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CONFIRMATORY SAMPLING INVESTIGATION REPORT FOR ASSEMBLY D VOLUME 1 OF 2 SECTIONS 1 THROUGH 6 APPENDICES A THROUGH H FOR ASSEMBLY D MILLINGTON SUPPACT TN (DRAFT ACTING AS FINAL)
6/1/1996
ENSAFE ALLEN AND HOSHALL

DRAFT CONFIRMATORY SAMPLING INVESTIGATION REPORT NAVAL SUPPORT ACTIVITY MEMPHIS

ASSEMBLY D

CTO-094
CONTRACT NUMBER: N62467-89-D-0318

Volume I

Sections 1-6
Appendices A-H

Prepared for:

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

Prepared by:

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June 1996

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ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations appear in the accompanying report.

1,2-DCE	1,2-dichloroethene
1,1-DCE	1,1-dichloroethene
1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
AIMD	Aircraft Intermediate Maintenance Department
BaP	benzo(a)pyrene
BCT	BRAC Cleanup Team
bls	below land surface
BRAC	Base Realignment and Closure Act
cm/sec	centimeters per second
CSI	Confirmatory Sampling Investigation
DPT	Direct Push Technology
DQO	Data Quality Objectives
DRO	Diesel range organics
E/A&H	EnSafe/Allen & Hoshall
EM	Electromagnetic
FOSL	Finding of Suitability to Lease
GRO	Gasoline range organics
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
IDW	Investigation-derived waste
ILCR	Incremental Lifetime Cancer Risk
mg/kg	milligrams per kilogram
NET	National Environmental Testing, Inc.
NFA	No Further Action
NSA	Naval Support Activity (formerly Naval Air Station Memphis)
OWSER	Officer of Solid Waste and Emergency Response
PCB	Polychlorinated biphenyls
PCE	perchloroethene
ppb	parts per billion
ppm	parts per million
PRE	Preliminary Risk Evaluation
RBC	Risk-Based Concentration
RC	Reference Concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RIS	Rapid Immunoassay Screening
SSL	Soil Screening Level
SVOC	Semivolatile organic compound

SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TDEC	Tennessee Department of Environment and Conservation
TPH	Total petroleum hydrocarbons
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground storage tank
VOC	Volatile organic compound
VSI	Visual Site Inspection
μg/L	micrograms per liter
μg/kg	micrograms per kilogram

EXECUTIVE SUMMARY

As a result of the Base Closure and Realignment Act of 1990 (BRAC), a portion of Naval Support Activity (NSA) Memphis, which includes Assembly D, will be closed and prepared for transfer to the City of Millington. Assembly D is composed of six solid waste management units (SWMU)s: SWMUs 11; 36; 42 and 53; 44; 50, 51, and 52; and 64. All SWMUs required confirmatory sampling investigations (CSIs) to confirm whether contaminants are present or have been released, and, if so, whether characterization will be required. The CSI, undertaken by EnSafe/Allen & Hoshall and the U.S. Geological Survey, adhered to the requirements of the Hazardous and Solid Waste Amendments portion (HSWA-TN002) of Resource Conservation and Recovery Act (RCRA) Permit No. TN2-170-022-600 and applicable regulations.

As part of the U.S. Navy Comprehensive Long-Term Environmental Action Navy program, the following CSI Report has been prepared for the six SWMUs in Assembly D. The following summary of the conclusions and recommendations presented in this report.

Conclusions:

- **SWMU 11, Oiled Dirt Roads (Northside Only)**
  - Dieldrin exceeded the residential soil risk based concentrations (RBC) in one of six samples collected from the surface interval but did not exceed the industrial soil RBC.
  - The average dieldrin concentration exceeded the transfer from soil to groundwater soil screening level (SSL); however, due to its chemical properties, the physical properties of the soil, the shallow depth, and infrequency of detection at SWMU 11, it is not expected to leach into groundwater or migrate horizontally.
  - Based on a preliminary risk evaluation (PRE) performed on data from surface soil samples, SWMU 11 is suitable for lease for residential purposes.

- **SWMU 36, Northside Sewage Treatment Plant Incinerator**
  - Concentrations of semivolatile organic compounds (SVOCs) benzo(a)pyrene and dibenz(a,h)anthracene and the pesticide dieldrin exceeded residential soil RBCs, but no detected concentrations exceeded industrial soil RBCs.
  - The average dieldrin concentration exceeded the transfer from soil to groundwater SSL; however, due to its chemical properties, the physical properties of the soil, and the depth of detection, it is not expected to leach into groundwater or migrate horizontally.
  - Based on a PRE performed on data from surface soil samples and one groundwater sample, SWMU 36 is suitable for lease for residential purposes.
- **SWMUs 42 and 53, Building N-12, Interim Hazardous Waste Storage Area and Building N-126, Hazardous Waste Accumulation Point for the AIMD**
  - Concentrations of the SVOC benzo(a)pyrene and the pesticide dieldrin exceeded their residential soil RBCs, but not their industrial soil RBCs.
  - The average dieldrin concentration exceeded the transfer from soil to groundwater SSL; however, due to its chemical properties, the physical properties of the soil, and the depth of detection, it is not expected to leach into groundwater or migrate horizontally.
  - Based on a PRE performed on data from surface soil samples, SWMUs 42 and 53 are suitable for lease for residential purposes.
- **SWMU 44, Building N-102, Hazardous Waste Accumulation Point**
  - Concentrations of the SVOC benzo(a)pyrene and the polychlorinated biphenyl (PCB) Aroclor 1260 exceeded residential soil RBCs, but none exceeded industrial RBCs or transfer from soil to groundwater SSLs.

- Total petroleum hydrocarbons (TPH) for gasoline and diesel range organics (GRO + DRO) in one surface soil sample exceeded the state soil cleanup level for total TPH.

- The average chromium concentration exceeded the transfer from soil to groundwater SSL; however, when data from the surface interval and the 2' to 3' deep interval are compared separately, only the average concentration in the surface interval exceeded the SSL. Due to the chemical properties of chromium, the physical properties of the soil, and the shallow depth of SSL exceedance, chromium is not expected to leach into groundwater or migrate horizontally.

- Based on a PRE performed on data from surface soil samples, SWMU 44 is suitable for lease for residential purposes.

- **SWMU 50, 51, and 52, Building N-126, Hazardous Waste Accumulation Point for the MAG-42, VR-60, and VP-67 Squadrons**
  - Concentrations of the SVOC benzo(a)pyrene and the pesticide dieldrin exceeded residential soil RBCs, but no organic concentrations exceeded industrial RBCs.

  - Concentrations of two pesticides (aldrin and dieldrin) exceeded transfer from soil to groundwater SSLs; however, due to chemical properties of pesticides, the physical properties of the soil, and the shallow depth and infrequency of detection, they are not expected to leach into groundwater or migrate horizontally.

  - Based on a PRE performed on data from surface interval samples, SWMUs 50, 51, and 52 are suitable for lease for residential purposes.

- **SWMU 64, Building N-16, Materials Storage Area**
  - Concentrations of SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, the PCB Aroclor 1260, and the pesticide dieldrin exceeded residential soil RBCs in surface samples.

  - Concentrations of the SVOC benzo(a)pyrene and the PCB Aroclor 1260 exceeded industrial soil RBCs in surface samples.

  - Concentrations of the pesticides aldrin and dieldrin, the SVOC carbazole, and the PCB Aroclor 1260 exceeded transfer from soil to groundwater SSLs. Due to chemical properties, the physical properties of the soil, and the depth and infrequency of detection, aldrin, dieldrin, and carbazole are not expected to leach into groundwater or migrate horizontally.

  - Aroclor 1260 has not been detected in groundwater monitoring wells surrounding SWMU 64, with the closest well located 15 feet to the southwest; therefore, Aroclor 1260 is not expected to leach into groundwater or migrate horizontally.

  - Concentrations of arsenic in seven surface soil samples exceeded both residential and industrial soil RBCs for arsenic as a carcinogen; however, the highest arsenic concentration was well below its residential soil RBC as a noncarcinogen and only slightly exceeded the 2× mean background reference concentration.

  - The concentration of lead in one surface soil sample exceeded both residential and industrial soil cleanup levels (USEPA, OSWER Directive, 9355.4-12); however, the mean lead concentration in surface samples did not exceed the residential soil cleanup level.

  - Based on a PRE performed on data from surface interval samples SWMU 64 is suitable for lease for commercial purposes.

Recommendations:

In accordance with PRE methodology and the proposed land use for the SWMUs in Assembly D, no further action is recommended.

1.0 INTRODUCTION

As part of the U.S. Navy Comprehensive Long-term Environmental Action Navy program, the following Confirmatory Sampling Investigation (CSI) report has been prepared for six Solid Waste Management Units (SWMUs) in Assembly D at Naval Support Activity (NSA) Memphis, Millington, Tennessee. Figure 1-1 provides a vicinity map of Assembly D SWMUs.

As a result of the Base Closure and Realignment Act of 1990 (BRAC), a portion of NSA Memphis, which includes Assembly D, will be closed and prepared for transfer to the City of Millington. Eight SWMU assemblies (i.e., groups) have been defined for the NSA Memphis Resource Conservation and Recovery Act (RCRA) Corrective Action Program. Four of these assemblies (A, B, C, and D) are on closing portions of the base and have been categorized and ranked according to their BRAC status. Assembly D includes six SWMUs requiring CSIs to confirm whether contaminants are present or have been released and, if so, whether RCRA Facility Investigation (RFI) characterization will be required. The remaining four assemblies (E, F, G, and H) are on portions of the base that will remain open. The CSI, undertaken by EnSafe/Allen & Hoshall (E/A&H) and the U.S. Geological Survey (USGS), adhered to the requirements of the Hazardous and Solid Waste Amendments portion (HSWA-TN002) of RCRA Permit No. TN2-170-022-600 and applicable regulations. Assembly D consists of the following SWMUs:

SWMU	Description
11	Oiled Dirt Roads (Northside Only)
36	Northside Sewage Treatment Plant Incinerator
42 and 53	Building N-12, Interim Hazardous Waste Storage Area and Building N-126, Hazardous Waste Accumulation Point for the Aircraft Intermediate Maintenance Department
44	Building N-102, Hazardous Waste Accumulation Point
50, 51, and 52	Building N-126, Hazardous Waste Accumulation Point for the MAG-42, VR-60, and VP-67 Squadrons
64	Building N-16, Materials Storage Area

Two phases of field sampling investigation were planned to fill the data gaps described in Section 4.2 of the *Assembly D Site Investigation Plans* (E/A&H, 1995), and to delineate the horizontal and vertical extent of any soil contamination at the SWMUs in Assembly D. The first phase consisted of a surface and subsurface soil investigation using a hand-auger and/or a truck-mounted Geoprobe to collect samples. If first phase results warrant further investigation, a second phase will consist of installing soil borings and monitoring wells. This report summarizes the activities conducted during the first-phase of the CSI and provides conclusions and recommendations for each SWMU. All samples were collected and processed in accordance with Section 4 of the *Comprehensive RFI Work Plan* (E/A&H, 1994).

The data gaps are summarized as follows:

- The potential for surface and subsurface soil contamination associated with the following activities:

SWMU 11	—	Spraying waste oil on dirt roads and horse-riding trails;
SWMU 36	—	Incineration of paper and plastic, and presence of a fuel underground storage tank (UST);
SWMUs 42/53	—	Storage of waste oil, paint, paint-thinner waste, mineral spirits, and solvents;
SWMU 44	—	Former storage of batteries and current storage of equipment;
SWMUs 50/51/52	—	Storage of mineral spirits and paint-thinner waste; and
SWMU 64	—	Storage of used oil, fire-fighting chemicals, and transformers.

- The potential for groundwater contamination, if soil contamination is indicated.

Sections 2 through 4 describe the regional geology, background conditions, and general sampling and analysis methods used during the Assembly D CSI. Detailed sampling schemes, analytical results, and conclusions/recommendations for each Assembly D SWMU are presented in Section 5. Analytical data and other information related to specific SWMUs are presented in attachments in Volume II of this report.

2.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

The Memphis area general hydrogeology is discussed in detail in Section 2.11 and a conceptual model of the hydrogeology at NSA Memphis is presented in Section 2.12 of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Updated information is available in the *Hydrogeology of Post-Wilcox Group Stratigraphic Units in the Area of the Naval Air Station Memphis, Near Millington, Tennessee* (Kingsbury and Carmichael, 1995). On the basis of this updated information, the hydrogeology of NSA Memphis is re-summarized below.

The two stratigraphic units investigated during the RFIs at NSA Memphis are the loess/alluvial deposits of Pleistocene and Holocene age and the underlying fluvial deposits of Pleistocene to Pliocene age. The loess — eolian deposits consisting of silt, silty clay, clay, and minor amounts of sand — is the principal unit occurring at land surface throughout the NSA Memphis Northside. Alluvium, which is restricted to stream valleys, includes alluviated or reworked loess. The loess is typically 0 to 65 feet in the Memphis area; at NSA Memphis it ranges from 15 to 45 feet thick. Water-bearing zones are present in the loess primarily in the upper part of this unit; however, yields are low and water quality analyses performed during the water use survey portion of previous UST investigations indicate that uncontaminated loess groundwater does not meet many primary and secondary drinking water standards. Previous investigations at NSA Memphis have found depth to water in the loess varying between 5 and 15 feet below land surface (bls) and vertical hydraulic conductivities to range from 10^{-6} to 10^{-8} centimeter per second (cm/sec). Although the loess may be considered an aquitard on the basis of the relatively low hydraulic conductivities, this shallowest water-bearing zone is present within this interval. Groundwater flow in the loess is primarily downward, although locally some groundwater in the loess may discharge to nearby streams, drainage ditches, and other surface water bodies.

The fluvial deposits underlie the loess in upland areas and consist of sand, gravel, and some clay, with thin layers of ferruginous sandstone and conglomerate at the base. This unit ranges from 0 to 100 feet thick in the Memphis area; on the Northside of NSA Memphis it ranges from

10 to 35 feet thick and represents the most significant component of the surficial aquifer. Many shallow domestic wells in Memphis rural areas are completed in the fluvial deposits. Relative groundwater elevations between wells completed in the loess/alluvium and fluvial deposits indicate semiconfined to confined conditions in the fluvial deposits. Typically a downward vertical gradient exists between water in the loess and the fluvial deposits. Sediments in the fluvial deposits generally coarsen with depth, and the upper portion typically consists of a mixture of very fine sand with varying degrees of silt and clay that becomes increasingly less silty with depth, grading into a fine to medium sand near the middle of the unit. Grain sizes typically coarsen below this interval, grading into a gravelly sand near the fluvial deposits' basal section.

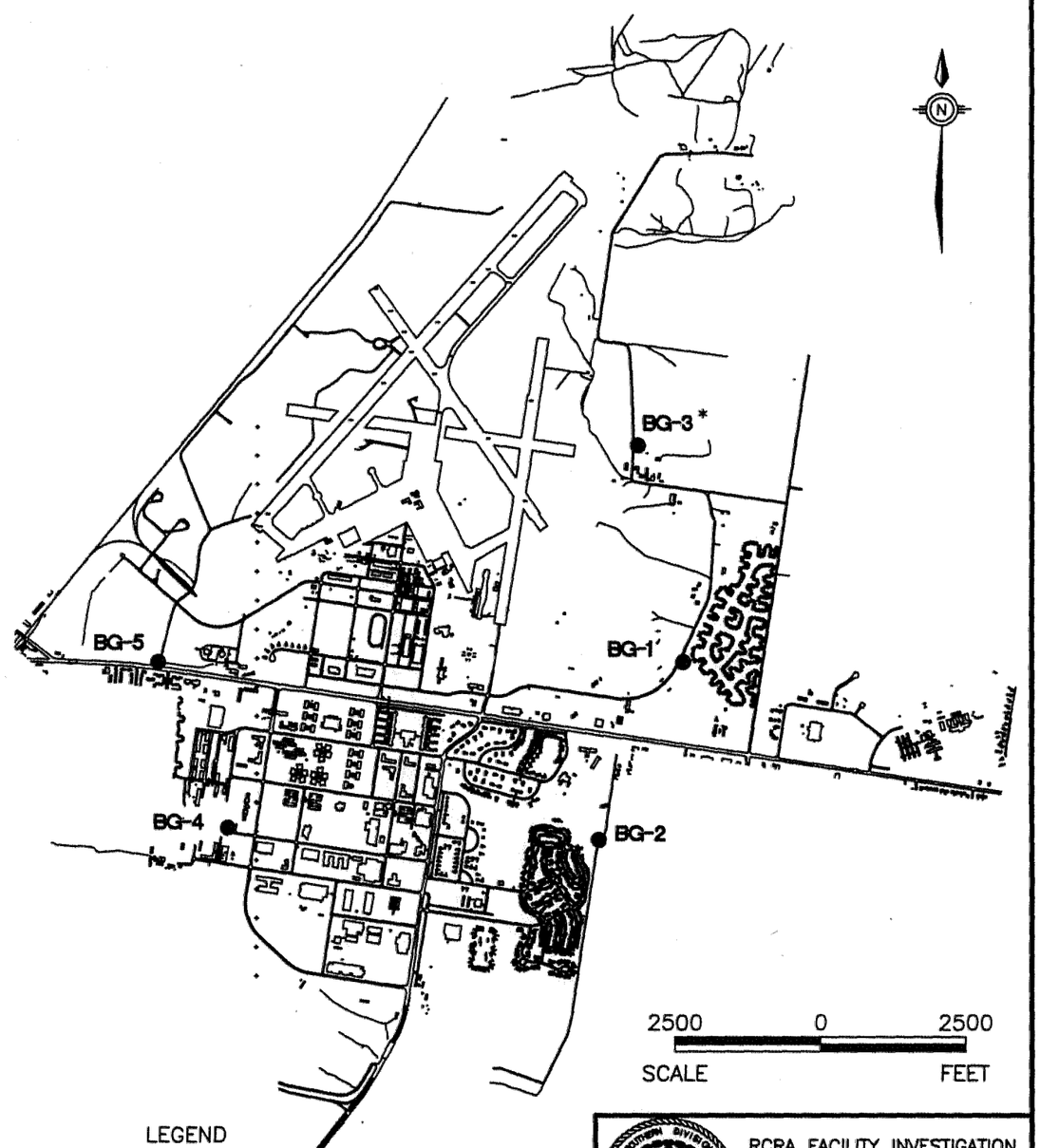
The fluvial deposits are underlain by the Cockfield Formation, a part of the Jackson-upper Claiborne confining unit, which is a heterogeneous formation consisting of very fine silty sand interbedded with clay and silt lenses or clay with interbedded fine sand lenses. The more permeable characteristics of the fluvial deposits, compared to the relatively impermeable properties of the overlying loess/alluvium and the underlying Jackson-upper Claiborne confining unit, result in the fluvial deposits being the preferential zone of groundwater flow and the route for contaminant transport in the subsurface at NSA Memphis.

3.0 BACKGROUND REFERENCE CONCENTRATIONS

Five background locations were established to assess ambient soil and groundwater conditions across NSA Memphis. Background data for soil consist of 11 samples collected from five borings, shown on Figure 3-1. Background reference concentrations were established for metals detected in soil to compare to samples collected at Assembly D SWMUs. The background reference concentrations (RCs) were calculated by doubling (2×) the mean concentrations of analytes detected at all the background locations. Two RCs were established for soil: RC_S, 2× the mean or average concentration detected from 0 to 1 foot (surface) for use in later risk evaluation; and RC_{SS}, 2× the mean or average concentration detected from 9 to 10 feet deep (10 to 11 feet for sample 4BGS000411). Table 3-1 shows RCs that were used to compare metals detected in samples collected from Assembly D SWMUs. Data summary tables for each SWMU (Section 5) compare metals concentrations to background RCs, Risk-Based Concentrations (RBCs), and transfer from soil to groundwater screening levels (SSLs). RBCs and SSLs were obtained from the U.S. Environmental Protection Agency (USEPA) Region III Risk-Based Concentration Table (July to December, 1995).

Background samples were also analyzed for chlorinated pesticides to determine average concentrations due to routine application for pest control. Also, the June 2, 1995, Technical Memorandum *Discussion of Dieldrin Risk Management Issues* (E/A&H, 1995), has been included in Attachment 1, Volume II, of this CSI report. The memorandum stated that dieldrin was ubiquitous at NSA Memphis as a result of aerial applications during a U.S. Department of Agriculture (USDA) quarantine on the white-fringed beetle during the 1950s and 1960s. Dieldrin was also used in the pest-control trade along with chlordane for general subterranean termite control. Risk estimates based on the reported dieldrin concentrations in soil at NSA Memphis did not exceed 1E-4 Incremental Lifetime Cancer Risk (ILCR). As stated in the memorandum, "This finding indicates that dieldrin levels found at each SWMU do not necessitate remedial action in the absence of other significant carcinogenic risk contributors."

At background locations, dieldrin concentrations ranged from below quantitation limits to 311 micrograms per kilogram (μg/kg) with a mean of 131 μg/kg.



LEGEND

* SOIL BACKGROUND DATA ONLY

BG–2 BACKGROUND LOCATION 2

NOTE: SOIL DATA CONSIST OF ONE SURFACE & TWO SUBSURFACE SOIL SAMPLES. GROUNDWATER DATA CONSIST OF THREE SAMPLES; THE LOESS, UPPER FLUVIAL DEPOSITS & LOWER FLUVIAL DEPOSITS.

RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 3–1
SOIL AND GROUNDWATER
BACKGROUND SAMPLE LOCATIONS

DWG DATE: 04/04/96 | DWG NAME: 94SGBLA

Table 3-1
Background Reference Concentrations for Metals in Soil (mg/kg)

	Sample ID												
	1BGS000101	1BGS000110	2BGS000201	2BGS000210	3BGS000301	3BGS000310	4BGS000401	4BGS000411	5BGS000501	5BGS000510	5BGC000510		
Sample Date	09-Jan-95	09-Jan-95	12-Jan-95	12-Jan-95	10-Jan-95	10-Jan-95	11-Jan-95	11-Jan-95	12-Jan-95	12-Jan-95	12-Jan-95	RC_s	RC_{ss}
Parameter													
Antimony	13.4 UR	10.4 UR	10.3 UR	10 UR	10.8 UR	9.8 UR	9.9 UR	10.3 UR	9.8 UR	10.2 UR	10.3 UR	BDL	BDL
Arsenic	7.1 J	20.2 J	5.4 J	1.8 J	6.3 J	8.7 J	9.1 J	11.1 J	4.9 J	9 J	10.4 J	13.1	20.4
Barium	70.8 J	93.8 J	93.3 J	193 J	101 J	132 J	131 J	130 J	81.7 J	114 J	205 J	191	289
Beryllium	0.4 J	0.39 J	0.39 J	0.58 J	0.52 J	0.51 J	0.69 J	0.61 J	0.4 J	0.42 J	0.55 J	0.96	1.02
Cadmium	1.9 UJ	3.4 J	1.7 UJ	2.4 UJ	3.0 UJ	2.9 UJ	3.0 UJ	2.3 UJ	2.3 UJ	1.8 UJ	2.2 UJ	BDL	6.8
Chromium	9.5	11.7	12.2	17	14.8	12.7	18	16.6	11.6	12.7	15.1	26.4	28.6
Cobalt	7.8 J	7.3 J	5.8 J	5 J	8.3 J	8.9 J	9.1 J	7.8 J	6.6 J	6.9 J	10.1 J	15.0	15.3
Copper	9.9 U	14.8	12	12.6	14.5	18.8	17.8	19.9	9.7	15.2	20.3	23.6	33.9
Cyanide	0.57 U	0.5 U	0.5 U	0.5 U	0.51 U	0.55 U	0.5 U	0.58 U	0.5 U	0.5 U	0.54 U	BDL	BDL
Lead	14.5 J	8.7 J	18 J	7.9 J	11.6 J	12.2 J	18 J	11.7 J	9.7 J	9 J	14.2 J	28.7	25.1
Mercury	2.1	0.13 U	0.21	0.12 U	0.12 U	0.12 U	0.12 U	0.19	0.12 U	0.13 U	0.13 U	1.1	0.38
Nickel	10.7 UJ	19.4 UJ	12.8 UJ	14.2 UJ	15.8 UJ	21.5 UJ	20.8 UJ	18.1 UJ	10.1 UJ	14.1 UJ	29.9 J	BDL	59.8
Selenium	0.52 UJ	0.52 UJ	0.51 UJ	0.50 UJ	0.49 UJ	0.49 UJ	0.50 UJ	0.51 UJ	0.49 UJ	0.51 UJ	0.52 UJ	BDL	BDL
Silver	1.2 U	1.7 U	1.6 U	1.8 UJ	1.5 U	1.9 U	1.6 U	1.7 U	1.5 U	2.5 U	2 U	BDL	BDL
Thallium	0.52 U	0.52 U	0.51 U	0.5 U	0.49 U	0.49 U	0.5 U	0.51 U	0.49 U	0.51 U	0.52 U	BDL	BDL
Tin	25.7 UJ	32.3 UJ	21.3 UJ	22.5 UJ	31.9 UJ	22.6 UJ	23.9 UJ	29.1 UJ	22.7 UJ	22.8 UJ	38.7 UJ	BDL	BDL
Vanadium	17.8	18.5	20.8	18.6	29.3	22.5	33.1	27.3	22.9	22.3	29.8	49.6	46.3
Zinc	35.2 J	47.7 J	39.8 J	60.8 J	49.1 J	54.8 J	62.7 J	59.7 J	34 J	49.5 J	63.1 J	88.3	111.8

Notes:
U — Analyzed parameter not detected.
UR — Nondetect result; detection limit was rejected due to laboratory nonconformity.
J — Estimated value because quality control criteria were not met.
RC_s — Surface Reference Concentration = Parameter average concentration across the surface (0-1') interval × 2.
RC_{ss} — Subsurface Reference Concentration = Parameter average concentration across the subsurface (>1') interval × 2.
BDL — Below detection limits.
mg/kg — Milligrams per Kilogram

4.0 GENERAL FIELD INVESTIGATION METHODS

The CSI sampling program was intended to confirm whether contaminants present were associated with past activities at the Assembly D SWMUs. This section summarizes the general sampling and analytical tasks from the first phase of the CSI. The field sampling activities followed the procedures outlined in the USEPA and Tennessee Department of Environment and Conservation (TDEC)-approved *Comprehensive RFI Work Plan* (E/A&H, 1994) and *Assembly D Site Investigation Plans* (E/A&H, 1995).

The CSI soil screening phase required collecting surface and subsurface soil samples at all SWMUs with a stainless steel hand-auger for laboratory analyses. Supplementary tasks to this general investigation approach included the following:

SWMU 11 — Additional samples were collected and analyzed onsite for polychlorinated biphenyls (PCBs) using an immunoassay testing kit;

SWMU 36 — Subsurface and shallow groundwater samples were collected for laboratory analyses using Geoprobe equipment; and

— A geophysical survey was performed using frequency-domain electromagnetic instrumentation (EM-31) which included conductivity and in-phase (metal detection) surveys.

Any deviations from the general investigation approach, descriptions of sample locations and intervals, and rationale for laboratory analyses are presented and discussed in detail in the SWMU-specific discussions in Section 5, Confirmatory Sampling Investigations. Deviations from the proposed strategy were documented in the field logbook. Table 4-1 below summarizes the sampling and analytical requirements for the first phase of the Assembly D CSI.

Table 4-1
Assembly D — Sampling and Analysis Summary

SWMU	Description	Sample Locations	Samples Collected	Medium Sampled	Interval Sampled	OVA [a] Screen	Laboratory Analyses [b, c]
11	Oiled Dirt Roads (Northside Only)	19	18	Soil	0-1'	No	PCB Immunoassay
			6	Soil	0-1'	No	Appendix IX Metals, Pesticides/PCBs
36	Northside Sewage Treatment Plant Incinerator	6	5	Soil	0-1'	Yes	SVOC, Appendix IX Metals, Pesticides/PCBs, Dioxin
			4	Soil	8-10'	No	TPH
			1	Groundwater	43'	No	VOC
42/53	Building N-12 Interim Hazardous Waste Storage Area and Building N-126 Hazardous Waste Accumulation Point for the AIMD	8	8	Soil	0-1'	Yes	VOC, SVOC, Appendix IX Metals, Pesticides/PCBs
			8	Soil	2-3'	Yes	VOC, SVOC, Appendix IX Metals
44	Building N-102 Hazardous Waste Accumulation Point	4	4	Soil	0-1'	Yes	VOC, SVOC, Appendix IX Metals, Pesticides/PCBs, TPH
			4	Soil	2-3'	Yes	VOC, SVOC, Appendix IX Metals, TPH
50/51/52	Building N-126 Hazardous Waste Accumulation Point for the MAG-42, VR-60, and VP-67 Squadrons	14	14	Soil	0-1'	Yes	VOC, SVOC, Appendix IX Metals, Pesticides/PCBs
			14	Soil	2-3'	Yes	VOC, SVOC, Appendix IX Metals
64	Building N-16 Materials Storage Area	9	9	Soil	0-1'	Yes	VOC, SVOC, Appendix IX Metals, Pesticides/PCBs
			9	Soil	2-3'	Yes	VOC, SVOC, Appendix IX Metals, Pesticides/PCBs

Notes:
a — Organic vapor analyzer.
b — PCB = polychlorinated biphenyl; SVOC = semivolatile organic compounds; TPH = total petroleum hydrocarbons; VOC = volatile organic compounds
c — Appendix IX Metals = USEPA SW-846 Method 6010/7000 Series; Pesticides/PCBs = USEPA SW-846 Method 8080; SVOC = USEPA SW-846 Method 8270; Dioxin = USEPA SW-846 Method 8290; TPH = Tennessee Modified 8015 Gasoline Range Organics and Diesel Range Organics; VOC = USEPA SW-846 Method 8240.

4.1 Analytical Requirements

All samples were shipped to National Environmental Testing, Inc. (NET), in Bedford, Massachusetts, for the analytical suite prescribed for each SWMU in the *Assembly D RFI Work Plans* (E/A&H, 1995) using Level III-equivalent Data Quality Objectives (DQOs) for 95% of the samples and Level IV-equivalent DQOs for the remaining 5% of the samples. Validata Chemical Services, Inc., of Norcross, Georgia, validated the NET analytical data. Attachment 2 in Volume II of this CSI report contains the validation report, which indicates that the overall data quality of the analytical work for Assembly D is satisfactory.

4.2 Sample Management

Sample management procedures during the CSI adhered to Sections 4.12 and 5 of the *Comprehensive RFI Work Plan.*

4.3 Sample Custody

Sample custody during the CSI adhered to Section 4.12.5 of the *Comprehensive RFI Work Plan.*

4.4 Quality Assurance/Quality Control

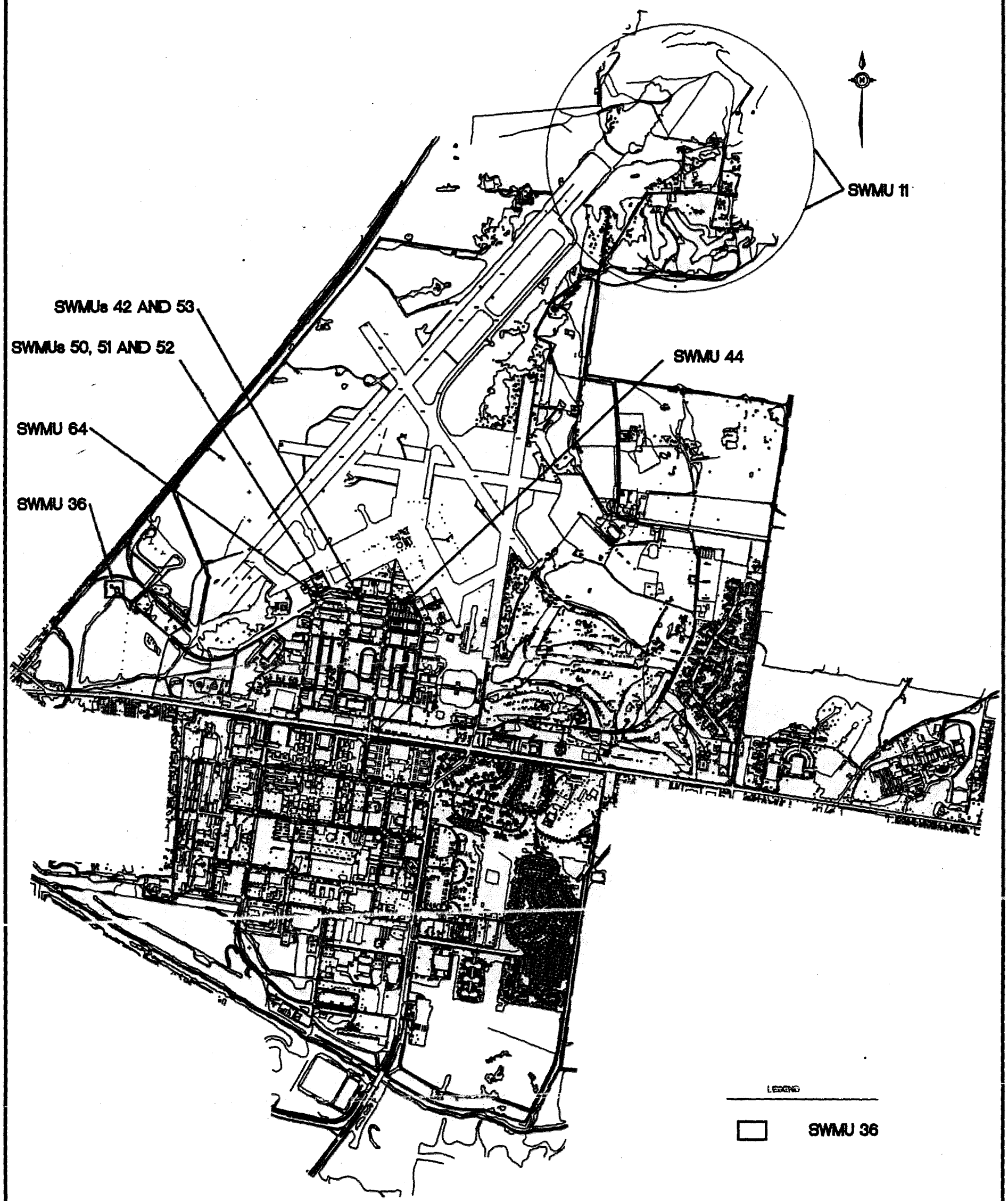
Quality assurance/quality control procedures followed during the CSI adhered to Section 4.14 of the *Comprehensive RFI Work Plan.*

4.5 Decontamination Procedures

Decontamination procedures during the CSI adhered to Section 4.11 of the *Comprehensive RFI Work Plan.*

4.6 Investigation-Derived Waste

Investigation-derived waste (IDW) was handled as specified in Section 4.13 of the *Comprehensive RFI Work Plan* and the *NSA Memphis IDW Management Plan* (E/A&H, 1995).



RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 1-1
VICINITY MAP
ASSEMBLY D SWMUs

DWG DATE: 04/05/96 | DWG NAME: 94VMAD17

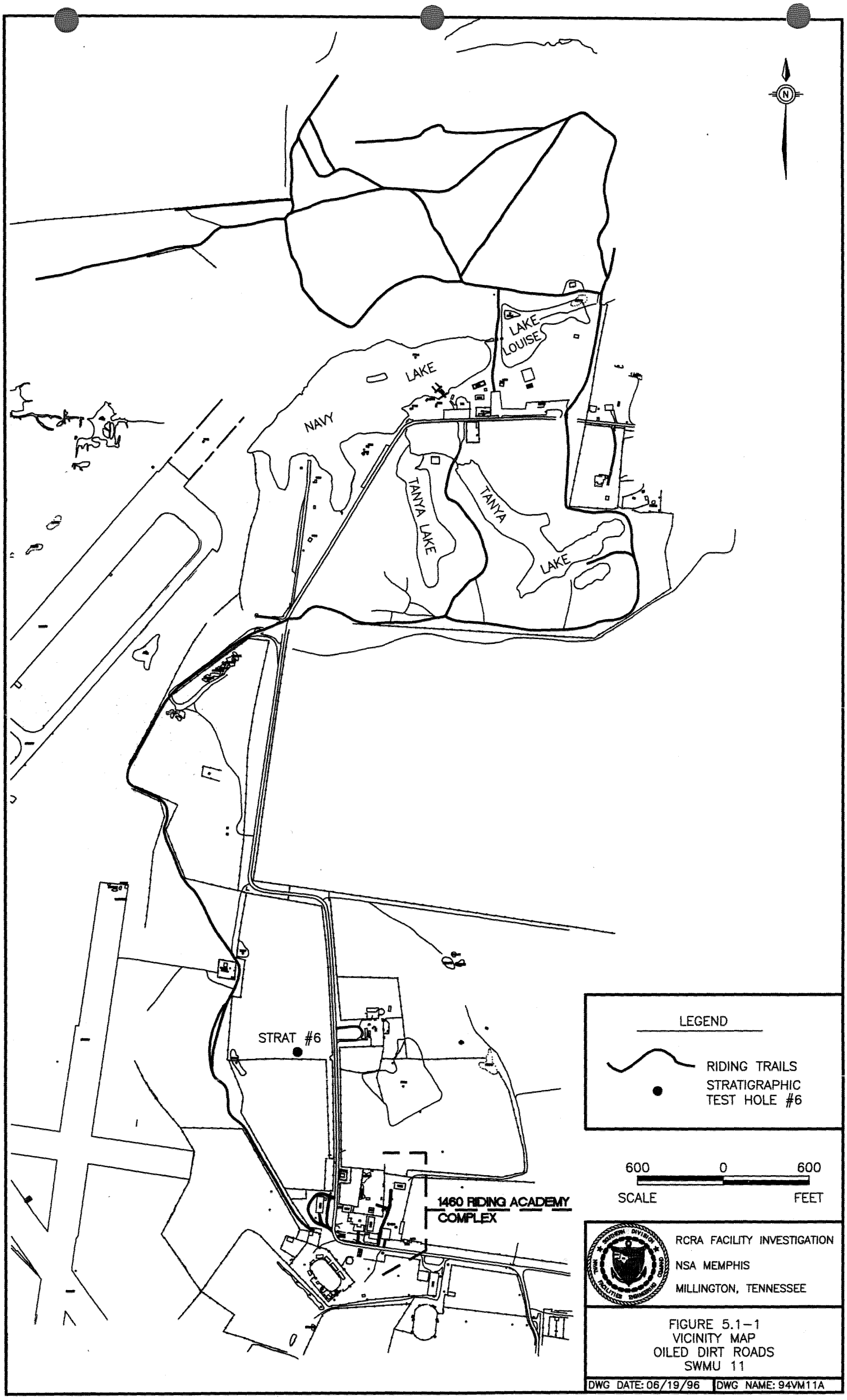


FIGURE 5.1-1
VICINITY MAP
OILED DIRT ROADS
SWMU 11

NSA Memphis personnel have indicated that most of the spraying likely occurred on the dirt roads (and associated parking lots) near the Riding Academy, on the main horse trails, and at road/trail intersections. Although no records are known to exist that verify the use of PCB-contaminated oil for dust suppression, it is possible that oil contaminated with these compounds may have been used because PCBs were not regulated during the reported period of spraying.

5.1.2 Topography and Drainage

Based on the USGS 7.5-Minute Brunswick quadrangle and maps of NSA Memphis based on digital orthophotography, surface runoff near the Riding Academy and main horse trail generally drains east and southeast toward a drainage ditch which runs along the eastern side of the Northside. At its closest location, the drainage ditch is approximately 1,000 feet east of the academy and eventually joins the Big Creek Drainage Canal 8,000 feet south of the academy. Surface runoff from the northern portion of the horse trails drains into the Navy Lake Complex. Lake Louise and Tanya Lake receive overflow from Navy Lake. A topographic map showing local land elevations for the NSA Memphis Northside is provided in Attachment 3, Volume II, of this CSI report.

5.1.3 Site-Specific Geology and Hydrogeology

A USGS exploratory soil boring, designated Stratigraphic Test Hole 6, was completed approximately 1,500 feet north of the riding academy stables. The test hole originally was to be advanced approximately 15 feet into the Cook Mountain Formation (the confining unit separating the Memphis Aquifer from the overlying Cockfield Formation and shallower units). However, due to the unanticipated thinness of the Cockfield Formation, this borehole was advanced approximately 30 feet into the Memphis Sand. Based on an interpretation of the USGS geophysical logs, the following lithology is present in the northern portion of the NSA Memphis Northside:

Loess: Approximately 24 feet of wind-blown silt and clay deposits.

Fluvial Deposits: Approximately 10 feet of sand and gravel.

Cockfield Formation: Approximately 176 feet of alternating sand, clay, and some lignite.

Cook Mountain Formation: The Cook Mountain, characterized as a light olive-gray to pinkish-gray clay, is defined as the upper confining unit between the surficial aquifers and the Memphis Aquifer. Test Hole 6 penetrated approximately 12 feet of the Cook Mountain Formation, its total thickness at this location.

Memphis Sand: The Memphis Sand, characterized as a thick (between 865 and 880 feet) deposit of primarily fine to very coarse sand with lenses of clay, silt, and lignite, supplies water to industries and municipalities throughout Shelby County.

Subsurface soil information was also collected during the Assembly A RFI at SWMU 8, the Cemetery Disposal Area, approximately 1,000 feet west of the horse trail circling Navy Lake at its closest point.

In January and February 1995, three shallow (20 feet bls) monitoring wells were installed in the loess at SWMU 8, and were closed shortly thereafter due to the absence of groundwater in the wells. Four intermediate (30 to 35 feet bls) monitoring wells also were installed in the upper-level fluvial deposits at SWMU 8 in January and February 1995. The SWMU 8 boring logs indicated the presence of a low-permeability silt between 18 and 25 feet bls (loess). The laboratory-measured vertical hydraulic conductivity for a soil sample collected from 23 to 25 feet bls is 3.0×10^{-8} cm/sec. Underlying the loess is a silty sand with gravel unit extending to at least 50 feet bls (fluvial deposits), which exhibited some silt and silty clay layers up to

5 feet thick. No hydraulic conductivity data were collected for the silty sand and gravel unit at SWMU 8. SWMU 8 boring logs and geotechnical laboratory results are provided in Attachment 3 of the *Assembly D RFI Site Investigation Plans*.

5.1.4 Preliminary Investigations

According to the *Initial Assessment Study* (IAS) (Harmon Engineering and Testing/NEESA, 1983), six soil samples collected from three locations on the oiled dirt roads on the NSA Memphis Southside were analyzed for PCBs. No PCBs were identified in the samples above a detection limit of 0.5 parts per million (ppm). Based on the analytical results, no further action (NFA) was recommended in the report. TDEC forwarded a letter (dated July 29, 1986) to the Navy in response to the IAS and the 1985 Phase II *Navy Assessment and Control of Installation Pollutants Department (NACIP) Program Confirmation Study, Verification Phase* (Geraghty and Miller, 1985). The letter stated that because soil samples were collected from only three locations along one road on the NSA Memphis Southside, limited sampling was not adequate to characterize the entire facility. Despite this letter, the subsequent ERC/EDGe 1990 RFA also indicated SWMU 11 required NFA by the Navy, and was approved by USEPA Region IV and TDEC. In 1995, the NSA Memphis BRAC Cleanup Team (BCT) determined that SWMU 11 and several other NFA SWMUs on the Northside would require investigation before transfer of the property following the partial closure and realignment of NSA Memphis.

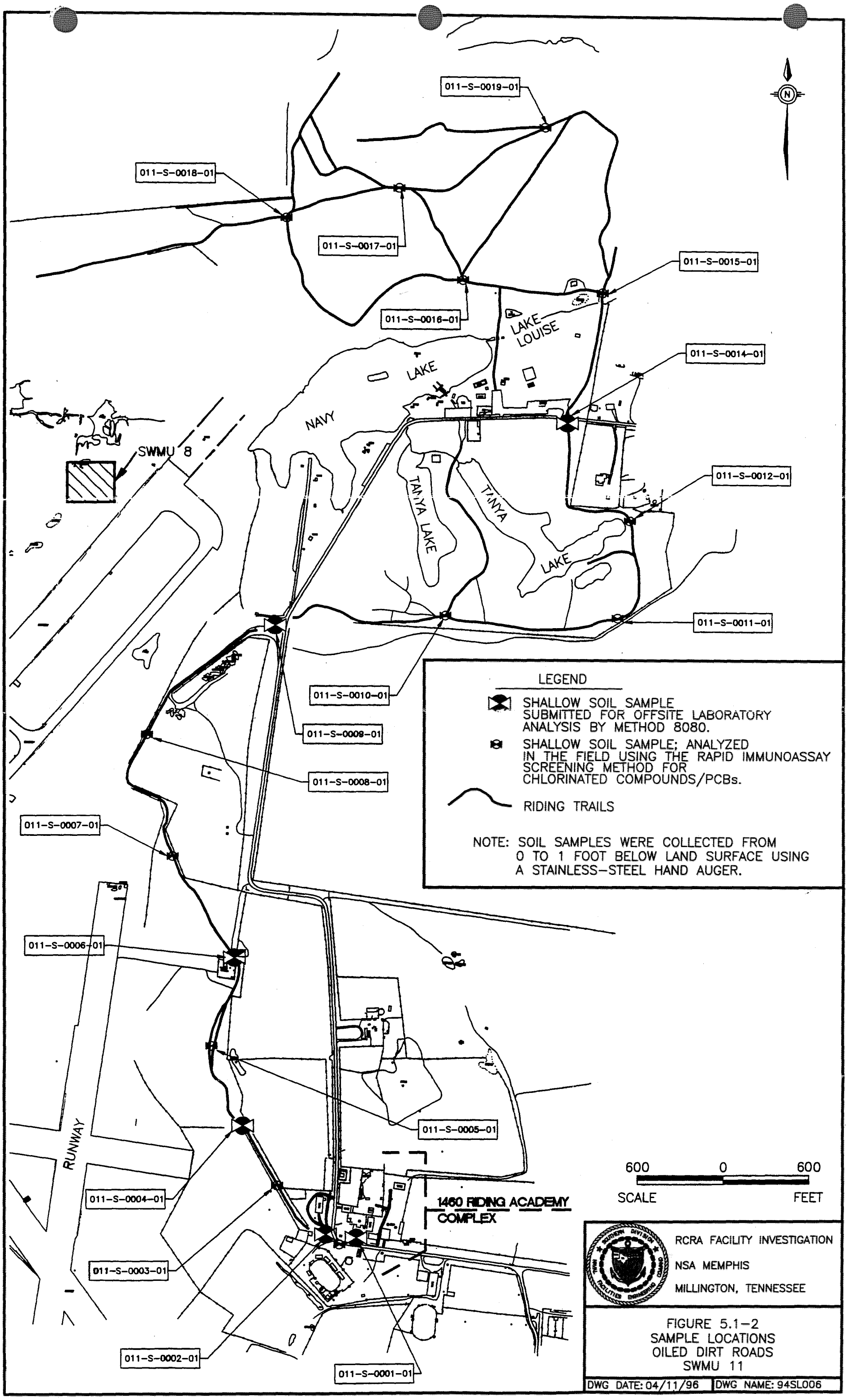
Additional information from samples collected from the Navy Lake area in 1995 is available in the *Gray Area Investigation Report* (E/A&H, 1995). Sediment and soil samples collected from the three recreational lakes near the oiled dirt roads were analyzed for pesticides and herbicides. Five samples were collected from Navy Lake, three from Lake Louise, and seven from Tanya Lake. Analytical results indicated the presence of the following pesticides and herbicides at concentrations considerably less than their sediment screening values and/or RBCs (as outlined in USEPA Region III Risk-Based Concentration Table, July to December 1995) for residential

soil: merphos, dieldrin, and 2,4,5-TP. These compounds were attributed to normal pest/weed management practices.

