the control limit of 0.990. The results for bromomethane in the five samples in this SDG were qualified as estimated "UJ" for nondetect results.

6. The percent recovery of the surrogate toluene-d_8 exceeded the lower QC requirements of 88% to 110% in sample 018H000860 (86%). All results in this sample were qualified as estimated "J" for positive results and "UJ" for nondetect results.