5.1.5 Field Investigation Methods and Analytical Requirements

The SWMU 11 field investigation prescribed in *Assembly D Site Investigation Plans* consisted of collecting 19 soil samples from the surface interval (0 to 1 foot bls) using a stainless-steel hand auger according to the sampling methods outlined in Section 4.4.4.3 of the *Comprehensive RFI Work Plan.* Figure 5.1-2 shows the soil sample locations. A proposed sampling point between locations of samples 011-S-0001-01 and 011-S-0002-01 was omitted during fieldwork at SWMU 11 due to its proximity to these points; however, the remaining 18 samples were collected in accordance with the site investigation plan.

Based on conversations with NSA Memphis personnel, certain areas of the dirt roads, trails, and parking lots have historically experienced more frequent pedestrian, equine, and vehicular traffic and, therefore, may have received more frequent waste oil application than other trails. Specifically, the areas where waste oil may have been applied frequently include the dirt parking lot associated with the riding stable, trail-road intersections, and trail intersections. As shown in Figure 5.1-2, six surface soil samples were collected from these areas. Each sample was split, with one portion submitted to an offsite laboratory for PCB analysis by Method 8080, Appendix IX metals by the 6010/7000 series method, and cyanide by Method 9010. The remaining sample portions were analyzed in the field using the Rapid Immunoassay Screening (RIS) method, which can detect chlorinated compounds such as PCBs at concentrations greater than 1 ppm, with results available within 30 minutes of sample collection. Twelve additional shallow soil samples (Figure 5.1-2) were collected at various locations along the dirt roads and horse trails to provide supplemental coverage throughout the SWMU. These 12 samples were also analyzed in the field for PCBs using the RIS system.


011-S-0019-01
011-S-0018-01
011-S-0017-01
011-S-0016-01
011-S-0015-01
011-S-0014-01
011-S-0012-01
011-S-0011-01
011-S-0010-01
011-S-0009-01
011-S-0008-01
011-S-0007-01
011-S-0006-01
011-S-0005-01
011-S-0004-01
011-S-0003-01
011-S-0002-01
011-S-0001-01
LAKE LOUISE
NAVY LAKE
TANYA LAKE
TANYA LAKE
SWMU 8
RUNWAY
1460 RIDING ACADEMY COMPLEX
N
LEGEND
SHALLOW SOIL SAMPLE SUBMITTED FOR OFFSITE LABORATORY ANALYSIS BY METHOD 8080.
SHALLOW SOIL SAMPLE; ANALYZED IN THE FIELD USING THE RAPID IMMUNOASSAY SCREENING METHOD FOR CHLORINATED COMPOUNDS/PCBs.
RIDING TRAILS
NOTE: SOIL SAMPLES WERE COLLECTED FROM 0 TO 1 FOOT BELOW LAND SURFACE USING A STAINLESS-STEEL HAND AUGER.
600 0 600
SCALE FEET
RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE
FIGURE 5.1-2
SAMPLE LOCATIONS
OILED DIRT ROADS
SWMU 11
DWG DATE: 04/11/96
DWG NAME: 94SL006

PCB analysis by immunoassay in the field adhered to the manufacturer's guidelines and standards. Screening samples submitted to an offsite laboratory for analysis adhered to Level IV-equivalent DQO.

Immunoassay Testing

All 18 surface soil samples were analyzed in the field for PCBs with the EnSys RISc Test System. Analysis consisted of adding standards, samples, and color-change reagents to test tubes coated with a PCB-specific chemical. The PCB concentration in the sample was determined by comparing its color intensity with that of a standard.

The PCB concentration is inversely proportional to color intensity; the lighter the sample's color development, the higher the PCB concentration. The colorimetric measurement was made by comparing samples against a 1 ppm standard using a differential photometer. A sample color lighter than the 1 ppm standard would yield a negative photometer result, indicating the presence of PCBs above the concentration of the standard; a sample color darker than the standard would yield a positive photometer result, indicating no PCBs above the concentration of the standard.

5.1.6 Nature and Extent of Contamination

This section provides the analytical results for surface soil (0-1') samples collected during the first phase of the SWMU 11 CSI. Analytical results for surface soil samples were compared to RBCs for residential and industrial soil (USEPA Region III, July to December 1995). Constituent averages for SWMU 11 were compared to transfer from soil to groundwater SSLs to determine the need for further study or action (Office of Solid Waste and Emergency Response (OSWER) Soil Screening Guidance memorandum, USEPA, 1994). Constituent concentrations from individual samples were also compared to SSLs. Metals analytical results were compared to background RCs (2× mean). Table 5.1.1 summarizes SWMU 11 PCB Immunoassay results. Tables 5.1.2 and 5.1.3 summarize laboratory analytical results compared to RBCs and SSLs for organic and inorganic compounds at SWMU 11, respectively.

Table 5.1.1
SWMU 11 — PCB Immunoassay Soil Screening Results

Sample Identification	Date Analyzed	ΔOD[a,b] Standards	OD Sample 1 ppm	Interpretation
Standard	10/6/95	-0.06		
011S000101	10/6/95		1.04	< 1 ppm
011S000201	10/6/95		1.44	< 1 ppm
Standard	10/5/95	-0.16		New Standard
011S000301	10/5/95		0.18	< 1 ppm
011S000401	10/5/95		0.56	< 1 ppm
Standard	10/5/95	-0.01		
011S000501	10/5/95		0.59	< 1 ppm
011S000601	10/5/95		0.6	< 1 ppm
011S000701	10/5/95		0.56	< 1 ppm
011S000801	10/5/95		0.62	< 1 ppm
Standard	10/5/95	-0.32		
011S000901	10/5/95		0.42	< 1 ppm
011S001001	10/5/95		0.31	New Standard
011S001101	10/5/95		0.41	< 1 ppm
011S001201	10/5/95		0.47	< 1 ppm
Standard	10/5/95	-0.09		
011S001401	10/5/95		0.45	< 1 ppm
011S001501	10/5/95		0.43	< 1 ppm
011S001601	10/5/95		0.47	< 1 ppm
011S001701	10/5/95		0.64	< 1 ppm
Standard	10/5/95	-0.05		New Standard
011S001801	10/5/95		0.63	< 1 ppm
011S001901	10/6/95		0.36	New Standard

Notes:
a — Optical density
b — A set of standards was analyzed with each sample batch; a new set of standards was prepared every eight samples.
< — less than

Table 5.1.2
SWMU 11 — Organics in Surface Soil (µg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
4,4'-DDE	0-1'	1/6	20	N/A	1.90e+03	0	1.70e+04	0	500	N
Dieldrin	0-1'	1/6	130	N/A	40	1	360	0	1	Y

Notes:
a — Feet bls.
b — Six samples collected from six locations from 0 to 1 foot bls was analyzed for Appendix IX Metals, cyanide, and Pesticides/PCBs.
c — Range lower limit is the lowest detected parameter concentration.
d — Mean is based on detected parameter concentrations only.
e — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo). RBCs are only applicable for comparison to data from samples collected across the 0 to 1-foot bls interval.
f — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk Based Concentration Table, July to December, 1995).
g — Contaminant averages were compared to SSLs for determination of need for further study or action.
N/A — Not applicable..

Table 5.1.3
SWMU 11 — Inorganics in Surface Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic Soil RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Arsenic	0-1'	6/6	2.7 - 6.8	4.9	13.1	0	0.43[i]	6	3.8[i]	4	15	N
Barium	0-1'	6/6	60.4 - 162	107	191	0	5.50e+03	0	1.40e+05	0	32	Y
Beryllium	0-1'	6/6	0.29 - 0.46	0.40	0.96	0	0.15	6	1.3	0	180	N
Cadmium	0-1'	6/6	1.1 - 3.5	2.6	BDL	6	39	0	1.00e+03	0	6	N
Chromium	0-1'	6/6	8.6 - 19.5	11.3	26.4	0	390[j]	0	1.00e+04[j]	0	19[j]	N
Cobalt	0-1'	6/6	4 - 9.6	7	15	0	4.70e+03	0	1.20e+05	0	k	N

Table 5.1.3
SWMU 11 — Inorganics in Surface Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic Soil RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Copper	0-1'	6/6	7.7 - 15.5	12.5	23.6	0	3.10e+03	0	7.60e+04	0	k	N
Lead	0-1'	6/6	6.8 - 78.7	21.0	28.7	1	400[l]	0	1000[l]	0	k	N
Mercury	0-1'	1/6	0.24	N/A	1.1	0	23	0	610	0	3	N
Nickel	0-1'	6/6	6 - 40.9	17	BDL	6	1.60e+03	0	4.10e+04	0	21	N
Selenium	0-1'	2/6	0.34 - 0.39	0.37	BDL	2	390	0	1.00e+04	0	3	N
Vanadium	0-1'	6/6	15.2 - 24.3	20.0	49.6	0	550	0	1.40e+04	0	k	N
Zinc	0-1'	6/6	26.5 - 134	59	88.3	1	2.30e+04	0	6.10e+05	0	4,200	N

Notes:

a — Feet bls.
b — Six samples collected from six locations from 0 to 1 foot bls were analyzed for Appendix IX Metals, cyanide, and Pesticides/PCBs.
c — Range lower limit is the lowest detected parameter concentration.
d — Mean of detected parameter concentrations.
e — Background reference concentration (2 × mean background). See Section 3 of this report for a discussion of RCs.
f — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC mem). RBCs are only applicable for comparison to data from samples collected across the 0 to 1-foot bls interval.
g — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk-Based Concentration Table, July to December 1995).
h — Contaminant averages were compared to SSLs to determine need for further study or action.
i — RBC for arsenic as a carcinogen.
j — Risk-based data for hexavalent chromium (VI).
k — SSL not available at this time.
l — Value is soil cleanup level for total lead (USEPA OSWER Directive, 9355.4-12).
N/A — Not applicable.
BDL — Below detection limit.

Table 5.1.3 also compares soil inorganic concentrations to background RCs as described in Section 3 of this report. Laboratory analytical data are presented as Appendix A.

Organics

Laboratory analysis did not identify PCBs above the RBCs for residential soil of (0.083 milligrams per kilogram (mg/kg)) nor did the RIS system identify PCBs/chlorinated compounds at a concentration of greater than 1 ppm. Therefore, additional shallow soil samples were not collected for offsite PCB analysis.

As Table 5.1.2 indicates, two pesticides were detected in the six samples collected from the surface interval at SWMU 11. Only one pesticide was detected at a concentration exceeding the residential soil RBC; dieldrin was detected in one of six samples (011-S-0006-01) collected from the surface interval at a concentration of 130 μg/kg, exceeding the residential soil RBC of 40 μg/kg. However, the dieldrin concentration was still well below the industrial RBC of 360 μg/kg.

As noted earlier, the *Discussion of Dieldrin Risk Management Issues* memorandum stated that dieldrin was ubiquitous at NSA Memphis as a result of aerial applications during a USDA quarantine on the white-fringed beetle during the 1950s and 1960s. Dieldrin was also used in the pest-control trade along with chlordane for general subterranean termite control. Risk estimates based on the soil dieldrin concentrations at NSA Memphis did not exceed 1E-4 ILCR. The average concentration of samples collected during a background study was 131 μg/kg with a maximum detected concentration of 311 μg/kg. As stated in the memorandum, "This finding indicates that dieldrin levels found at each SWMU do not necessitate remedial action in the absence of other significant carcinogenic risk contributors."

No compounds exceeded industrial soil RBCs in surface soil samples. Dieldrin was detected in one of six samples at a concentration of 130 μg/kg. The detected dieldrin exceeded the transfer

from soil to groundwater SSL of 1 μg/kg and is near the average dieldrin concentration of 131 μg/kg detected in background samples. Although dieldrin exceeded the SSL in one sample, because of it's chemical properties, the physical properties of soil, and the depth and frequency at which it was detected at SWMU 11, dieldrin is not expected to leach in appreciable quantities (if at all) into underlying groundwater. Also, the physical adsorption of the contaminants to soil particles and organic material greatly limits horizontal migration.

Figure 5.1-3 provides a plot of pesticides in surface soil samples (0 to 1 foot bls). Figure 5.1-4 provides a plot of transfer from soil to groundwater SSL exceedances.

Metals

As Table 5.1.2 indicates, 13 metals were detected in the surface interval; however no concentrations exceeded both background RCs and residential RBCs.

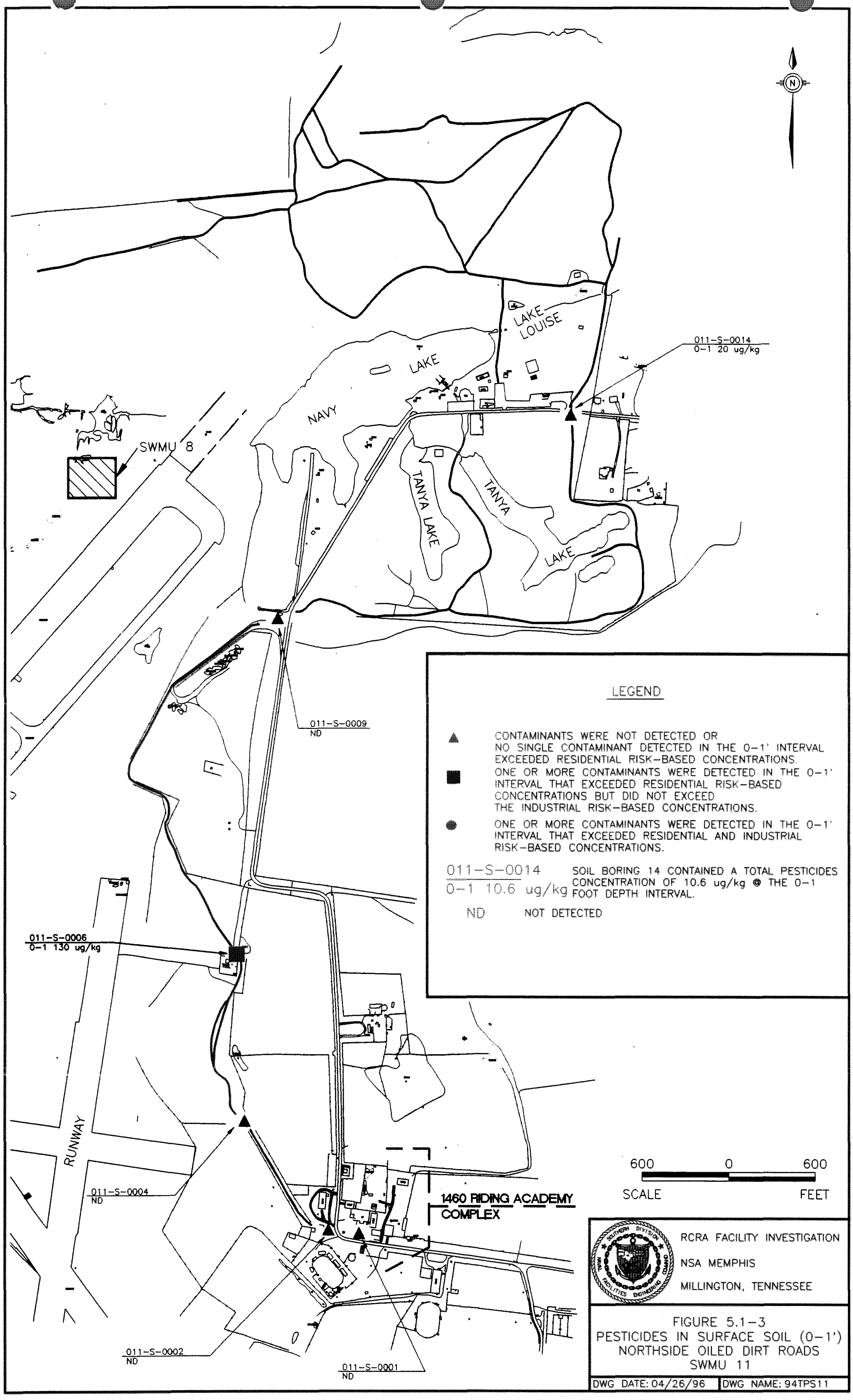
Concentrations of three metals exceeded transfer from soil to groundwater SSLs in individual samples:

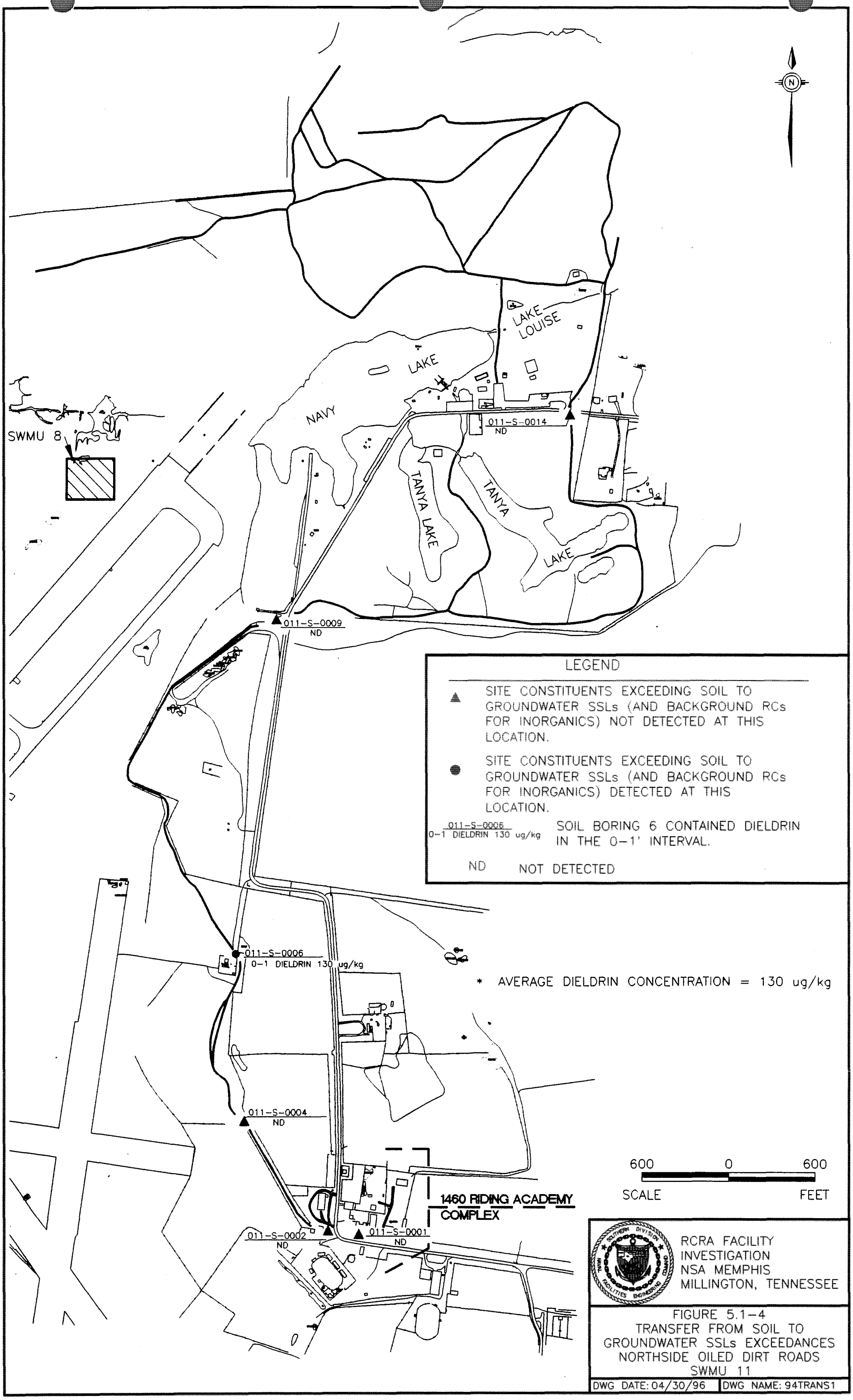
- Barium exceeded the SSL of 32 mg/kg in all six samples with a maximum detected concentration of 162 mg/kg.

- Chromium exceeded the SSL of 19 mg/kg in one sample (011-S-0006-01) at a concentration of 19.5 mg/kg.

- Nickel exceeded the SSL of 21 mg/kg in one sample (011-S-0006-01) at a concentration of 40.9 mg/kg.

Although chromium and nickel concentrations in individual samples exceeded SSLs, their average concentrations at 11 mg/kg and 17 mg/kg, respectively, did not, indicating no need for


N
LAKE LOUISE
LAKE
NAVY
TANYA LAKE
TANYA
LAKE
SWMU 8
011-S-0014
0-1 20 ug/kg
011-S-0009
ND
011-S-0006
0-1 130 ug/kg
RUNWAY
011-S-0004
ND
011-S-0002
ND
011-S-0001
ND
1460 RIDING ACADEMY COMPLEX
LEGEND
CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.
ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.
ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.
011-S-0014
0-1 10.6 ug/kg
SOIL BORING 14 CONTAINED A TOTAL PESTICIDES CONCENTRATION OF 10.6 ug/kg @ THE 0-1 FOOT DEPTH INTERVAL.
ND
NOT DETECTED
600 0 600
SCALE
FEET
RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE
FIGURE 5.1-3
PESTICIDES IN SURFACE SOIL (0-1')
NORTHSIDE OILED DIRT ROADS
SWMU 11
DWG DATE: 04/26/96
DWG NAME: 94TPS11


N
LAKE LOUISE
NAVY LAKE
TANYA LAKE
TANYA LAKE
SWMU 8
011-S-0014
ND
011-S-0009
ND
LEGEND
SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) NOT DETECTED AT THIS LOCATION.
SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) DETECTED AT THIS LOCATION.
011-S-0006
0-1 DIELDRIN 130 ug/kg
SOIL BORING 6 CONTAINED DIELDRIN IN THE 0-1' INTERVAL.
ND NOT DETECTED
011-S-0006
0-1 DIELDRIN 130 ug/kg
* AVERAGE DIELDRIN CONCENTRATION = 130 ug/kg
011-S-0004
ND
1460 RIDING ACADEMY COMPLEX
011-S-0002
ND
011-S-0001
ND
600 0 600
SCALE FEET
RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE
FIGURE 5.1-4
TRANSFER FROM SOIL TO GROUNDWATER SSLs EXCEEDANCES NORTHSIDE OILED DIRT ROADS SWMU 11
DWG DATE: 04/30/96
DWG NAME: 94TRANS1

further study or action. The average barium concentration of 107 mg/kg exceeded the SSL of 32 mg/kg; however, the maximum detected concentration of barium in surface soil at 162 mg/kg did not exceed the 2× mean surface soil background RC of 191 mg/kg. Site constituent averages were calculated using constituent sample data from all sampling intervals.

5.1.7 Preliminary Risk Evaluation

In accordance with *Guidance on Preliminary Risk Evaluations (PREs) for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV Memorandum, 1994), a PRE was conducted for SWMU 11 using data from the six surface soil samples collected during the CSI. The PRE was conducted by constructing a table for carcinogenic and systemic (noncarcinogenic) compounds. The maximum concentration for each detected constituent and its corresponding RBC concentration was entered into the table to calculate cumulative human health risk. However, if the constituent maximum concentration did not exceed the background reference concentration, it was not included in the PRE. Soil data used in the calculations were exclusively from samples collected across the surface (0 to 1 foot bls). Proportionate risk was calculated for each detected site constituent by comparing its maximum reported concentration with the respective RBC value. Residential and commercial scenarios were calculated separately. RBC values were calculated by USEPA based on a risk threshold of 10^{-6} for carcinogens or a hazard quotient (HQ) threshold of 1.0 for noncarcinogens. Therefore, a risk ratio was calculated for each contaminant by the following equations:

Carcinogenic Risk Ratio: $RR = (\text{media concentration/screening value}) \times TR$

Noncarcinogenic Risk Ratio: $RR = (\text{media concentration/screening value}) \times THQ$

where:

RR	=	the risk ratio
Media Concentration	=	the maximum concentration of a site constituent
Screening Value	=	the RBC value for that particular constituent
TR	=	target risk for RBCs
THQ	=	target HQ for RBCs

The risk ratios for each chemical were summed separately for both residential and commercial scenarios to determine the overall site risk. If the carcinogenic ILCR was greater than 10^{-4} or the noncarcinogenic hazard index (HI) was greater than 1, the site may require additional investigation for the corresponding land use scenario. If neither threshold was exceeded, no further action was recommended and the property was considered suitable to lease for the specified land use scenario.

According to Figure XVII-1, the Aviation-Related Development Alternative presented in the *Base Reuse and Development Plan* (RKG, 1995), the area that includes SWMU 11 will be used for commercial purposes. Tables 5.1.4 and 5.1.5 summarize PRE results for SWMU 11.

Table 5.1.4
SWMU 11 — Preliminary Risk Evaluation — Carcinogens (μg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Screening Value[c]		Risk Ratio	
			Residential	Industrial	Residential	Industrial
Arsenic	6,800	13,100	4.30e+02	3.80e+02	0.00e+00	0.00e+00
Beryllium	460	960	1.50e+02	1.30e+02	0.00e+00	0.00e+00
4,4'-DDE *	20	N/A	1.90e+03	1.70e+04	1.05e-08	1.18e-09
Dieldrin *	130	N/A	4.00e+01	3.60e+02	3.25e-06	3.61e-07
ILCR					3.26e-06	3.62e-07

Notes:
a — The highest detected concentration for each compound was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
N/A — Not applicable.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not ILCR calculation.

Table 5.1.5
SWMU 11 — Preliminary Risk Evaluation — Noncarcinogens (μg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Soil Screening Value[c]		Risk Ratio	
			Residential	Industrial	Residential	Industrial
Arsenic	6,800	31,000	2.30e+04	6.10e+05	0.00e+00	0.00e+00
Barium	162,000	191,000	5.50e+06	1.40e+08	0.00e+00	0.00e+00
Cadmium *	3,500	BDL	4.68e+05	1.00e+06	0.00e+00	0.00e+00
Chromium	19,500	26,400	3.90e+05	1.00e+07	0.00e+00	0.00e+00
Cobalt	9,600	15,000	4.70e+06	1.20e+08	0.00e+00	0.00e+00
Copper	15,500	23,600	3.10e+06	7.60e+07	0.00e+00	0.00e+00
Mercury	240	1,100	2.30e+04	6.10e+05	0.00e+00	0.00e+00
Nickel *	40,900	BDL	1.60e+06	4.10e+07	2.56e-02	9.98e-04
Selenium *	390	BDL	3.90e+05	1.00e+07	1.00e-03	3.90e-05
Vanadium	24,300	49,600	5.50e+05	1.40e+07	0.00e+00	0.00e+00
Zinc *	134,000	88,300	2.30e+07	6.10e+08	5.83e-03	2.20e-04
HI					0.03	<0.01

Notes:
a — The highest detected concentration for each compound was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs are from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
BDL — Below detection limit.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not HI calculation.

The resulting residential and industrial carcinogen ILCRs at 3.26e-06 and 3.62e-07, respectively, fell well below the 10^{-4} criteria, indicating no risk in either scenario. The resulting residential and industrial noncarcinogen HIs at 0.03 and <0.01, respectively, fell well below the criteria of 1, indicating no risk in either scenario. Property including SWMU 11 is suitable for residential lease.

5.1.8 Conclusions and Recommendations

Based on the information gathered during this investigation, the following conclusions and recommendations have been reached:

- SWMU 11 will be developed for commercial recreational land use according to the Base Reuse Plan.

- Immunoassay field screening did not detect any PCBs above 1 mg/kg; laboratory analysis of the six samples collected from high-traffic locations did not indicate PCBs greater than the laboratory detection limit.

- Concentrations of two pesticides, 4,4'-DDE and dieldrin, were detected in surface soil.

  — Dieldrin exceeded the residential soil RBC in one of six samples collected from the surface interval but did not exceed the industrial soil RBC.

  — The average dieldrin concentration exceeded the SSL; however, due to its chemical properties, the physical properties of the soil, the shallow depth, and infrequency of detection at SWMU 11, it is not expected to leach into groundwater or migrate horizontally.

- Concentrations of 13 metals were detected in the surface interval; however, no concentration exceeded both background RCs and residential RBCs.

- Based on a PRE performed on data from samples collected from surface soil (0 to 1 foot bls):

— Carcinogens: neither the residential nor industrial carcinogen ILCR exceeded 10^{-4} indicating suitability for lease with no further action.

— Noncarcinogens: neither the residential nor the industrial noncarcinogen HI exceeded 1, indicating suitability for lease with no further action.

— In accordance with PRE methodology, the property is suitable for residential lease.

- Based on the surface soil samples collected, no further action is recommended for SWMU 11.

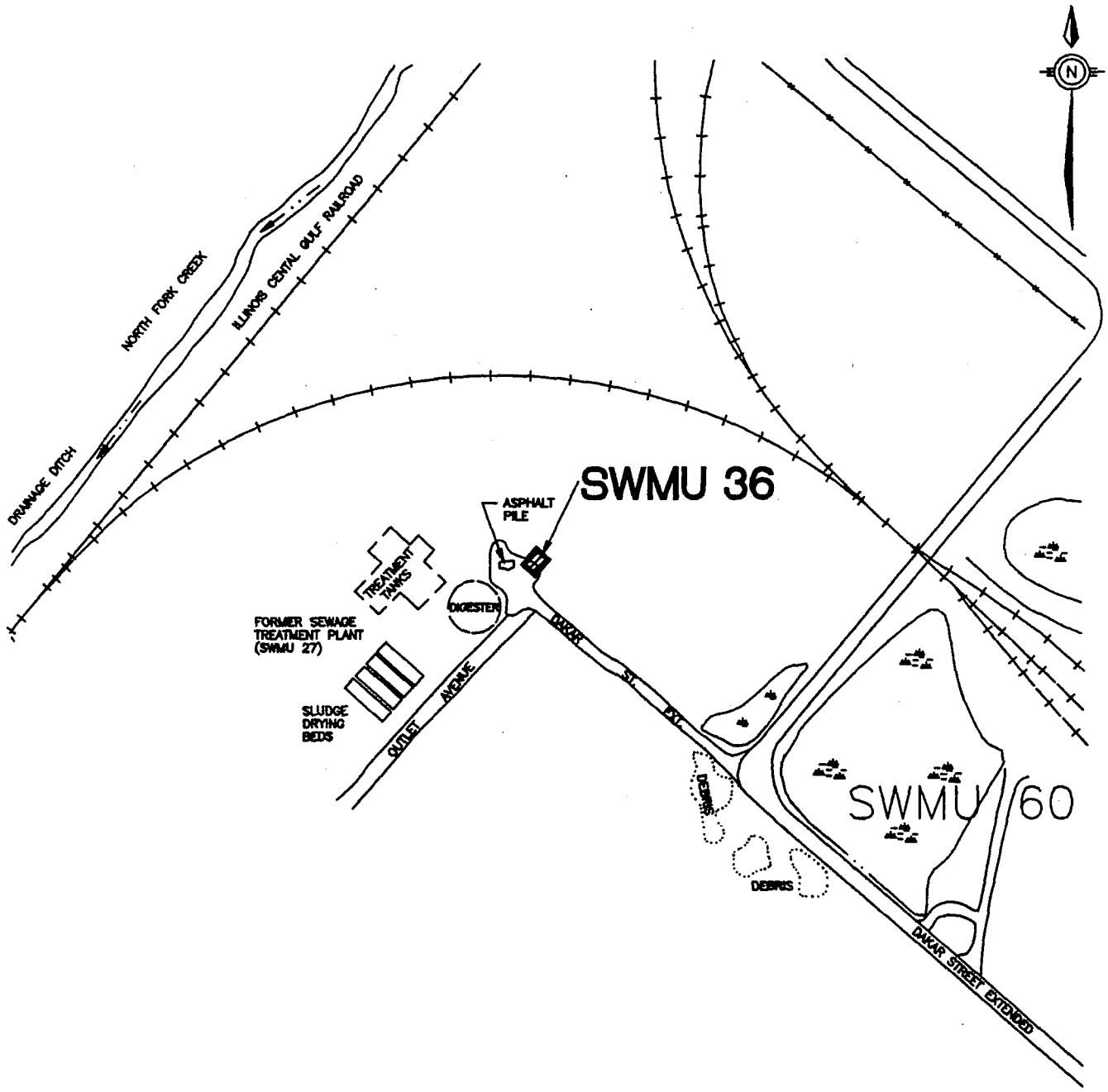
5.2 SWMU 36 — Northside Sewage Treatment Plant Incinerator

This section summarizes the activities conducted during the first phase of the CSI performed at SWMU 36, the Northside Sewage Treatment Plant Incinerator, and outlines any proposed RFI activities.

5.2.1 Site Description and Historical Information

The incinerator was approximately 200 feet northeast of the Northside Sewage Treatment Plant (see Figures 5.2-1 and 5.2-2). From approximately 1943 to 1984, the unit, known as Incinerator No. 4, burned classified material including nonhazardous paper and plastic identification cards. A review of engineering plan drawings dated June 1942 indicates that the building was constructed of wood and concrete bricks, had two levels, and was approximately 26 feet long and 22 feet wide. The upper level was designated as the first floor, or charging floor, and the lower level was designated as the ground floor, where the incinerator equipment was housed. Approximately 7 feet of the 11-foot lower level were below grade. The incinerator stack was constructed of concrete brick to approximately 24 feet above grade. The plan indicated a 1,100-gallon UST for fueling the incinerator equipment was outside the building with associated piping entering the side of the building at ground floor. The plans also indicate a manway and fill port for the UST would have been constructed at grade outside the building. The incinerator and treatment plant were demolished in 1984, and the property is currently unused and overgrown. No records were located to document the UST removal during demolition.

According to the 1990 RFA, SWMU 36 was determined to require NFA by the Navy and USEPA Region IV. However, due to the forthcoming transfer of property under BRAC, the BCT determined that a CSI should be performed because plastics were incinerated onsite, details regarding disposal of the ash are uncertain, and a UST used for fuel storage may be present.



LEGEND

FLOW DIRECTION

SWMU 36

200 0 200

SCALE FEET

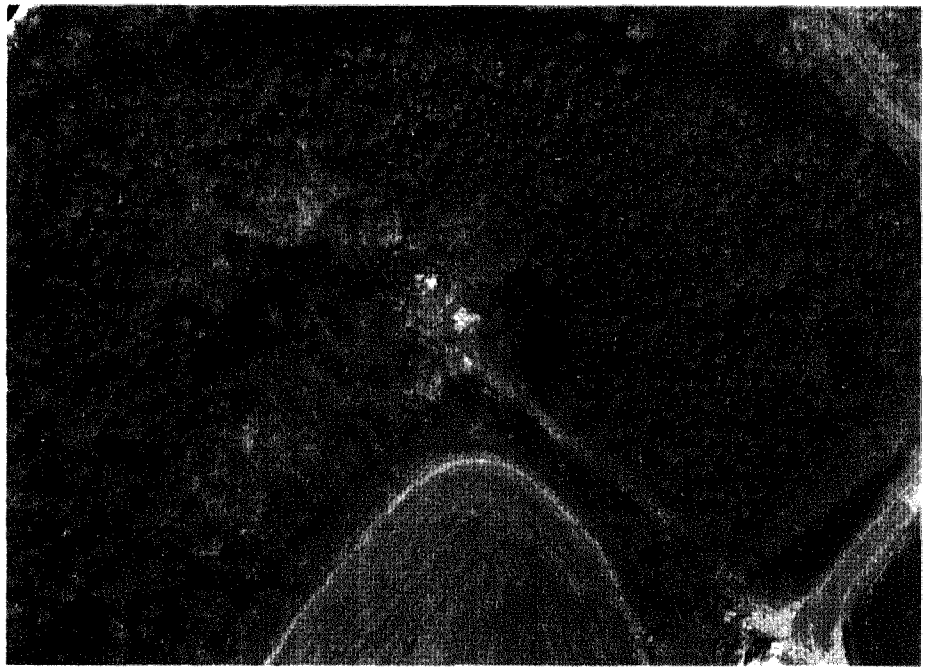
RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 5.2–1
SITE MAP
NORTHSIDE SEWAGE TREATMENT
PLANT INCINERATOR
SWMU 36

DWG DATE: 04/04/96 | DWG NAME: 94VM36A

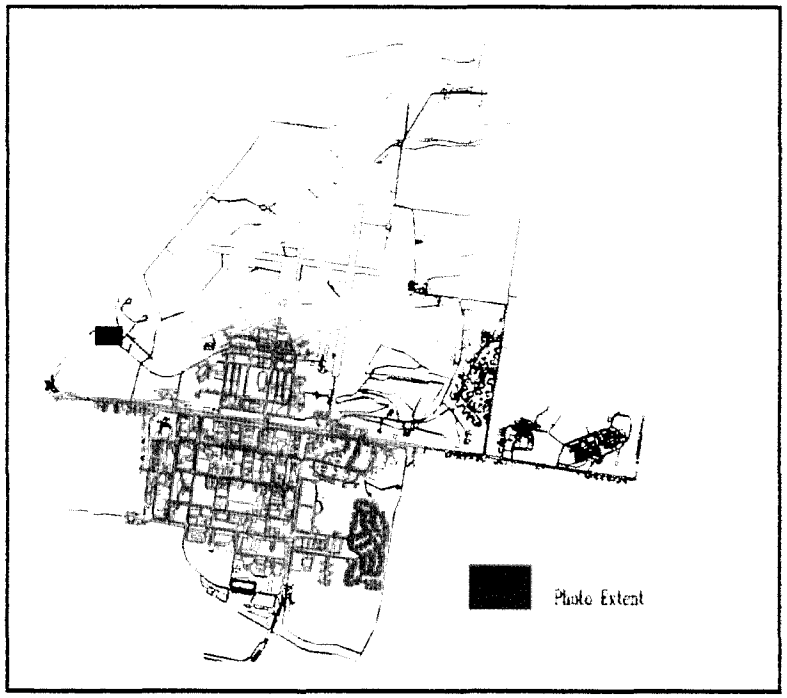


SWMU 36
BOUNDARY

N

Photograph Scale

0 200 400 Ft.



RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 5.2-2
DIGITAL ORTHOPHOTOGRAPH
NORTHSIDE SEWAGE TREATMENT
PLANT INCINERATOR - SWMU 36

AML: home/cel/reserve/site_dir/

5.2.2 Topography and Drainage

The area has been disturbed by past activities but is generally level. SWMU 36 is approximately 1,000 feet east of North Fork Creek and 500 feet from a drainage ditch along the NSA Memphis boundary, according to the USGS 7.5-Minute Millington Quadrangle of the area and maps of NSA Memphis based on digital orthophotography. A topographic map showing local land elevations for NSA Memphis is provided in Attachment 3, Volume II, of this CSI report.

5.2.3 Site-Specific Geology and Hydrogeology

In 1994, the USGS drilled Stratigraphic Test Hole 4 to approximately 200 feet deep approximately 500 feet south of the main runway and about 2,000 feet east of SWMU 36. The test hole originally was to be advanced approximately 15 feet into the Cook Mountain Formation (the confining unit separating the Memphis Aquifer from the overlying Cockfield Formation and shallower units). However, due to the unanticipated thinness of the Cockfield Formation, this borehole was advanced approximately 50 feet into the Memphis Sand. This test hole was visually logged by a field geologist during drilling and geophysically logged following completion. The lithology encountered below land surface in the test hole was as follows:

Loess:	Approximately 39 feet of wind-blown silt and clay deposits.
Fluvial Deposits:	Approximately 30 feet of sand and gravel.
Cockfield Formation:	Approximately 35 feet of alternating sand, clay, and some lignite.
Cook Mountain Formation:	The Cook Mountain, characterized as a gray to blue-gray dense clay approximately 46 feet thick, is defined as the upper confining unit between the surficial aquifers and the Memphis Aquifer.
Memphis Sand:	The Memphis Sand, characterized as a thick (between 865 and 880 feet) deposit of primarily fine to very coarse sand with lenses of clay, silt, and lignite, supplies water to industries and municipalities throughout Shelby County.

Subsurface soil information was also collected during the Assembly A RFI at SWMU 60, the Northside Landfill, which is approximately 500 feet east-southeast of SWMU 36 (Figure 5.2-1). Six shallow (20 feet bls) monitoring wells were installed in the loess, and four intermediate (75 to 95 feet bls) monitoring wells were installed in the lower part of the deposits at various locations around the landfill in January and February 1995. The SWMU 60 boring logs indicated low to very low-permeability silt with varying degrees of clay to approximately 40 feet bls (loess). A laboratory-measured vertical hydraulic conductivity for a subsurface soil sample collected from 20 to 22 feet bls was 1.7×10^{-7} cm/sec. Underlying the loess were sand and gravel deposits to a depth of between 75 and 96 feet (fluvial deposits). Underlying the fluvial deposits, a silty clay to clay unit was encountered (Cockfield Formation). No hydraulic conductivity data are available for the fluvial deposits at SWMU 60. SWMU 60 boring logs and geotechnical test results are provided in Attachment 4, Volume II, of this CSI report.

Background well cluster BG-05 was installed near Navy Road approximately 1,800 feet south-southeast of SWMU 36 in January 1995. Three monitoring wells were installed, one each in the loess and the upper and lower fluvial deposits, respectively. The lithology encountered in this well cluster was similar to that encountered at SWMU 60. BG-05 boring logs are provided in Attachment 4, Volume II, of this CSI report.

5.2.4 Preliminary Investigations

The 1990 Visual Site Inspection (VSI) (ERC/EDGe, 1990) report indicated no visual evidence of a release at the SWMU. An additional visual site inspection conducted by an E/A&H representative on April 10, 1995, did not identify any surface releases. No other preliminary investigations for SWMU 36 have been performed or are known to exist.

5.2.5 Field Investigation and Analytical Methods

The SWMU 36 investigation prescribed in *Assembly D Site Investigation Plans* (E/A&H, 1995) consisted of a geophysical survey, collecting surface (0 to 1 foot) and subsurface (8 to 10 feet)

soil samples, and collecting shallow groundwater samples. Figure 5.2-3 shows the soil and groundwater sampling locations.

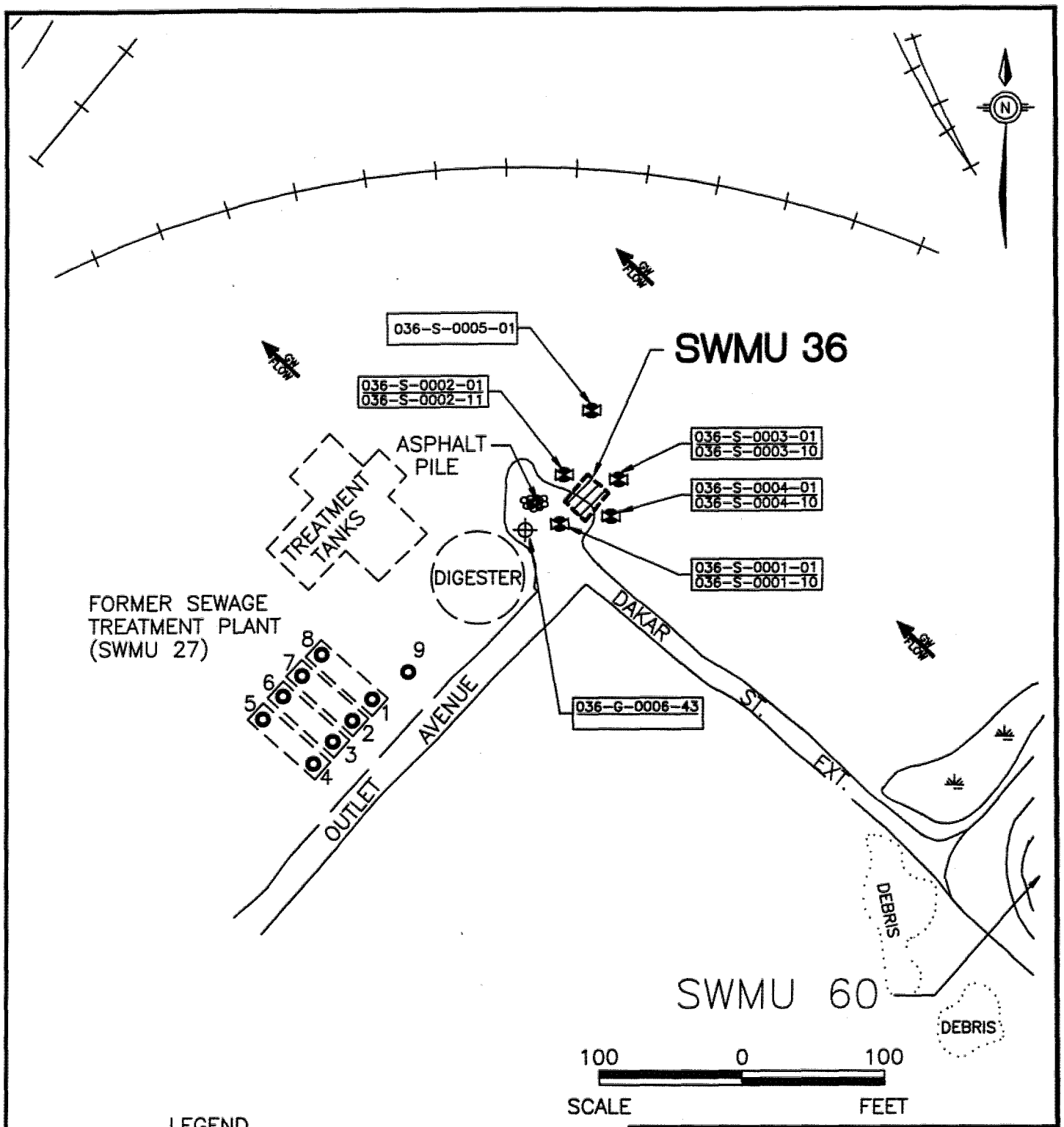
Geophysical Survey

To determine the location of the incinerator building and associated UST, engineering drawings were studied. The engineering drawings depicted a 1,100-gallon UST buried approximately 2 feet bls outside the split-level incinerator building. However, no northing direction was depicted on the engineering drawings, so the location of the UST in relation to the former building could not be confirmed.

On July 19 and 20, 1995, E/A&H performed a geophysical survey of SWMU 36. The EM-31 survey included a conductivity survey and an in-phase (metal detection) survey. Anomalies from disturbed soil or metal objects were plotted on maps. CSI sample locations were chosen with regard to the geophysical survey results. The geophysical survey identified anomalous features clustered in a pattern consistent with the dimensions of the incinerator building. Identification of the associated UST was difficult due to the lack of a northing direction on engineering site plans, and the high amplitude response from the source bodies onsite (i.e., surface piles of asphalt and rebar). An additional anomaly, trending east-west across the northern perimeter of the site, may be attributed to a buried sewer line. Appendix B provides the *SWMU 36 Geophysical Survey Report* (E/A&H, 1995) which contains the geophysical survey results for SWMU 36.

Soil and Groundwater Screening Phase

The proposed soil investigation consisted of shallow soil and groundwater sampling. Five sample locations were selected as shown in Figure 5.2-3. Four of the sample locations (036-S-0001, 036-S-0002, 036-S-0003, and 036-S-0004) were chosen because they surround the



LEGEND

- SAMPLE LOCATION
- SWMU 27 SAMPLE LOCATION
- GROUNDWATER SAMPLE
- PRESUMED GROUNDWATER FLOW DIRECTION BASED ON SWMU 60 DATA
- **SWMU 36**
- LOCATION OF FORMER STRUCTURES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 5.2-3
SAMPLE LOCATIONS
NORTHSIDE SEWAGE TREATMENT PLANT INCINERATOR
SWMU 36

DWG DATE: 04/04/96 | DWG NAME: 94SL001

former ground floor area that reportedly housed the incinerator and associated UST; the fifth sample (036-S-0005) was selected to represent a downwind area to the north which could have received fallout from the incinerator stack. As outlined on Figure 2-6 of the *Comprehensive RFI Work Plan* (E/A&H, 1994), the prevailing winds at NSA Memphis are from the south.

Surface soil samples were collected with a hand auger and submitted to NET and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), Appendix IX metals, chlorinated pesticides/PCBs, and dioxin. One soil sample collected from the surface interval was duplicated for the same analyses. Direct Push Technology (DPT) was used to collect subsurface soil samples (8 to 10 feet bls) at the four sample locations surrounding the former incinerator building. The 8 to 10 feet bls interval was chosen to correspond to the 2-foot interval below the ground floor slab and native soil beneath the reported UST. The four subsurface soil samples were submitted to NET and analyzed for total petroleum hydrocarbons gasoline and diesel range organics (TPH/GRO.DRO). A Geoprobe sampler was used to collect a groundwater sample from a sixth sample location shown in Figure 5.2-3. Shallow (loess) groundwater was not present at the sample location; therefore, a groundwater sample was collected from the upper fluvial deposits, the first water-bearing zone, at 43 feet bls. The groundwater sample was submitted to NET and analyzed for VOCs. Laboratory analytical data are presented in Appendix C.

5.2.6 Nature and Extent of Contamination

This section provides the analytical results for surface (0-1') and subsurface soil and groundwater samples collected during the first phase of the SWMU 36 CSI. Analytical results for surface samples and groundwater samples were compared to residential and industrial RBCs. Constituent averages for SWMU 36 were compared to transfer from soil to groundwater SSLs to determine the need for further study or action (OSWER Soil Screening Guidance memorandum, USEPA, 1994.) Constituent concentrations from individual soil samples were also compared to SSLs. Metals analytical results for soil samples were compared to background

reference concentrations (2 × mean). Tables 5.2.1 and 5.2.2 summarize laboratory analytical results compared to RBCs and SSLs for organic and inorganic compounds detected in soil samples at SWMU 36, respectively. Table 5.2.2 also compares soil inorganic concentrations to background RCs as described in Section 3 of this report. Groundwater results are discussed following Table 5.2.2.

Organics

As Table 5.2.1 indicates, 31 organic compounds were detected in the five samples collected from the surface interval at SWMU 36, but concentrations of only two SVOCs and one chlorinated pesticide exceeded residential soil RBCs in surface samples.

- Benzo(a)pyrene exceeded the residential soil RBC of 88 μg/kg in two of five samples (036-S-0003-01 and 036-S-0004-01) with a maximum detected concentration of 380 μg/kg.

- Dibenz(a,h)anthracene exceeded the residential soil RBC of 88 μg/kg in one of five samples (036-S-0004-01) at a concentration of 120 μg/kg.

- Dieldrin exceeded the residential soil RBC of 40 μg/kg in three of five samples (036-S-0001-01, 036-S-0003-01, and 036-S-0004-01) with a maximum detected concentration of 120 μg/kg.

Table 5.2.1
SWMU 36 — Organics in Soil (µg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Acenaphthene	0-1'	2/5	47 - 120	84	4.70e+06	0	1.20e+08	0	2.00e+05	N
Anthracene	0-1'	2/5	55 - 140	98	2.30e+07	0	6.10e+08	0	4.30e+06	N
Benzo(a)anthracene	0-1'	4/5	42 - 410	161	880	0	7.80e+03	0	700	N
Benzo(a)pyrene	0-1'	4/5	41 - 380	148	88	2	780	0	4.00e+03	N
Benzo(b)fluoranthene	0-1'	4/5	45 - 410	162	880	0	7.80e+03	0	4.00e+03	N
Benzo(g,h,i)perylene	0-1'	4/5	37 - 300	133	2.30e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
Benzo(k)fluoranthene	0-1'	4/5	40 - 340	134	8.80e+03	0	7.80e+04	0	4.00e+03	N
Carbazole	0-1'	2/5	42 - 150	96	32,000	0	2.90e+05	0	500	N
alpha-Chlordane	0-1'	4/5	3.4 - 26	10	490[i]	0	4.40e+03[i]	0	2.00e+03[i]	N
gamma-Chlordane	0-1'	3/5	1.6 - 8.6	4.0	490[i]	0	4.40e+03[i]	0	2.00e+03[i]	N
Chrysene	0-1'	4/5	46 - 450	174	8.80e+04	0	7.80e+05	0	1.00e+03	N
4,4'-DDE	0-1'	3/5	7.2 - 27	18	1.90e+03	0	1.70e+04	0	500	N
4,4'-DDT	0-1'	4/5	3 - 31	17	1.90e+03	0	1.70e+04	0	1.00e+03	N
Dibenz(a,h)anthracene	0-1'	2/5	36 - 120	78	88	1	780	0	1.10e+04	N
Dibenzofuran	0-1'	1/5	61	N/A	3.10e+05	0	8.20e+06	0	1.20e+05	N
Dieldrin	0-1'	5/5	3.6 - 120	57	40	3	360	0	1	Y
1234678-HpCDD	0-1'	4/5	0.0331 - 0.0685	<0.1	0.43	0	j	0	j	N
1234678-HpCDF	0-1'	3/5	0.0048 - 0.0067	<0.01	0.43	0	j	0	j	N
OCDD	0-1'	5/5	1.2084 - 3.7353	2.1	4.3	0	j	0	j	N
OCDF	0-1'	2/5	0.0062 - 0.0071	<0.01	4.3	0	j	0	j	N
Endosulfan II	0-1'	1/5	2.2	N/A	4.70e+05	0	1.20e+07	0	3.00e+03	N
Endrin ketone	0-1'	1/5	1.6	N/A	2.30e+04	0	j	0	400	N
Fluoranthene	0-1'	4/5	77 - 810	314	3.10e+06	0	8.20e+07	0	9.80e+05	N
Fluorene	0-1'	2/5	40 - 90	65	3.10e+06	0	8.20e+07	0	1.60e+05	N
Heptachlor epoxide	0-1'	2/5	1.8 - 9.8	5.8	70	0	630	0	30	N
Indeno(1,2,3-cd)pyrene	0-1'	3/5	60 - 270	135	880	0	7.80e+03	0	3.50e+04	N
2-Methylnaphthalene	0-1'	1/5	44	N/A	3.10e+06	0	j	0	j	N

Table 5.2.1
SWMU 36 — Organics in Soil (µg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Naphthalene	0-1'	2/5	75 - 110	93	3.10e+06	0	8.20e+07	0	3.00e+04	N
Phenanthrene	0-1'	4/5	49 - 660	246	2.30e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
Pyrene	0-1'	4/5	71 - 680	263	2.30e+06	0	6.10e+07	0	1.40e+06	N
TPH - Gasoline Range Organics	9-10'	2/4	56 - 59	58	1.00e+05[k]	0	N/A	0	N/A	N
Technical Chlordane	0-1'	1/5	210	N/A	490[i]	0	4.40e+03[i]	0	2.00e+03[i]	N

***Notes*:**

a — Feet bls
b — Nine samples collected from five locations. Five samples collected from 0 to 1 foot bls were analyzed for Appendix IX metals, pesticides/PCBs, SVOCs, and dioxins. Four samples collected from 9 to 10 feet bls were analyzed for TPH/GRO.DRO. One sample was duplicated for Appendix IX metals, pesticides/PCBs, SVOCs, and dioxins.
c — Range lower limit is the lowest detected parameter concentration.
d — Mean based on detected parameter concentrations only.
e — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo.) RBCs are only applicable for comparison to data from samples collected across 0 to 1 foot bls.
f — Soil Screening Level (SSL) considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Ris -Based Concentration Table, July to December 1995).
g — Contaminant averages were compared to SSLs for determination of need for further study or action.
h — Risk-based data not available; data for pyrene used as surrogate.
i — Risk-based data not available; data for chlordane used as surrogate.
j — Risk-based data not available.
k — RBC does not exist; value shown is TDEC soil cleanup level for total TPH (GRO + DRO).
N/A — Not applicable

Table 5.2.2
SWMU 36 — Inorganics in Surface Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Arsenic	0-1'	5/5	3.9 - 11	7	13.1	0	0.48[i]	5	3.8[i]	5	15[i]	N
Barium	0-1'	5/5	63.3 - 118	89	191	0	5.50e+03	0	1.40e+05	0	32	Y
Beryllium	0-1'	5/5	0.28 - 0.79	0.49	0.96	0	0.15	5	1.30e+03	0	180	N
Chromium	0-1'	5/5	3.5 - 10.6	6.7	26.4	0	390[j]	0	1.00e+04[j]	0	19[j]	N
Cobalt	0-1'	5/5	2.2 - 7.7	6.4	15	0	4.70e+03	0	1.20e+05	0	k	N
Copper	0-1'	5/5	4.8 - 13.1	8.3	23.6	0	3.10e+03	0	7.60e+04	0	k	N
Lead	0-1'	5/5	12 - 79	35	28.7	2	400[l]	0	1,000[l]	0	k	N
Nickel	0-1'	1/5	6.8	N/A	BDL	1	1.60e+03	0	4.10e+04	0	21	N
Selenium	0-1'	1/5	0.25	N/A	BDL	1	390	0	1.00e+04	0	3	N
Silver	0-1'	1/5	0.77	N/A	BDL	1	390	0	1.00e+04	0	k	N
Tin	0-1'	3/5	7.1 - 8	8	BDL	3	4.70e+04	0	1.00e+06	0	k	N
Vanadium	0-1'	5/5	6.1 - 23.5	17.2	49.6	0	550	0	1.40e+04	0	k	N
Zinc	0-1'	5/5	20.4 - 50	32	88.3	0	2.30e+04	0	6.10e+05	0	4,200	N

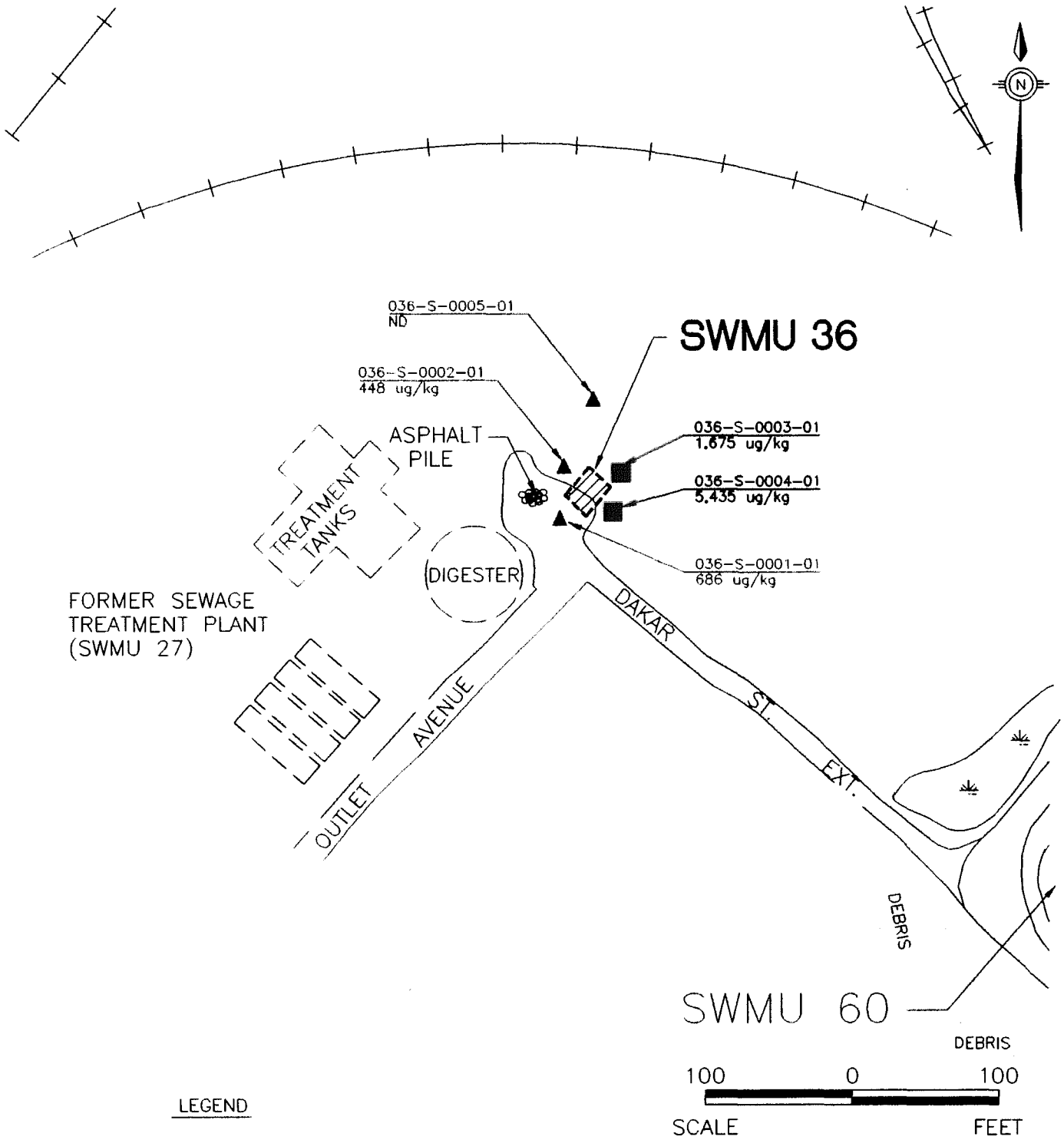
Notes:

a — Feet bls
b — Nine samples collected from five locations. Five samples collected from 0 to 1 foot bls analyzed for Appendix IX metals, pesticides/PCBs, SVOCs, VOCs, and dioxins. Four samples collected from 9 to 10 feet bls were analyzed for TPH/GRO.DRO. One sample was duplicated for Appendix IX metals, pesticides/PCBs, SVOCs, VOCs, and dioxins.
c — Range lower limit is the lowest detected parameter concentration.
d — Mean is based on detected parameter concentrations only.
e — Background reference concentration (2 × mean background). See Section 3.0 of this report for a discussion of reference concentrations (RCs).
f — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995 USEPA Region III RBC memo) RBCs are only applicable for comparison to data from samples collected across the 0 to 1-foot bls interval.
g — SSL considered protective of contaminant transfer from soil to groundwater (from Region IV Risk-Based Concentration Table, July to December 1995).
h — Contaminant averages were compared to SSLs for determination of need for further study or action.
i — RBC for arsenic as a carcinogen.
j — Risk-based data for hexavalent chromium (VI).
k — Risk-based data not available at this time.
l — Value is soil cleanup level for total lead (USEPA OSWER Directive, 9355.4-12)
N/A — Not applicable
BDL — Below detection limit.

As noted earlier, the *Discussion of Dieldrin Risk Management Issues* memorandum stated that dieldrin was ubiquitous at NSA Memphis as a result of aerial applications during a USDA quarantine on the white-fringed beetle during the 1950s and 1960s. Dieldrin was also used in the pest-control trade along with chlordane for general subterranean termite control. Risk estimates based on the soil dieldrin concentrations at NSA Memphis did not exceed 1E-4 ILCR. The average concentration of samples collected during a background study was 131 μg/kg with a maximum detected concentration of 311 μg/kg. As stated in the memorandum, "This finding indicates that dieldrin levels found at each SWMU do not necessitate remedial action in the absence of other significant carcinogenic risk contributors."

Dieldrin was detected in all five surface soil samples with an average of 57 μg/kg, exceeding the transfer from soil to groundwater SSL of 1 μg/kg. Constituent averages were calculated using sample data from all sampling intervals. The maximum dieldrin concentration of 120 μg/kg detected at SWMU 36 was below the average dieldrin concentration of 131 μg/kg detected in background samples. Although the SWMU 36 average dieldrin concentration exceeded the SSL, because of the chemical properties of dieldrin, the physical properties of soil, and the depths at which dieldrin was detected, it is not expected to leach in appreciable quantities (if at all) into underlying groundwater. Also, the physical adsorption of the contaminants to soil particles and organic material greatly limits horizontal migration. All organic concentrations were well below industrial RBCs. Figures 5.2-4 and 5.2-5 provide plots of SVOCs and pesticides, respectively, in surface soil. Figure 5.2-6 provides a plot of transfer from soil to groundwater SSL exceedances.

TPH-GRO was detected in two of four subsurface soil samples (036-S0003-10 and 036-S-0004-10) from 9 to 10 feet bls with the highest concentration at 59 μg/kg, well below the 100,000 μg/kg TDEC (Division of Solid Waste Management, State Remediation Section) soil cleanup level for total TPH (GRO + DRO).



LEGEND

▲ CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

036-S-0004 / 0-1 10.6 ug/kg — SOIL BORING 4 CONTAINED A TOTAL SVOC CONCENTRATION OF 10.6 ug/kg @ THE 0-1 FOOT DEPTH INTERVAL.

ND — NOT DETECTED

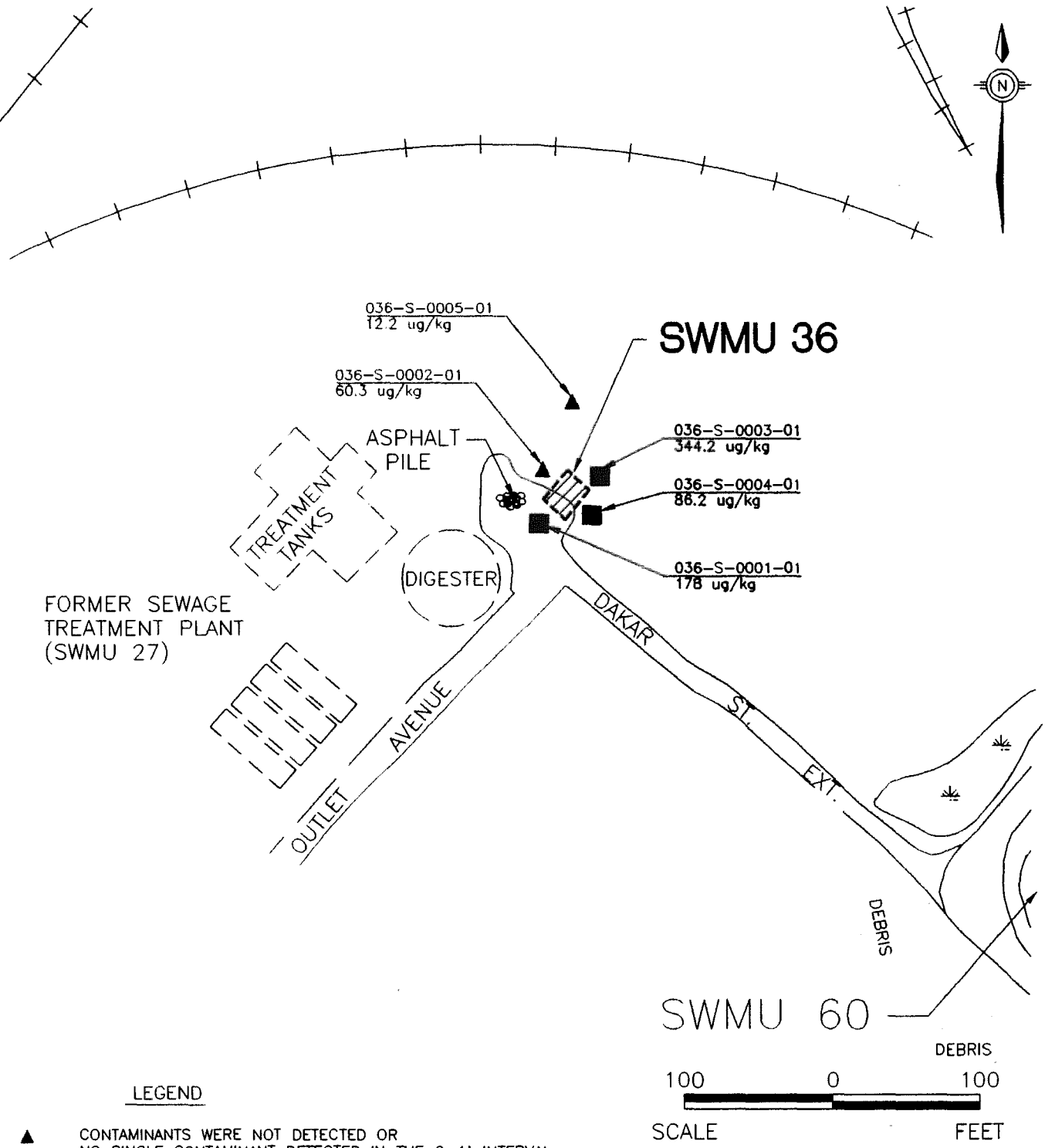
RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 5.2-4
TOTAL SVOCs IN SURFACE SOIL
NORTHSIDE SEWAGE TREATMENT PLANT INCINERATOR
SWMU 36

DWG DATE: 04/30/96 | DWG NAME: 94TSS36



LEGEND

▲ CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

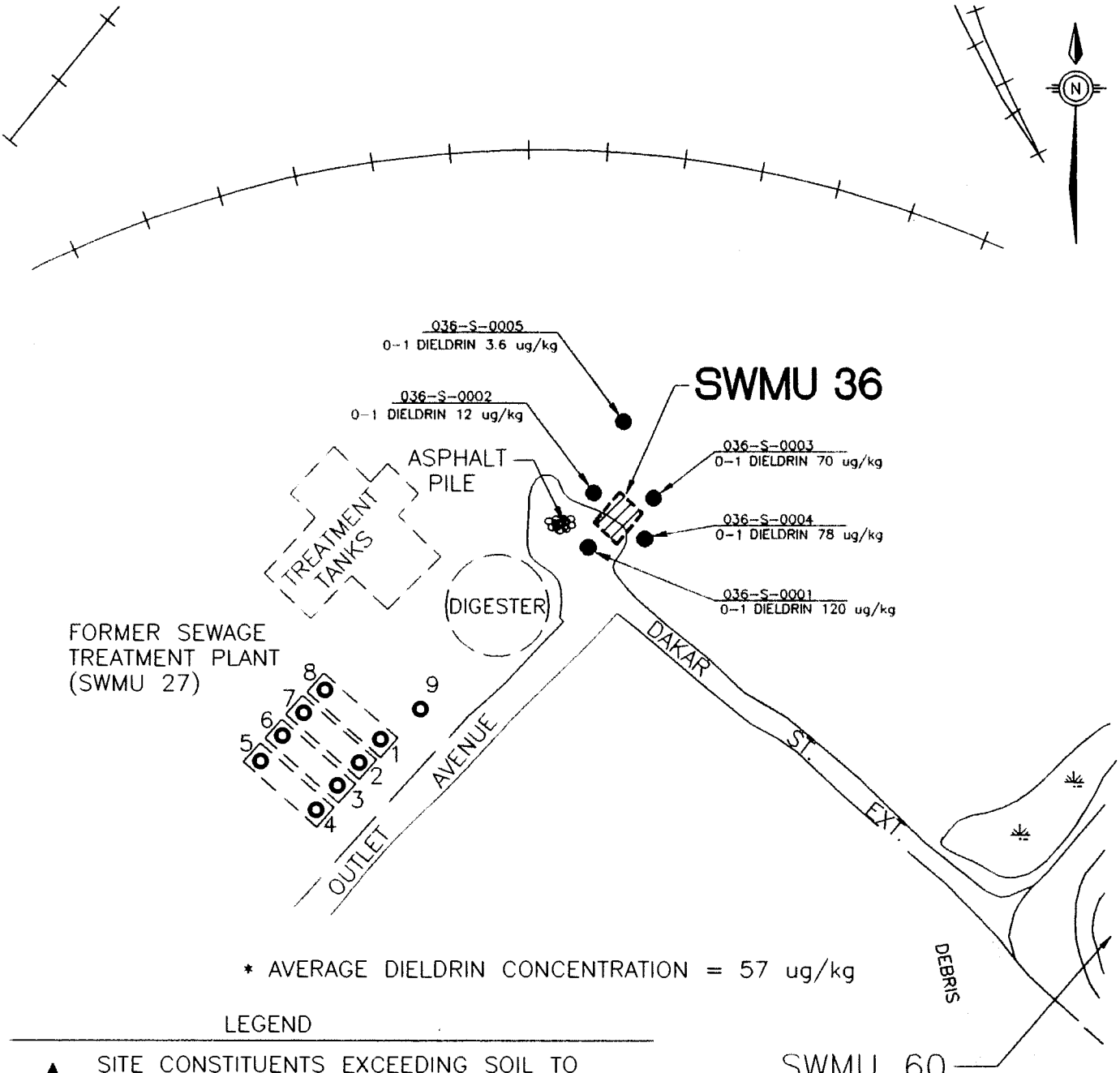
036-S-0004
0-1 10.6 ug/kg — SOIL BORING 4 CONTAINED A TOTAL PESTICIDES CONCENTRATION OF 10.6 ug/kg @ THE 0-1 FOOT DEPTH INTERVAL.

ND NOT DETECTED

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 5.2-5
TOTAL PESTICIDES IN SURFACE SOIL
NORTHSIDE SEWAGE TREATMENT PLANT INCINERATOR
SWMU 36

DWG DATE: 04/25/96 | DWG NAME: 94TPS36



* AVERAGE DIELDRIN CONCENTRATION = 57 ug/kg

LEGEND

▲ SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) NOT DETECTED AT THIS LOCATION.

● SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) DETECTED AT THIS LOCATION.

036-S-0004
0-1 DIELDRIN 78 ug/kg — SOIL BORING 4 CONTAINED A DIELDRIN CONCENTRATION OF 78 ug/kg IN THE 0-1' INTERVAL.

ND — NOT DETECTED

○ SWMU 27 SAMPLE LOCATION

SWMU 36

— — — — LOCATION OF FORMER STRUCTURES

100 0 100
SCALE FEET

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 5.2-6
TRANSFER FROM SOIL TO GROUNDWATER SSL EXCEEDANCES
NORTHSIDE SEWAGE TREATMENT PLANT INCINERATOR
SWMU 36

DWG DATE: 04/30/96 | DWG NAME: 94TRANS2

Toluene, the only constituent detected in groundwater, was detected in the upper fluvial deposits groundwater sample collected from 43 feet bls at a concentration of 1 microgram per liter (μg/L), well below the tap water RBC of 750 μg/L.

Metals

As Table 5.2.2 indicates, 13 metals were detected in the surface soil interval; however, no individual concentration exceeded both background RCs and residential RBCs. The average barium concentration at 89 mg/kg exceeded the SSL of 32 mg/kg; however, the maximum detected concentration of barium in surface soil at 118 mg/kg did not exceed the 2× mean background RC of 191 mg/kg.

5.2.7 Preliminary Risk Evaluation

In accordance with USEPA Region IV Memorandum, November, 1994, a PRE was conducted for SWMU 36 using data from soil and groundwater samples collected during the CSI as detailed in Section 5.17 a.

This PRE does not include an acute or subchronic assessment of subsurface soil data. USEPA uses an exposure duration of 25 years — a chronic exposure scenario. Exposure durations less than seven years, such as what would be assumed for a construction worker scenario, are considered acute or subchronic. Assuming a construction worker was exposed to subsurface soil for three years, cumulative risk and hazard estimates would be approximately one order of magnitude less than those presented in this PRE.

USEPA either used chronic-based toxicological information when calculating RBCs, or made conservative adjustments to reflect chronic exposure. In addition to the effect the exposure duration differences would have on a construction worker's cumulate risk and hazard estimates, toxicological information used by USEPA to calculate RBCs would be adjusted to reflect acute or subchronic toxicological endpoints rather than the chronic endpoints typically used. Acute

and subchronic thresholds are based on lower exposure durations than chronic thresholds, and higher concentrations are generally necessary to elicit observable toxic effects. Higher thresholds for toxic effects result in less conservative toxicological information, which would be used to adjust RBCs for either acute or subchronic exposure. Because a construction worker would be exposed under either acute or subchronic conditions and RBCs based on chronic exposure are generally more conservative, the commercial site worker scenario presented in this PRE would be a more conservative scenario than that for a construction worker.

The maximum concentrations reported in SWMU 36 soil were in the surface interval, and exposure to maximum reported soil concentrations would occur within that interval. Subsurface samples were analyzed for TPH; no concentrations exceeded 100 mg/kg, the TDEC cleanup level for soil.

According to Figure XVII-1, the Aviation-Related Development Alternative presented in the *Base Reuse and Development Plan* (RKG, 1995), the area that includes SWMU 36 will be used for a commercial warehouse. Tables 5.2.3 and 5.2.4 summarize PRE results for SWMU 36.

The resulting residential and industrial carcinogen ILCRs at 1.13e-05 and 1.37e-06, respectively, fell well below the 10^{-4} criteria, indicating no risk in either scenario. The resulting residential and industrial noncarcinogen HIs at 0.01 and <0.01, respectively, fell well below the criteria of 1, indicating no risk in either scenario. Property including SWMU 36 is suitable for residential lease.

Table 5.2.3
SWMU 36 — Preliminary Risk Evaluation — Carcinogens (μg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Screening Value[c]		Risk Ratio	
			Residential	Industrial	Residential	Industrial
Arsenic	11,000	13,100	4.30e+02	3.80e+03		
Benzo(a)anthracene *	410	N/A	8.80e+02	7.80e+03	4.66e-07	5.26e-08
Benzo(a)pyrene *	380	N/A	8.80e+01	7.80e+02	4.32e-06	4.87e-07
Benzo(b)fluoranthene *	410	N/A	8.80e+02	7.80e+03	4.66e-07	5.26e-08
Benzo(k)fluoranthene *	340	N/A	8.80e+03	7.80e+04	3.86e-08	4.36e-09
Beryllium	790	960	1.50e+02	1.30e+03		
Carbazole *	150	N/A	3.20e+04	2.90e+05	4.69e-09	5.17e-10
alpha-Chlordane *	26	N/A	4.70e+02	4.40e+03	5.53e-08	5.91e-09
gamma-Chlordane *	8.6	N/A	4.70e+02	4.40e+03	1.83e-08	1.95e-09
Chrysene *	450	N/A	8.80e+04	7.80e+05	5.11e-09	5.77e-10
4,4'-DDE *	27	N/A	1.90e+03	1.70e+04	1.42e-08	1.59e-09
4,4'-DDT *	31	N/A	1.90e+03	1.70e+04	1.63e-08	1.82e-09
Dibenz(a,h)anthracene *	120	N/A	8.80e+01	7.80e+02	1.36e-06	1.54e-07
Dieldrin *	120	N/A	4.00e+01	3.60e+02	3.00e-06	3.33e-07
1234678-HpCDD *	0.0685	N/A	4.30e-01	2.00e+00	1.59e-07	3.43e-08
1234678-HpCDF *	0.0067	N/A	4.30e-01	2.00e+00	1.56e-08	3.35e-09
OCDD *	3.7353	N/A	4.30e+00	2.00e+01	8.69e-07	1.87e-07
OCDF *	0.0071	N/A	4.30e+00	2.00e+01	1.65e-09	3.55e-10
Heptachlor epoxide *	9.8	N/A	7.00e+01	6.30e+02	1.40e-07	1.56e-08
Indeno(1,2,3-cd)pyrene *	270	N/A	8.80e+02	7.80e+03	3.07e-07	3.46e-08
ILCR					1.13e-05	1.37e-06

Notes:

a — The highest detected concentration for each contaminant was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo)
N/A — Not applicable.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not ILCR calculation.

Table 5.2.4
SWMU 36 — Preliminary Risk Evaluation — Noncarcinogens (μg/kg)

				Screening Value[d]				Risk Ratio			
	Concentration[a]		Background Reference	Residential		Industrial		Residential		Industrial	
Parameter	GW[b]	Soil	Concentration[c]	GW[b]	Soil	GW[b]	Soil	GW[b]	Soil	GW[b]	Soil
Acenaphthene *	NT	120	N/A	N/A	4.70e+06	N/A	1.20e+08	0.00e+00	2.55e-05	0.00e+00	1.00e-06
Anthracene *	NT	140	N/A	N/A	2.30e+07	N/A	6.10e+08	0.00e+00	6.09e-06	0.00e+00	2.30e-07
Arsenic	NT	11,000	13,100	N/A	2.30e+04	N/A	6.10e+05	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Barium	NT	118,000	191,000	N/A	5.50e+06	N/A	1.40e+08	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Benzo(g,h,i)perylene*	NT	300	N/A	N/A	3.10e+06	N/A	6.10e+07	0.00e+00	9.68e-05	0.00e+00	4.92e-06
Chromium	NT	10,600	26,400	N/A	3.90e+05	N/A	1.00e+07	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Cobalt	NT	7,700	15,000	N/A	4.70e+06	N/A	1.20e+08	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Copper	NT	13,100	23,600	N/A	3.10e+06	N/A	7.60e+07	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Dibenzofuran *	NT	61	N/A	N/A	3.10e+05	N/A	8.20e+06	0.00e+00	1.97e-04	0.00e+00	7.44e-06
Endosulfan II *	NT	2.2	N/A	N/A	4.70e+05	N/A	1.20e+07	0.00e+00	4.68e-06	0.00e+00	1.83e-07
Endrin ketone *	NT	1.6	N/A	N/A	2.30e+04	N/A	3.10e+04	0.00e+00	6.96e-05	0.00e+00	5.16e-05
Fluoranthene *	NT	810	N/A	N/A	3.10e+06	N/A	8.20e+07	0.00e+00	2.61e-04	0.00e+00	9.88e-06
Fluorene *	NT	90	N/A	N/A	3.10e+06	N/A	8.20e+07	0.00e+00	2.90e-05	0.00e+00	1.10e-06
2-Methylnaphthalene*	NT	44	N/A	N/A	3.10e+06	N/A	4.10e+06	0.00e+00	1.42e-05	0.00e+00	1.07e-05
Naphthalene *	NT	110	N/A	N/A	3.10e+06	N/A	8.20e+07	0.00e+00	3.55e-05	0.00e+00	1.34e-06
Nickel *	NT	6,800	BDL	N/A	1.60e+06	N/A	4.10e+07	0.00e+00	4.25e-03	0.00e+00	1.66e-04
Phenanthrene *	NT	220	N/A	N/A	3.10e+06	N/A	6.10e+07	0.00e+00	7.10e-05	0.00e+00	3.61e-06
Pyrene *	NT	680	N/A	N/A	2.30e+06	N/A	6.10e+07	0.00e+00	2.96e-04	0.00e+00	1.11e-05
Selenium *	NT	250	BDL	N/A	3.90e+05	N/A	1.00e+07	0.00e+00	6.41e-04	0.00e+00	2.50e-05
Silver *	NT	770	BDL	N/A	3.90e+05	N/A	1.00e+07	0.00e+00	1.97e-03	0.00e+00	7.70e-05
Tin *	NT	6,000	BDL	N/A	4.70e+07	N/A	1.00e+09	0.00e+00	1.28e-04	0.00e+00	6.00e-06
Toluene *	1	1	N/A	750	N/A	3000	N/A	1.33e-03	0.00e+00	3.33e-04	0.00e+00
Vanadium	NT	23,500	49,600	N/A	5.50e+05	N/A	1.40e+07	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Zinc	NT	50,000	88,300	N/A	2.30e+07	N/A	6.10e+08	0.00e+00	0.00e+00	0.00e+00	0.00e+00
HI								<0.01	0.01	<0.01	<0.01

***Notes*:**

a — The highest detected concentration for each contaminant was used.
b — Only one groundwater sample was collected and analyzed for VOCs.
c — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
d — Screening values are RBCs are from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
GW — Groundwater
NT — Not tested
N/A — Not applicable
BDL — Below detection limit
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not HI calculation.

5.2.8 Conclusions and Recommendations

Based on the information gathered during this investigation, the following conclusions and recommendations have been reached:

- SWMU 36 will be developed for commercial use according to the Base Reuse Plan.

- Thirty-one organic compounds were detected in five samples from the surface interval.

  — Concentrations of SVOCs benzo(a)pyrene and dibenz(a,h)anthracene and the pesticide dieldrin exceeded residential soil RBCs, but no detected concentrations exceeded industrial soil RBCs.

  — The average dieldrin concentration exceeded the SSL; however, due to its chemical properties, the physical properties of the soil, and the depth of detection, it is not expected to leach into groundwater or migrate horizontally.

- TPH-GRO detected in two samples from the subsurface interval was well below the soil cleanup level for total TPH (GRO + DRO).

- Toluene was detected in the upper fluvial deposits groundwater sample, but at a concentration well below the tap water RBC.

- Concentrations of 13 metals were detected in the surface interval; however, no concentrations exceeded both the background RCs and residential RBCs.

- Based on a PRE performed on data from surface soil samples and one groundwater sample:

  — Carcinogens: neither the residential nor commercial ILCR exceeded the 10^{-4} threshold, indicating suitability for lease with no further action.

  — Noncarcinogens: neither the residential nor the industrial HI exceeded 1, indicating suitability for lease with no further action.

- Based on data from surface and subsurface soil and groundwater samples, no further action is recommended for SWMU 36. In accordance with PRE methodology, SWMU 36 is suitable for residential lease.

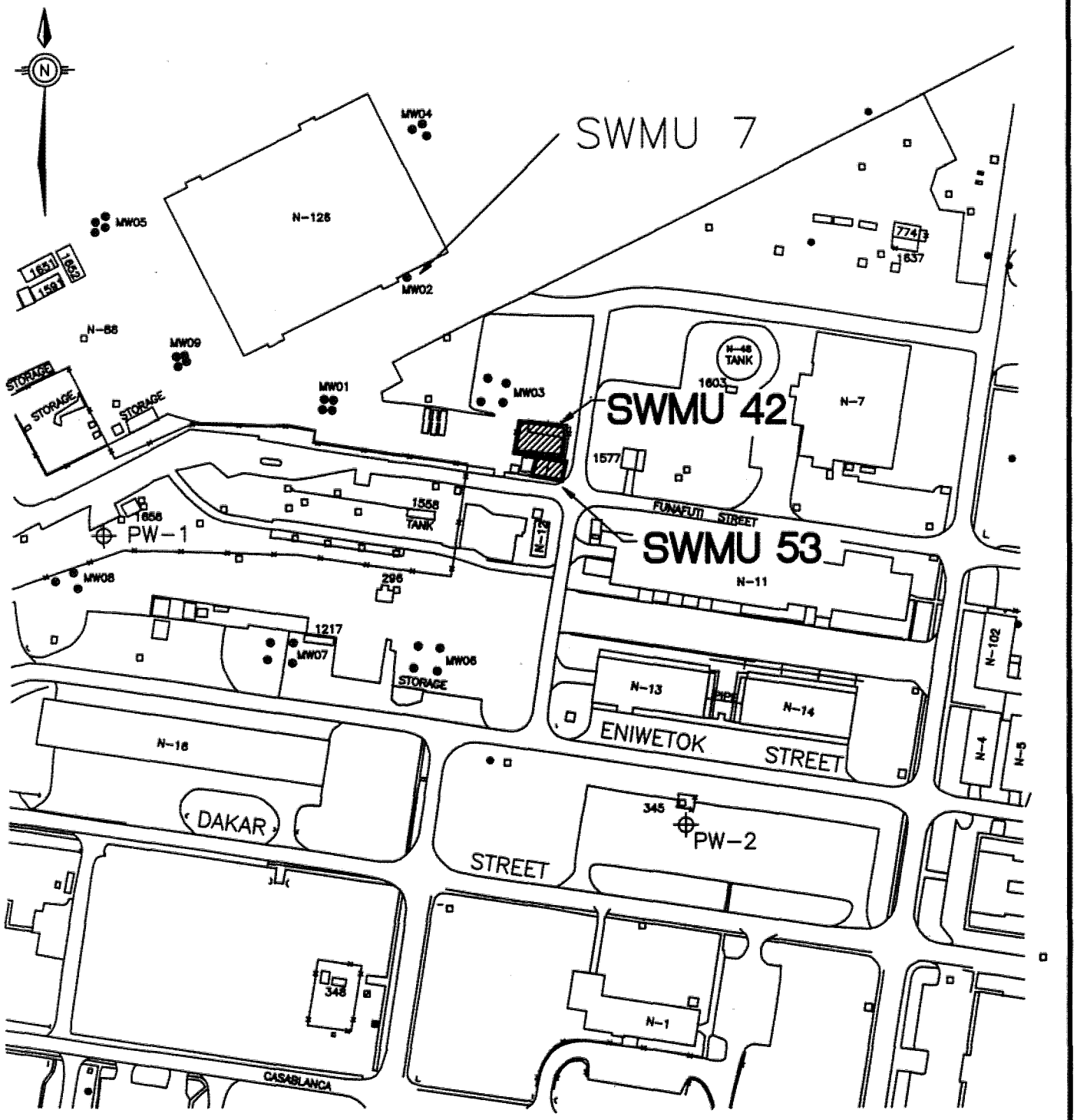
5.3 SWMUs 42 and 53 — Building N-12 Interim Hazardous Waste Storage Area and Building N-126 Interim Hazardous Waste Accumulation Point for the AIMD

This section summarizes the activities conducted during the first phase of the CSI performed at SWMUs 42 and 53, the Building N-12 interim hazardous waste storage area and the Building N-126 hazardous waste accumulation point for the Aircraft Intermediate Maintenance Department (AIMD), and outlines any proposed RFI activities.

5.3.1 Site Description and Historical Information

The CSIs for SWMUs 42 and 53 have been combined because they are in the same general area and both have stored hazardous wastes. Figures 5.3-1 and 5.3-2 provide a vicinity map and digital orthophotograph of SWMUs 42 and 53, respectively.

SWMU 42, the Building N-12 Interim Hazardous Waste Storage Area, was a greater-than-90-day hazardous waste accumulation point. The accumulation point currently consists of a 70-foot by 45-foot asphalt-paved, fenced, storage area and Quonset hut that once stored waste oil, paint, and solvents. The accumulation point is approximately 1,400 feet southeast of the main runway and 40 feet north of Building N-12, across Funafuti Street. At present, painting and paint-stripping operations continue at Building N-12. The SWMU 42 area has been a hazardous waste accumulation and storage area since the 1940s. In 1989, the Navy closed SWMU 42 under RCRA guidelines, which included collecting and analyzing closure samples. The Navy provided analytical results to TDEC on May 3, 1989, along with a recommendation for clean closure. The closure recommendation letter and the memorandum indicating the previous storage of PCB-contaminated items are provided in Appendix D. According to NSA Memphis Public Works personnel, PCB-contaminated items also have been occasionally stored in the fenced enclosure since 1989. SWMU 42 is presently a less-than-90-day hazardous waste accumulation point.



LEGEND

PW-2 PRODUCTION WELL

MW01 EXISTING MONITORING WELL

SWMU

200 0 200

SCALE FEET

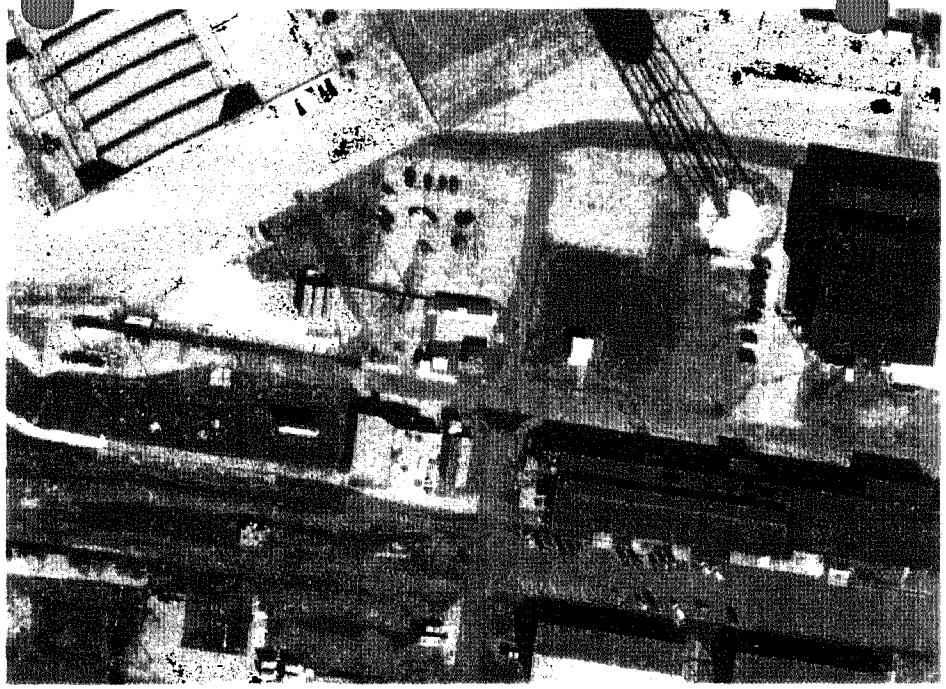
RCRA FACILITY INVESTIGATION

NSA MEMPHIS

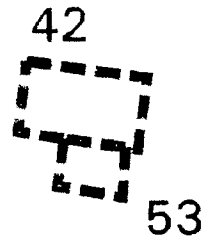
MILLINGTON, TENNESSEE

FIGURE 5.3-1
VICINITY MAP
BLDG N-12 INTERIM HAZARDOUS WASTE STORAGE AREA AND BLDG N-126 HAZARDOUS WASTE ACCUMULATION POINT SWMUs 42 & 53

DWG DATE: 04/04/96 | DWG NAME: 94VM42A

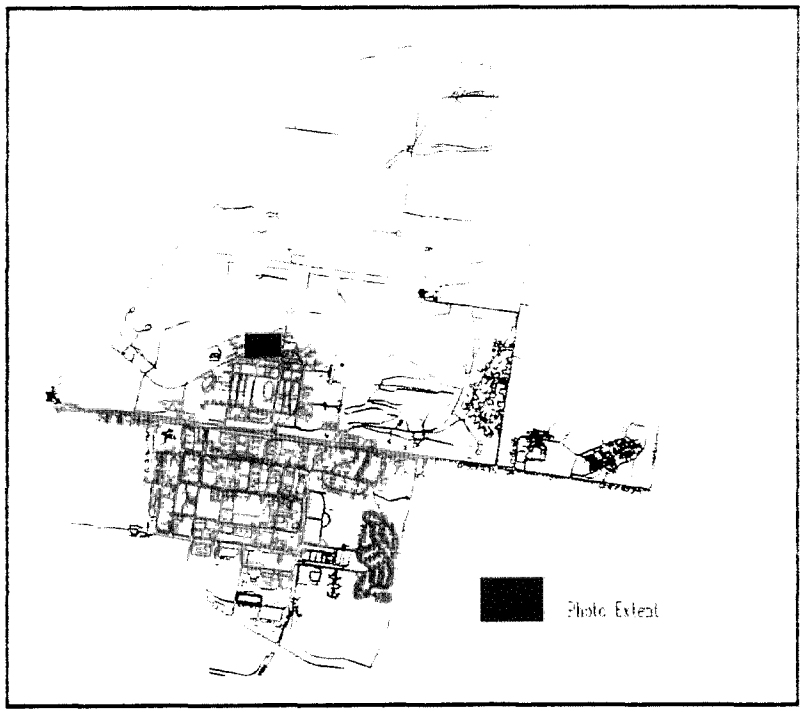


SWMU 42 & 53 BOUNDARIES



Photograph Scale

0 250 500 Ft.



RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 5.3-2

DIGITAL ORTHOPHOTOGRAPH
BUILDING N-12 INTERIM HAZARDOUS WASTE STORAGE AREA AND BUILDING N-126 HAZARDOUS WASTE ACCUMULATION POINT - SWMUs 42 & 53

AML: home1/cel/treesite_dir/

According to the 1990 VSI Report, an inspection conducted on April 19, 1990, identified the accumulation point as empty with no evidence of a surface release. On April 10, 1995, an E/A&H representative visually inspected the site; no evidence of a surface release was noted, and the concrete paving appeared to be intact.

SWMU 53 is the hazardous waste accumulation point for storage of drummed trichloroethene (TCE), mineral spirits, and paint-thinner wastes generated by the AIMD, as well as used oil. The SWMU, a fenced asphalt compound north of Building N-12 across Funafuti Street, contains a flammable materials storage locker and a drum storage area west of the Quonset hut/open storage shed. The Quonset hut was associated with activities at SWMU 53 and is currently included in SWMU 42 storage operations. SWMU 53, once an interim hazardous waste storage facility, has operated since 1955. The interim storage facility was closed on June 10, 1987, in accordance with an approved closure plan dated September 15, 1986 (see Appendix D for closure plan and closure certification).

The 1990 RFA and the *1990 RCRA Facility Investigation Work Plan* (SOUTHDIV, 1990) indicate the AIMD hazardous waste accumulation point has been at various locations. In 1987, the collection point was reportedly inside Building N-126. Then in 1989, it was reported to be west of Building N-126 in a fenced asphalt compound with containment (at the same location as SWMU 50). However, a records review indicates that it has been at the closed western portion of the Quonset hut since 1987.

5.3.2 Topography and Drainage

The topography at SWMUs 42 and 53 is generally level. Surface water at the site drains south and west over paved areas into nearby storm drains associated with the SWMU 6 storm sewer and drainage ditch, approximately 500 feet northwest of SWMUs 42 and 53. The SWMU 6 drainage ditch ultimately empties into the North Fork Creek. A topographic map showing local land elevations for NSA Memphis is provided in Attachment 3, Volume II, of this document.

5.3.3 Site-Specific Geology and Hydrogeology

USGS Stratigraphic Test Hole 5, approximately 700 feet east of SWMUs 42 and 53, provides lithologic data for the area. This stratigraphic test hole was advanced a few feet into the top of the Cook Mountain Formation to better understand site lithologies before monitoring-well installation at adjacent sites. The test hole was visually logged by a field geologist during drilling and geophysically logged to its total depth following completion. Stratigraphy and lithologies encountered in the test hole were as follows:

Loess:	Approximately 30 feet of wind-blown silt and clay deposits.
Fluvial Deposits:	Approximately 54 feet of sand and gravel.
Cockfield Formation:	Approximately 104 feet of alternating sand and clay with some lignite.
Cook Mountain Formation:	Characterized as a gray to blue-gray dense clay. Defined as the upper confining unit between the surficial aquifers and the Memphis Aquifer. Because the stratigraphic test hole was only advanced 20 feet into the Cook Mountain Formation, the entire thickness is not known.

Subsurface soil information was also collected during the Assembly A RFI for SWMU 7, the Building N-126 Plating Shop Dry Well, which is approximately 300 feet northwest of SWMUs 42 and 53 (Figure 5.3-1). During the Assembly A investigation, nine monitoring well clusters (designated MW-01 through MW-09) were installed north, south, and west of SWMUs 42 and 53. MW-01, MW-02, MW-03, and MW-06 (Figure 5.3-1) were the SWMU 7 monitoring well clusters closest to SWMUs 42 and 53, from 75 to 400 feet away. The general lithology encountered in the soil borings associated with these four clusters was as follows:

- Clayey silt, silty clay, and sandy clay from ground surface to between 25 and 34 feet bls (loess).

- Sand with gravel, silt, and clay from between 25 and 34 feet bls to between 69 and 96 feet bls (fluvial deposits).

- Silty sand, clayey sand, sandy clay, and lignite from between 69 and 82 feet to between 94 and 116 feet bls.

- Hard, waxy clay with sand laminations from between 94 and 116 feet bls to the termination depth of the borings between 101 and 125 feet bls (Cockfield Formation).

Laboratory-measured vertical hydraulic conductivity for a subsurface soil sample collected from 20 to 22 feet bls (loess) at MW-09 was 9.5×10^{-7} cm/sec. MW-09 was approximately 450 feet west of SWMUs 42 and 53. Laboratory-measured vertical hydraulic conductivity for a soil sample collected from 75 to 77 feet bls (lower part of the fluvial deposits) at MW-01 was 6.8×10^{-5} cm/sec. MW-01 was approximately 225 feet west of SWMUs 42 and 53.

Laboratory-measured vertical hydraulic conductivity for samples collected from the Cockfield Formation (MW-01, 110 to 112 feet bls; MW-03, 115 to 117 feet bls; and MW-08, 125 to 127 feet bls) ranged from 8.7×10^{-7} cm/sec to 1.6×10^{-8} cm/sec. Well clusters MW-01, MW-03, and MW-08 are 225 feet west, 30 feet northwest, and 600 feet southwest, respectively, of SWMUs 42 and 53. The boring and monitoring-well logs and hydraulic-conductivity data sheets for SWMU 7 are provided in Attachment 4, Volume II, of this document.

5.3.4 Preliminary Investigations

Several investigations have been performed on nearby property at SWMU 7 (Building N-126 Plating Shop Dry Well) and SWMU 15 (N-94 UST Farm). These investigations have identified compounds in soil and groundwater associated with petroleum and solvent releases. Primary hazardous constituents associated with mineral spirits, paint- thinner wastes, and solvents include VOCs, SVOCs, and metals.

According to the 1990 RFI Work Plan, in 1989, the Navy performed a RCRA closure of the former interim hazardous waste storage areas currently identified as SWMUs 42 and 53. Based on the closure soil sample results, the Navy recommended that TDEC grant the site clean closure. VSLs conducted since 1990 have not indicated any evidence of a surface release at the existing units.

In March and May 1995, as part of the SWMU 7 RFI, the nine monitoring well clusters around SWMU 7 were sampled, including the wells in the four closest clusters to SWMUs 42 and 53 (designated MW-01, MW-02, MW-03, and MW-06, which are less than 300 feet from the SWMUs). At least one of the compounds listed below was detected in at least one monitoring well in the four clusters near SWMUs 42 and 53 (concentrations in parts per billion [ppb]):

Constituent	Concentration
1,1-dichloroethene (1,1-DCE)	1 to 3 ppb
1,2-dichloroethene (1,2-DCE)	2 to 34 ppb
1,1-dichloroethane (1,1-DCA)	2 to 79 ppb
1,2-dichloroethane (1,2-DCA)	3 to 26 ppb
TCE	2 to 73 ppb
Tetrachloroethene (PCE)	1 to 2 ppb
Benzene	7 to 8 ppb
Carbon tetrachloride	4 to 16 ppb
Chloroform	2 ppb
Carbon disulfide	3 ppb

No pesticides, herbicides, SVOCs, or TPH were detected in these wells.

DPT surveys also were performed on the property surrounding SWMU 7 in November and December 1994, and May and June 1995 as part of the SWMU 7 RFI. Several DPT sampling locations were less than a few hundred feet away from SWMUs 42 and 53. Soil and

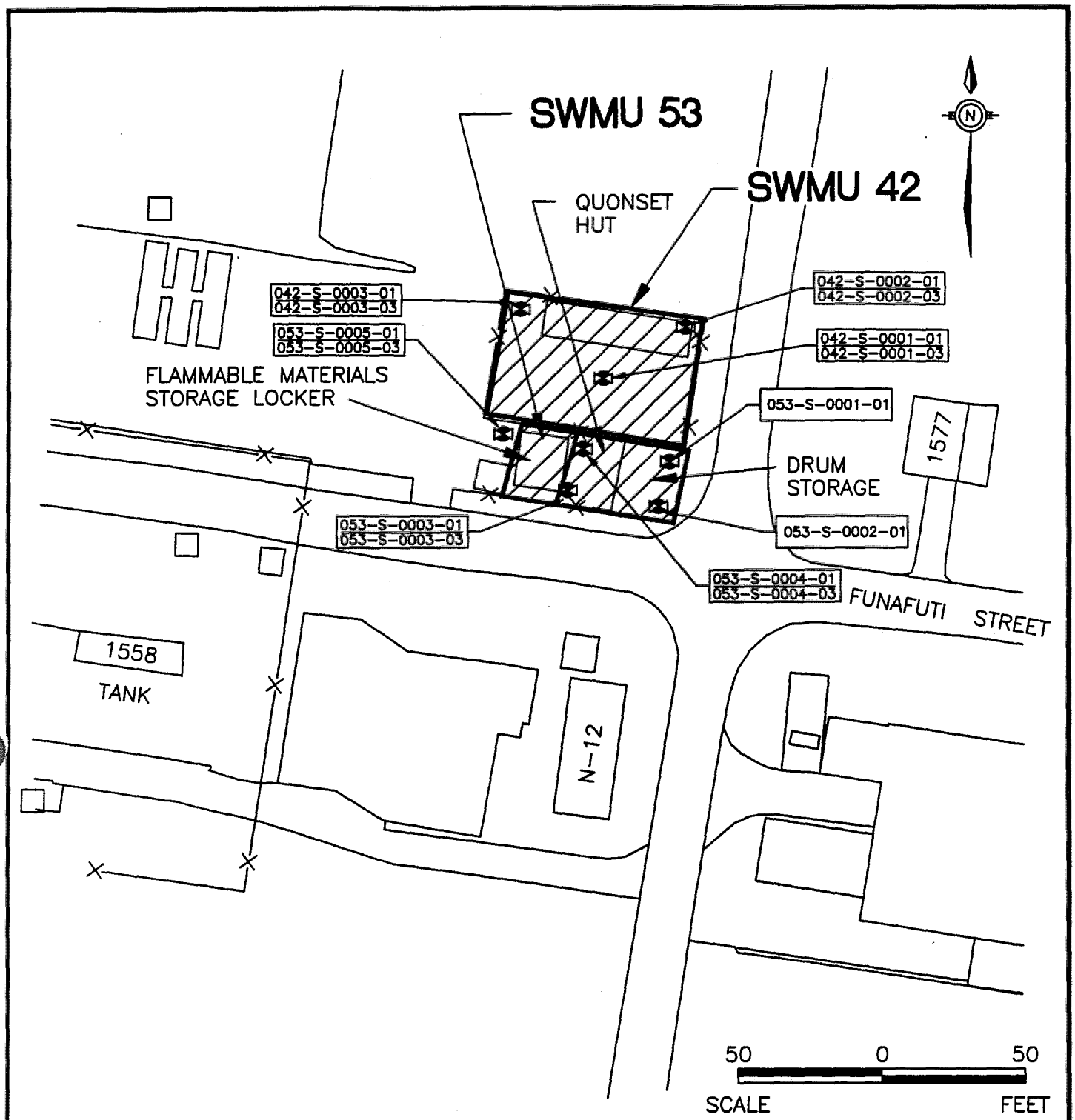
groundwater samples were analyzed for VOCs by an onsite laboratory. Analytical data from these surveys indicated the presence of chlorinated solvents in groundwater in the upper part of the fluvial deposits at distances of a few hundred feet south and east of Building N-126. These chlorinated solvents include 1,1-DCE, 8.8 to 43.7 ppb; 1,2-DCE, 1.5 to 200 ppb; 1,1-DCA, 8.2 to 320 ppb; TCE, 1.6 to 20 ppb; PCE, 8 to 174 ppb; xylenes, 4.9 ppb; and trichlorofluoromethane, 8.5 ppb.

5.3.5 Field Investigation and Analytical Methodologies

The SWMUs 42 and 53 investigation prescribed in the *Assembly D Site Investigation Plans* consisted of sampling eight locations beneath the asphalt or concrete. Samples were collected across the surface interval and from 2 to 3 feet bls using a stainless-steel hand auger according to the sampling methods outlined in Section 4.4.4.3 of the *Comprehensive RFI Work Plan.*

Soil samples were not collected from the subsurface interval at sample points 053S0001 and 053S0002 due to hand auger refusal. A concrete or asphalt layer was encountered at both of these sampling points at approximately 18 inches bls, at which point the soil boring was terminated. The remaining samples were collected in accordance with the work plan; 14 samples were collected. Following sample collection, each boring was sealed with bentonite. Figure 5.3-3 shows the soil sample collection locations.

All samples were submitted to an offsite laboratory for analysis of Appendix IX metals, VOCs and SVOCs. All samples from the surface interval were also analyzed for pesticides/PCBs. One sample (053-C-0001-01) collected from the surface interval was duplicated for analysis of Appendix IX metals, VOCs, SVOCs, and pesticides/PCBs. Laboratory analytical data are presented as Appendix E.



LEGEND

SAMPLE LOCATION

SWMU

RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 5.3-3
SAMPLE LOCATIONS
BUILDING N-12 INTERIM HAZARDOUS WASTE STORAGE AREA AND BUILDING N-126 HAZARDOUS WASTE ACCUMULATION POINT
SWMUs 42 & 53

DWG DATE: 04/11/96 | DWG NAME: 94SL002

5.3.6 Nature and Extent of Contamination

This section provides the analytical results for surface and subsurface soil samples collected during the first phase of the SWMUs 42 and 53 CSI. Analytical results for surface soil samples were compared to RBCs for residential and industrial soil (USEPA Region III, July to December 1995). Constituent averages for SWMUs 42 and 53 were compared to transfer from soil to groundwater SSLs to determine the need for further study or action (OSWER Soil Screening Guidance memorandum, USEPA, 1994). Constituent concentrations from individual samples were also compared to SSLs for informational purposes. Metals analytical results were compared to background RCs (2× mean). Tables 5.3.1 and 5.3.2 summarize laboratory analytical results compared to RBCs and SSLs for organic and inorganic compounds at SWMUs 42 and 53, respectively; Table 5.3.2 also compares soil inorganic concentrations to background RCs as described in Section 3 of this report.

Organics

As Table 5.3.1 indicates, 28 organics were detected in the samples collected at SWMUs 42 and 53. Fifteen compounds were detected in the surface soil interval while 13 were detected in both the surface interval and 2 to 3 feet bls.

Concentrations of one SVOC and one pesticide exceeded residential soil RBCs in the surface soil interval:

- Benzo(a)pyrene exceeded the residential soil RBC of 88 μg/kg in four of eight samples (042-S-0001-01, 042-S-0003-01, 053-S-0004-01, and 053-S-0005-01) with a maximum detected concentration of 480 μg/kg.

5.4.2 Topography and Drainage

SWMU 44 is about 3 feet higher than Funafuti Street. Surface water drains into the existing storm sewer along Funafuti Street, which empties into the open ditch which is part of SWMU 6, approximately 2,500 feet west of SWMU 44. SWMU 6 eventually discharges into North Fork Creek west of NSA Memphis. A topographic map showing land surface elevations at NSA Memphis is provided in Attachment 3, Volume II, in this CSI Report.

5.4.3 Site-Specific Geology and Hydrogeology

USGS Stratigraphic Test Hole 5, approximately 250 feet northwest of SWMU 44, provides lithologic data for the area. This stratigraphic test hole was advanced a few feet into the top of the Cook Mountain Formation to better understand site lithologies before monitoring-well installation at adjacent sites. The test hole was visually logged by a field geologist during drilling and geophysically logged to its total depth following completion. Stratigraphy and lithologies encountered in the test hole were as follows:

Loess:	Approximately 30 feet of wind-blown silt and clay deposits.
Fluvial Deposits:	Approximately 54 feet of sand and gravel.
Cockfield Formation:	Approximately 104 feet of alternating sand and clay with some lignite.
Cook Mountain Formation:	Characterized as a gray to blue-gray dense clay. Defined as the upper confining unit between the surficial aquifers and the Memphis Aquifer. Because the stratigraphic test hole was only advanced 20 feet into the Cook Mountain Formation, the entire thickness is not known.

Subsurface soil information was also collected during the Assembly A RFI for SWMU 7, the Building N-126 Plating Shop Dry Well, which is approximately 900 feet west-northwest of SWMU 44. During the Assembly A investigation, nine monitoring-well clusters (designated

MW-01 through MW-09) were installed at various locations around SWMU 7. MW-02, MW-03, and MW-06 were the SWMU 7 monitoring well clusters that are closest to SWMU 44 (between 700 and 1,000 feet west). The general lithology encountered in the soil borings associated with these three clusters is as follows:

- Clayey silt, silty clay, and sandy clay from ground surface to between 25 and 34 feet bls (loess).

- Sand with gravel and silty clayey sand from between 25 and 34 feet bls to between 77 and 82 feet bls (fluvial deposits).

- Silty clayey sand, silty sand with clay lenses, clay with sand lenses, and lignite from between 77 and 82 feet to the termination depth of the boring, between 101 and 125 feet (Cockfield Formation).

Laboratory-measured vertical hydraulic conductivity for a subsurface soil sample collected from 20 to 22 feet bls (loess) at MW-09 was 9.5×10^{-7} cm/sec. MW-09 was approximately 1,300 feet west of SWMU 44. Laboratory-measured vertical hydraulic conductivity for a soil sample collected from 75 to 77 feet bls (lower part of the fluvial deposits) at MW-01 was 6.8×10^{-5} cm/sec. MW-01 is approximately 1,100 feet west of SWMU 44.

Laboratory-measured vertical hydraulic conductivity for soil samples collected from the Cockfield Formation (MW-01, 110 to 112 feet bls; MW-03, 115 to 117 feet bls; and MW-08, 125 to 127 feet bls) ranged from 8.7×10^{-7} cm/sec to 1.6×10^{-8} cm/sec. Monitoring-well clusters MW-01, MW-03, and MW-08 were 1,100 feet west, 850 feet west, and 1,210 feet west-southwest of SWMU 44, respectively. The boring logs and hydraulic-conductivity data sheets for SWMU 7 are provided in Attachment 4, Volume II, of this CSI report.

5.4.4 Preliminary Investigations

Building N-122 was investigated in November 1994, as part of the NSA Memphis Gray Area Investigation. The investigation consisted of collecting shallow (0 to 1 foot bls) soil samples with a stainless-steel hand auger at five locations around the north, east, and south sides of the building, and in the drainage ditch north of the building, and submitting the samples for laboratory analysis. Analytical parameters for this sampling event included VOCs, SVOCs, metals, and TPH. Concentrations of analytes in all four categories were elevated in surficial soil within a low-lying area south of Building N-122, indicating a potential release of petroleum and/or solvents/degreasers in this area. VOCs, SVOCs, and metals were also present in the sediment sample from the ditch, as well as next to the double doors at the north end of Building N-122, but at considerably lower concentrations (E/A&H, 1995).

In response to the findings of the N-122 Gray Area Investigation, a soil was removed from the low-lying area south of the building. Approximately 6 to 8 inches of soil was removed and a confirmation sample was collected from the bottom of the excavation. Analytical data from the confirmation sample indicate that polyaromatic hydrocarbons (PAH) concentrations in the remaining soil were below residential RBC, except for benzo(a)pyrene (BaP). The concentration of BaP was above the residential RBC, but below the industrial RBC.

During the Assembly C CSI, soil samples collected from three sample stations around SWMU 26, were analyzed for six metals (arsenic, cadmium, lead, mercury, nickel, and zinc.) Detected concentrations of metals were less than background RCs (2× mean) and/or RBCs.

5.4.5 Field Investigation and Analytical Methodologies

The SWMU 44 investigation prescribed in *Assembly D Site Investigation Plans* consisted of sampling four locations. Samples were collected across the surface soil interval and from 2 to 3 feet bls using a stainless-steel hand auger according to the sampling methods outlined in

Section 4.4.4.3 of the *Comprehensive RFI Work Plan*. Eight soil samples were collected. Figure 5.4-3 shows the sample locations.

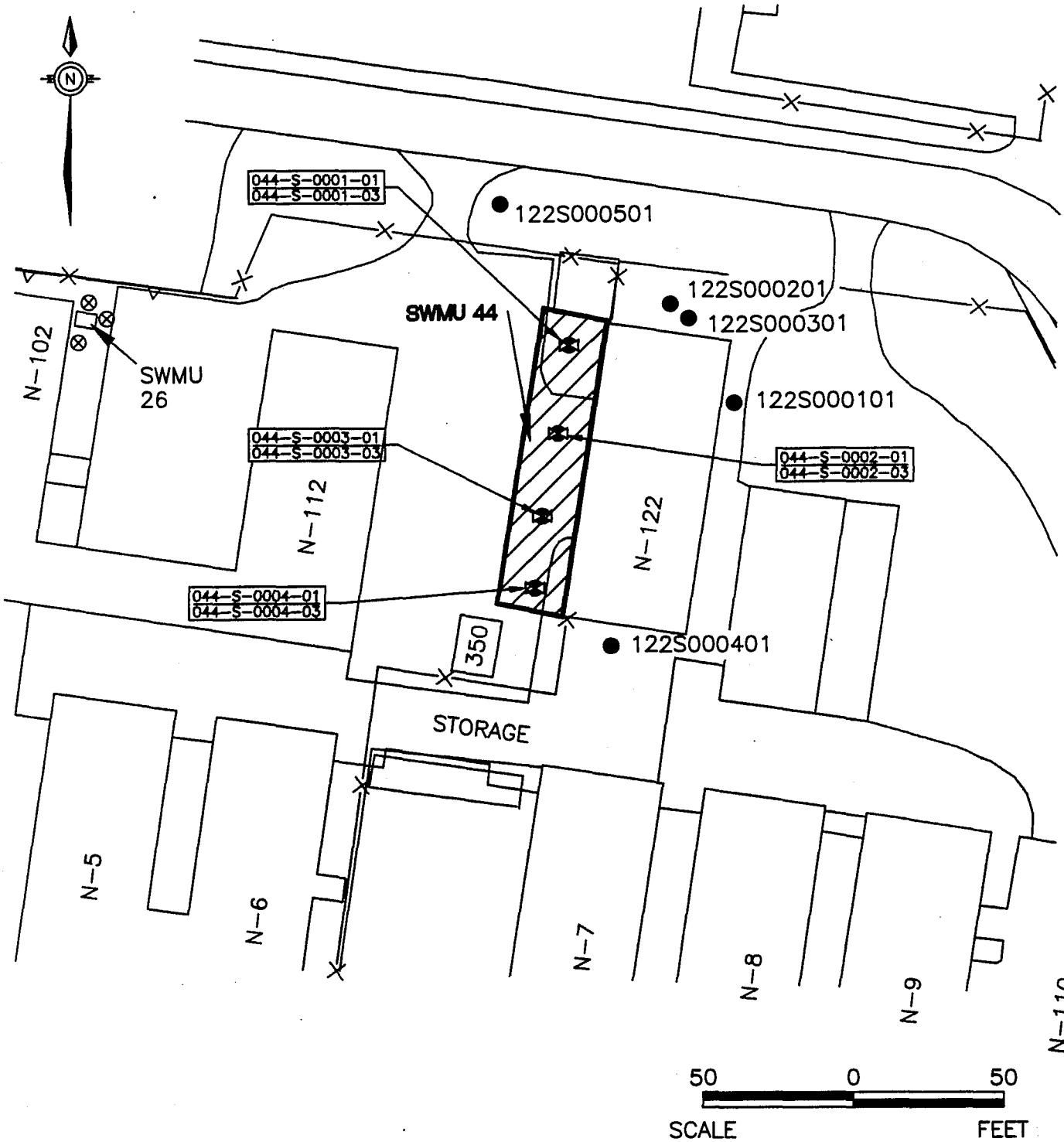
All samples were submitted to an offsite laboratory for analysis of Appendix IX metals and SW846-PCBs. Samples 044-S-0003-01 and 044-S-0003-03 were analyzed for SVOCs and TPH/GRO.DRO. One sample (044-C-0004-03) collected from the surface interval was duplicated for Appendix IX metals and SW846-PCBs analyses. Laboratory analytical data are presented as Appendix F.

5.4.6 Nature and Extent of Contamination

This section provides the analytical results for surface and subsurface soil samples collected during the first phase of the SWMU 44 CSI. Analytical results for surface soil samples were compared to RBCs for residential and industrial soil (USEPA Region III, July to December 1995). Constituent averages for SWMU 44 were compared to transfer from soil to groundwater SSLs to determine the need for further study or action (OSWER Soil Screening Guidance memorandum, USEPA, 1994.) Constituent concentrations from individual samples were also compared to SSLs. Metals analytical results were compared to background RCs (2× mean). Tables 5.4.1 and 5.4.2 summarize laboratory analytical results compared to RBCs and SSLs for organic and inorganic compounds, respectively, at SWMU 44. Table 5.4.2 also compares soil inorganic concentrations to background RCs as described in Section 3 of this report.

Organics

As Table 5.4.1 indicates, one PCB compound and 18 SVOCs were detected in SWMU 44 soil samples. All SVOCs were detected in samples collected from one location (only samples from this location were submitted for SVOCs and TPH.GRO/DRO).



LEGEND

- SAMPLE LOCATION
- 122S000401 ● GRAY AREA INVESTIGATION SOIL SAMPLE LOCATION
- ⊗ ASSEMBLY C SOIL SAMPLE LOCATION
- **SWMU 44**

RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 5.4-3
SAMPLE LOCATIONS
BLDG N-102 HAZARDOUS WASTE
ACCUMULATION POINT
SWMU 44

DWG DATE: 04/05/96 | DWG NAME: 94SL003

Table 5.4.1
SWMU 44 — Organics in Soil (μg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Aroclor-1260	0-1'	2/4	46 -120	83	83	1	740	0	1.00e+03	N
	2-3'	0/4	ND	ND	N/A	0	N/A	0		
bis(2-Ethylhexyl)phthalate (BEHP)	0-1'	1/1	480	N/A	4.60e+04	0	4.10e+05	0	1.10e+04	N
	2-3'	1/1	45	N/A	N/A	0	N/A	0		
Anthracene	0-1'	1/1	100	N/A	2.30e+07	0	6.10e+08	0	4.30e+06	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Pyrene	0-1'	1/1	490	N/A	2.30e+06	0	6.10e+07	0	1.40e+06	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Benzo(g,h,i)perylene	0-1'	1/1	140	N/A	2.30e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Indeno(1,2,3-cd)pyrene	0-1'	1/1	120	N/A	880	0	7.80e+03	0	3.50e+04	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Benzo(b)fluoranthene	0-1'	1/1	280	N/A	880	0	7.80e+03	0	4.00e+03	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Fluoranthene	0-1'	1/1	550	N/A	3.10e+06	0	8.20e+07	0	9.80e+05	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Fluorene	0-1'	0/1	ND	ND	N/A	0	N/A	0	1.60e+05	N
	2-3'	1/1	640	N/A	N/A	0	N/A	0		
Benzo(k)fluoranthene	0-1'	1/1	240	N/A	8.80e+03	0	7.80e+04	0	4.00e+03	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Chrysene	0-1'	1/1	280	N/A	8.80e+04	0	7.80e+05	0	1.00e+03	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Benzo(a)pyrene	0-1'	1/1	240	N/A	88	1	780	0	1.40e+06	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Dibenz(a,h)anthracene	0-1'	1/1	68	N/A	88	0	780	0	1.10e+04	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		

Table 5.4.1
SWMU 44 — Organics in Soil (μg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Benzo(a)anthracene	0–1'	1/1	240	N/A	880	0	7.80e+03	0	700	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Phenanthrene	0-1'	1/1	620	N/A	3.10e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
	2-3'	1/1	380	N/A	N/A	0	N/A	0		
Butylbenzylphthalate	0-1'	1/1	81	N/A	1.60e+07	0	4.10e+08	0	6.80e+04	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Carbazole	0-1'	1/1	76	N/A	3.20e+04	0	2.90e+05	0	500	N
	2-3'	0/1	ND	ND	N/A	0	N/A	0		
Naphthalene	0-1'	1/1	1,200	N/A	3.10e+06	0	8.20e+07	0	3.00e+04	N
	2-3'	1/1	2,900	N/A	N/A	0	N/A	0		
2-Methylnaphthalene	0-1'	1/1	3,300	N/A	3.10e+06	0	i	0	i	N
	2-3'	1/1	8,200	N/A	N/A	0	N/A	0		
TPH - Gasoline Range Organics	0-1'	1/1	27,000	N/A	1.00e+05[j]	0	N/A	0	N/A	N
	2-3'	1/1	36,000	N/A	N/A	0	N/A	0		
TPH - Diesel Range Organics	0-1'	1/1	1,000,000	N/A	1.00e+05[j]	1	N/A	0	N/A	N
	2-3'	0/1	ND	ND	1.00e+05[j]	0	N/A	0		

Notes:

a — Feet bls
b — Eight samples collected from four locations. Four samples were collected from 0 to 1 foot bls and four from 2 to 3 feet bls, all analyzed for Appendix IX metals and PCBs. Samples from 0 to 1 foot and 2 to 3 feet bls from one location were analyzed for TPH/GRO.DRO and SVOCs. One sample was duplicated for Appendix IX metals and PCBs.
c — Range lower limit is the lowest detected parameter concentration.
d — Mean is based on detected parameter concentrations only.
e — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo). RBCs are only applicable for comparison to data from samples collected across the surface interval.
f — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk-Based Concentration Table July to December 1995).
g — Contaminant averages were compared to SSLs to determine the need for further study or action.
h — Risk-based data not available; data for pyrene used as surrogate.
I — Risk-based data not available at this time.
j — RBC does not exist; value shown is TDEC soil cleanup level for total TPH (GRO + DRO).
N/A — Not applicable
ND — Parameter not detected.

Table 5.4.2
SWMU 44 — Inorganics in Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Arsenic	0-1'	4/4	3.8 — 7.9	5.3	13.1	0	0.43[i]	4	3.8[i]	4	15[i]	N
	2-3'	4/4	7.5 — 9.9	9.0	20.4	0	N/A	0	N/A	0		
Barium	0-1'	4/4	37.3 — 102	65	191	0	5.50e+03	0	1.40e+05	0	32	Y
	2-3'	4/4	80 — 131	107	289	0	N/A	0	N/A	0		
Beryllium	0-1'	4/4	0.31 — 0.39	0.35	0.96	0	0.15	4	1.3	0	180	N
	2-3'	4/4	0.46 — 0.48	0.47	1.02	0	N/A	0	N/A	0		
Cadmium	0-1'	4/4	2.8 — 9.1	5.4	BDL	4	39	0	1.00e+03	0	6	N
	2-3'	4/4	1.4 — 2.3	1.9	6.8	0	N/A	0	N/A	0		
Chromium	0-1'	4/4	11.2 — 165	57	26.4	2	390[j]	0	1.00e+04[j]	0	19[j]	Y
	2-3'	4/4	9.9 — 12	11	28.6	0	N/A	0	N/A	0		
Cobalt	0-1'	4/4	2.7 — 5.4	4.7	15	0	4.70e+03	0	1.20e+05	0	k	N
	2-3'	4/4	7 — 8.2	8	15.3	0	N/A	0	N/A	0		
Copper	0-1'	4/4	11.2 — 38.1	28.4	23.6	3	3.10e+03	0	7.60e+04	0	k	N
	2-3'	4/4	15.9 — 17	17	33.9	0	N/A	0	N/A	0		
Lead	0-1'	4/4	26.4 — 200	78	28.7	3	400[l]	0	1000[l]	0	k	N
	2-3'	4/4	8.9 — 11.2	9.9	25.1	0	N/A	0	N/A	0		
Mercury	0-1'	2/4	0.14 — 0.17	0.16	1.1	0	23	0	610	0	3	N
	2-3'	1/4	0.14	N/A	0.38	0	N/A	0	N/A	0		
Nickel	0-1'	4/4	6.2 — 13.2	8.8	BDL	4	1.60e+03	0	4.10e+04	0	21	N
	2-3'	4/4	19 — 20.3	20	59.8	0	N/A	0	N/A	0		
Vanadium	0-1'	4/4	10.6 — 16.3	13.5	49.6	0	550	0	1.40e+04	0	k	N
	2-3'	4/4	20.7 — 23	22	46.3	0	N/A	0	N/A	0		
Zinc	0-1'	4/4	63.6 — 589	242	88.3	3	2.30e+04	0	6.10e+05	0	4,200	N
	2-3'	4/4	48.5 — 53.3	51.5	111.8	0	N/A	0	N/A	0		

Notes:

a — Feet bls

b — Eight samples collected from four locations. Four samples were collected from 0 to 1 foot bls and four from 2 to 3 feet bls, all analyzed for Appendix IX metals and PCBs. Samples from 0 to 1 foot and 2 to 3 feet bls from one location were analyzed for TPH/GRO.DRO and SVOCs. One sample was duplicated for Appendix IX metals and PCBs.

c — Range lower limit is the lowest detected parameter concentration.

Notes (cont'd):

d — Mean of detected parameter concentrations.
e — Background reference concentration (2x mean background). See Section 3 of this report for a discussion of RCs.
f — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo). RBCs are only applicable for comparison to data from samples collected across the surface interval.
g — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk-Based Concentration Table, July to December 1995).
h — Contaminant averages were compared to SSLs to determine the need for further study or action.
i — Risk-based data for arsenic as a carcinogen.
j — Risk-based data for hexavalent chromium (VI).
k — Risk-based data not available at this time.
l — Value is soil cleanup level for total lead (USEPA OSWER Directive, 9355.4-12)
N/A — Not applicable
BDL — Below detection limit

Concentrations of one SVOC and one PCB exceeded residential soil RBCs in surface samples:

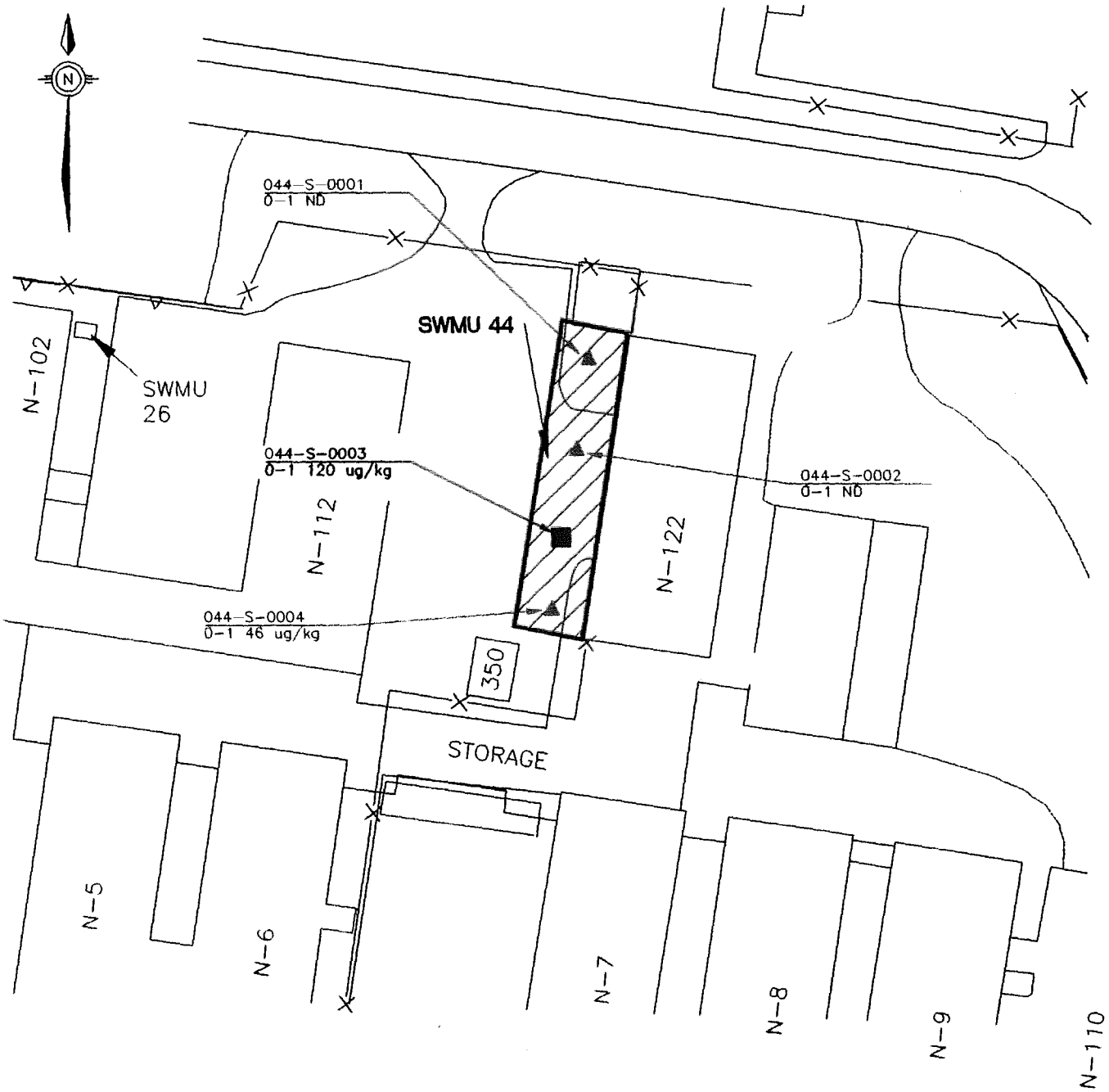
- BaP exceeded the residential soil RBC of 88 μg/kg in one sample (044-S-0003-01) at a concentration of 240 μg/kg;

- Aroclor-1260 exceeded the residential soil RBC of 83 μg/kg in one of four samples (044-S-0003-01) at a concentration of 120 μg/kg.

All detected PCB and SVOC concentrations were well below industrial RBCs and transfer from soil to groundwater SSLs. No PCBs were detected below the surface interval. Total TPH (GRO + DRO) was detected in one sample (044-S-0003-01) from the surface interval at 1.027×10^3 μg/kg with DRO making up 1 million μg/kg of the total TPH. The total TPH of this sample exceeded the 100,000 μg/kg TDEC (Division of Solid Waste Management, State Remediation Section) soil cleanup level for total TPH (GRO + DRO). TPH-GRO was also detected at the same sample location form 2 to 3 feet bls at a concentration of 36,000 μg/kg. The elevated TPH concentrations detected in the surface soil interval were believed to have resulted from leaking equipment parked in the area. Because similar elevated TPH concentrations were not detected in the 2 - 3 foot interval, the TPH is not considered a threat for groundwater contamination or significant horizontal migration. Figures 5.4-4 and 5.4-5 provide plots of PCBs and SVOCs, respectively, in soil.

Metals

As Table 5.4.2 indicated, 12 metals were detected in both the surface soil interval and 2 to 3 feet bls; however, no metals exceeded both background RCs and residential RBCs.



LEGEND

▲ CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

044-S-0004
0-1 10.6 ug/kg — SOIL BORING 4 CONTAINED A TOTAL PCB CONCENTRATION OF 10.6 ug/kg ● THE 0-1 FOOT DEPTH INTERVAL.

ND — NOT DETECTED

50 0 50
SCALE FEET

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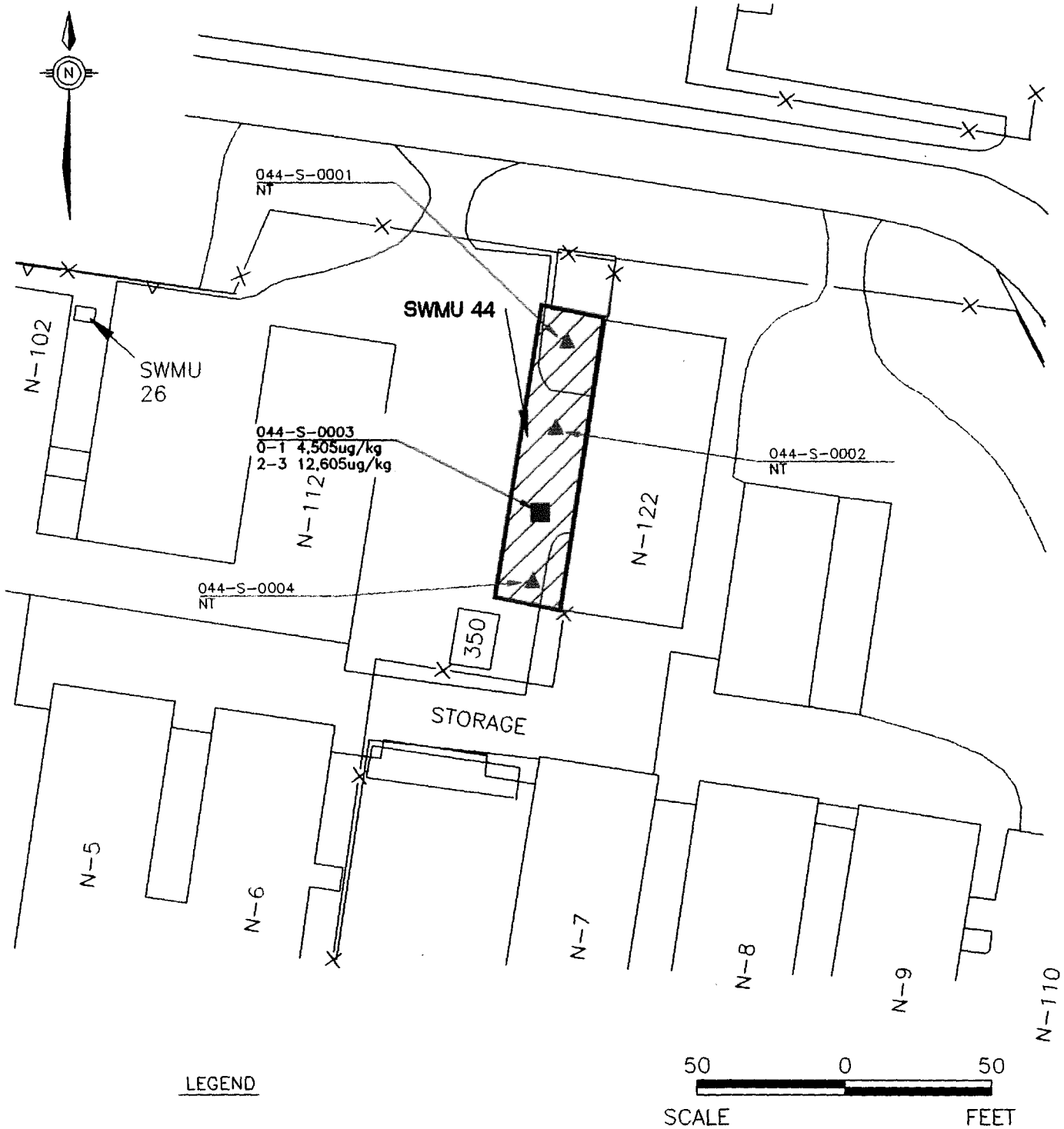
FIGURE 5.4-4
TOTAL PCBs IN SURFACE SOIL
BUILDING N-102 HAZARDOUS WASTE
ACCUMULATION POINT
SWMU 44

DWG DATE: 04/25/96 | DWG NAME: 94TPS44



LEGEND

▲ THESE SAMPLES NOT TESTED FOR SVOCs

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

044-S-0004
0-1 10.6 ug/kg — SOIL BORING 4 CONTAINED A TOTAL SVOC CONCENTRATION OF 10.6 ug/kg ● THE 0-1 FOOT DEPTH INTERVAL.

NT — NOT TESTED

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FIGURE 5.4-5
TOTAL SVOCs IN SOIL
BUILDING N-102 HAZARDOUS WASTE
ACCUMULATION POINT
SWMU 44

DWG DATE: 04/25/96 | DWG NAME: 94TSS44

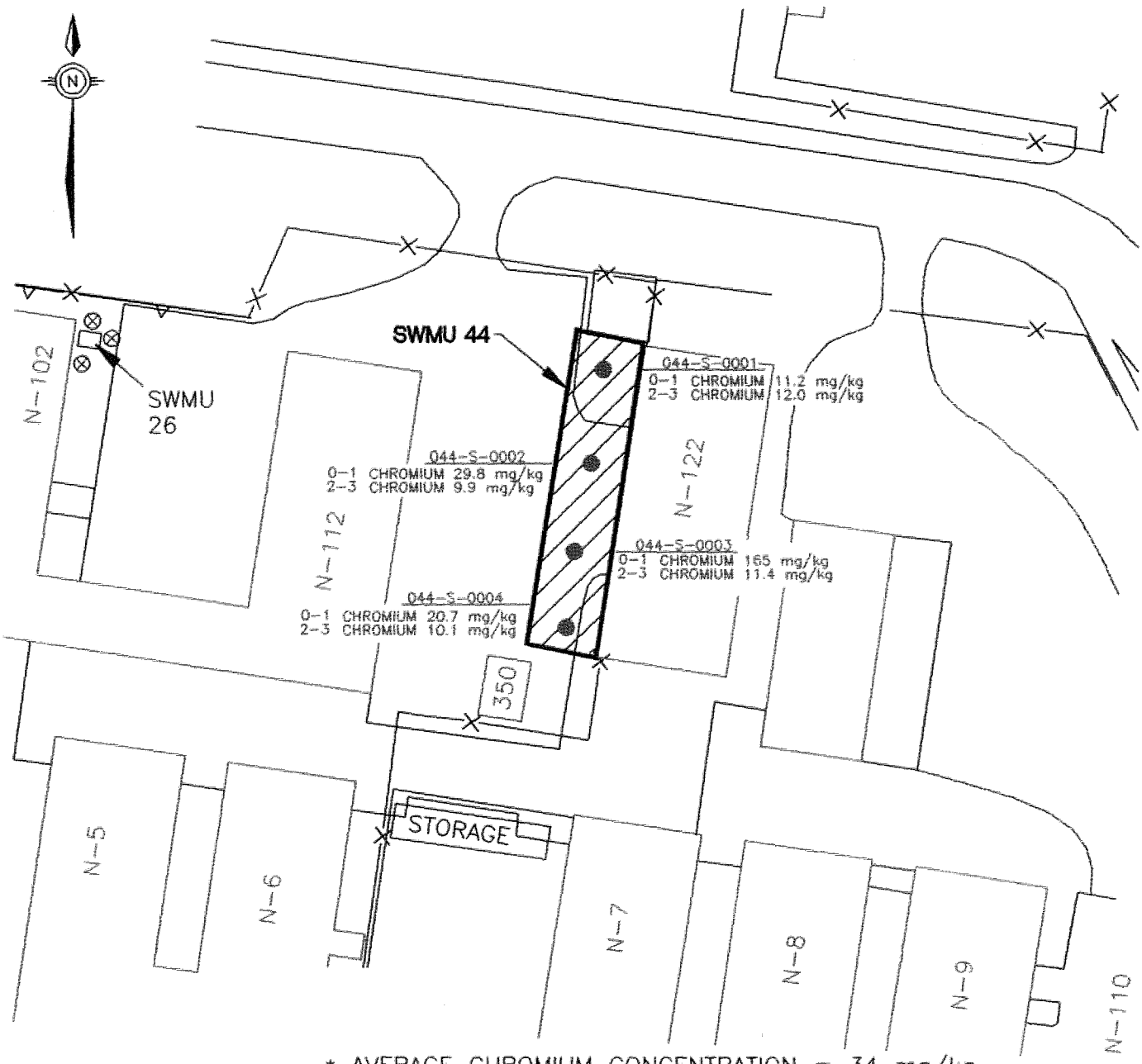
Concentrations of three metals exceeded transfer from soil to groundwater SSLs in individual samples:

- Barium exceeded the SSL of 32 mg/kg in all eight samples collected with a maximum detected concentration of 131 mg/kg.

- Cadmium exceeded the SSL of 6 mg/kg in two of eight samples (044-S-0001-01, 044-S-0003-01) with a maximum detected concentration of 9.1 mg/kg.

- Chromium exceeded the SSL for hexavalent chromium of 19 mg/kg in three of eight samples (044-S-0002-01, 044-S-0003-01, and 044-S-0004-01) with a maximum detected concentration of 165 mg/kg.

Although cadmium concentrations in two samples exceeded the SSL, the average cadmium concentration at 4 mg/kg did not exceed the SSL, indicating no need for further study or action. The average barium concentration at 86 mg/kg exceeded the SSL of 32 mg/kg, but the highest detected concentration at 131 mg/kg did not exceed the 2× mean surface soil background RC of 191 mg/kg. Chromium concentrations in three samples and the average chromium concentration at 34 mg/kg exceeded the chromium SSL of 19 mg/kg. Averages were calculated using constituent sample data from all sampling intervals. However, the average chromium concentrations in surface soil and 2 to 3 feet bls are 57 mg/kg and 11 mg/kg, respectively, indicating a chromium SSL exceedance in the surface interval only. Additionally, chromium concentrations in the 2 to 3 foot bls interval were well below the background RC of 28.6 mg/kg. Because of the chemical properties of inorganics, the physical properties of soil, and the shallow depths at which chromium exceeded the SSL, it is not expected to leach in appreciable quantities (if at all) into underlying groundwater. Also, the physical adsorption of the contaminants to soil particles and organic material greatly limits horizontal migration. Figure 5.4-6 provides a plot of transfer from soil to groundwater SSL exceedances.



* AVERAGE CHROMIUM CONCENTRATION = 34 mg/kg

LEGEND

▲ SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) NOT DETECTED AT THIS LOCATION.

● SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) DETECTED AT THIS LOCATION.

044-S-0004
0-1 CHROMIUM 20.7 mg/kg
2-3 CHROMIUM 10.1 mg/kg

SOIL BORING 4 CONTAINED CHROMIUM AT 20.7 mg/kg IN THE 0-1' INTERVAL AND 10.1 mg/kg IN THE 2-3' INTERVAL.

ND NOT DETECTED

SWMU 44

50 0 50
SCALE FEET

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FIGURE 5.4-6
TRANSFER FROM SOIL TO GROUNDWATER SSL EXCEEDANCES
BUILDING N-102 HAZARDOUS WASTE ACCUMULATION POINT
SWMU 44

DWG DATE: 06/18/96 | DWG NAME: 94TRANS4

5.4.7 Preliminary Risk Evaluation

In accordance with USEPA Region IV Memorandum, November, 1994, a PRE was conducted for SWMU 44 using data from surface soil samples collected during the CSI.

According to Figure XVII-1, the Aviation Related Development Alternative presented in the Base Reuse and Development Plan (RKG Associates, Inc., 1995), the area that includes SWMU 44 will be used for commercial purposes. Tables 5.4.3 and 5.4.4 summarize PRE results for SWMU 44.

The resulting residential and industrial carcinogen ILCRs at 5.72e-06 and 6.44e-07, respectively, fell well below the 10^{-4} criteria, indicating no risk in either scenario. The resulting residential and industrial noncarcinogen HIs at 0.85 and 0.04, respectively, fell well below the criteria of 1, indicating no risk in either scenario. Property including SWMU 44 is suitable for residential lease.

Table 5.4.3
SWMU 44 — Preliminary Risk Evaluation — Carcinogens (µg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Screening Value[c] Residential	Screening Value[c] Industrial	Risk Ratio Residential	Risk Ratio Industrial
Aroclor-1260 *	120	N/A	8.30e+01	7.40e+02	1.45e-06	1.62e-07
Arsenic	7900	13,100	4.30e+02	3.80e+03	0.00e+00	0.00e+00
Benzo(a)anthracene *	240	N/A	8.80e+02	7.80e+03	2.73e-07	3.08e-08
Benzo(a)pyrene *	240	N/A	8.80e+01	7.80e+02	2.73e-06	3.08e-07
Benzo(b)fluoranthene *	280	N/A	8.80e+02	7.80e+03	3.18e-07	3.59e-08
Benzo(k)fluoranthene *	240	N/A	8.80e+03	7.80e+04	2.73e-08	3.08e-09
Beryllium	390	960	1.50e+02	1.30e+03	0.00e+00	0.00e+00
bis(2-Ethylhexyl)phthalate(BEHP)*	480	N/A	4.60e+04	4.10e+05	1.04e-08	1.17e-09
Carbazole *	76	N/A	3.20e+04	2.90e+05	2.38e-09	2.62e-10
Chrysene *	280	N/A	8.80e+04	7.80e+05	3.18e-09	3.59e-10
Dibenz(a,h)anthracene *	68	N/A	8.80e+01	7.80e+02	7.73e-07	8.72e-08
Indeno(1,2,3-cd)pyrene *	120	N/A	8.80e+02	7.80e+03	1.36e-07	1.54e-08
ILCR					5.72e-06	6.44e-07

Notes:
a — The highest detected concentration for each contaminant was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
N/A — Not applicable.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not ILCR calculation.

Table 5.4.4
SWMU 44 — Preliminary Risk Evaluation — Noncarcinogens (μg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Screening Value[c]		Risk Ratio	
			Residential	Industrial	Residential	Industrial
Anthracene *	100	N/A	2.30e+07	6.10e+08	4.35e-06	1.64e-07
Arsenic *	7,900	13,100	2.30e+04	6.10e+05	3.43e-01	1.30e-02
Barium *	102,000	191,000	5.50e+06	1.40e+08	1.85e-02	7.29e-04
Benzo(g,h,i)perylene *	140	N/A	3.10e+06	6.10e+07	4.52e-05	2.30e-06
Butylbenzylphthalate *	81	N/A	1.60e+07	4.10e+08	5.06e-06	1.98e-07
Cadmium *	9,100	BDL	4.68e+05	1.00e+06	1.94e-02	9.10e-03
Chromium *	165,000	26,400	3.90e+05	1.00e+07	4.23e-01	1.65e-02
Cobalt	5,400	15,000	4.70e+06	1.20e+08	0.00e+00	0.00e+00
Copper *	38,100	23,600	3.10e+06	7.60e+07	1.23e-02	5.01e-04
Fluoranthene *	550	N/A	3.10e+06	8.20e+07	1.77e-04	6.71e-06
Mercury	170	1,100	2.30e+04	6.10e+05	0.00e+00	0.00e+00
2-Methylnaphthalene *	3,300	N/A	3.10e+06	4.10e+06	1.06e-03	8.05e-04
Naphthalene *	1,200	N/A	3.10e+06	8.20e+07	3.87e-04	1.46e-05
Nickel *	13,200	BDL	1.60e+06	4.10e+07	8.25e-03	3.22e-04
Phenanthrene *	620	N/A	3.10e+06	6.10e+07	2.00e-04	1.02e-05
Pyrene *	490	N/A	2.30e+06	6.10e+07	2.13e-04	8.03e-06
Vanadium	16,300	49,600	5.50e+05	1.40e+07	0.00e+00	0.00e+00
Zinc *	589,000	88,300	2.30e+07	6.10e+08	2.56e-02	9.66e-04
HI					0.85	0.04

Notes:

a — The highest detected concentration for each contaminant was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs are from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
N/A — Not applicable.
BDL — Below detection limit.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not HI calculation.

5.4.8 Conclusions and Recommendations

Based on the information gathered during this investigation, the following conclusions and recommendations have been reached:

- SWMU 44 will be developed for commercial use according to the Base Reuse Plan.

- Nineteen organics were detected at SWMU 44 in both the surface interval and 2 to 3 feet bls at one sample location (only samples from this location were analyzed for SVOCs and TPH.GRO/DRO).

  — Concentrations of the SVOC benzo(a)pyrene and the PCB Aroclor 1260 exceeded residential soil RBCs, but none exceeded industrial RBCs or transfer from soil to groundwater SSLs.

  — Total TPH (GRO + DRO) in one surface soil sample exceeded the TDEC soil cleanup level for total TPH.

- Concentrations of 12 metals were detected in both the surface soil interval and 2 to 3 feet bls; however no single concentration exceeded both background RCs and residential soil RBCs.

  — The average chromium concentration exceeded the transfer from soil to groundwater SSL; however, when data from the surface interval and the 2 to 3 feet bls interval are compared separately, only the average concentration in the surface interval exceeded the SSL. Due to the chemical properties of chromium, the physical properties of the soil, and the shallow depth of SSL exceedance, chromium is not expected to leach into groundwater or migrate horizontally.

- Based on a PRE performed on data from surface soil samples:

  — Carcinogens: neither the residential nor commercial ILCR exceeded the 10^{-4} threshold, indicating suitability for lease with no further action.

  — Noncarcinogens: neither the residential nor the industrial HI exceeded 1, indicating suitability for lease with no further action.

- Based on the surface soil samples collected, no further action is recommended for SWMU 44. In accordance with PRE methodology, the property is suitable for residential lease. The elevated TPH concentrations detected in surface soil samples are believed to result from surface staining due to leakage from equipment parked in the area.

5.5 SWMUs 50, 51, and 52 — Building N-126 Hazardous Waste Accumulation Point for the MAG-42, VR-60, and VP-67 Squadrons

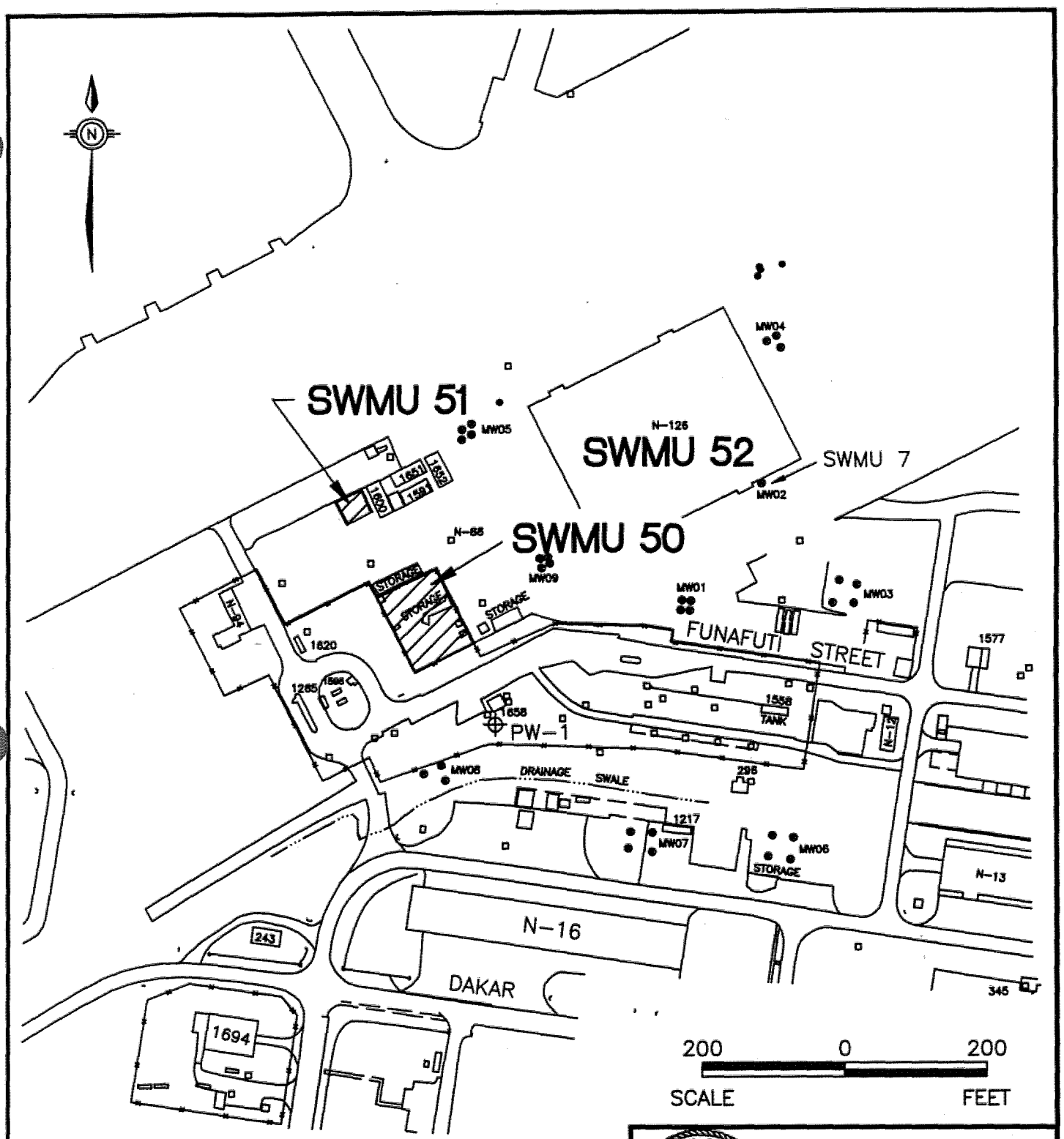
This section summarizes the activities conducted during the first phase of the CSI at SWMUs 50, 51, and 52, the Building N-126 Hazardous Waste Accumulation Points for the MAG-42, VR-60, and VP-67 Squadrons, and outlines any proposed RFI activities.

5.5.1 Site Description and Historical Information

SWMUs 50, 51, and 52 have been grouped because they are in the same general area on NSA Memphis Northside and all have been used as hazardous waste accumulation points for mineral spirits and waste paint thinners. Figures 5.5-1 and 5.5-2 provide a vicinity map and digital orthophotograph, respectively, of SWMUs 50, 51, and 52.

SWMU 50 served as an accumulation point for automobile batteries and containerized mineral spirits and paint thinners from 1955 to 1985. Wastes were accumulated in drums (on pallets) and mobile bowsers (tanks on wheels). The accumulation point has changed location several times. In 1985, the Tennessee Department of Health and Environment inspected the SWMU and reported its location as being inside the fenced, asphalt-paved compound west of Building N-126. The 1990 RFA indicates that releases have occurred in the fenced compound (ERC/EDGe, 1990; SOUTHDIV, 1990). This fenced compound was investigated during the CSI. After 1985, the accumulation point was moved to a bermed and roofed open compound inside a fenced area southeast of Building N-9, near the A-4 hangar (Building 798).

SWMU 51 served as an accumulation point for mineral spirits and paint thinner wastes generated by the VR-60 squadron. Accumulation activities began around 1955; however, the accumulation point has moved several times. From 1985 until 1990, the SWMU was inside a fenced compound on the west side of Building N-126, on asphalt, within a sand bag containment area. Records indicated the VR-60 waste also may have been stored in mobile bowsers.



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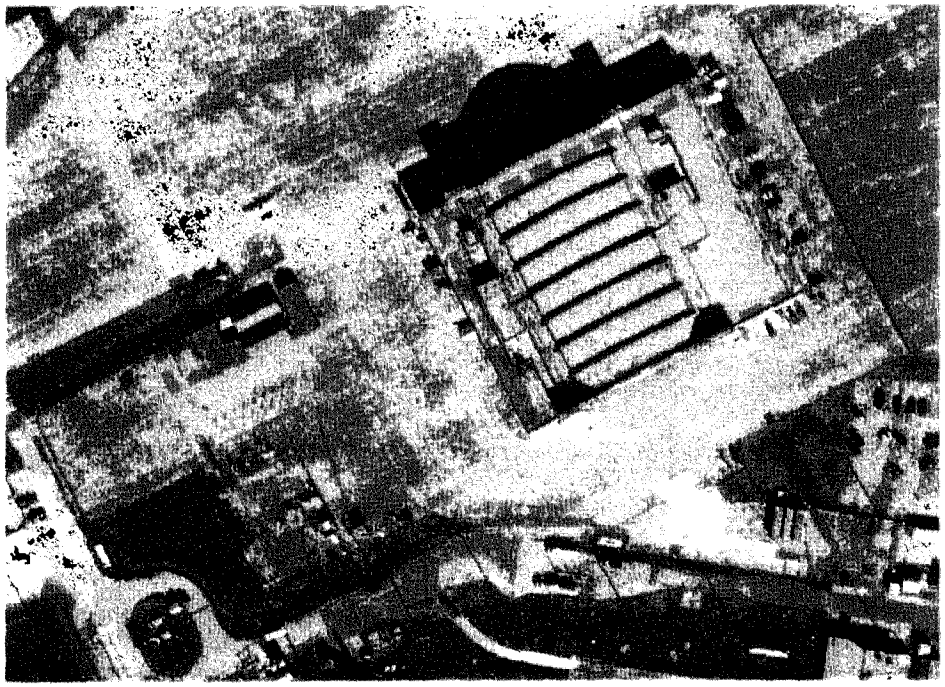
LEGEND

PW-1 PRODUCTION WELL

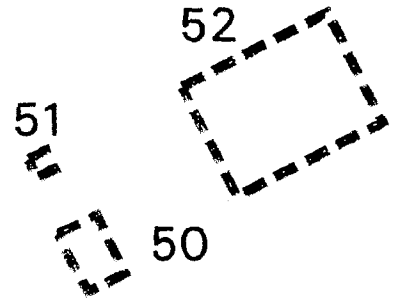
MW01 EXISTING MONITORING WELL CLUSTER

FIGURE 5.5-1
VICINITY MAP
BLDG. N-126 HAZARDOUS WASTE
ACCUMULATION POINTS
SWMUs 50, 51 AND 52

DWG DATE: 04/11/96 | DWG NAME: 94VM50A



SWMU 50, 51, 52 BOUNDARIES



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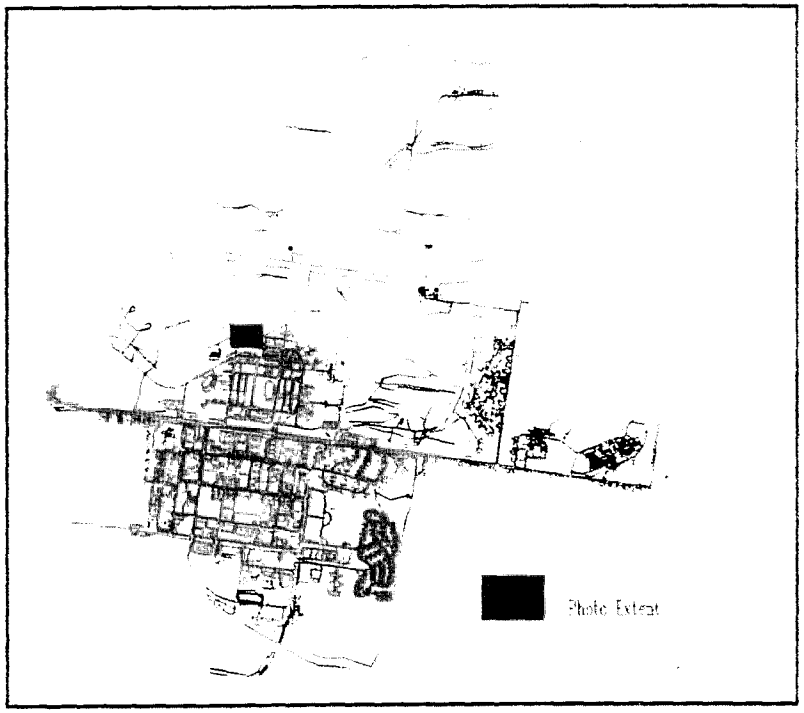

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FIGURE 5.5-2
DIGITAL ORTHOPHOTOGRAPH
BUILDING N-126 HAZARDOUS WASTE
ACCUMULATION POINTS - SWMU 50,51,52

During the *Environmental Baseline Survey* (E/A&H, 1994), the VR-60 accumulation point consisted of drums stored in self-contained, locked, hazardous materials lockers on the concrete apron against Building N-126's north side. During an April 10, 1995, site visit, an E/A&H representative observed that the lockers had been removed from the north side of Building N-126 and no stains were visible on the concrete there.

The 1990 RFI Work Plan (SOUTHDIV, 1990) reported that the accumulation point was on the edge of the apron north of Building N-1600. On April 10, 1995, an E/A&H representative performing a VSI identified a partially fenced, former drum storage area immediately west of Building N-1600. The fence was in disrepair and numerous stains were on the asphalt. An additional area, possibly an accumulation point, was identified northeast of Building N-1600 near the edge of the concrete apron. This area is paved with concrete, no stains were visible, but four former postholes filled with concrete were identified. These three areas were investigated during this CSI.

SWMU 52 was a hazardous waste collection point for the storage of drummed mineral spirits and paint thinners generated by the VP-67 squadron. The collection point has operated since 1955 and has been moved several times. In 1987, the VP-67 accumulation point was reported to be inside Building N-126. A bowser was also reportedly used to store the wastes. Records dated after 1987 indicated the accumulation point was moved outside to the fenced, asphalt-paved compound west of Building N-126 (SOUTHDIV, 1990; ERC/EDGe, 1990). This fenced compound was investigated during this CSI as SWMU 50. No releases have been reported in Building N-126 and the accumulation point receiving VP-67 hazardous waste was investigated during this CSI; therefore, SWMU 52 was not recommended for investigation. *As discussed in the August 1995 BCT meeting, no further action is recommended for SWMU 52. A formal NFA Request will be submitted for SMWU 52.*

5.5.2 Topography and Drainage

The SWMU 50 and 51 areas are generally level. Surface water drains south and west into SWMU 6 storm sewers, which empty into the open ditch portion of the SWMU 6 storm sewer northwest of SWMUs 50 and 51. SWMU 6 eventually discharges into SWMU 38, a tributary of North Fork Creek, approximately 1200 feet west of the site. A topographic map showing local land elevations at NSA Memphis is provided in Attachment 3, Volume II, of this CSI report.

5.5.3 Site-Specific Geology and Hydrogeology

In 1994, USGS drilled Stratigraphic Test Hole 4 to approximately 200 feet approximately 500 feet bls south of the main runway and about 800 feet west of SWMUs 50 and 51. The test hole was originally to be advanced approximately 15 feet into the Cook Mountain Formation (the confining unit separating the Memphis Aquifer from the overlying Cockfield Formation and shallower units). However, due to the unanticipated thinness of the Cockfield Formation, this borehole was advanced approximately 50 feet into the Memphis Sand. This test hole was visually logged by a field geologist during drilling and geophysically logged following completion. Lithologies encountered below land surface in the test hole were as follows:

Loess:	Approximately 40 feet of wind-blown silt and clay deposits.
Fluvial Deposits:	Approximately 30 feet of sand and gravel.
Cockfield Formation:	Approximately 35 feet of alternating sand, clay, and some lignite.
Cook Mountain Formation:	The Cook Mountain formation, characterized as a gray to blue-gray dense clay approximately 46 feet thick, is defined as the upper confining unit between the surficial aquifers and the Memphis Aquifer.
Memphis Sand:	The Memphis Sand, characterized as a thick (between 865 and 880 feet) deposit of primarily fine to very coarse sand with lenses of clay, silt, and lignite, supplies water to industries and municipalities throughout Shelby County.

Subsurface soil information was also collected during the Assembly A RFI for SWMU 7, the Building N-126 Plating Shop Dry Well, which is approximately 400 feet northeast of SWMUs 50 and 51. During the Assembly A investigation, nine monitoring well clusters (designated MW-01 through MW-09) were installed north, east, and south of SWMUs 50 and 51 (Figure 5.5-1). MW-01, MW-05, MW-08, and MW-09 are the closest monitoring well clusters to SWMUs 50 and 51 (between 75 to 300 feet away).

The general lithology encountered in the soil borings associated with these four clusters was as follows:

- Clayey silt and silty clay from ground surface to between 25 and 33 feet bls (loess).
- Sand with gravel, silt, and clay from between 25 and 33 feet bls to between 69 and 76 feet bls (fluvial deposits).
- Silty sand, clayey sand, sandy clay, and lignite from between 69 and 76 feet to between 105 and 128 feet bls (Cockfield Formation).
- Hard, waxy clay with sand laminations from between 105 and 128 feet to the termination depth of the borings between 110 and 135 feet (Cook Mountain Formation).

Laboratory-measured vertical hydraulic conductivity for a subsurface soil sample collected from 20 to 22 feet bls (loess) at MW-09 was 9.5×10^{-7} cm/sec. MW-09 was approximately 75 feet east of the fenced asphalt compound, SWMU 51. Laboratory-measured vertical hydraulic conductivity for a soil sample collected from 75 to 77 feet bls (lower fluvial deposits) at MW-01 was 6.8×10^{-5} cm/sec. MW-01 was approximately 200 feet east of SWMU 51. Laboratory-measured vertical hydraulic conductivity for soil samples collected from the Cockfield Formation (MW-01, 110 to 112 feet bls; MW-03, 115 to 117 feet bls; and MW-08,

125 to 127 feet bls) ranges from 8.7×10^{-7} cm/sec to 1.6×10^{-8} cm/sec. Monitoring-well clusters MW-01, MW-03, and MW-08 are 75 feet east, 500 feet east, and 200 feet south, respectively, of SWMU 51. The boring and monitoring-well logs and hydraulic-conductivity data sheets for SWMU 7 are provided in Attachment 4, Volume II, of this CSI report.

5.5.4 Preliminary Investigations

Several investigations have been performed on adjacent property at SWMU 7 and nearby SWMU 15. The Assembly A investigation consisted of installing and sampling nine monitoring-well clusters around SWMU 7 in early 1995. The groundwater results indicate the presence of at least one of the following VOCs in at least one monitoring well in the fluvial deposits: 1,1-DCE, 1,2-DCE, 1,1-DCA, 1,2-DCA, chloroform, carbon tetrachloride, carbon disulfide, TCE, PCE, 1,2-dichloropropene, and benzene. These compounds were detected at concentrations less than 100 ppb in all groundwater sample.

Two DPT surveys also were performed on the property surrounding SWMU 7 in November and December 1994, and May and June 1995. Soil and groundwater samples were analyzed for VOCs by an onsite laboratory. Analytical data from these surveys indicated the presence of chlorinated solvents in groundwater in the upper part of the fluvial deposits at distances of a few hundred feet south and east of Building N-126. These chlorinated solvents included 1,1-DCE, 8.8 to 43.7 ppb; 1,2-DCE, 1.5 to 200 ppb; 1,1-DCA, 8.2 to 320 ppb; TCE, 1.6 to 20 ppb; PCE, 8 to 174 ppb; xylenes, 4.9 ppb; and trichlorofluoromethane, 8.5 ppb. A DPT survey also was performed at SWMU 15 (approximately 150 feet south-southwest of SWMUs 50 and 51) in May 1995. Samples from this survey also were analyzed for VOCs using an onsite laboratory. Analytical results from SWMU 15 indicated the presence of hydrocarbon-related compounds in both soil and groundwater in the loess and fluvial deposits.

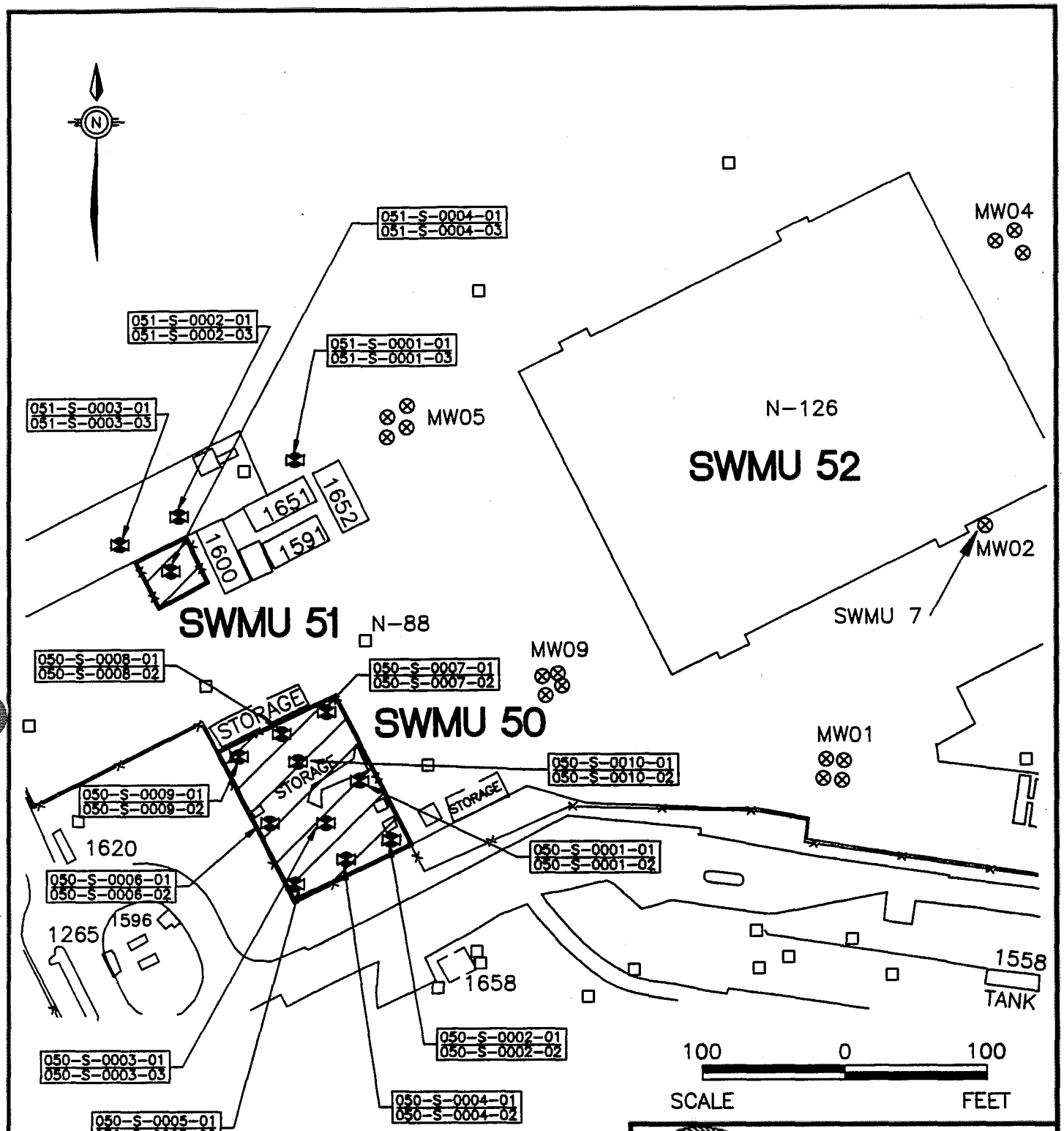
5.5.5 Field Investigation and Analytical Methods

The SWMUs 50 and 51 investigation prescribed in *Assembly D Site Investigation Plans* (E/A&H, 1995) consisted of sampling 14 locations, coring through asphalt or concrete where necessary. Samples were collected across the surface soil interval and 2 to 3 feet bls using a stainless-steel hand auger according to the sampling methods outlined in Section 4.4.4.3 of the *Comprehensive RFI Work Plan*. Twenty-eight soil samples were collected from 14 locations as shown in Figure 5.5-3. Following sample collection, each boring was sealed with bentonite.

All samples collected from the surface interval were submitted to NET, Massachusetts, for analysis of Appendix IX metals, VOCs, SVOCs, and pesticides/PCBs. All soil samples collected from 2 to 3 feet bls were analyzed for SVOCs and Appendix IX metals. Only 11 of the subsurface samples were analyzed for VOCs. Three samples — one surface and two subsurface, (050-S-0004-01, 050-S-0004-02, and 050-S-0005-02) — were analyzed for TPH (GRO + DRO) with one sample (050-C-0004-01) duplicated for the same analysis. Four soil samples (050-C-0001-01, 050-C-0004-01, 050-C-0010-01, and 051-C-0002-01) collected from the surface interval were duplicated for Appendix IX metals, VOCs, SVOCs, and pesticides/PCBs analyses. Laboratory analytical data are presented as Appendix G.

5.5.6 Nature and Extent of Contamination

This section provides the analytical results for surface and subsurface soil samples collected during the first phase of the CSI at SWMUs 50 and 51. Analytical results for surface soil samples were compared to RBCs for residential and industrial soil (USEPA Region III, July to December 1995). Constituent averages for SWMUs 50 and 51 were compared to transfer from soil to groundwater SSLs to determine the need for further study or action (OSWER Soil Screening Guidance memorandum, USEPA, 1994.) Constituent concentrations from individual samples were also compared to SSLs for informational purposes. Metals analytical results were compared to background RCs (2× mean). Tables 5.5.1 and 5.5.2 summarize laboratory



LEGEND

SAMPLE LOCATION

MW01 EXISTING MONITORING WELL CLUSTER

RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 5.5-3
SAMPLE LOCATIONS
BLDG N-126 HAZARDOUS WASTE
ACCUMULATION POINTS
SWMUs 50, 51 AND 52

DWG DATE: 04/05/96 | DWG NAME: 94SL004

Table 5.5.1
SWMUs 50 and 51 — Organics in Soil (μg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Acenaphthene	0-1'	1/14	110	N/A	4.70e+06	0	1.80e+08	0	2.00e+05	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Acetone	0-1'	4/14	250 - 890	445	7.80e+06	0	2.00e+08	0	8.00e+03	N
	2-3'	1/11	240	N/A	N/A	0	N/A	0		
Aldrin	0-1'	4/14	1 - 10	5.4	3.80e+01	0	340	0	5	Y
	2-3'	NT	ND	ND	N/A	0	N/A	0		
Anthracene	0-1'	1/14	240	N/A	2.30e+07	0	6.10e+08	0	4.30e+06	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Benzo(a)anthracene	0-1'	4/14	39 - 480	174	8.80e+02	0	7.80e+03	0	700	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Benzo(a)pyrene	0-1'	3/14	86 - 390	205	8.80e+01	2	780	0	4.00e+03	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Benzo(b)fluoranthene	0-1'	4/14	42 - 360	158	8.80e+02	0	7.80e+03	0	4.00e+03	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Benzo(g,h,i)perylene	0-1'	3/14	46 - 130	77	2.30e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Benzo(k)fluoranthene	0-1'	3/14	94 - 410	215	8.80e+03	0	7.80e+04	0	4.00e+03	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
bis(2-Ethylhexyl)phthalate (BEHP)	0-1'	0/14	ND	ND	4.60e+04	0	4.10e+05	0	1.10e+04	N
	2-3'	3/14	44 - 130	73	N/A	0	N/A	0		
2-Butanone (MEK)	0-1'	6/14	8 - 48	24	4.70e+07	0	1.00e+09	0	i	N
	23'	0/11	ND	ND	N/A	0	N/A	0		
Carbazole	0-1'	1/14	100	N/A	3.20e+04	0	2.90e+05	0	500	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		

Table 5.5.1
SWMUs 50 and 51 — Organics in Soil (µg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Carbon disulfide	0-1'	0/14	ND	ND	7.80e+06	0	2.00e+08	0	1.40e+04	N
	2-3'	1/11	2	N/A	N/A	0	N/A	0		
Chrysene	0-1'	4/14	39 - 510	192	8.80e+04	0	7.80e+05	0	1.00e+03	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
4,4'-DDD	0-1'	4/14	5.9 - 98	32	2.70e+03	0	2.40e+04	0	700	N
	2-3'	0/0	N/A	ND	N/A	0	N/A	0		
4,4'-DDE	0-1'	5/14	10 - 160	41	1.90e+03	0	1.70e+04	0	500	N
	2-3'	0/0	N/A	ND	N/A	0	N/A	0		
4,4'-DDT	0-1'	1/14	16	N/A	1.90e+03	0	1.70e+04	0	1.00e+03	N
	2-3'	0/0	N/A	ND	N/A	0	N/A	0		
Dibenz(a,h)anthracene	0-1'	1/14	60	N/A	8.80e+01	0	780	0	1.10e+04	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Dibenzofuran	0-1'	1/14	41	N/A	3.10e+05	0	8.20e+06	0	1.20e+05	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Dieldrin	0-1'	5/14	18 - 130	58	4.00e+01	3	360	0	1	Y
	2-3'	0/0	N/A	ND	N/A	0	N/A	0		
Ethylbenzene	0-1'	1/14	29	N/A	7.80e+06	0	2.00e+08	0	5.00e+03	N
	2-3'	0/11	ND	ND	N/A	0	N/A	0		
Fluoranthene	0-1'	6/14	39 - 1200	314	3.10e+06	0	8.20e+07	0	9.80e+05	N
	2-3'	1/14	270	N/A	N/A	0	N/A	0		
Fluorene	0-1'	1/14	74	N/A	3.10e+06	0	8.20e+07	0	1.60e+05	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Indeno(1,2,3-cd)pyrene	0-1'	3/14	48 - 160	86	8.80e+02	0	7.80e+03	0	3.50e+04	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		

Table 5.5.1
SWMUs 50 and 51 — Organics in Soil (µg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Naphthalene	0-1'	1/14	140	N/A	3.10e+06	0	8.20e+07	0	3.00e+04	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Phenanthrene	0-1'	3/14	56 - 920	357	2.30e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
	2-3'	0/14	ND	ND	N/A	0	N/A	0		
Pyrene	0-1'	5/14	56 - 890	299	2.30e+06	0	6.10e+07	0	1.40e+06	N
	2-3'	1/14	240	N/A	N/A	0	N/A	0		
TPH - Diesel Range Organics	0-1'	1/1	15,000	N/A	1.00e+05[i]	0	N/A	0	N/A	N
	2-3'	0/2	ND	ND	N/A	0	N/A	0		
TPH - Gasoline Range Organics	0-1'	1/1	780	N/A	1.00e+05[i]	0	N/A	0	N/A	N
	2-3'	1/2	230	N/A	1.00e+05[i]	0	N/A	0		
Toluene	0-1'	12/14	2 - 79	13	1.60e+07	0	4.10e+08	0	5.00e+03	N
	2-3'	8/11	2 - 7	5	N/A	0	N/A	0		
Xylene (Total)	0-1'	1/14	2	N/A	1.60e+08	0	1.00e+09	0	7.40e+04	N
	2-3'	0/11	ND	ND	N/A	0	N/A	0		

Notes:

a — Feet bls.

b — Twenty-eight samples collected from 14 locations. Fourteen samples collected from 0 to 1 foot bls were analyzed for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs. Fourteen samples collected from 2 to 3 feet bls were analyzed for SVOCs, and Appendix IX metals. Eleven samples collected from 2 to 3 feet bls were analyzed for VOCs. One sample collected from 0 to 1 foot bls and two collected from 2 to 3 feet bls were analyzed for TPH/GRO.DRO. Four samples were duplicated for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs.

c — Range lower limit is the lowest detected parameter concentration.

d — Mean based on detected parameter concentrations only.

e — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo). RBCs are only applicable for comparison to data from samples collected across the surface interval.

f — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk-Based Concentration Table July to December 1995).

g — Contaminant averages were compared to SSLs to determine the need for further study or action.

h — Risk-based data not available; data for pyrene used as surrogate.

i — Risk-based data not available at this time.

j — RBC does not exist; value shown is TDEC soil cleanup level for total TPH (GRO + DRO).

ND — Parameter not detected.

N/A — Not applicable.

Table 5.5.2
SWMUs 50 and 51 — Inorganics in Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Antimony	0-1'	1/14	19.1	N/A	BDL	1	31	0	820	0	i	N
	2-3'	1/14	14.7	N/A	BDL	1	N/A	0	N/A	0		
Arsenic	0-1'	14/14	5.4 - 11	8	13.1	0	0.43[j]	14	3.8[j]	14	15[j]	N
	2-3'	14/14	7.5 - 13.4	9.7	20.4	0	N/A	0	N/A	0		
Barium	0-1'	14/14	85.5 - 162	126	191	0	5,500	0	1.40e+05	0	32	Y
	2-3'	14/14	86.8 - 138	115	289	0	N/A	0	N/A	0		
Beryllium	0-1'	14/14	0.4 - 0.63	0.5	0.96	0	0.15	14	1.3	0	180	N
	2-3'	14/14	0.41 - 0.79	0.60	1.02	0	N/A	0	N/A	0		
Cadmium	0-1'	14/14	1.4 - 4.3	2.4	BDL	14	39	0	1.00e+03	0	6	N
	2-3'	14/14	1.1 - 3.8	2.3	6.8	0	N/A	0	N/A	0		
Chromium	0-1'	14/14	8.8 - 16.4	11.5	26.4	0	390[k]	0	1.00e+04[k]	0	19[k]	N
	2-3'	14/14	10.2 - 18.2	13.3	28.6	0	N/A	0	N/A	0		
Cobalt	0-1'	14/14	8.5 - 52.5	14.2	15	2	4,700	0	1.20e+05	0	i	N
	2-3'	14/14	5.5 - 16.3	9.8	15.3	1	N/A	0	N/A	0		
Copper	0-1'	14/14	10.5 - 19.1	15.2	23.6	0	3,100	0	7.60e+04	0	i	N
	2-3'	14/14	11.3 - 19.7	16.6	33.9	0	N/A	0	N/A	0		
Lead	0-1'	14/14	3 - 42	16	28.7	1	400[l]	0	1000[l]	0	i	N
	2-3'	14/14	8.7 - 23	13	25.1	0	N/A	0	N/A	0		
Nickel	0-1'	14/14	6.2 - 21.5	14.4	BDL	14	1,600	0	4.10e+04	0	21	N
	2-3'	14/14	6.3 - 19.7	14.6	59.8	0	N/A	0	N/A	0		
Selenium	0-1'	5/14	0.25 - 0.37	0.30	BDL	5	390	0	1.00e+04	0	3	N
	2-3'	5/14	0.24 - 0.49	0.35	BDL	5	N/A	0	N/A	0		
Silver	0-1'	1/14	1.4	N/A	BDL	1	390	0	1.00e+04	0	i	N
	2-3'	1/14	0.86	N/A	BDL	1	N/A	0	N/A	0		

Table 5.5.2
SWMUs 50 and 51 — Inorganics in Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Vanadium	0-1'	14/14	18.4 - 32.6	25.5	49.6	0	550	0	1.40e+04	0	i	N
	2-3'	14/14	20.2 - 41.7	27.0	46.3	0	N/A	0	N/A	0		
Zinc	0-1'	14/14	33.3 - 69	51	88.3	0	23,000	0	6.10e+05	0	4,200	N
	2-3'	14/14	37.2 - 69.3	53.9	111.8	0	N/A	0	N/A	0		

Notes:

a — Feet bls.

b — Twenty-eight samples collected from14 locations. Fourteen samples collected from 0 to 1 foot bls were analyzed for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs. Fourteen samples collected from 2 to 3 feet bls were analyzed for SVOCs, and Appendix IX metals. Eleven samples collected from 2 to 3 feet bls were analyzed for VOCs. One sample collected from 0 to 1 foot bls and two collected from 2 to 3 feet bls were analyzed for TPH/GRO.DRO. Four samples were duplicated for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs.

c — Range lower limit is the lowest detected parameter concentration.

d — Mean based on detected parameter concentrations only.

e — Background reference concentration (2x mean background). See Section 3 of this report for a discussion of RCs.

f — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo). RBCs are only applicable for comparison to data from samples collected across the surface interval.

g — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk-Based Concentration Table, July to December 1995).

h — Contaminant averages were compared to SSLs to determine the need for further study or action.

i — Risk-based data not available at this time.

j — Risk-based data for arsenic as a carcinogen.

k — Risk-based data for hexavalent chromium (VI).

l — Value is soil cleanup level for total lead (USEPA OSWER Directive, 9355.4-12).

N/A — Not applicable.

BDL — Below detection limit.

analytical results compared to RBCs and SSLs for organic and inorganic compounds, respectively. Table 5.5.2 also compares soil inorganic concentrations to background RCs as described in Section 3 of this report.

Organics

As Table 5.5.1 indicates, 29 organic compounds were detected in soil samples collected at SWMUs 50 and 51.

Concentrations of one SVOC and one pesticide exceeded residential soil RBCs in the surface interval:

- BaP exceeded the residential soil RBC of 88 μg/kg in two of 14 samples (050-S-0004-01 and 051-S-0003-01) with a maximum detected concentration of 390 μg/kg;

- Dieldrin exceeded the residential soil RBC of 40 μg/kg in three of 14 samples (051-S-0001-01, 051-S-0002-01, and 051-S-0004-01) with a maximum detected concentration of 130 μg/kg.

As noted earlier, the Technical Memorandum *Discussion of Dieldrin Risk Management Issue* has been included in Attachment 1, Volume II, of this CSI report. Risk estimates based on the soil dieldrin concentrations detected at NSA Memphis did not exceed 1E-4 ILCR. The average concentration of dieldrin in soil samples collected during a background study was 131 μg/kg with a maximum detected concentration of 311 μg/kg. As stated in the memorandum, "This finding indicates that dieldrin levels found at each SWMU do not necessitate remedial action in the absence of other significant carcinogenic risk contributors."

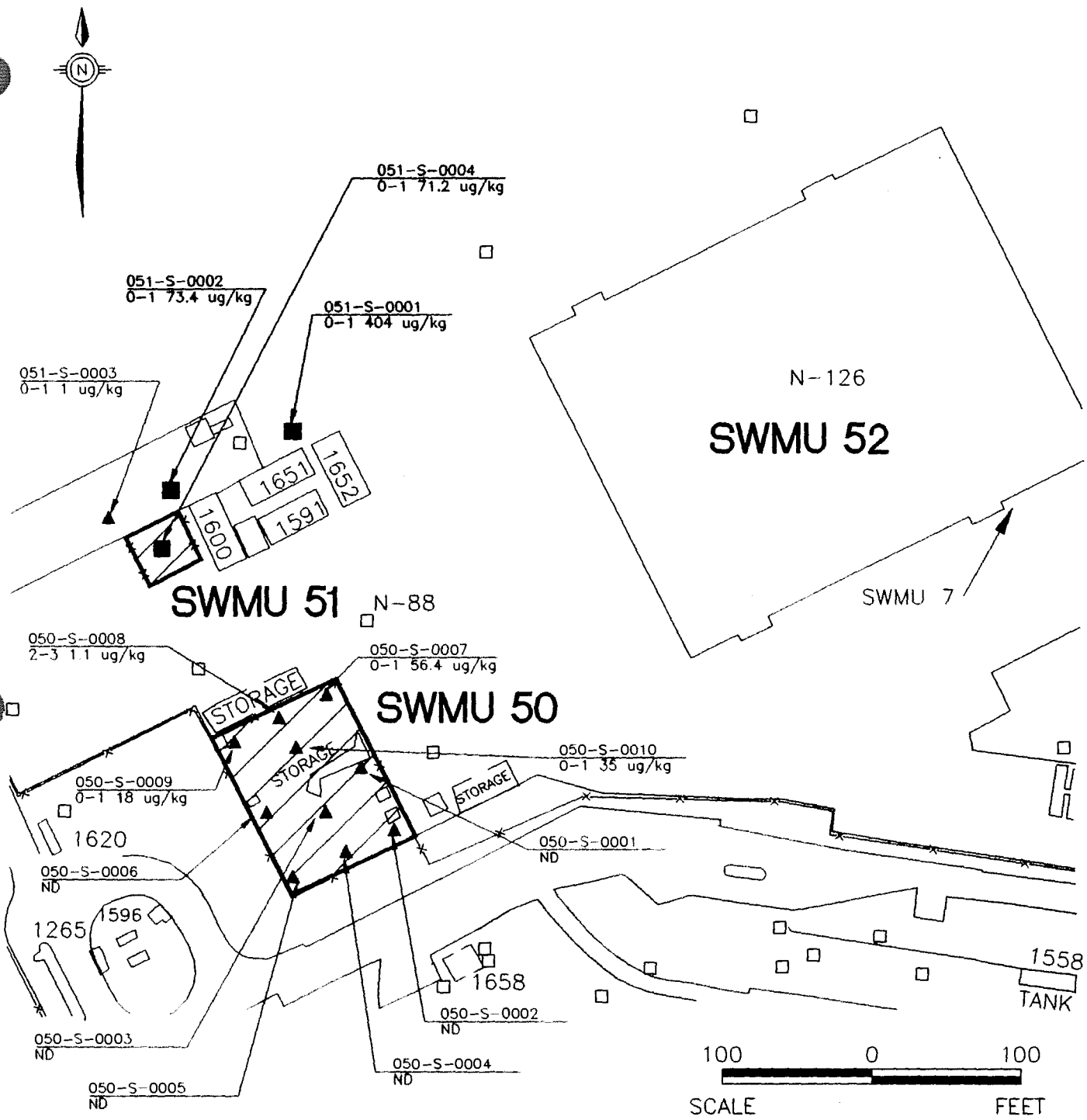
Concentrations of all detected organics were well below industrial RBCs. Concentrations of two pesticides, aldrin and dieldrin, exceeded transfer from soil to groundwater SSLs in individual samples.

- Aldrin exceeded the SSL of 5 μg/kg in two of 14 samples (050-S-0007-01 and 051-S-0004-01) with a maximum detected concentration of 10 μg/kg.

- Dieldrin exceeded the SSL of 10 μg/kg in five of 14 samples (050-S-0007-01, 050-S-0009-01, 051-S-0001-01, 051-S-0002-01, and 051-S-0004-01) with a maximum detected concentration of 130 μg/kg.

The average concentrations of both aldrin and dieldrin at 5.4 μg/kg and 58 μg/kg exceeded the SSLs of aldrin and dieldrin of 5 μg/kg and 1 μg/kg, respectively. Averages were calculated using constituent sample data from all sampling intervals. The highest detected dieldrin concentration of 130 μg/kg at SWMUs 50 and 51 was near the average dieldrin concentration of 131 μg/kg detected in background samples. Although average dieldrin and aldrin concentrations at SWMUs 50 and 51 exceeded the SSL, because of the chemical properties of pesticides, the physical properties of soil, and the shallow depth and infrequency at which aldrin and dieldrin were detected at SWMUs 50 and 51, the contaminants are not expected to leach in appreciable quantities (if at all) into underlying groundwater. Also, the physical adsorption of pesticides to soil particles and organic material greatly limits horizontal migration.

Total TPH (GRO + DRO) was detected in one sample (050-S-0004-01) from the surface interval at 15,780 μg/kg with DRO making up 15,000 μg/kg of the total TPH. The total TPH of this sample was well below the 100,000 μg/kg TDEC (Division of Solid Waste Management, State Remediation Section) soil cleanup level for total TPH (GRO + DRO). TPH-GRO was also detected at the same sample location in from 2 to 3 feet bls at a concentration of 250 μg/kg. Figures 5.5-4 and 5.5-5 provide plots of pesticide and SVOC concentrations in soil samples compared to RBCs. Figure 5.5-6 provides a plot of transfer from soil to groundwater SSL exceedances.



LEGEND

▲ CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

050-S-0004
0-1 10.6 ug/kg — SOIL BORING 4 CONTAINED A TOTAL PESTICIDES CONCENTRATION OF 10.6 ug/kg @ THE 0-1 FOOT DEPTH INTERVAL.

ND — NOT DETECTED

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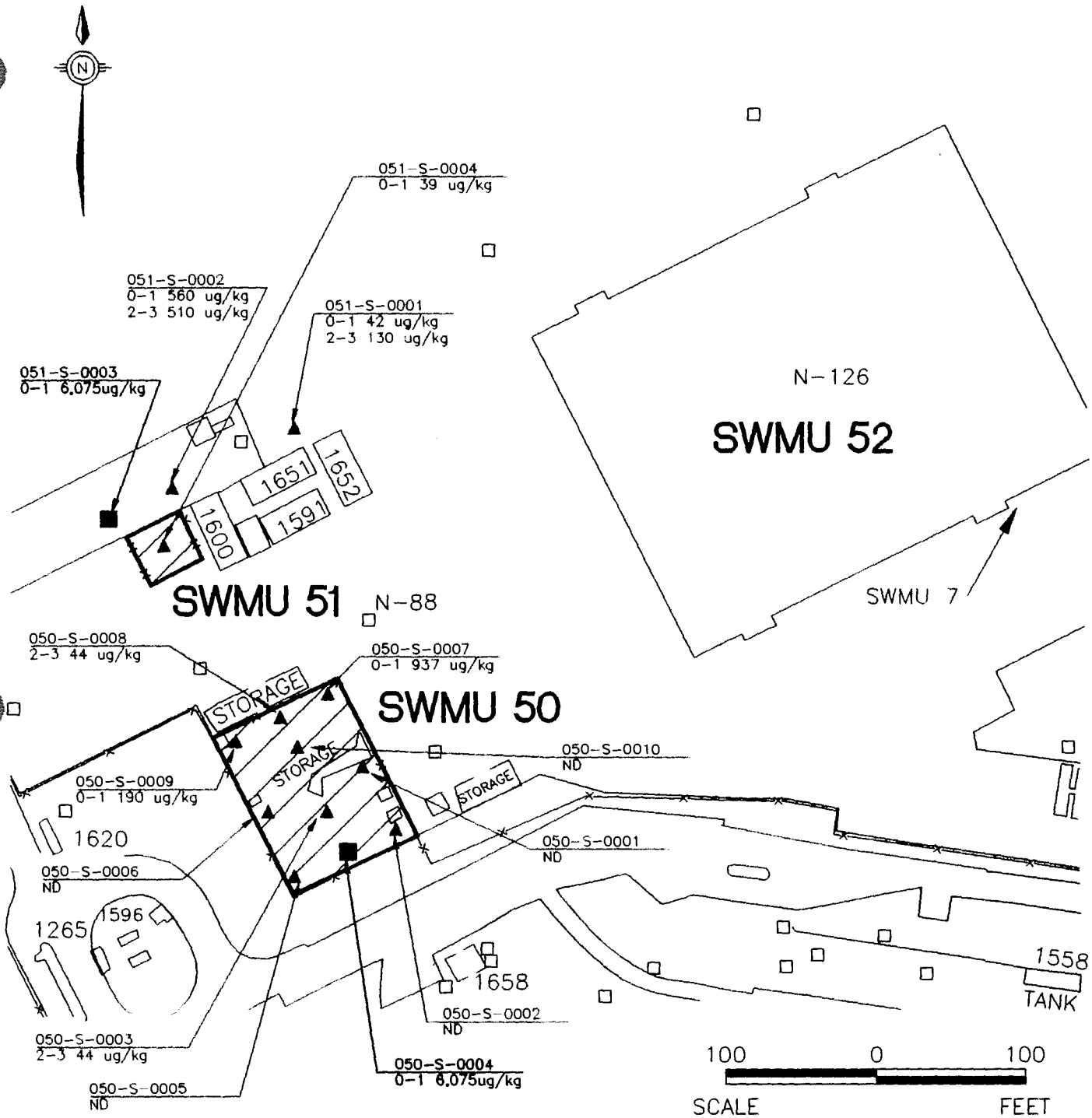
FIGURE 5.5-4
TOTAL PESTICIDES IN SURFACE SOIL
BUILDING N-126 HAZARDOUS WASTE
ACCUMULATION POINTS
SWMUs 50, 51 AND 52

DWG DATE: 04/24/96 | DWG NAME: 94TPS52



LEGEND

▲ CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

050-S-0004
0-1 10.6 ug/kg — SOIL BORING 4 CONTAINED A TOTAL SVOC CONCENTRATION OF 10.6 ug/kg ● THE 0-1 FOOT DEPTH INTERVAL.

ND — NOT DETECTED

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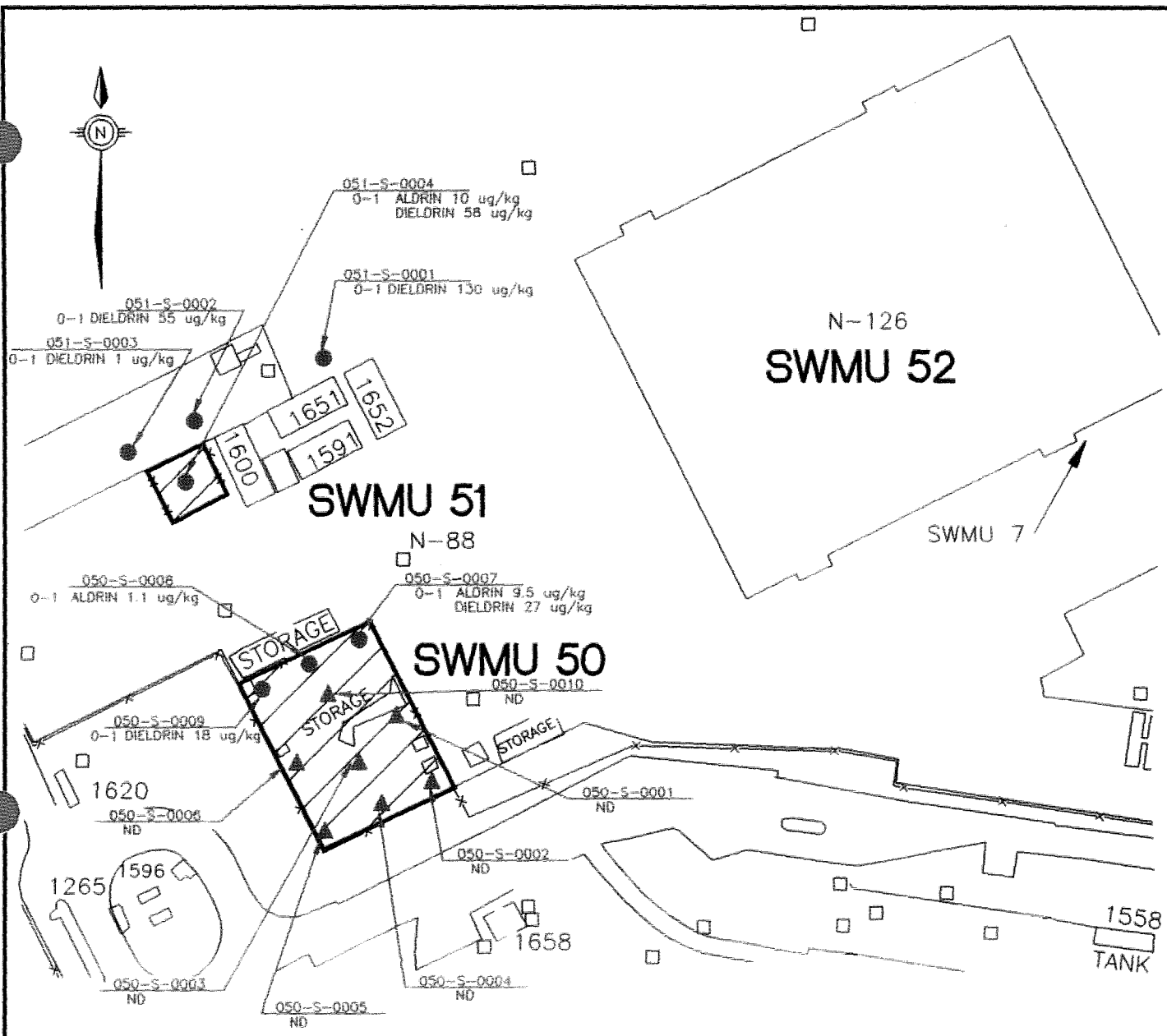
FIGURE 5.5-5
TOTAL SVOCs IN SOIL
BUILDING N-126 HAZARDOUS WASTE
ACCUMULATION POINTS
SWMUs 50, 51 AND 52

DWG DATE: 04/24/96 | DWG NAME: 94TSS52



* AVERAGE ALDRIN CONCENTRATION = 5.4 ug/kg
AVERAGE DEILDRIN CONCENTRATION = 58 ug/kg

LEGEND

▲ SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) NOT DETECTED AT THIS LOCATION.

● SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) DETECTED AT THIS LOCATION.

051-S-0003 / 0-1 ALDRIN 1 ug/kg — SOIL BORING 3 CONTAINED ALDRIN AT 1 ug/kg IN THE 0-1' INTERVAL.

ND — NOT DETECTED

SWMU 51

100 0 100
SCALE FEET

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INVESTIGATION
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FIGURE 5.5-6
TRANSFER FROM SOIL TO
GROUNDWATER SSL EXCEEDANCES
BUILDING N-126 HAZARDOUS WASTE
ACCUMULATION POINTS
SWMUs 50, 51 AND 52

DWG DATE: 04/30/96 | DWG NAME: 94TRANS6

Metals

As Table 5.5.2 indicates, 14 metals were detected at both the surface interval and 2 to 3 feet bls; however, no metals exceeded both background RCs and residential RBCs.

Concentrations of two metals exceeded transfer from soil to groundwater SSLs in individual samples:

- Barium exceeded the SSL of 32 mg/kg in all 28 samples collected with a maximum detected concentration of 162 mg/kg;

- Nickel exceeding the SSL of 21 mg/kg in one of 28 samples (051-S-0001-01) at a concentration of 21.5 mg/kg.

Although nickel concentrations in individual samples exceeded SSLs, the average nickel concentration at 17 mg/kg did not, indicating no need for further study or action. The average barium concentration at 121 mg/kg exceeded the SSL of 32 mg/kg but did not exceed the 2 × mean background RC of 191 mg/kg.

5.5.7 Preliminary Risk Evaluation

In accordance with USEPA Region IV Memorandum, November, 1994, a PRE was conducted for SWMUs 50 and 51 using data from soil samples collected during the CSI.

According to Figure XVII-1, the Aviation-Related Development Alternative presented in the Base Reuse and Development Plan (RKG, 1995), the area that includes SWMUs 50 and 51 will be used for commercial purposes. Tables 5.5.3 and 5.5.4 summarize PRE results for SWMUs 50 and 51.

Table 5.5.3
SWMUs 50 and 51 — Preliminary Risk Evaluation — Carcinogens (µg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Screening Value[c] Residential	Screening Value[c] Industrial	Risk Ratio Residential	Risk Ratio Industrial
Arsenic	11000	13,100	4.30e+02	3.80e+03	0.00e+00	0.00e+00
Aldrin *	10	N/A	3.80e+01	3.40e+02	2.63e-07	2.94e-08
Benzo(a)anthracene *	480	N/A	8.80e+02	7.80e+03	5.45e-07	6.15e-08
Benzo(b)fluoranthene *	360	N/A	8.80e+01	7.80e+02	4.09e-06	4.62e-07
Benzo(g,h,i)perylene *	130	N/A	8.80e+02	7.80e+03	1.48e-07	1.67e-08
Benzo(k)fluoranthene *	410	N/A	8.80e+03	7.80e+04	4.66e-08	5.26e-09
Beryllium	630	960	1.50e+02	1.30e+03	0.00e+00	0.00e+00
Carbazole *	100	N/A	3.20e+04	2.90e+05	3.13e-09	3.45e-10
Chrysene *	510	N/A	8.80e+04	7.80e+05	5.80e-09	6.54e-10
4,4'-DDD *	98	N/A	2.70e+03	2.40e+04	3.63e-08	4.08e-09
4,4'-DDE *	160	N/A	1.90e+03	1.70e+04	8.42e-08	9.41e-09
4,4'-DDT *	16	N/A	1.90e+03	1.70e+04	8.42e-09	9.41e-10
Dibenz(a,h)anthracene *	60	N/A	8.80e+01	7.80e+02	6.82e-07	7.69e-08
Dieldrin *	130	N/A	4.00e+01	3.60e+02	3.25e-06	3.61e-07
Indeno(1,2,3-cd)pyrene *	160	N/A	8.80e+02	7.80e+03	1.82e-07	2.05e-08
ILCR					9.35e-06	1.05e-06

Notes:

a — The highest detected concentration for each contaminant was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
N/A — Not applicable.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not ILCR calculation.

Table 5.5.4
SWMUs 50, 51, and 52 — Preliminary Risk Evaluation — Noncarcinogens (µg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Screening Value[c] Residential	Screening Value[c] Industrial	Risk Ratio Residential	Risk Ratio Industrial
Acenaphthene *	110	N/A	4.70e+06	1.20e+08	2.34e-05	9.17e-07
Acetone *	890	N/A	7.80e+06	2.00e+08	1.14e-04	4.45e-06
Anthracene *	240	N/A	2.30e+07	6.10e+08	1.04e-05	3.93e-07
Antimony *	19,100	BDL	3.10e+04	8.20e+05	6.16e-01	2.33e-02
Arsenic	11,000	13,100	2.30e+04	6.10e+05	0.00e+00	0.00e+00
Barium	162,000	191,000	5.50e+06	1.40e+08	0.00e+00	0.00e+00
2-Butanone (MEK) *	48	N/A	4.70e+07	1.00e+09	1.02e-06	4.80e-08
Cadmium *	4,300	BDL	4.68e+05	1.00e+06	9.19e-03	4.30e-03
Chromium	16,400	26,400	3.90e+05	1.00e+07	0.00e+00	0.00e+00
Cobalt *	52,500	15,000	4.70e+06	1.20e+08	1.12e-02	4.38e-04
Copper	19,100	23,600	3.10e+06	7.60e+07	0.00e+00	0.00e+00
Dibenzofuran *	41	N/A	3.10e+05	8.20e+06	1.32e-04	5.00e-06
Ethylbenzene *	29	N/A	7.80e+06	2.00e+08	3.72e-06	1.45e-07
Fluoranthene *	1,200	N/A	3.10e+06	8.20e+07	3.87e-04	1.46e-05
Fluorene *	74	N/A	3.10e+06	8.20e+07	2.39e-05	9.02e-07
Naphthalene *	140	N/A	3.10e+06	8.20e+07	4.52e-05	1.71e-06
Nickel *	21,500	BDL	1.60e+06	4.10e+07	1.34e-02	5.24e-04
Phenanthrene *	920	N/A	3.10e+06	6.10e+07	2.97e-04	1.51e-05
Pyrene *	890	N/A	2.30e+06	6.10e+07	3.87e-04	1.46e-05
Selenium *	370	BDL	3.90e+05	1.00e+07	9.49e-04	3.70e-05
Silver *	1,400	BDL	3.90e+05	1.00e+07	3.59e-03	1.40e-04
Toluene *	79	N/A	1.60e+07	4.10e+08	4.94e-06	1.93e-07
Vanadium	32,600	49,600	5.50e+05	1.40e+07	0.00e+00	0.00e+00
Xylene (Total) *	2	N/A	1.60e+08	1.00e+09	1.25e-08	2.00e-09
Zinc	69,000	88,300	2.30e+07	6.10e+08	0.00e+00	0.00e+00
HI					0.66	0.03

Notes:

a — The highest detected concentration for each contaminant was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
N/A — Not applicable.
BDL — Below detection limit.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not HI calculation.

The resulting residential and industrial carcinogen ILCRs at 9.35e-06 and 1.05e-06, respectively, fell well below the 10^{-4} criteria, indicating no risk in either scenario. The resulting residential and industrial noncarcinogen HIs at 0.66 and 0.03, respectively, fell well below the criteria of 1, indicating no risk in either scenario. Property including SWMU 11 is suitable for residential lease.

5.5.8 Conclusions and Recommendations

Based on the information gathered during this investigation, the following conclusions and recommendations have been reached:

- SWMUs 50 and 51 will be developed for commercial use according to the Base Reuse Plan.

- Twenty-nine organics were detected at SWMUs 50, 51, and 52 in both the surface soil interval and 2 to 3 feet bls.

  — Concentrations of the SVOC BaP and the pesticide dieldrin exceeded residential soil RBCs, but no organic concentrations exceeded industrial RBCs.

  — Concentrations of two pesticides (aldrin and dieldrin) exceeded transfer from soil to groundwater SSLs; however, due to chemical properties of pesticides, the physical properties of the soil, and the shallow depth and infrequency of detection, they are not expected to leach into groundwater or migrate horizontally.

- Fourteen metals were detected in both the surface soil interval and 2 to 3 feet bls, however no single concentration exceeded both background RCs and residential soil RBCs.

- Based on a PRE performed on data from samples collected from the surface interval:

  — Carcinogens: neither the residential nor industrial ILCR exceeded the 10^{-4} threshold, indicating no significant risk in either setting;

  — Noncarcinogens: neither the residential nor the industrial noncarcinogen HI exceeded 1, indicating suitability for lease with no further action.

- Based on data from soil samples, no further action is recommended for SWMUs 50, 51, and 52. In accordance with PRE methodology, the property is suitable for residential lease.

5.6 SWMU 64 — N-16 Materials Storage Area

This section summarizes the activities conducted during the first phase of the CSI performed at SWMU 64, the Building N-16 Materials Storage Area, and outlines any proposed RFI activities.

5.6.1 Site Description and Historical Information

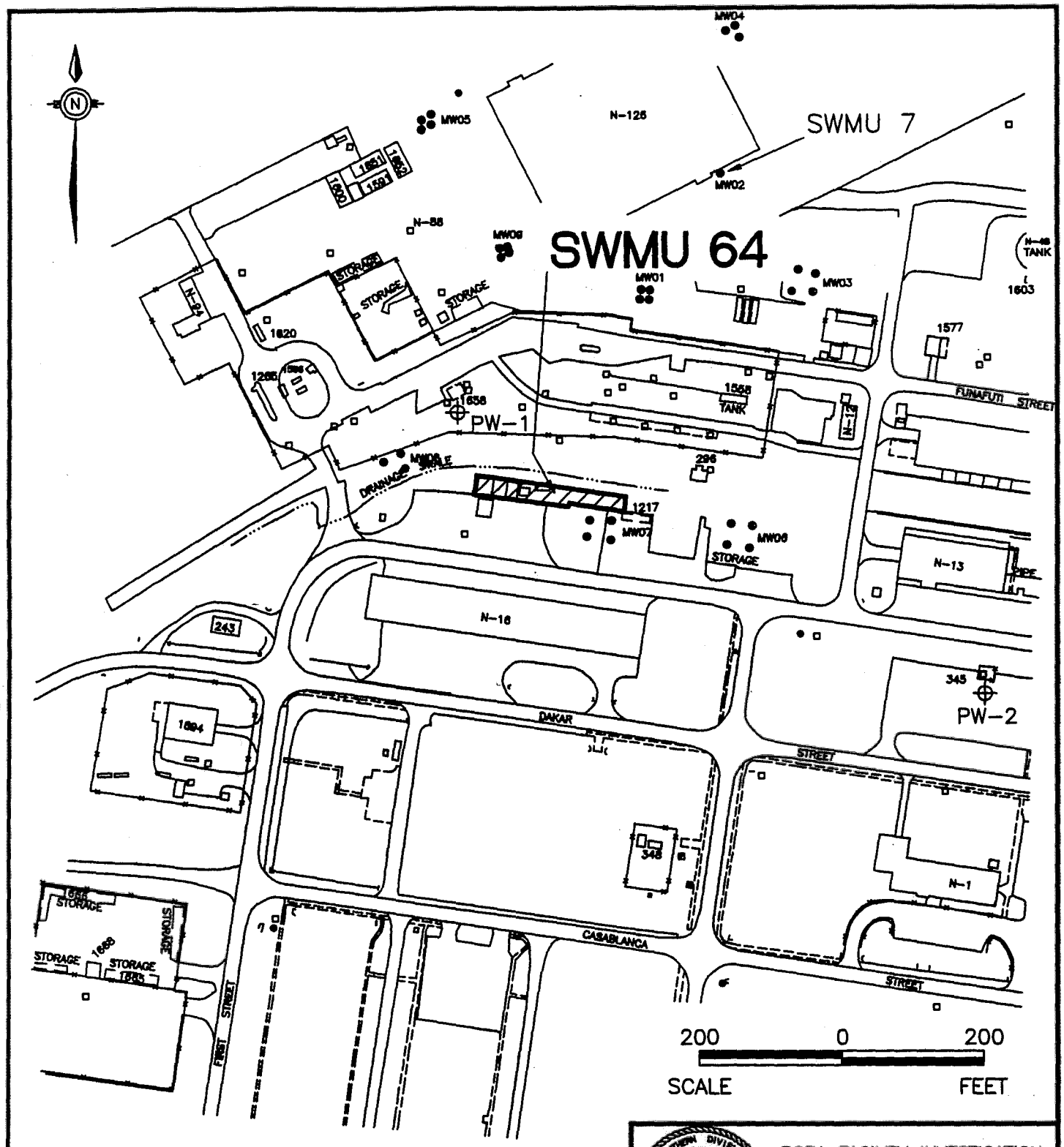
SWMU 64, an active materials storage area for Building N-16, is approximately 1,200 feet southeast of the main runway and 200 feet north of Building N-16. Figures 5.6-1 and 5.6-2 provide a vicinity map and digital orthophotograph of SWMU 64, respectively.

SWMU 64 consists of a concrete pad, approximately 22 feet wide by 200 feet long, currently used for drum and equipment storage by the NSA Memphis Fire Department. A storage shed is on the concrete pad. The 1990 RFA report (ERC/EDGe, 1990) indicated that used oil and containers of aqueous film-forming fluid and Purple K, two fire extinguishing agents, were stored at the SWMU. No evidence of spills was observed by E/A&H personnel during an April 10, 1995, VSI.

Based on visual observations and interviews with Navy personnel, the concrete pad is the foundation of a former building. A 1947 NSA Memphis base map shows Building 90 at the current location of SWMU 64. The use of former Building 90 is unknown. According to NSA Memphis Public Works personnel, transformers may have been stored on an unpaved area east of and adjacent to SWMU 64. This former transformer storage area (see Figure 5.6-3) was included in the SWMU 64 CSI.

5.6.2 Topography and Drainage

Drainage from SWMU 64 enters an unlined drainage swale north of the SWMU, flows northwest, and enters the SWMU 6 drainage system approximately 500 feet northwest of SWMU 64. A topographic map showing local land elevations is provided in Attachment 3, Volume II, of this CSI Report.



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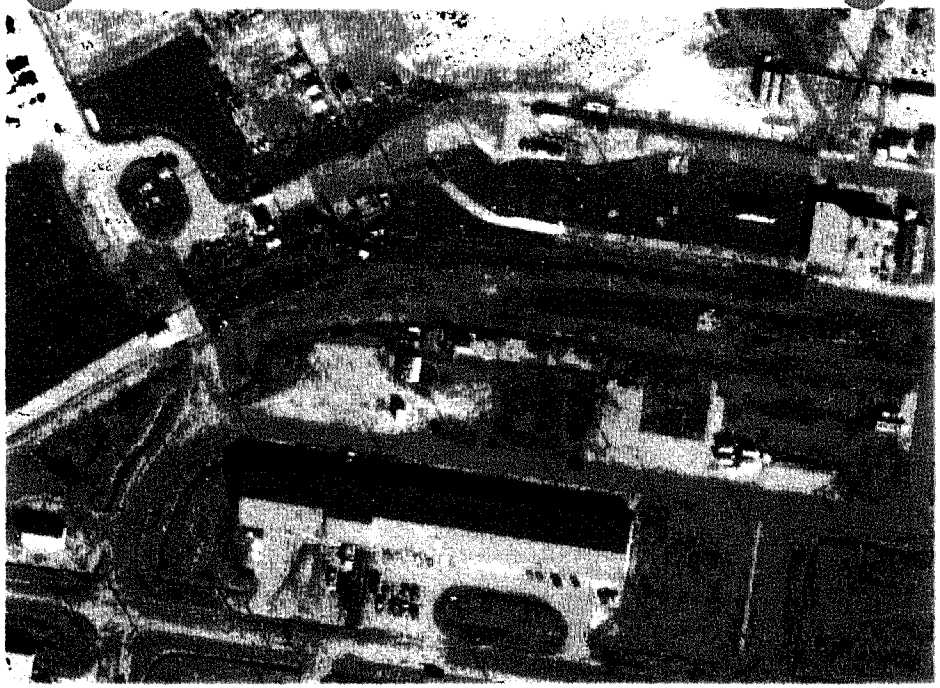
LEGEND

MW01● EXISTING MONITORING WELL CLUSTER

PW-2 PRODUCTION WELL

FIGURE 5.6-1
VICINITY MAP
N-16 MATERIALS STORAGE AREA
SWMU 64

DWG DATE: 04/05/96 | DWG NAME: 94VM64A



SWMU 64
BOUNDARY

Photograph Scale

0 250 500 Ft.

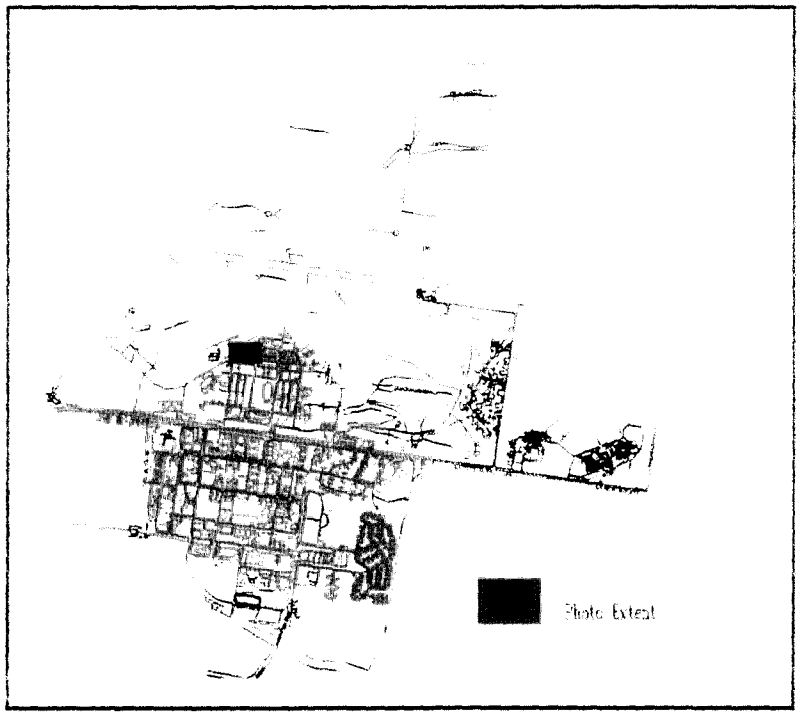


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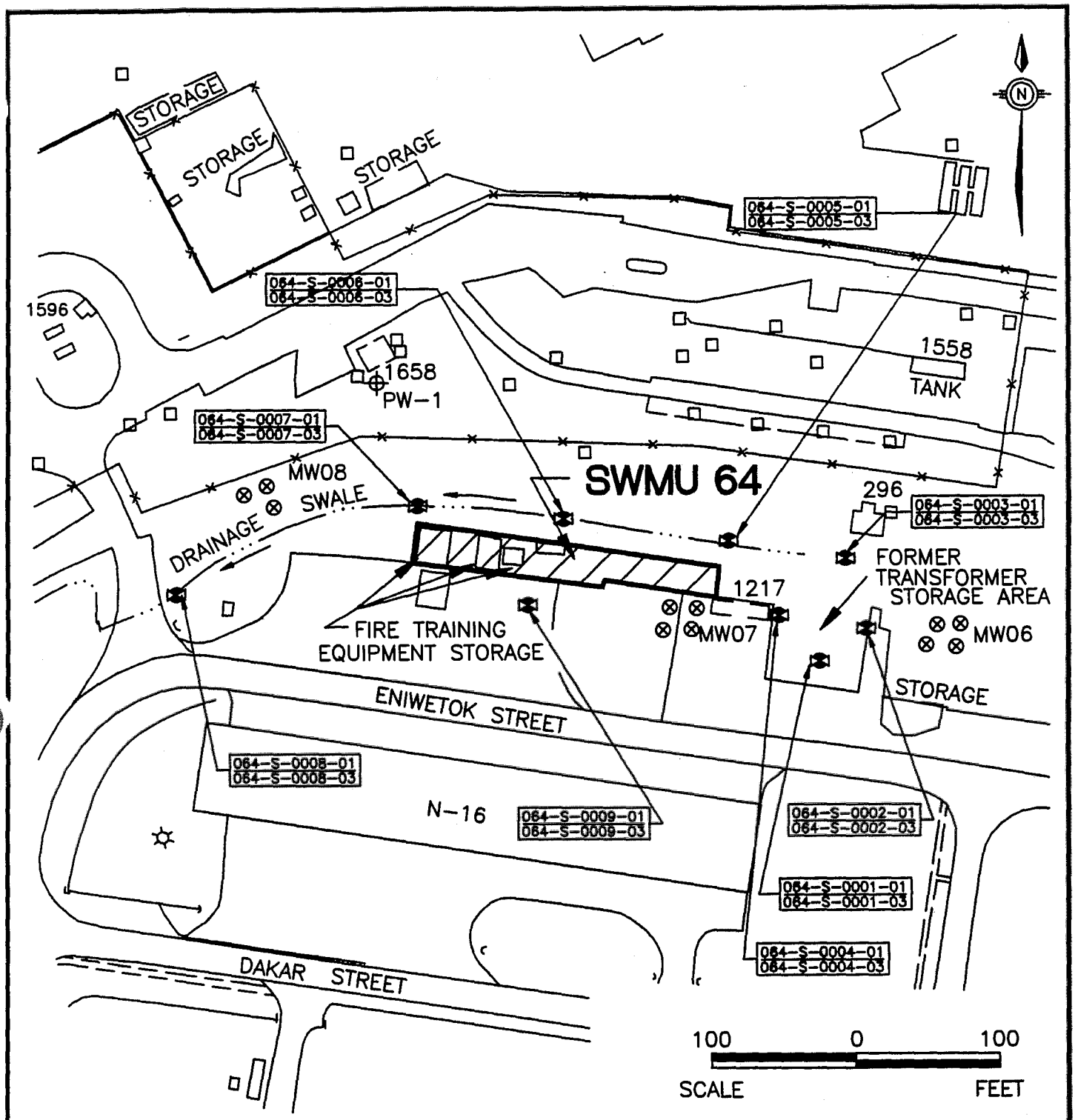
FIGURE 5.6-2
DIGITAL ORTHOPHOTOGRAPH
N-16 MATERIALS STORAGE AREA
SWMU 64



LEGEND

- SAMPLE LOCATION
- EXISTING MONITORING WELL CLUSTER
- PW-1 PRODUCTION WELL
- DRAINAGE SWALE
- SURFACE WATER FLOW DIRECTION
- UNDERGROUND UTILITY
- **SWMU 64**

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FIGURE 5.6-3
SAMPLE LOCATIONS
N-16 MATERIALS STORAGE AREA
SWMU 64

DWG DATE: 04/05/96 | DWG NAME: 94SL005

5.6.3 Site-Specific Geology and Hydrogeology

USGS Stratigraphic Test Hole 5, approximately 1,100 feet northeast of SWMU 64 and just north of Building N-122, provides lithologic data for the area near SWMU 64. The stratigraphic test hole was advanced a few feet into the top of the Cook Mountain Formation to better understand site lithologies before monitoring-well installations at adjacent sites. The test hole was visually logged by a field geologist during drilling and geophysically logged to its total depth following completion. Stratigraphy and lithologies encountered in the test hole were as follows:

Loess:	Approximately 30 feet of wind-blown silt and clay deposits.
Fluvial Deposits:	Approximately 54 feet of sand and gravel.
Cockfield Formation:	Approximately 104 feet of alternating sand and clay with some lignite.
Cook Mountain Formation:	Characterized as a gray to blue-gray dense clay. Defined as the upper confining unit between the surficial aquifers and the Memphis Aquifer. Because the stratigraphic test hole was only advanced 20 feet into the Cook Mountain Formation, the entire thickness is not known.

Subsurface soil information was also collected during the Assembly A RFI for SWMU 7, the Building N-126 Plating Shop Dry Well, which is approximately 650 feet north-northeast of SWMU 64. During the Assembly A investigation, nine monitoring well clusters (designated MW-01 through MW-09) were installed at various locations around SWMU 7. Clusters MW-06, MW-07, and MW-08 are less than 200 feet away from SWMU 64 (Figure 5.6-1). The general lithology encountered in the soil borings associated with these three clusters was as follows:

- Clayey silt from ground surface to between 33 and 35 feet bls (loess).

- Sand with gravel and silty clayey sand from between 33 and 35 feet bls to between 76 and 78 feet bls (fluvial deposits).

- Silty clayey sand, silty sand with clay lenses, clay with sand lenses from between 76 and 78 feet to a termination depth of between 101 and 125 feet (Cockfield Formation).

The laboratory-measured vertical hydraulic conductivity for a subsurface soil sample collected from 20 to 22 feet bls (loess) at MW-09 was 9.5×10^{-7} cm/sec; MW-09 is approximately 300 feet north of SWMU 64. Laboratory-measured vertical hydraulic conductivity for a soil sample collected from 75 to 77 feet bls (lower part of the fluvial deposits) at MW-01 was 6.8×10^{-5} cm/sec; MW-01 is approximately 250 feet north of SWMU 64. The laboratory-measured vertical hydraulic conductivity for samples collected from the Cockfield Formation (MW-01, 110 to 112 feet bls; MW-03, 115 to 117 feet bls; and MW-08, 125 to 127 feet bls) ranged from 8.7×10^{-7} cm/sec to 1.6×10^{-8} cm/sec. Monitoring-well clusters MW-01, MW-03, and MW-08 are 250 feet north, 400 feet northeast, and 75 feet northwest of SWMU 64, respectively. The boring logs and geotechnical laboratory results for SWMU 7 are provided in Attachment 4, Volume II, of this CSI report.

5.6.4 Preliminary Investigations

During the Assembly A RFI, the nine monitoring well clusters around SWMU 7 were installed and sampled, including the wells in the three clusters closest to SWMU 64 (MW-06, MW-07, and MW-08). Well clusters MW-06 and MW-07 each consist of four wells installed in the loess, upper fluvial deposits, lower fluvial deposits, and Cockfield Formation. Cluster MW-08 consists of three monitoring wells installed in the upper fluvial deposits, lower fluvial deposits, and Cockfield Formation.

The wells were sampled in March and May 1995. At least one of the VOCs listed below was detected in at least one monitoring well in the three clusters surrounding SWMU 64: 1,1-DCE,

1,2-DCE, 1,1-DCE, 1,2-DCA, TCE, PCE, benzene, carbon tetrachloride, vinyl chloride, chloroform, and bromomethane. No pesticides, PCBs, herbicides, semivolatiles, or TPH were detected in groundwater. PCBs (Aroclor-1260, 20,000 μg/kg) and TPH (1,400 mg/kg) were detected in a soil sample collected from the surface interval at monitoring well cluster MW-07, approximately 15 feet southeast of the concrete pad at SWMU 64.

5.6.5 Field Investigation and Analytical Methodologies

The SWMU 64 investigation prescribed in *Assembly D Site Investigation Plans* (E/A&H, 1995) consisted of sampling nine locations. Samples were collected across the surface interval and 2 to 3 feet bls using a stainless-steel hand auger according to the sampling methodology outlined in Section 4.4.4.3 of the *Comprehensive RFI Work Plan*. Eighteen samples were collected from nine locations as shown in Figure 5.6-3.

All samples were submitted to NET, for analysis of Appendix IX metals, pesticides/PCBs, VOCs, and SVOCs. One sample (064-C-0003-01) collected from the surface interval was duplicated for Appendix IX metals, pesticides/PCBs, VOCs, and SVOCs analyses. Laboratory analytical data are presented as Appendix H.

5.6.6 Nature and Extent of Contamination

This section provides the analytical results for surface and subsurface soil samples collected during the first phase of the SWMU 64 CSI. Analytical results for surface soil samples were compared to RBCs for residential and industrial soil (USEPA Region III, July to December 1995). Constituent averages for SWMU 64 were compared to transfer from soil to groundwater SSLs to determine the need for further study or action (OSWER Soil Screening Guidance memorandum, USEPA, 1994). Metals analytical results were compared to background RCs (2× mean). Tables 5.6.1 and 5.6.2 summarize laboratory analytical results compared to RBCs and SSLs for organic and inorganic compounds, respectively, at SWMU 64. Table 5.6.2 also compares soil inorganic concentrations to background RCs as described in Section 3 of this report.

Table 5.6.1
SWMU 64 — Organics in Soil (μg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Acenaphthene	0-1'	1/9	790	N/A	4.70e+06	0	1.20e+08	0	2.00e+05	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Acetone	0-1'	0/9	ND	N/A	7.80e+06	0	2.00e+08	0	8.00e+03	N
	2-3'	2/9	210	210	N/A	0	N/A	0		
Aldrin	0-1'	2/9	3 - 21	12	38	0	340	0	5	Y
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Anthracene	0-1'	1/9	1,400	N/A	2.30e+07	0	6.10e+08	0	4.30e+06	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Aroclor-1260	0-1'	8/9	510 - 12,000	4,795	83	8	740	6	1.00e+03	Y
	2-3'	5/9	150 - 810	380	N/A	0	N/A	0		
Benzo(a)anthracene	0-1'	4/9	50 - 2,000	550	880	1	7.80e+03	0	700	N
	2--3'	0/9	ND	ND	N/A	0	N/A	0		
Benzo(a)pyrene	0-1'	5/9	45 - 1,400	330	88	1	780	1	4.00e+03	N
	2-3'	1/9	41	N/A	N/A	0	N/A	0		
Benzo(b)fluoranthene	0-1'	6/9	48 - 1,500	317	880	1	7.80e+03	0	4.00e+03	N
	2-3'	1/9	42	N/A	N/A	0	N/A	0		
Benzo(g,h,i)perylene	0-1'	4/9	46 - 800	251	2.30e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
	2-3'	1/9	43	N/A	N/A	0	N/A	0		
Benzo(k)fluoranthene	0-1'	6/9	38 - 1,100	240	8.80e+03	0	7.80e+04	0	4.00e+03	N
	2-3'	1/9	44	N/A	N/A	0	N/A	0		
Carbazole	0-1'	1/9	830	N/A	32,000	0	2.90e+05	0	500	Y
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
alpha-Chlordane	0-1'	2/9	11 - 62	37	490[i]	0	4.40e+03[i]	0	2.00e+03[i]	N
	2-3'	2/9	1.1 - 5.1	3.1	N/A	0	N/A	0		
gamma-Chlordane	0-1'	2/9	13 - 62	38	490[i]	0	4.40e+03[i]	0	2.00e+03[i]	N
	2-3'	2/9	0.97 - 5.6	3.3	N/A	0	N/A	0		

Table 5.6.1
SWMU 64 — Organics in Soil (μg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Chrysene	0-1'	6/9	41 - 2,000	406	8.80e+04	0	7.80e+05	0	1.00e+03	N
	2-3'	1/9	43	N/A	N/A	0	N/A	0		
4,4'-DDE	0-1'	2/9	23 - 32	28	1.90e+03	0	1.70e+04	0	500	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
4,4'-DDT	0-1'	2/9	22 - 120	71	1.90e+03	0	N/A	0	1.00e+03	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Dibenz(a,h)anthracene	0-1'	1/9	340	N/A	88	1	780	0	1.10e+04	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Dibenzofuran	0-1'	1/9	480	N/A	3.10e+05	0	8.20e+06	0	1.20e+05	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Dieldrin	0-1'	6/9	54 - 330	149	40	6	360	0	1	Y
	2-3'	3/9	6.2 - 22	14	N/A	0	N/A	0		
Endrin aldehyde	0-1'	1/9	25	N/A	2.30e+04	0	6.10e+05	0	400	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Fluoranthene	0-1'	7/9	37 - 3,900	659	3.10e+06	0	8.20e+07	0	9.80e+05	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Fluorene	0-1'	1/9	770	N/A	3.10e+06	0	8.20e+07	0	1.60e+05	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Indeno(1,2,3-cd)pyrene	0-1'	4/9	43 - 760	224	880	0	7.80e+03	0	3.50e+04	N
	2-3'	1/9	38	N/A	N/A	0	N/A	0		
4-Methyl-2-Pentanone(MIBK)	0-1'	0/9	ND	ND	N/A	0	N/A	0	j	N
	2-3'	1/9	3	N/A	N/A	0	N/A	0		
2-Methylnaphthalene	0-1'	1/9	140	N/A	3.10e+06	0	j	0	j	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Naphthalene	0-1'	1/9	110	N/A	3.10e+06	0	8.20e+07	0	3.00e+04	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		

Table 5.6.1
SWMU 64 — Organics in Soil (μg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Residential Soil RBC[e]	RBC-Res. Exceedances	Industrial Soil RBC[e]	RBC-Ind. Exceedances	SSL[f]	SSL Exceeded?[g]
Phenanthrene	01'	4/9	80 - 4,600	1215	2.30e+06[h]	0	6.10e+07[h]	0	1.40e+06[h]	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Pyrene	0-1'	7/9	36 - 3,500	586	2.30e+06	0	6.10e+07	0	1.40e+06	N
	2-3'	1/9	38	N/A	N/A	0	N/A	0		
Toluene	0-1'	3/9	1 - 4	2	1.60e+07	0	4.10e+08	0	5.00e+03	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		
Xylene (Total)	0-1'	2/9	3 - 5	4	1.60e+08	0	1.00e+09	0	7.40e+04	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0		

Notes:

a — Feet bls.
b — Eighteen samples collected from nine locations. All samples collected from 0 to 1 foot and 2 to 3 feet bls intervals were analyzed for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs. One sample was duplicated for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs.
c — Range lower limit is the lowest detected parameter concentration.
d — Mean based on detected parameter concentrations only.
e — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo). RBCs are only applicable for comparison to data from samples collected across the surface interval.
f — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk-Based Concentration Table, July to December 1995).
g — Contaminant averages were compared to SSLs to determine need for further study or action.
h — Risk-based data not available; data for pyrene used as surrogate.
i — Risk-based data not available; data for chlordane used as surrogate.
j — Risk-based data not available at this time.
ND — Parameter not detected.
N/A — Not applicable.

Table 5.6.2
SWMU 64 — Inorganics in Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Arsenic	0-1'	7/9	6.2 - 13.3	9.7	13.1	1	0.43[i]	9	3.8[i]	9	15[i]	N
	2-3'	6/9	6.6 - 11	9	20.4	0	N/A	0	N/A	0		
Barium	0-1'	9/9	91.1 - 188	128	191	0	5.50e+03	0	1.40e+05	0	32	Y
	2-3'	9/9	101 - 165	136	289	0	N/A	0	N/A	0		
Beryllium	0-1'	9/9	0.32 - 0.59	0.46	0.96	0	0.15	9	1.3	0	180	N
	2-3'	9/9	0.47 - 0.6	0.5	1.02	0	N/A	0	N/A	0		
Cadmium	0-1'	9/9	1.3 - 4.9	2.5	BDL	9	39	0	1.00e+03	0	6	N
	2-3'	9/9	1 - 3.3	2	6.8	0	N/A	0	N/A	0		
Chromium	0-1'	9/9	8.1 - 15.8	11.8	26.4	0	390[j]	0	1.00e+04[j]	0	19[j]	N
	2-3'	9/9	7.1 - 14.6	11.1	28.6	0	N/A	0	N/A	0		
Cobalt	0-1'	9/9	5.3 - 15.7	9.1	15	1	4.70e+03	0	1.20e+05	0	k	N
	2-3'	9/9	8.7 - 13.6	10.8	15.3	0	N/A	0	N/A	0		
Copper	0-1'	9/9	14.9 - 34.9	22.3	23.6	3	2.90e+03	0	7.60e+04	0	k	N
	2-3'	9/9	14.9 - 75	23	33.9	1	N/A	0	N/A	0		
Lead	0-1'	9/9	0.56 - 1210	167	28.7	5	400[l]	1	1000[l]	1	k	N
	2-3'	9/9	10.9 - 44.5	17.7	25.1	1	N/A	0	N/A	0		
Mercury	0-1'	2/9	0.15 - 1.6	0.9	1.1	1	23	0	610	0	3	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0	N/A	0		
Nickel	0-1'	9/9	8.2 - 21.6	15.0	BDL	9	1.60e+03	0	4.10e+04	0	21	N
	2-3'	9/9	15.7 - 24	19	59.8	0	N/A	0	N/A	0		

Table 5.6.2
SWMU 64 — Inorganics in Soil (mg/kg)

Parameter	Sampling Interval[a]	Frequency of Detection[b]	Range of Detection[c]	Mean[d]	Inorganic RC[e]	RC Exceedances	Residential Soil RBC[f]	RBC-Res. Exceedances	Industrial Soil RBC[f]	RBC-Ind. Exceedances	SSL[g]	SSL Exceeded?[h]
Selenium	0-1'	1/9	0.35	N/A	BDL	1	390	0	1.00e+04	0	3	N
	2-3'	0/9	ND	ND	N/A	0	N/A	0	N/A	0		
Vanadium	0-1'	9/9	16 - 26.5	22	49.6	0	550	0	1.40e+04	0	k	N
	2-3'	9/9	19 - 30	24	46.3	0	N/A	0	N/A	0		
Zinc	0-1'	9/9	50.9 - 672	163	88.3	5	2.30e+04	0	6.10e+05	0	4,200	N
	2-3'	9/9	53.2 - 91	67	111.8	0	N/A	0	N/A	0		

Notes:

a — Feet bls.
b — Eighteen samples collected from nine locations. All samples collected from 0 to 1 foot and 2 to 3 feet bls intervals were analyzed for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs. One sample was duplicated for Appendix IX metals, pesticides/PCBs, SVOCs, and VOCs.
c — Range lower limit is the lowest detected parameter concentration.
d — Mean based on detected parameter concentrations only.
e — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
f — Residential and industrial screening values (RBC-Res., RBC-Ind.) are from the July to December 1995 Risk-Based Concentration Table (October 20, 1995, USEPA Region III RBC memo). RBCs are only applicable for comparison to data from samples collected across the surface interval.
g — SSL considered protective of contaminant transfer from soil to groundwater (from USEPA Region III Risk-Based Concentration Table, July to December 1995).
h — Contaminant averages were compared to SSLs to determine need for further study or action.
i — Risk-based data for arsenic as a carcinogen.
j — Risk-based data for hexavalent chromium (VI).
k — Risk-based data not available at this time.
l — Value is soil cleanup level for total lead (USEPA OSWER Directive, 9355.4-12).
N/A — Not applicable.
BDL — Below detection limit.

Organics

As Table 5.6.1 indicates, 30 organic compounds were detected at SWMU 64. Concentrations of four SVOCs, one PCB, and one pesticide exceeded residential soil RBCs in surface samples:

- Benzo(a)anthracene exceeded the residential soil RBC of 88 μg/kg in one of nine samples (064-S-0005-01) at a concentration of 2,000 μg/kg.

- Benzo(a)pyrene exceeded the residential soil RBC of 88 μg/kg in one of nine samples (064-S-0005-01) at a concentration of 1,400 μg/kg.

- Benzo(b)fluoranthene exceeded the residential soil RBC of 880 μg/kg in one of nine samples (064-S-0005-01) at a concentration of 1,500 μg/kg.

- Dibenz(a,h)anthracene exceeded the residential soil RBC of 88 μg/kg in one of nine samples (064-S-0005-01) at a concentration of 340 μg/kg.

- Aroclor 1260 exceeded the residential soil RBC of 83 μg/kg in eight of nine samples (064-S-0001-01, 064-S-0002-01, 064-S-0003-01, 064-S-0004-01, 064-S-0005-01, 064-S-0006-01, 064-S-0007-01, 064-S-0008-01) with a maximum detected concentration of 12,000 μg/kg.

- Dieldrin exceeded the residential soil RBC of 40 μg/kg in six of nine samples (064-S-0003-01, 064-S-0004-01, 064-S-0005-01, 064-S-0006-01, 064-S-0007-01, and 064-S-0008-01) with a maximum detected concentration of 330 μg/kg.

The June 2, 1995, Technical Memorandum *Discussion of Dieldrin Risk Management Issues,* has been included in Attachment 1, Volume II, of this CSI report and is discussed earlier. Risk estimates based on the soil dieldrin concentrations detected at NSA Memphis did not exceed

1E-4 ILCR. The average concentration of samples collected during a background study was 131 μg/kg with a maximum detected concentration of 311 μg/kg. As stated in the memorandum, "This finding indicates that dieldrin levels found at each SWMU do not necessitate remedial action in the absence of other significant carcinogenic risk contributors."

Concentrations of one SVOC and one PCB exceeded industrial soil RBCs in surface samples:

- BaP exceeded the industrial soil RBC of 780 μg/kg in one of nine samples (064-S-0005-01) at a concentration of 1,400 μg/kg.

- Aroclor 1260 exceeded the industrial soil RBC of 740 μg/kg in six of nine samples (064-S-0002-01, 064-S-0003-01, 064-S-0004-01, 064-S-0005-01, 064-S-0006-01, and 064-S-0008-01) with a maximum detected concentration of 12,000 μg/kg.

Concentrations of six compounds exceeded transfer from soil to groundwater SSLs in individual samples:

- Aldrin exceeded the SSL of 5 μg/kg in one of 18 samples (064-S-0005-01) at a concentration of 21 μg/kg.

- Aroclor 1260 exceeded the SSL of 1,000 μg/kg in six of 18 samples (064-S-0002-01, 064-S-0003-01, 064-S-0004-01, 064-S-0005-01, 064-S-0006-01, and 064-S-0008-01) with a maximum detected concentration of 12,000 μg/kg;

- Benzo(a)anthracene exceeded the SSL of 700 μg/kg in one of 18 samples (064-S-0005-01) at a concentration of 2,000 μg/kg.

- Carbazole exceeded the SSL of 500 μg/kg in one of 18 samples (064-S-0005-01) at a concentration of 830 μg/kg.

- Chrysene exceeded the SSL of 1,000 μg/kg in one of 18 samples (064-S-0005-01) at a concentration of 2,000 μg/kg.

- Dieldrin exceeded the SSL of 1 μg/kg in nine of 18 samples (064-S-0003-01, 064-S-0004-01, 064-S-0005-01, 064-S-0006-01, 064-S-0007-01, 064-S-0008-01, 064-S-0003-01, 064-S-0005-01, and 064-S-0006-01) with a maximum detected concentration of 330 μg/kg.

Although benzo(a)anthracene and chrysene concentrations in individual samples exceeded SSLs, their averages of 550 μg/kg and 354 μg/kg, respectively, did not, indicating no need for further study or action. Averages were calculated using constituent sample data from all sampling intervals. The average concentrations of both aldrin and dieldrin at 12 μg/kg and 104 μg/kg, respectively, exceeded their respective SSLs of 5 μg/kg and 1 μg/kg. The highest detected dieldrin concentration at 330 μg/kg at SWMU 64 was near the maximum detected dieldrin concentration of 331 μg/kg detected in background samples. Although average dieldrin and aldrin concentrations at SWMU 64 exceeded the SSL, because of the chemical properties of pesticides, the physical properties of soil, and the shallow depth at which aldrin and dieldrin were detected at SWMU 64, the contaminants are not expected to leach in appreciable quantities (if at all) into underlying groundwater. Also, the physical adsorption of pesticides to soil particles and organic material greatly limits horizontal migration.

The average Aroclor-1260 concentration at 3,097 μg/kg exceeded the PCB SSL of 1,000 μg/kg, indicating the need for additional study or action. The maximum detected concentration at SWMU 64 was 12,000 μg/kg, which is less than the concentration detected in a surface soil sample (20,000 μg/kg) collected from the adjacent SWMU 7 monitoring well cluster MW-7

located approximately 18 feet southeast of the concrete pad at SWMU 64. Although the SSL was exceeded, groundwater samples collected from monitoring well clusters MW-6, MW-7, and MW-8 at SWMU 7 did not indicate the presence of PCBs.

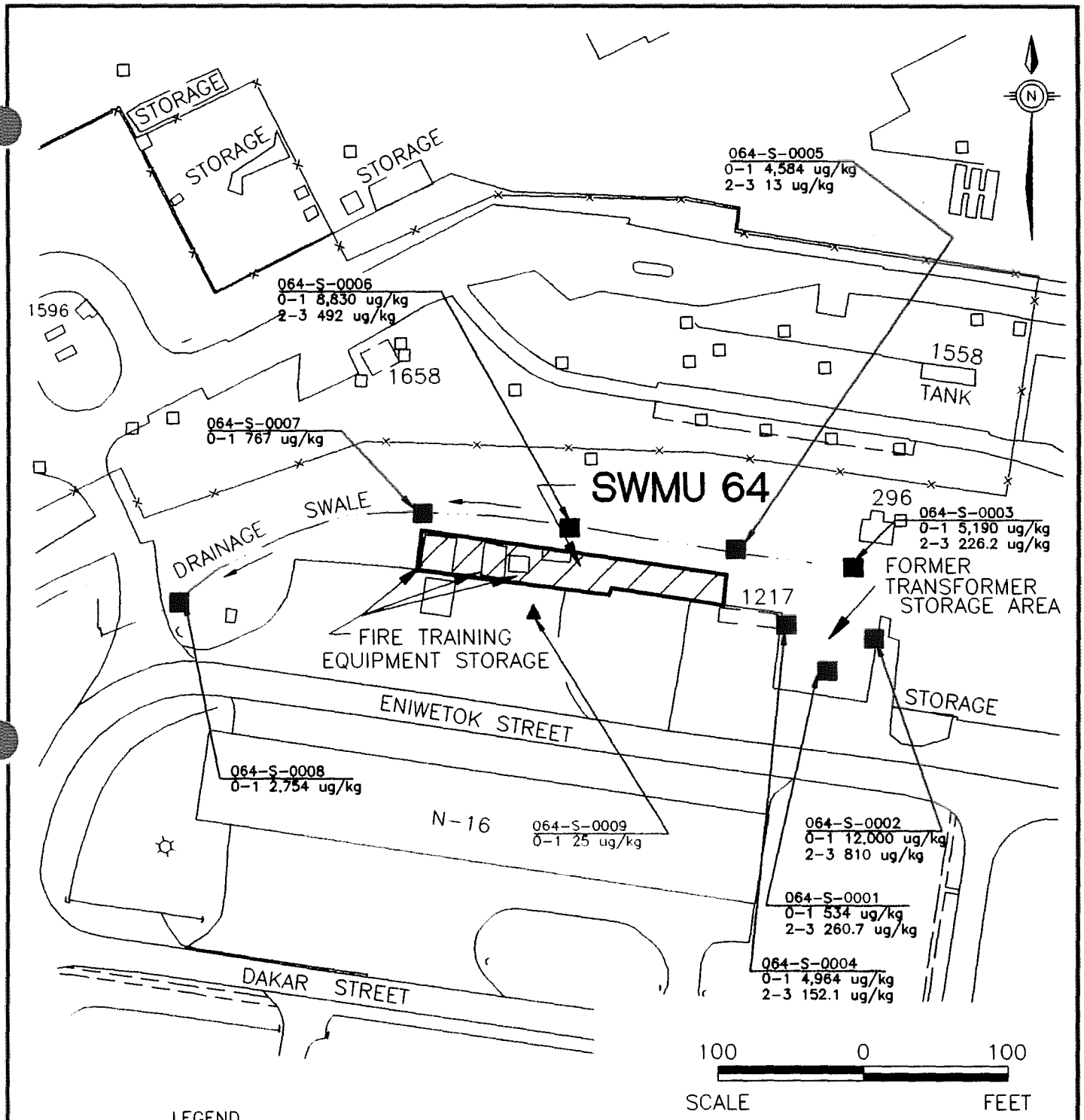
Groundwater samples were collected from monitoring well clusters MW-6, MW-7, and MW-8 at SWMU 7 during separate events in March and October 1995, from loess, upper and lower fluvial deposits, and upper Cockfield groundwater. The wells at SWMU 7 were resampled in April 1996, and a final sampling is scheduled for August 1996. Because of the chemical properties of PCBs, the physical properties of soil, and the depths at which they were detected at SWMU 64, the contaminants are not expected to leach in appreciable quantities (if at all) into underlying groundwater. Also, the physical adsorption of PCBs to soil particles and organic material greatly limits horizontal migration.

The SVOC carbazole was detected in one of 18 samples and it exceeded the SSL; however, due to the low frequency of detection, carbazole is not considered a concern nor is it expected to leach in appreciable quantities (if at all) into groundwater.

Figures 5.6-4 and 5.6-5 provide plots of pesticides/PCBs and SVOCs, respectively, in soil samples; Figure 5.6-6 provides a plot of transfer from soil to groundwater SSL exceedances.

Metals

As Table 5.6.2 indicates, 13 metals were detected. Only arsenic exceeded residential and industrial soil RBCs, and the background RC (2× mean). Of the detected metals, arsenic was detected in seven samples (064-S-0001-01, 064-S-0003-01, 064-S-0005-01, 064-S-0006-01, 064-S-0007-01, 064-S-0008-01, and 064-S-0009-01) collected across the surface interval with the highest concentration of 13.3 mg/kg, and exceeded both residential and industrial RBCs for arsenic as a carcinogen at 0.43 mg/kg and 3.8 mg/kg, respectively. However, the highest concentration of arsenic was well below its residential RBC as a noncarcinogen of 23 mg/kg and only slightly exceeded the 2 × mean background RC of 13.1 mg/kg.



LEGEND

▲ CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

064-S-0009 / 0-1 25 ug/kg — SOIL BORING 9 CONTAINED A TOTAL PESTICIDES/PCB CONCENTRATION OF 25 ug/kg AT THE 0-1 FOOT DEPTH INTERVAL.

ND NOT DETECTED

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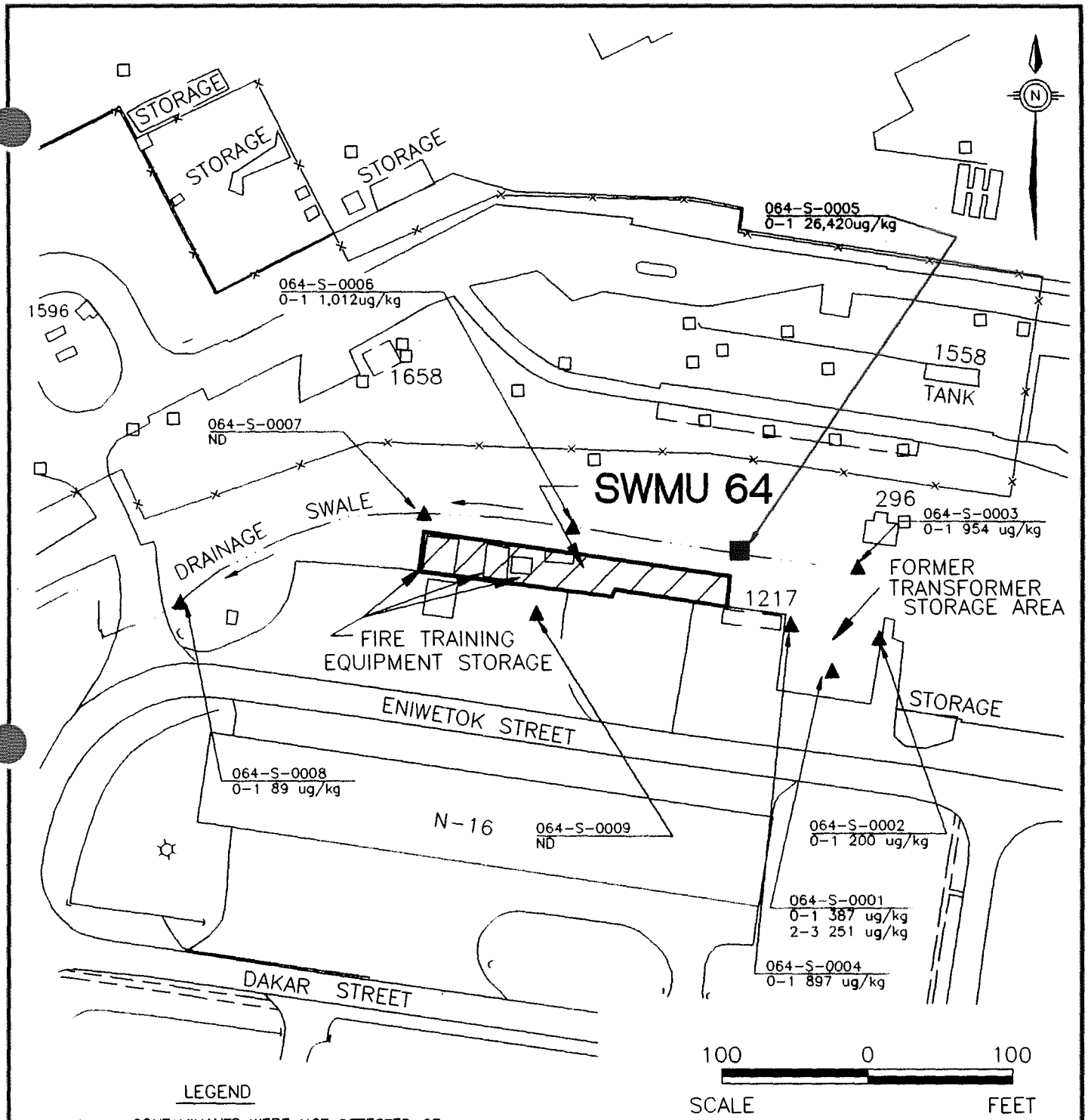
MILLINGTON, TENNESSEE

FIGURE 5.6-4
TOTAL PESTICIDES/PCBs IN SOIL
N-16 MATERIALS STORAGE AREA
SWMU 64

DWG DATE: 04/30/96 | DWG NAME: 94TPS64



LEGEND

▲ CONTAMINANTS WERE NOT DETECTED OR NO SINGLE CONTAMINANT DETECTED IN THE 0-1' INTERVAL EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS.

■ ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL RISK-BASED CONCENTRATIONS BUT DID NOT EXCEED THE INDUSTRIAL RISK-BASED CONCENTRATIONS.

● ONE OR MORE CONTAMINANTS WERE DETECTED IN THE 0-1' INTERVAL THAT EXCEEDED RESIDENTIAL AND INDUSTRIAL RISK-BASED CONCENTRATIONS.

064-S-0004
0-1 10.6 ug/kg — SOIL BORING 4 CONTAINED A TOTAL SVOC CONCENTRATION OF 10.6 ug/kg @ THE 0-1 FOOT DEPTH INTERVAL.

ND — NOT DETECTED

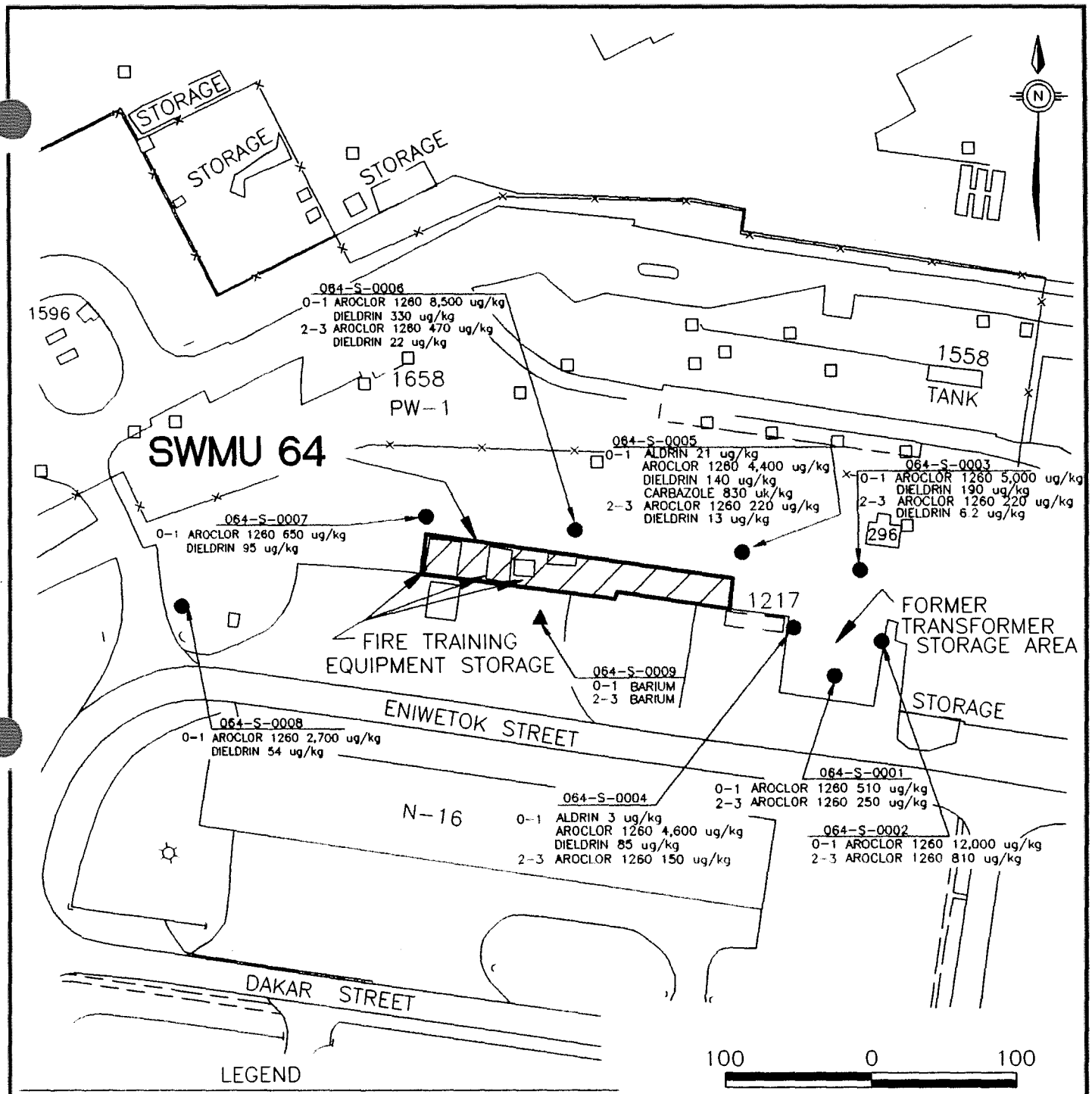
RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 5.6-5
TOTAL SVOCs IN SOIL
N-16 MATERIALS STORAGE AREA
SWMU 64

DWG DATE: 04/25/96 | DWG NAME: 94TSS64



LEGEND

▲ SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) NOT DETECTED AT THIS LOCATION.

● SITE CONSTITUENTS EXCEEDING SOIL TO GROUNDWATER SSLs (AND BACKGROUND RCs FOR INORGANICS) DETECTED AT THIS LOCATION.

064-S-0007
0-1 AROCLOR 1260 650 ug/kg
2-3 DIELDRIN 95 ug/kg

SOIL BORING 7 CONTAINED AROCLOR 1260 AT 650 ug/kg AND DIELDRIN AT 95 ug/kg IN THE 0-1' INTERVAL.

ND NOT DETECTED

SWMU 64

RCRA FACILITY
INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 5.6-6
TRANSFER FROM SOIL TO
GROUNDWATER SSL EXCEEDANCES
N-16 MATERIALS STORAGE AREA
SWMU 64

DWG DATE: 04/30/96 | DWG NAME: 94TRANS5

Lead was detected in one surface soil sample at a concentration of 1,210 mg/kg and exceeded both the residential and industrial soil cleanup levels of 400 mg/kg and 1,000 mg/kg, respectively (USEPA OSWER Directive, 9355.4-12). However, the mean lead concentration in samples from the surface interval of 167 mg/kg does not exceed the residential soil cleanup level. Figure 5.6-7 provides a plot of metals in soil.

Concentrations of two metals exceeded transfer from soil to groundwater SSLs in individual samples:

- Barium exceeded the SSL of 32 mg/kg in all 18 samples collected, with a maximum detected concentration of 188 mg/kg.

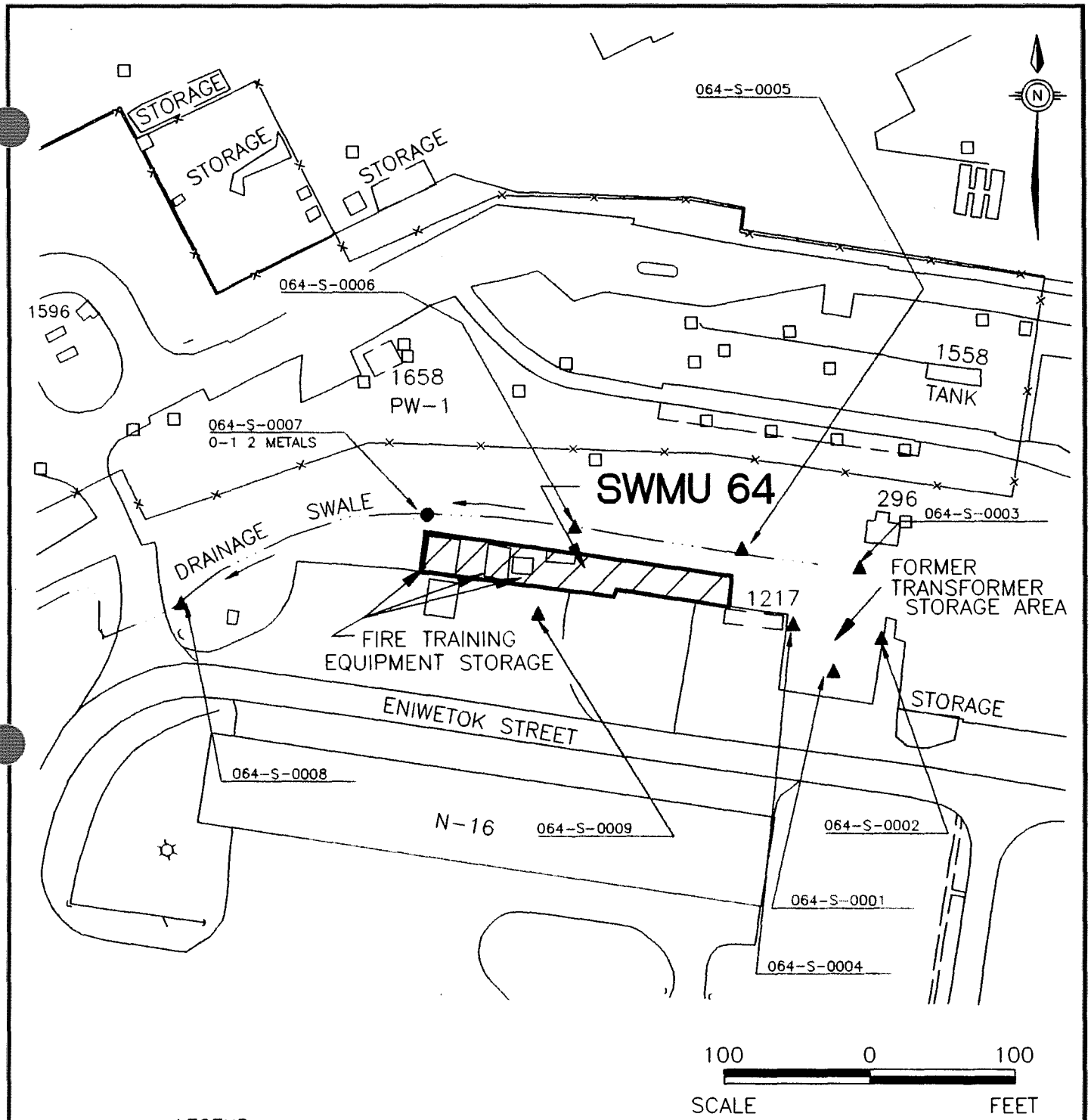
- Nickel exceeded the SSL of 21 mg/kg in three of 18 samples (064-S-0008-01, 064-S-0006-03, and 064-S-0008-03) with a maximum detected concentration of 21.6 mg/kg.

Although nickel concentrations in individual samples exceeded SSLs, the average nickel concentration at 17 mg/kg did not, indicating no need for further study or action. The average barium concentration at 132 mg/kg exceeded the SSL of 32 mg/kg but did not exceed the 2x mean background RC of 191 mg/kg.

5.6.7 Preliminary Risk Evaluation

In accordance with USEPA Region IV Memorandum, November, 1994, a PRE was conducted for SWMU 64 using data from soil samples collected during the CSI.

According to Figure XVII-1, the Aviation-Related Development Alternative presented in the Base Reuse and Development Plan (RKG, 1995), the area that includes SWMU 64 will be used for commercial purposes. Tables 5.6.3 and 5.6.4 summarize PRE results for SWMU 64.



LEGEND

▲ NO SINGLE METAL WAS DETECTED GREATER THAN 2X MEAN BACKGROUND CONCENTRATION AND RESIDENTIAL RBC.

● ONE OR MORE METALS WERE DETECTED AT CONCENTRATIONS GREATER THAN 2X MEAN BACKGROUND AND RESIDENTIAL RBC.

036-S-0002 SOIL BORING 8 CONTAINED 0 METALS EXCEEDING 2X BACKGROUND AND RESIDENTIAL RBC.

ND NOT DETECTED

SWMU 64

RCRA FACILITY INVESTIGATION

NSA MEMPHIS

MILLINGTON, TENNESSEE

FIGURE 5.6-7
METALS IN SURFACE SOIL
N-16 MATERIALS STORAGE AREA
SWMU 64

DWG DATE: 04/16/96 | DWG NAME: 94MSS64

Table 5.6.3
SWMU 64 — Preliminary Risk Evaluation — Carcinogens (μg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Soil Screening Value[c]		Risk Ratio	
			Residential	Industrial	Residential	Industrial
Arsenic *	13,300	13,100	4.30e+02	3.80e+03	3.09e-05	3.50e-06
Aldrin *	21	N/A	3.80e+01	3.40e+02	5.53e-07	6.18e-08
Aroclor-1260 *	12,000	N/A	8.30e+01	7.40e+02	1.45e-04	1.62e-05
Benzo(a)anthracene *	2,000	N/A	8.80e+02	7.80e+03	2.27e-06	2.56e-07
Benzo(a)pyrene *	1,400	N/A	8.80e+01	7.80e+02	1.59e-05	1.79e-06
Benzo(b)fluoranthene *	1,500	N/A	8.80e+02	7.80e+03	1.70e-06	1.92e-07
Benzo(k)fluoranthene *	1,100	N/A	8.80e+03	7.80e+04	1.25e-07	1.41e-08
Beryllium	590	960	1.50e+02	1.30e+03	0.00e+00	0.00e+00
Carbazole *	830	N/A	3.20e+04	2.90e+05	2.59e-08	2.86e-09
alpha-Chlordane *	62	N/A	4.70e+02	4.40e+03	1.32e-07	1.41e-08
gamma-Chlordane *	62	N/A	4.70e+02	4.40e+03	1.32e-07	1.41e-08
Chrysene *	2,000	N/A	8.80e+04	7.80e+05	2.27e-08	2.56e-09
4,4'-DDE *	32	N/A	1.90e+03	1.70e+04	1.68e-08	1.88e-09
4,4'-DDT *	120	N/A	1.90e+03	1.70e+04	6.32e-08	7.06e-09
Dibenz(a,h)anthracene *	340	N/A	8.80e+01	7.80e+02	3.86e-06	4.36e-07
Dieldrin *	330	N/A	4.00e+01	3.60e+02	8.25e-06	9.17e-07
Indeno(1,2,3-cd)pyrene *	760	N/A	8.80e+02	7.80e+03	8.64e-07	9.74e-08
ILCR					2.09e-04	2.35e-05

Notes:

a — The highest detected concentration for each contaminant was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
N/A — Not applicable.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not ILCR calculation.

Table 5.6.4
SWMU 64 — Preliminary Risk Evaluation — Noncarcinogens (μg/kg)

Parameter	Concentration[a]	Background Reference Concentration[b]	Screening Value[c] Residential	Screening Value[c] Industrial	Risk Ratio Residential	Risk Ratio Industrial
Acenaphthene *	790	N/A	4.70e+06	1.20e+08	1.68e-04	6.58e-06
Anthracene *	1,400	N/A	2.30e+07	6.10e+08	6.09e-05	2.30e-06
Arsenic *	13,300	13,100	2.30e+04	6.10e+05	5.78e-01	2.18e-02
Barium	188,000	191,000	5.50e+06	1.40e+08	0.00e+00	0.00e+00
Cadmium *	4,900	BDL	4.68e+05	1.00e+06	1.05e-02	4.90e-03
Chromium	15,800	26,400	3.90e+05	1.00e+07	4.05e-02	1.58e-03
Cobalt *	15,700	15,000	4.70e+06	1.20e+08	3.34e-03	1.31e-04
Copper *	34,900	23,600	3.10e+06	7.60e+07	1.13e-02	4.59e-04
Dibenzofuran *	480	N/A	3.10e+05	8.20e+06	1.55e-03	5.85e-05
Endrin aldehyde *	25	N/A	2.30e+04	3.10e+04	1.09e-03	8.06e-04
Fluoranthene *	3,900	N/A	3.10e+06	8.20e+07	1.26e-03	4.76e-05
Fluorene *	770	N/A	3.10e+06	8.20e+07	2.48e-04	9.39e-06
Mercury *	1,600	1,100	2.30e+04	6.10e+05	6.96e-02	2.62e-03
2-Methylnaphthalene *	140	N/A	3.10e+06	4.10e+06	4.52e-05	3.41e-05
4-Methyl-2-Pentanone (MIBK) *	3	N/A	3.90e+06	1.60e+08	7.69e-07	1.88e-08
Naphthalene *	110	N/A	3.10e+06	8.20e+07	3.55e-05	1.34e-06
Nickel *	21,800	BDL	1.60e+06	4.10e+07	1.35e-02	5.27e-04
Phenanthrene *	100	N/A	3.10e+06	6.10e+07	3.23e-05	1.64e-06
Pyrene *	3,500	N/A	2.30e+06	6.10e+07	1.52e-03	5.74e-05
Selenium *	350	BDL	3.90e+05	1.00e+07	8.97e-04	3.50e-05
Toluene *	4	N/A	1.60e+07	4.10e+08	2.50e-07	9.76e-09
Vanadium	26,500	49,600	5.50e+05	1.40e+07	0.00e+00	0.00e+00
Xylene (Total) *	5	N/A	1.60e+08	1.00e+09	3.13e-08	5.00e-09
Zinc *	672,000	88,300	2.30e+07	6.10e+08	2.92e-02	1.10e-03
HI					0.76	0.03

Notes:

a — The highest detected concentration for each contaminant was used.
b — Background reference concentration (2× mean background). See Section 3 of this report for a discussion of RCs.
c — Screening values are RBCs are from the July to December 1995 RBC Table (October 20, 1995, USEPA Region III RBC memo).
N/A — Not applicable.
BDL — Below detection limit.
* — Constituent exceeded background reference concentration. If background reference concentration was not exceeded, constituent was not HI calculation.

The resulting residential carcinogen ILCRs at 2.09e-04 exceeded the 10^{-4} criteria; however, the industrial ILCRs at 2.35e-05 did not, indicating no risk in an industrial setting. The resulting residential and industrial noncarcinogen HIs at 0.76 and 0.03, respectively, were below the criteria of 1, indicating no risk in either scenario. Property including SWMU 64 is suitable for commercial lease.

5.6.8 Conclusions and Recommendations

Based on the information gathered during this investigation, the following conclusions and recommendations have been reached:

- SWMU 64 will be developed for commercial use according to the Base Reuse Plan.

- Thirty organic compounds were detected at SWMU 64 in the surface interval and 2 to 3 feet bls.

  — Concentrations of SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, the PCB Aroclor-1260, and the pesticide dieldrin exceeded residential soil RBCs in surface samples.

  — Concentrations of the SVOC BaP and the PCB Aroclor-1260 exceeded industrial soil RBCs in surface samples.

  — Concentrations of the pesticides aldrin and dieldrin, the SVOC carbazole, and the PCB Aroclor-1260 exceeded SSLs. Due to chemical properties, the physical properties of the soil, and the depth and infrequency of detection, aldrin, dieldrin, and carbazole are not expected to leach into groundwater or migrate horizontally.

  — Aroclor-1260 has not been detected in groundwater monitoring wells surrounding SWMU 64, with the closest well 15 feet to the southwest; therefore, Aroclor-1260 is not expected to leach into groundwater or migrate horizontally.

- Thirteen metals were detected in the surface interval and 2 to 3 feet bls.

  — Concentrations of arsenic in seven surface soil samples exceeded both residential and industrial soil RBCs for arsenic as a carcinogen; however, the highest arsenic concentration was well below its residential soil RBC as a noncarcinogen and only slightly exceeded the 2 × mean background RC.

  — The concentration of lead in one surface soil sample exceeded both residential and industrial soil cleanup levels; however, the mean lead concentration in surface samples did not exceed the residential soil cleanup level.

- Based on a PRE performed on data from samples collected from the surface interval:

  — Carcinogens: the residential ILCR exceeded 10^{-4}, but the commercial ILCR did not, indicating no significant risk in a commercial setting;

  — Noncarcinogens: neither the residential nor the commercial HI exceeded 1, indicating no significant risk in either setting.

- Based on data from surface soil samples collected, no further action is recommended for SWMU 64. In accordance with PRE methodology, the property is suitable for commercial lease.

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Appendix A
SWMU 11 — Analytical Results

NSA MEMPHIS
NSA MEMPHIS, RFI, ASSEMBLY D
SWMU 11 - ANALYTICAL RESULTS

APX9-METAL													
	SAMPLE ID ------->	011-S-0001-01		011-S-0002-01		011-S-0004-01		011-S-0006-01		011-S-0009-01		011-S-0014-01	
	ORIGINAL ID ----->	011S000101		011S000201		011S000401		011S000601		011S000901		011S001401	
	LAB SAMPLE ID --->	136784S		136785S		136786S		136787S		136788S		136789S	
	ID FROM REPORT -->	011S000101		011S000201		011S000401		011S000601		011S000901		011S001401	
	SAMPLE DATE ----->												
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	1565	VAL	1565	VAL	1565	VAL	1565	VAL	1565	VAL	1565	VAL
SB	Antimony	11.1	UR	11.8	UR	11.	UR	11.	UR	11.9	UR	11.7	UR
AS	Arsenic	5.9		4.9		6.3		2.7		6.8		2.7	
BA	Barium	70.4		162.		115.		60.4		89.6		146.	
BE	Beryllium	0.29	J	0.46	J	0.44	J	0.32	J	0.46	J	0.41	J
CD	Cadmium	2.8		2.4		3.4		1.1	J	3.5		2.3	
CR	Chromium	9.6		9.5		11.4		19.5		8.6		8.9	
CO	Cobalt	4.6	J	7.6	J	8.2	J	4.	J	9.6	J	6.5	J
CU	Copper	10.6		14.		15.5		7.7		15.3		11.9	
PB	Lead	9.7		10.		8.9		6.8		12.		78.7	
HG	Mercury	0.11	U	0.12	U	0.24		0.11	U	0.12	U	0.12	U
NI	Nickel	8.8	J	16.2		19.4		40.9		9.1	J	6.	J
SE	Selenium	0.34	J	0.24	U	0.22	U	0.22	U	0.39	J	0.23	U
AG	Silver	0.67	UJ	0.71	UJ	0.66	UJ	0.66	UJ	0.71	UJ	0.7	UJ
TL	Thallium	0.44	UJ	0.47	UJ	0.44	UJ	0.44	UJ	0.47	UJ	0.47	UJ
V	Vanadium	21.		22.3		21.		15.2		24.3		16.3	
ZN	Zinc	36.8		50.7		53.6		26.5		55.3		134.	
SN	Tin	4.5	U	4.7	U	4.4	U	4.4	U	4.7	U	4.7	U

*** Validation Complete ***

NSA MEMPHIS
NSA MEMPHIS, RFI, ASSEMBLY D
SWMU 11 - ANALYTICAL RESULTS

SW846-PEST													
	SAMPLE ID ------->	011-S-0001-01		011-S-0002-01		011-S-0004-01		011-S-0006-01		011-S-0009-01		011-S-0014-01	
	ORIGINAL ID ----->	011S000101		011S000201		011S000401		011S000601		011S000901		011S001401	
	LAB SAMPLE ID --->	136784		136785		136786		136787		136788		136789	
	ID FROM REPORT -->	011S000101		011S000201		011S000401		011S000601		011S000901		011S001401	
	SAMPLE DATE ----->	10/05/95		10/05/95		10/04/95		10/04/95		10/04/95		10/04/95	
	DATE EXTRACTED -->	11/02/95		11/02/95		11/02/95		11/02/95		11/02/95		11/02/95	
	DATE ANALYZED --->	11/11/95		11/11/95		11/16/95		11/11/95		11/11/95		11/11/95	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	1565	VAL	1565	VAL	1565	VAL	1565	VAL	1565	VAL	1565	VAL
319-84-6	alpha-BHC	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
319-85-7	beta-BHC	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
319-86-8	delta-BHC	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
58-89-9	gamma-BHC (Lindane)	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
76-44-8	Heptachlor	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
309-00-2	Aldrin	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
1024-57-3	Heptachlor epoxide	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
959-98-8	Endosulfan I	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
60-57-1	Dieldrin	3.5	U	3.5	U	82.	U	130.	D	4.2	U	20.	U
72-55-9	4,4'-DDE	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
72-20-8	Endrin	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
33213-65-9	Endosulfan II	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
72-54-8	4,4'-DDD	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
1031-07-8	Endosulfan sulfate	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
50-29-3	4,4'-DDT	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
72-43-5	Methoxychlor	18.	U	18.	U	410.	U	92.	U	21.	U	98.	U
53494-70-5	Endrin ketone	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
7421-93-4	Endrin aldehyde	3.5	U	3.5	U	82.	U	18.	U	4.2	U	20.	U
5103-71-9	alpha-Chlordane	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
5103-74-2	gamma-Chlordane	1.8	U	1.8	U	41.	U	9.2	U	2.1	U	9.8	U
8001-35-2	Toxaphene	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U
12674-11-2	Aroclor-1016	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U
11104-28-2	Aroclor-1221	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U
53469-21-9	Aroclor-1242	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U
12672-29-6	Aroclor-1248	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U
11097-69-1	Aroclor-1254	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U
11096-82-5	Aroclor-1260	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U
12789-03-6	Technical Chlordane	36.	U	35.	U	820.	U	180.	U	42.	U	200.	U
11141-16-5	Aroclor-1232	35.	U	35.	U	820.	U	180.	U	42.	U	200.	U

*** Validation Complete ***

Appendix B
SWMU 36 — Geophysical Report

GEOPHYSICAL SURVEY REPORT
NAVAL AIR STATION
MEMPHIS, TENNESSEE

SWMU's 14, 36, and 65

CTO-094

Prepared For:

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

Prepared by:

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September 15, 1995

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EXECUTIVE SUMMARY

In support of environmental investigations at Naval Air Station (NAS) Memphis, EnSafe/Allen & Hoshall conducted geophysical surveys at Solid Waste Management Units (SWMUs) 14, 36, and 65 to identify building foundations, characterize the extent of buried material, and map features of potential environmental concern.

The anomalies were classified according to the likelihood that they might be of environmental concern: Type A anomalies are well-defined features needing further investigations, Type B are weaker anomalies, Type C are anomalies not related to buried features.

One moderate Type B anomaly was identified at SWMU 14 near the former location of an outdoor washbasin. The rest of the surveyed area was anomaly-free.

Four tightly grouped Type A anomalies were identified at SWMU 36 in the previous area of Incinerator 4 and its underground storage tank (UST). UST identification, however, is uncertain due anomaly overlap caused by the tight grouping, and the absence of a northing direction on the site engineering plans.

Geophysics data for SWMU 65 show one Type A anomaly in the former location of two USTs that fueled the engine test cell S-346. Two zones of culture were identified onsite, with the rest being anomaly-free.

Follow-up investigations may be needed at Type A sites to ascertain whether the anomalies are due to innocuous, minor buried rubble, such as metal debris, or if they represent a genuine environmental concern. The geophysics data indicate very specific locations to conduct follow-up investigations.

by a current pulse, which propagates into the ground as an electromagnetic field. As it encounters electrically responsive materials in the ground, the signal received at the surface in the receiving antenna is distorted. These distortions can then be interpreted to develop a graphical image of the subsurface.

The signal can penetrate to 6 meters below ground surface. FDEM is primarily a profiling method that does not yield detailed vertical resolution, although it can perform some limited sounding capability by varying the instrument height and dipole orientation. Resolution in plan view is often to within a meter or so. Signals are sensed by the instrument's electronics and the data are sent to a field data recorder, whose contents are downloaded to a second computer for processing and plotting.

Two parameters are measured: conductivity and in-phase. Conductivity is a measurement of how well the earth conducts electrical current. Dry materials yield low conductivities, while wet materials yield high conductivities. Saturated clays are particularly conductive. When present, buried metals may also increase the effective conductivity. Conductivity data have units of milliSiemens per meter (mS/m).

The in-phase component is a ratio of the secondary to primary field strengths (the primary field is the generated signal and the secondary is the ground's response). The in-phase component is primarily sensitive to metals, not soil moisture, and can go negative or positive over metallic objects, depending on the relative geometries of the conductor and instrument. In-phase has units of parts per thousand (ppt) of the secondary field strength.

FDEM was used on this project to detect disturbed soil and buried metals related to excavation activities, and to find potential underground storage tanks (USTs).

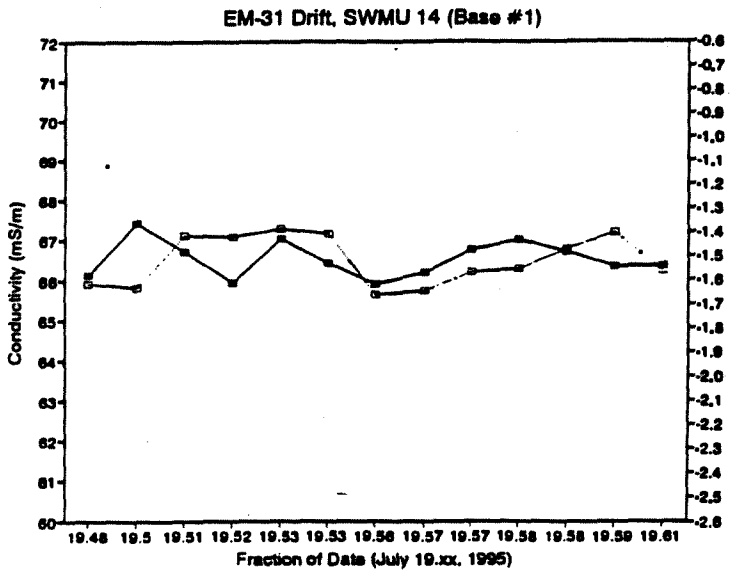
The precision is acceptable, judged by benchmarks set by the survey objectives, and hence does not influence the interpretability of the three datasets. The precision level is better than average for EM-31 surveys at the three base stations used in this investigation.

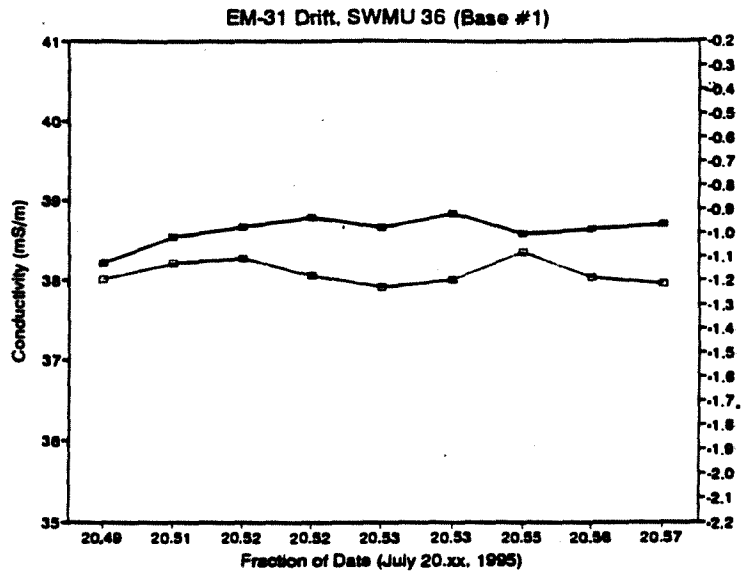
Long-term precision is primarily controlled by instrument drift, which occurs because of slight response changes in the instrument's electronics. Figure 1 shows the instrument drift recorded while occupying the three individual base stations. The minimum and maximum vertical scales are adjusted to represent $\pm 10\%$ of the conductivity value and ± 1 ppt of in-phase, considered to be "high drift" bounds which, when exceeded, suggest that drift corrections may need to be considered. The drift is smaller than usual for EM-31 measurements and does not exceed the desired minimum resolution benchmarks defined previously. No correction is required for the magnitude of drift observed at the three individual sites.

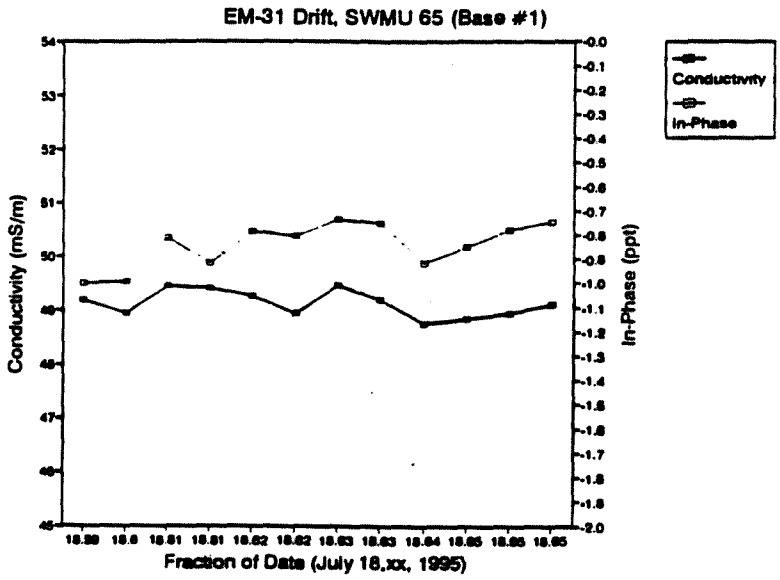
Data Biasing Effects

Spatial aliasing is an undersampling effect when searching for small, subtle targets, such as deeply buried single drums. The key to a successful survey is to optimize the grid spacing or data density to the smallest target being investigated. In this case, a single sump pump is the smallest object sought. Experience has shown that a 10- by 10 foot grid is a good compromise between effectiveness of detection and survey speed for objects the size of drums or pumps. Most objects of this size within the penetration range of the instrument will be detected in a 10- by 10-foot data grid.

Instrument response time/nonreciprocity effects can occur on large-scale surveys, when the instrument is advanced at a rapid rate along prescribed lines, which reverse direction on each line. This procedure produces a wavy pattern at the edges of high-amplitude anomalies due to a finite instrument response time and due to nonreciprocity when the receiver and transmitter antennas reverse positions. Effects of this nature do not compromise data quality or interpretability.


EM-31 Drift, SWMU 14 (Base #1)
Conductivity (mS/m)
In-Phase (ppt)
Fraction of Date (July 19.xx, 1995)


EM-31 Drift, SWMU 36 (Base #1)
Conductivity (mS/m)
In-Phase (ppt)
Fraction of Date (July 20.xx, 1995)


EM-31 Drift, SWMU 65 (Base #1)
Conductivity (mS/m)
In-Phase (ppt)
Fraction of Date (July 18.xx, 1995)
Conductivity
In-Phase

GENERAL NOTES ON DATA INTERPRETATION

Each investigation created plan-view maps taken from conductivity and in-phase datasets. Site features are superimposed to aid the interpretation.

The conductivity maps reveal soil moisture changes in each SWMU. The data are depicted in color according to the color bar on the right side of each map. Both large and small conductivity values (compared to background) may be significant, although they do not necessarily indicate separate features but may be edge effects from a single feature. Extremely large and small values, sometimes with a distinct linear appearance, are often associated with fences and underground utilities. Other anomalies not related to culture are observed, ranging from broad changes over several hundred feet to very small, isolated ones.

The in-phase data maps can roughly be thought of as a metal indicator. The nominal response in a metal-free area should be nearly zero. Large positive and negative values generally indicate the presence of metal features associated with buried objects, or aboveground culture such as fences, road signs, buildings, etc. As with conductivity data, in-phase data clearly indicate buried utilities, and also show numerous small, scattered anomalies.

The anomalies identified at the three sites are classified according to their interpretated significance with respect to the individual project objectives:

- Type A — Strong, well-defined anomaly characteristic of a buried object, for which some follow-up (site walkover, soil boring, trench, etc.) is recommended.

- Type B — Weaker or more poorly defined anomaly due to a buried object, but less likely to be of environmental concern. Follow-up is deemed less critical, but depends on the investigations of Type A anomalies.

Field Procedures

A 10-foot grid interval for SWMU 14 was used as a compromise for sampling potentially large footprint sources (i.e., building foundations), along with smaller sources such as sump pumps and drainage lines. Key east-west cross lines staked every 100 feet were marked with high-visibility paint. Data were obtained walking north on even-numbered lines and south on odd-numbered lines. The receiver antenna was pointed north on even lines and south on odd lines. Grid corners for the site are 1000N/1000E and 700N/1260E. Fieldwork for this site was completed in one session (July 19).

Data Interpretation

Figures 2 and 3 show the plan-view maps, consisting of conductivity and in-phase field data, respectively. Both sets of data show broad-band regional effects which characterize the inherent background conductivity levels of the subsurface. The data collection method introduced minor nonreciprocity effects along the southern boundary of the field data. The wavy pattern is the result of reversing the antenna orientation on north and south data traverses. The continuity of data, across known culture onsite, would suggest the entire dataset is valid.

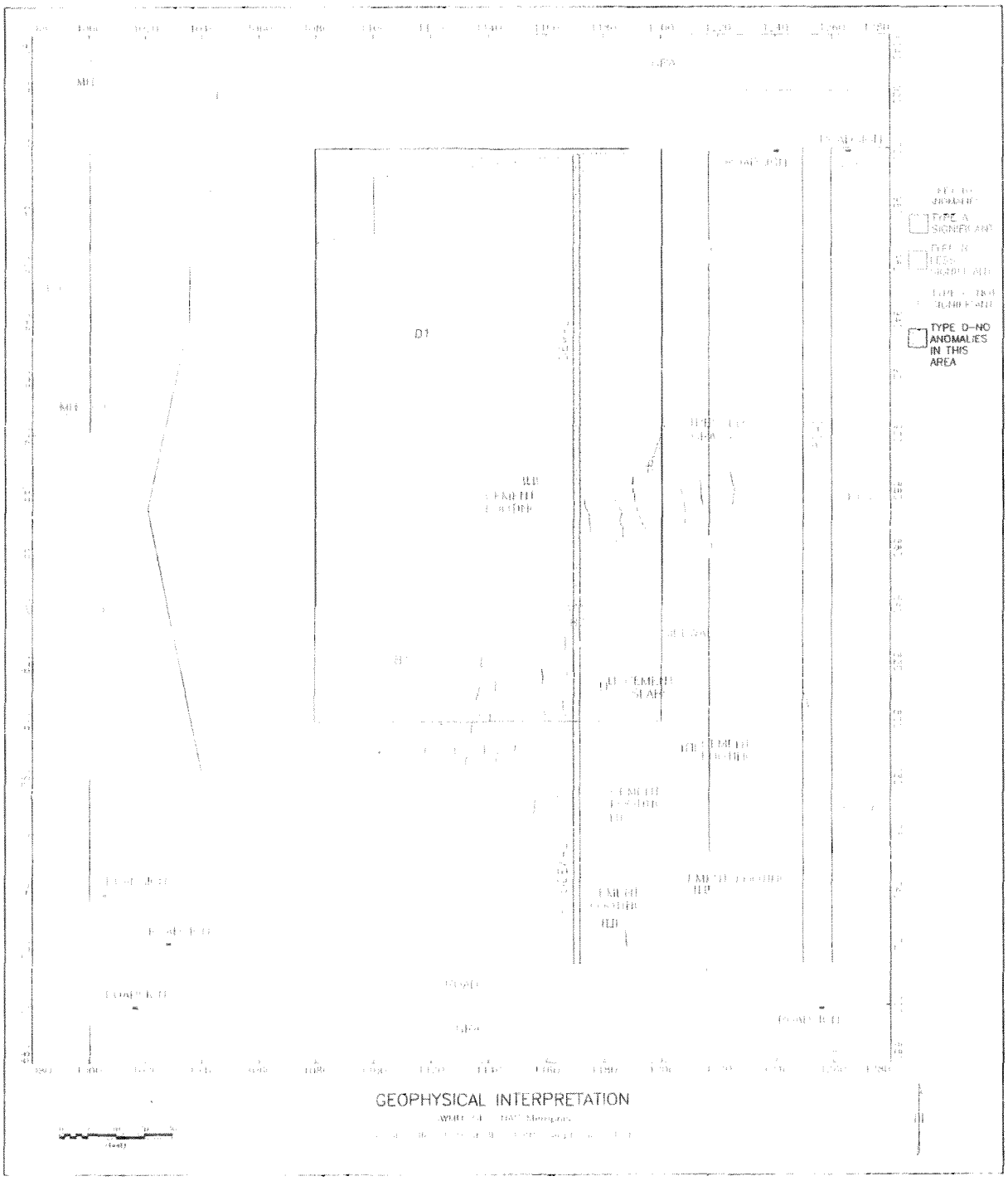
Anomaly Description

Table 1 lists the anomalies identified at SWMU 14. Most anomalies at SWMU 14 are near-surface, localized features most likely unrelated to the target source bodies outlined in the site investigation plan (i.e., sumps, paint separator, and discharge line) (Figure 4). Only one area was classified anomalous, a type B, based on its spatial map position to the previous outdoor washbasin south of S-140. A possible source for this anomaly may be demolition rubble used to fill the depression left by basin excavation. Otherwise, the absence of discernible anomalies would suggest that sumps and separators may have been removed during demolition. The discharge line may be undetectable if non-ferrous materials were used in its construction. Engineering plans for this site indicate the discharge line may have been

Figure 2
Conductivity Map of SWMU 14

Figure 3
In Phase Map of SWMU 14

Figure 4
Geophysical Interpretation for SWMU 14.



made of plastic, which would make it undetectable using FDEM. Type C anomalies, attributed to surface and subsurface culture, are quite prevalent here; the most noticeable example is the linear feature along the eastern survey boundary. The source for this anomaly may be an abandoned water line that supplied potable water to the adjacent property when it was a trailer park. The large magnitude response of the water line is due to a coupling effect along the north-south traverses. Culture has the potential of masking meaningful anomalies; however, at this site, the culture is distant enough not to interfere with site interpretation. Approximately three-quarters of the surveyed area is anomaly-free (Type D). The remainder was left undesignated due to cultural interference or because the data show subtle changes which could indicate some limited soil disturbance.

Table 1
SWMU 14 Anomaly Interpretations

No.	Best Position to Investigate	Notes
B1	1140E/810N	Moderate anomaly; metal indicated. Anomaly may be associated with washdown basin at S-140 site.
B2	—	Strong anomaly; metal indicated. Single station anomaly.
C1	—	Buried utilities; possibly water main.
C2	—	Surface culture; road sign.
C3	—	Surface culture; cement footing with metal cover.
C4	—	Buried utility; sewer main.
D1	—	Zone cleared of anomalies.

SWMU 36

Setting and Regional Geology

SWMU 36, the former location of Incinerator 4, is on the north side of NAS Memphis off from Dakar Street Extended near the base's northwestern perimeter. Since the incinerator's demolition in 1984, the lack of site activity has allowed the area to be overgrown with dense vegetation.

Data Interpretation

Figures 5 and 6 show plan-view maps of conductivity and in-phase field data, respectively. Most of the recorded response at this site could be characterized as nominal. Large anomalous responses occur in a localized area near surface piles of rebar and asphalt. Engineering plans place the incinerator and its fuel cell in the general area of the large anomalous responses. The proximity of these large anomalous features, both positive and negative, complicate delineating responses to a specific source body.

Anomaly Description

Table 2 lists the anomalies identified at SWMU 36. Anomalies cover a small percentage of the survey area, but a large percentage are classified Type A (Figure 7). Of the five anomalies identified, four are classified Type A and attributed to buried conductive material. The fifth anomaly is classified Type B, which usually requires no follow-up work. However, in some cases of clustered, strong anomalies, one anomaly relegated to Type B does not eliminate it from further invasive examination; it merely implies that Type A anomalies should be evaluated first. A Type C anomaly, attributed to a sewer line, is identified trending east-west across the northern portion of site. The rest of the site was anomaly-free (Type D). Culture at SWMU 36 did not hinder data interpretation.

Table 2
SWMU 36 Anomaly Interpretations

No.	Best Position to Investigate	Notes
A1	985E/990N	Strong anomalous zone; buried metals indicated. Demolition debris observed at surface this may due to same, but the strength and size of the anomaly suggests further investigation.
A2	985E/1005N	Strong anomaly; buried metals indicated. Rebar and demolition debris observed in area. Strength of anomaly suggests further investigation

Figure 5
Conductivity Map of SWMU 36

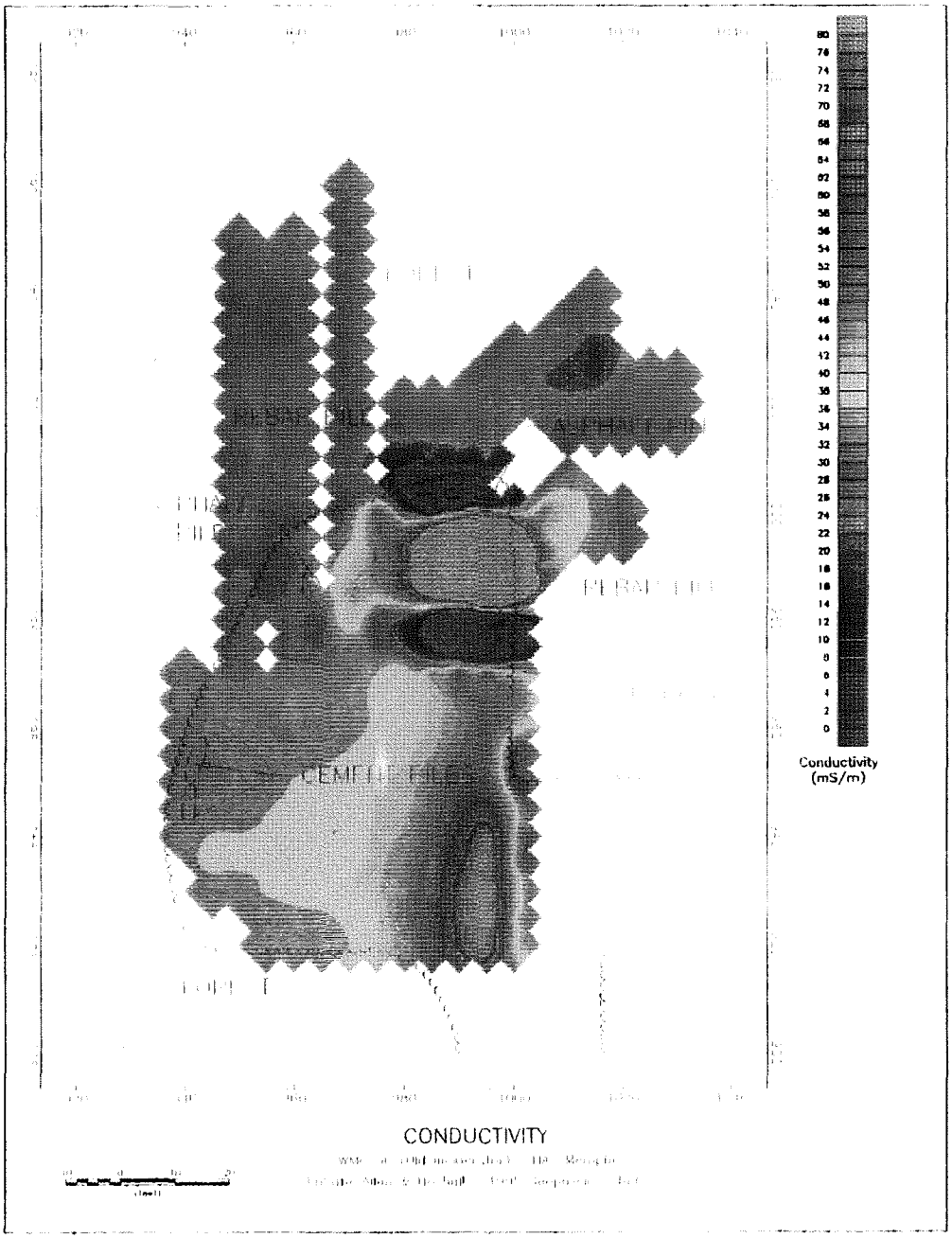


Figure 6
In-Phase Map of SWMU 36.

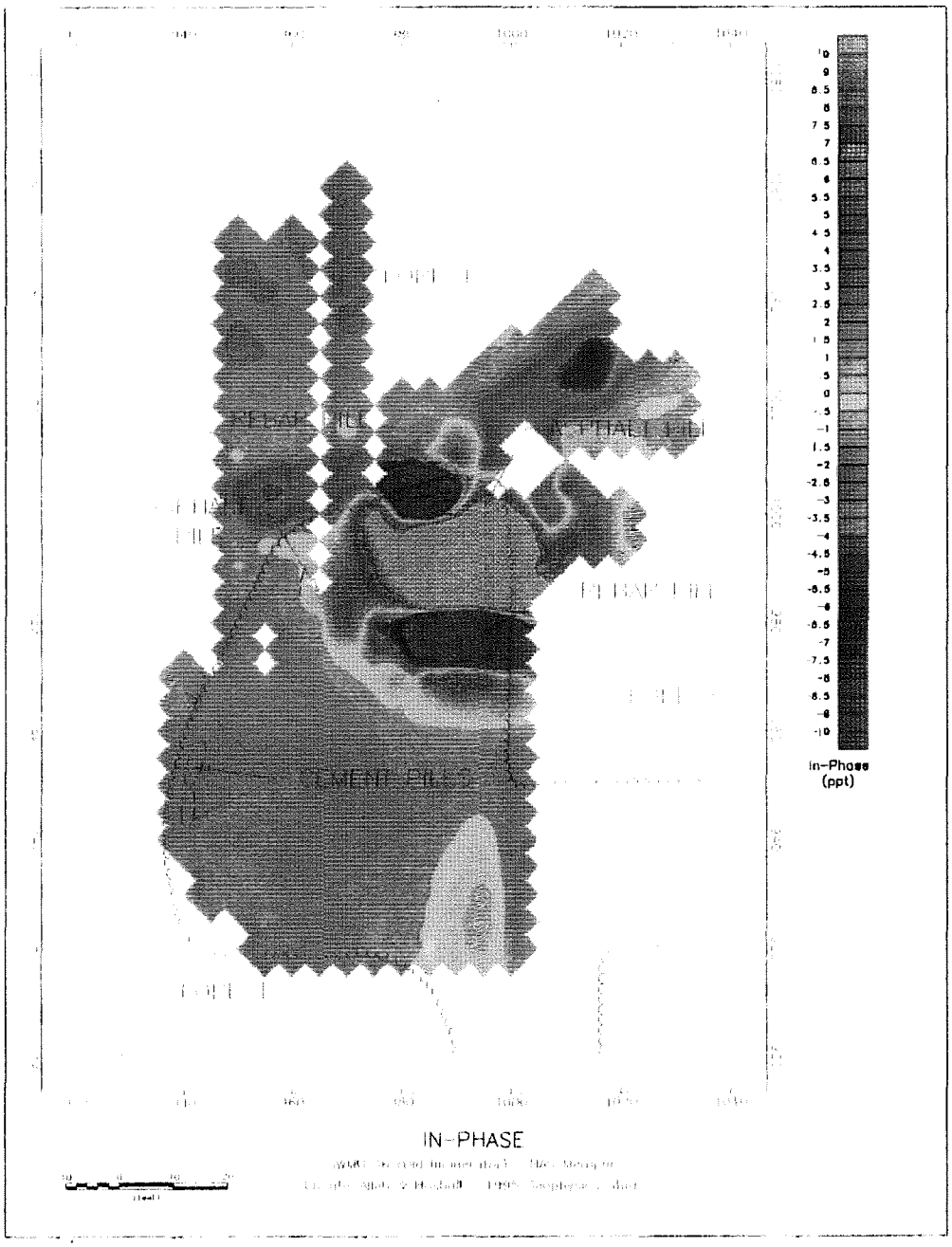
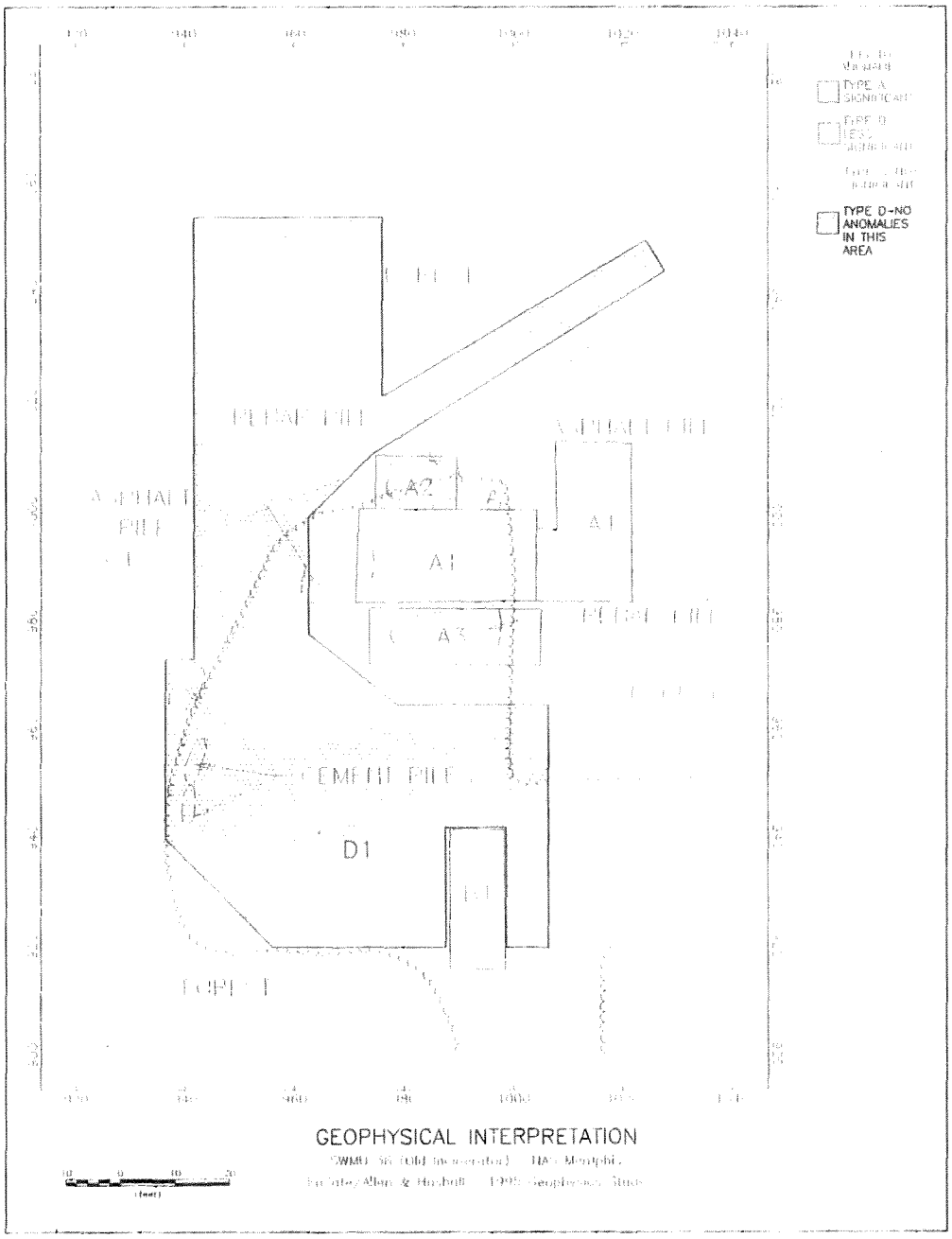


Figure 7
Geophysical Interpretation for SWMU 36



Field Procedures

Data collection on SWMU 65 used a 10-by 10-foot grid extending from 1200N/1000E to 1000N/1080E. Data were acquired in one session (July 18) walking north with the receiver antenna orientated north. High-visibility paint marked each grid node.

Data Interpretation

Figures 8 and 9 show the conductivity and in-phase field maps, respectively. The geophysics indicate most of the surveyed area responded in the nominal range. Several areas show evidence of strong anomalous activity with steep response gradients. It is unlikely that indigenous materials would produce gradients as large as those indicated in the field data. A probable source for such high gradient responses could be buried utilities. Minimal response time/nonreciprocity effects are observed in the dataset.

Anomaly Description

Table 3 lists the anomalies identified at SWMU 65. Only one significant anomaly was identified a Type A north of the Building S-346 (Figure 10). The source of this anomaly may be attributed to buried metal associated with the fuel system that supplied the engine test cell. A strong, localized anomaly, designated Type B, was identified along the southeastern boundary of the surveyed area. A source for this response is undetermined. The site also has two Type C anomalies which did not adversely affect data interpretation. Approximately one-fourth of the surveyed area is anomaly-free (Type D).

CONCLUSIONS

The geophysical surveys performed at NAS Memphis sufficiently defined the surveyed areas to state the following conclusions. SWMU 14 is generally free of anomalous activity associated to target source bodies outlined in the site investigation plan. Based on approximate source locations taken from the site plans, the geophysics for SWMU 14 do not suggest the presence of either a building foundation, sump pump, or paint separator. The absence of the discharge

Figure 8
Conductivity Map of SWMU 65.

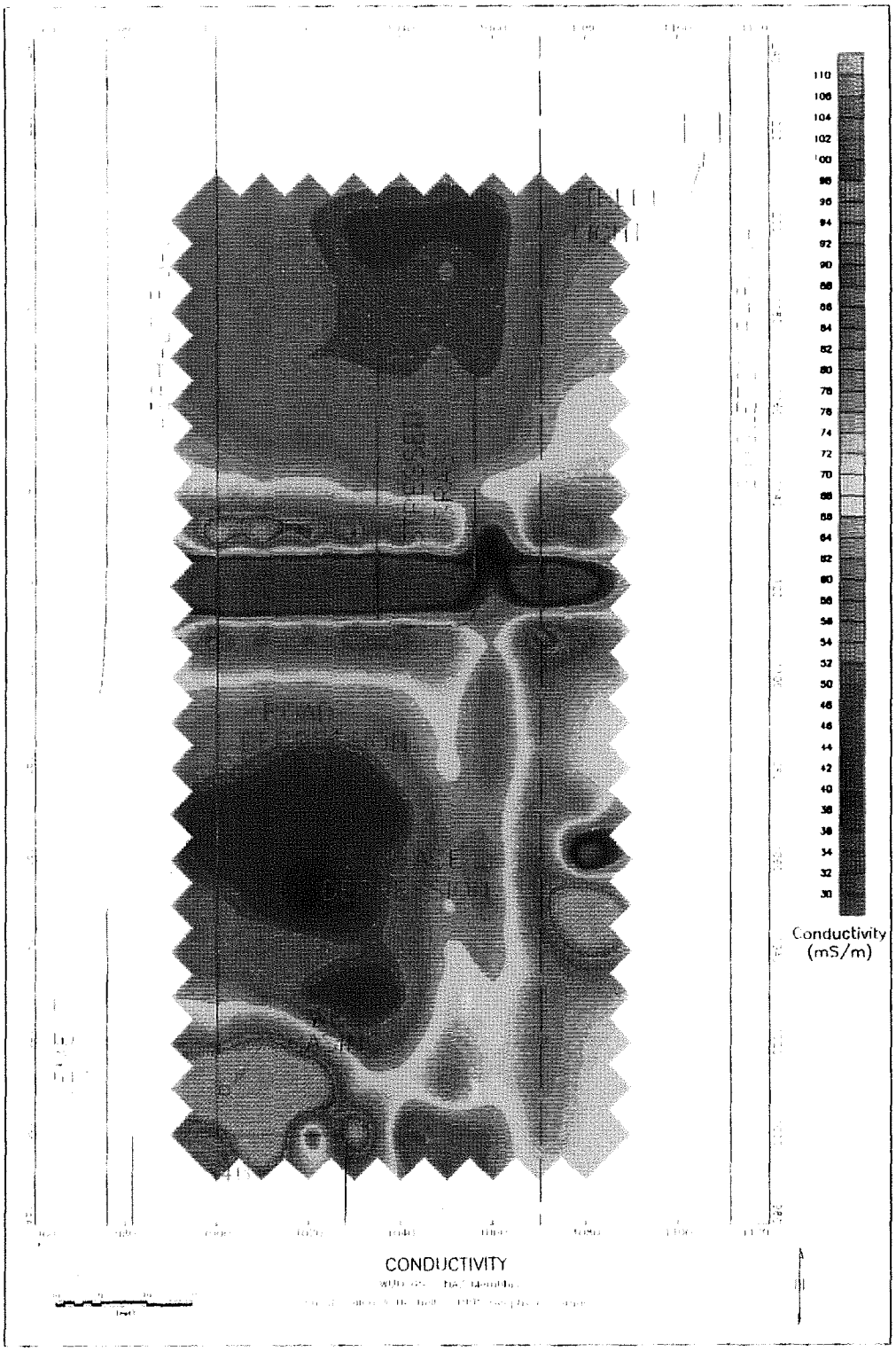


Figure 9
In-Phase Map of SWMU 65

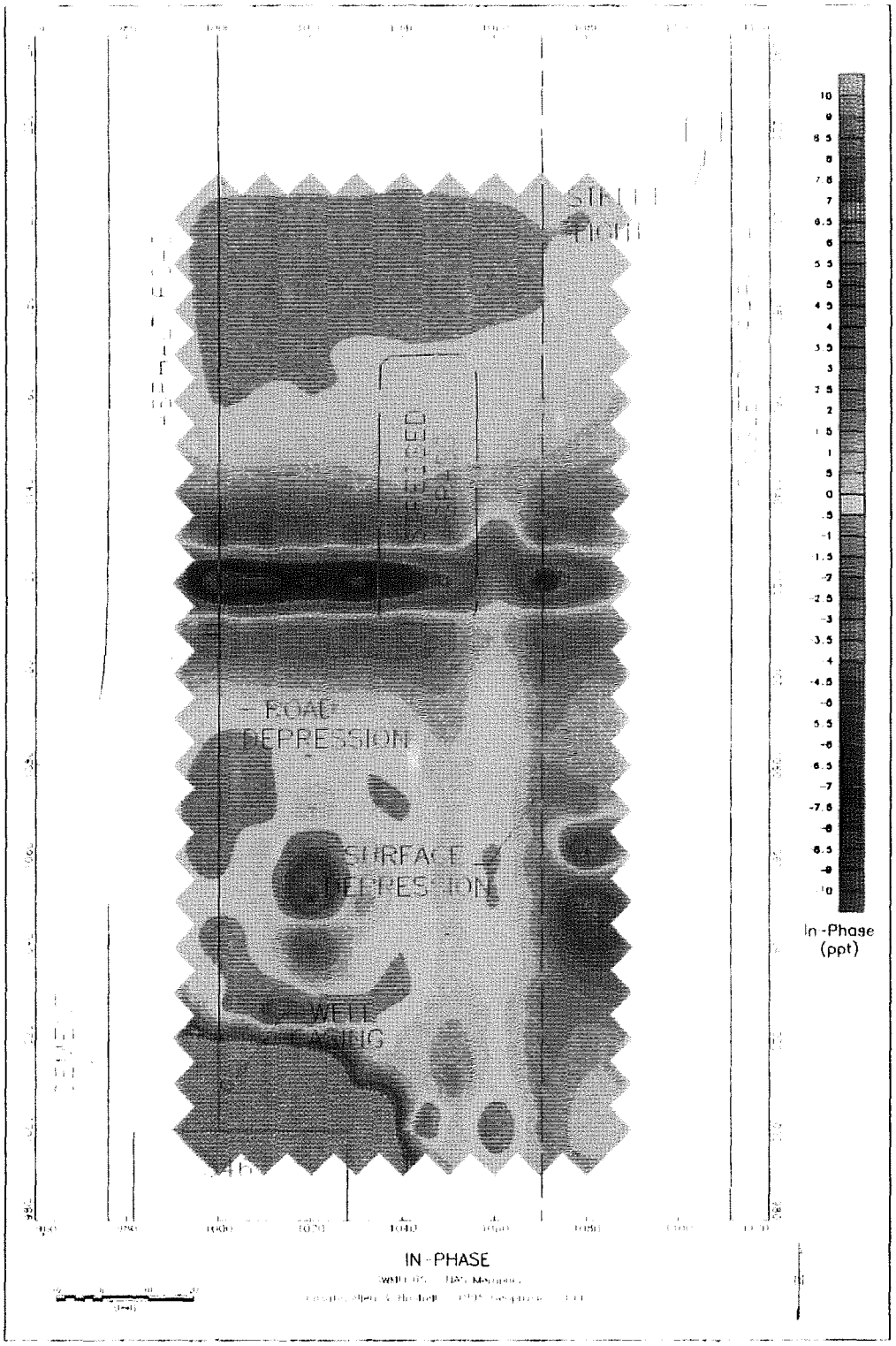


Figure 10
Geophysical Interpretation for SWMU 65.

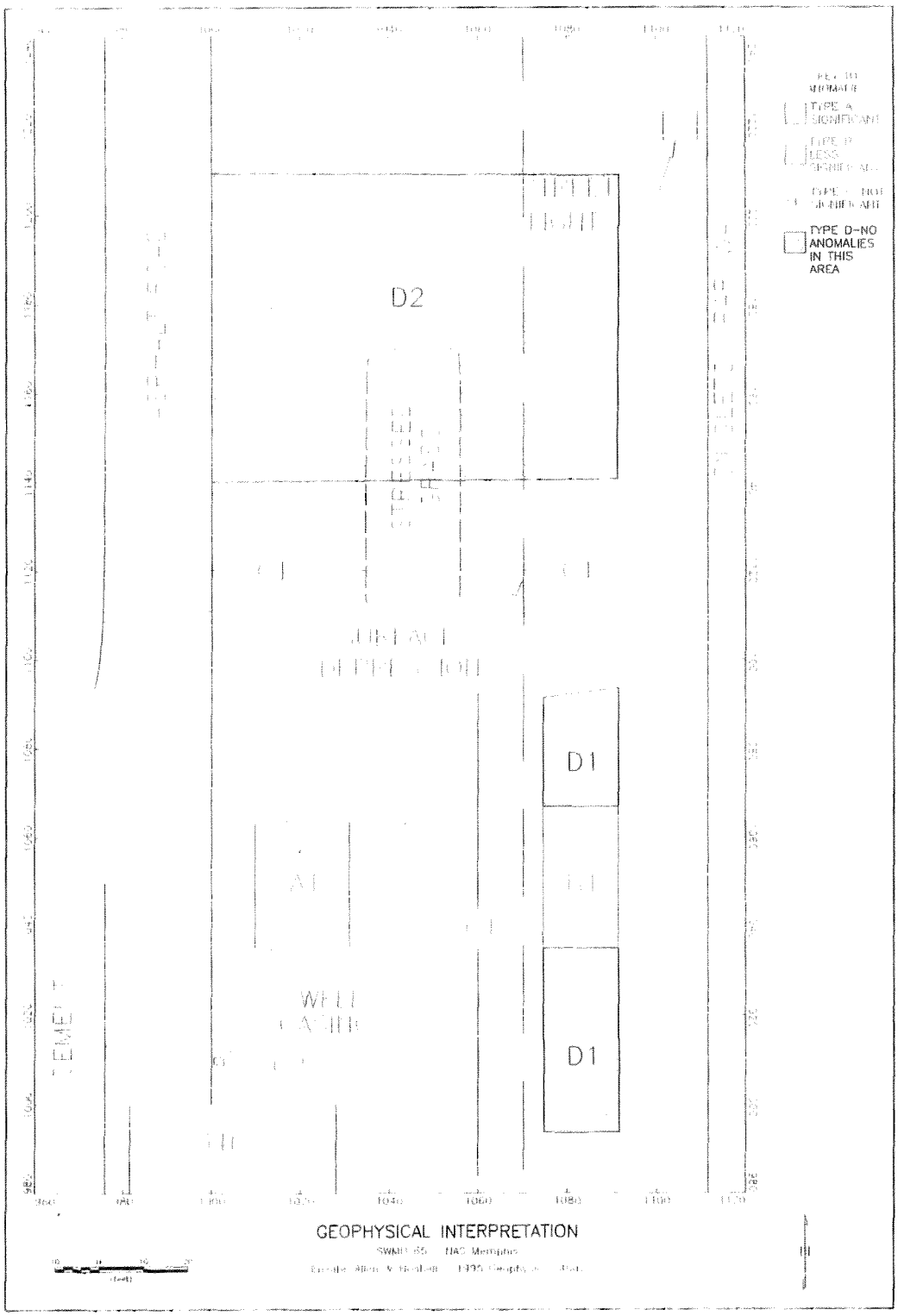


Table 3
SWMU 65 Anomaly Interpretations

No.	Best Position to Investigate	Notes
A1	1020E/1050N	Strong anomaly; buried metal indicated. Probable remnants of USTs. High priority for follow-up.
B1	—	Moderate anomaly; buried metal indicated. Anomaly unrelated to survey objectives.
C1	—	Buried utilities; possibly water main serving S-346.
C2	—	Surface metal associated with Building S-346.
D1	—	Zone cleared of anomalies.
D2	—	Zone cleared of anomalies.

line, in both the conductivity and in-phase datasets, is most likely due to the line's resistor qualities, rather than line excavation.

The survey results from SWMU 36 indicate anomalous features are clustered in a pattern consistent with the dimensions of Incinerator 4. UST identification is complicated due do the lack of a northing direction on the site engineering plans, and the high amplitude response from the source bodies onsite. One possible geophysical interpretation, based on site engineering plans and survey data, places a UST in the area of anomalous zone A4.

The geophysics performed at SWMU 65 may have identified the previous location of USTs that fueled the engine test cell S-346. Site plans for this SWMU indicated the fuel tanks were buried north of Building S-346; an anomalous response, attributed to buried metal, was recorded north of S-346, in the approximate area indicated for the USTs.

A site walkover, possibly followed by invasive investigation, is recommended for Type A anomalies.

Appendix C
SWMU 36 — Analytical Results

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SWMU 36 - ANALYTICAL DATA

APX9-METAL													
		SAMPLE ID ------->	036-S-0001-01		036-S-0002-01		036-S-0003-01		036-S-0004-01		036-C-0005-01		036-S-0005-01
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		SAMPLE DATE ----->	10/11/95		10/11/95		10/11/95		10/11/95		10/11/95		10/11/95
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		UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG
CAS #	Parameter		1564	VAL	1564	VAL	1564	VAL	1564	VAL	1564	VAL	1564	VAL
SB	Antimony		10.4	UJ	11.1	UJ	10.8	UJ	11.4	UJ	11.	UJ	11.2	UJ
AS	Arsenic		3.9		11.		5.7		7.3		7.5		8.3	
BA	Barium		63.3		118.		85.9		63.5		112.		115.	
BE	Beryllium		0.79	J	0.48	J	0.4	J	0.28	J	0.44	J	0.48	J
CD	Cadmium		0.62	U	0.66	U	0.65	U	0.68	U	0.66	U	0.67	U
CR	Chromium		3.5	J	10.6	J	8.2	J	3.5	J	7.7	J	7.7	J
CO	Cobalt		2.2	J	7.4	J	7.7	J	7.2	J	6.9	J	7.5	J
CU	Copper		4.8	J	13.1		8.4		6.		8.9		9.1	
PB	Lead		14.5		79.		12.		57.		12.8		12.7	
HG	Mercury		0.1	U	0.11	U	0.11	U	0.11	U	0.11	U	0.11	U
NI	Nickel		4.2	UJ	6.8	J	4.3	UJ	4.5	UJ	4.4	UJ	4.5	UJ
SE	Selenium		0.21	UJ	0.22	U	0.22	U	0.23	U	0.33	J	0.25	J
AG	Silver		0.77	J	0.66	UJ	0.65	UJ	0.68	UJ	0.66	UJ	0.67	UJ
TL	Thallium		0.42	UJ	0.44	UJ	0.43	UJ	0.45	UJ	0.44	UJ	0.45	UJ
V	Vanadium		6.1	J	23.5		21.8		14.5		19.8		20.2	
ZN	Zinc		20.4		50.		32.1		25.		36.		34.5	
SN	Tin		7.1	J	7.7	J	4.3	U	4.5	U	4.4	U	8.	J

*** Validation Complete ***

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SWMU 36 - ANALYTICAL DATA

DIOXIN													
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39001-02-0	OCDF	0.0161	U	0.0062		0.0037	U	0.0021	U	0.0071		0.0069	
1746-01-6	2378-TCDD	0.0019	U	0.0058	U	0.0058	U	0.004	U	0.0015	U	0.0022	U
51207-31-9	2378-TCDF	0.0018	U	0.0037	U	0.0054	U	0.0032	U	0.0016	U	0.0025	U
57117-41-6	12378-PeCDF	0.0025	U	0.0028	U	0.0059	U	0.0021	U	0.002	U	0.0037	U
40321-76-4	12378-PeCDD	0.0021	U	0.0051	U	0.0034	U	0.0036	U	0.0026	U	0.0031	U
57117-31-4	23478-PeCDF	0.0022	U	0.0026	U	0.0055	U	0.002	U	0.0018	U	0.0032	U
70648-26-9	123478-HxCDF	0.001	U	0.002	U	0.0033	U	0.0038	U	0.0007	U	0.0013	U
57117-44-9	123678-HxCDF	0.0009	U	0.0014	U	0.0022	U	0.0026	U	0.0007	U	0.0012	U
39227-28-6	123478-HxCDD	0.0072	U	0.0044	U	0.0058	U	0.0054	U	0.0058	U	0.0068	U
57653-85-7	123678-HxCDD	0.0031	U	0.0026	U	0.0035	U	0.0032	U	0.0025	U	0.0029	U
19408-74-3	123789-HxCDD	0.0042	U	0.0031	U	0.0042	U	0.0038	U	0.0033	U	0.0039	U
60851-34-5	234678-HxCDF	0.0017	U	0.002	U	0.0032	U	0.0037	U	0.0012	U	0.0021	U
72918-21-9	123789-HxCDF	0.002	U	0.0021	U	0.0035	U	0.004	U	0.0015	U	0.0025	U
67562-39-4	1234678-HpCDF	0.0067		0.0061		0.0024	U	0.0048		0.0041	U	0.0043	U
35822-46-9	1234678-HpCDD	0.0331		0.0461	J	0.0534		0.0685		0.0019	U	0.0336	
55673-89-7	1234789-HpCDF	0.005	U	0.0052	U	0.0033	U	0.0034	U	0.003	U	0.0026	U

*** Validation Complete ***

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SWMU 36 - ANALYTICAL DATA

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319-84-6	alpha-BHC	17.	U	1.8	U	1.8	U	9.4	U	1.9	U	1.8	U
319-85-7	beta-BHC	17.	U	1.8	U	1.8	U	9.4	U	1.9	U	1.8	U
319-86-8	delta-BHC	17.	U	1.8	U	1.8	U	9.4	U	1.9	U	1.8	U
58-89-9	gamma-BHC (Lindane)	17.	U	1.8	U	1.8	U	9.4	U	1.9	U	1.8	U
76-44-8	Heptachlor	17.	U	1.8	U	1.8	U	9.4	U	1.9	U	1.8	U
309-00-2	Aldrin	17.	U	1.8	U	1.8	U	9.4	U	1.9	U	1.8	U
1024-57-3	Heptachlor epoxide	17.	U	1.8	U	9.8		9.4	U	1.8	J	1.7	J
959-98-8	Endosulfan I	17.	U	1.8	U	1.8	U	9.4	U	1.9	U	1.8	U
60-57-1	Dieldrin	120.	D	12.		70.	D	78.	D	3.6	J	4.5	
72-55-9	4,4'-DDE	27.	JD	19.		7.2	J	19.	U	3.8	U	1.6	J
72-20-8	Endrin	34.	U	3.7	U	3.6	U	19.	U	3.8	U	3.7	U
33213-65-9	Endosulfan II	34.	U	3.7	U	2.2	J	19.	U	3.8	U	3.7	U
72-54-8	4,4'-DDD	34.	U	3.7	U	3.6	U	19.	U	3.8	U	3.7	U
1031-07-8	Endosulfan sulfate	34.	U	3.7	U	3.6	U	19.	U	3.8	U	3.7	U
50-29-3	4,4'-DDT	31.	JD	24.		8.8	J	19.	U	3.	J	5.2	J
72-43-5	Methoxychlor	170.	U	18.	U	18.	U	94.	U	19.	U	18.	U
53494-70-5	Endrin ketone	34.	U	3.7	U	1.6	J	19.	U	3.8	U	3.7	U
7421-93-4	Endrin aldehyde	34.	U	3.7	U	3.6	U	19.	U	3.8	U	3.7	U
5103-71-9	alpha-Chlordane	17.	U	3.4	J	26.		8.2	JD	4.		4.7	J
5103-74-2	gamma-Chlordane	17.	U	1.9	J	8.6		9.4	U	1.6	J	1.6	J
8001-35-2	Toxaphene	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U
12674-11-2	Aroclor-1016	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U
11104-28-2	Aroclor-1221	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U
53469-21-9	Aroclor-1242	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U
12672-29-6	Aroclor-1248	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U
11097-69-1	Aroclor-1254	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U
11096-82-5	Aroclor-1260	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U
12789-03-6	Technical Chlordane	340.	U	37.	U	210.		190.	U	38.	U	37.	U
11141-16-5	Aroclor-1232	340.	U	37.	U	36.	U	190.	U	38.	U	37.	U

*** Validation Complete ***

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SWMU 36 - ANALYTICAL DATA

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	UNITS ---------->	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
CAS #	Parameter	1564	VAL	1564	VAL	1564	VAL	1564	VAL	1564	VAL	1564	VAL
108-95-2	Phenol	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
111-44-4	bis(2-Chloroethyl)ether	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
95-57-8	2-Chlorophenol	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
541-73-1	1,3-Dichlorobenzene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
106-46-7	1,4-Dichlorobenzene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
95-50-1	1,2-Dichlorobenzene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
95-48-7	2-Methylphenol (o-Cresol)	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
106-44-5	4-Methylphenol (p-Cresol)	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
621-64-7	N-Nitroso-di-n-propylamine	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
67-72-1	Hexachloroethane	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
98-95-3	Nitrobenzene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
78-59-1	Isophorone	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
88-75-5	2-Nitrophenol	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
105-67-9	2,4-Dimethylphenol	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
120-83-2	2,4-Dichlorophenol	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
120-82-1	1,2,4-Trichlorobenzene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
91-20-3	Naphthalene	340.	U	370.	U	75.	J	110.	J	380.	U	370.	U
106-47-8	4-Chloroaniline	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
87-68-3	Hexachlorobutadiene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
111-91-1	bis(2-Chloroethoxy)methane	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
59-50-7	4-Chloro-3-methylphenol	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
91-57-6	2-Methylnaphthalene	340.	U	370.	U	370.	U	44.	J	380.	U	370.	U
77-47-4	Hexachlorocyclopentadiene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
88-06-2	2,4,6-Trichlorophenol	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
95-95-4	2,4,5-Trichlorophenol	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
91-58-7	2-Chloronaphthalene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
88-74-4	2-Nitroaniline	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
131-11-3	Dimethyl phthalate	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
208-96-8	Acenaphthylene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
606-20-2	2,6-Dinitrotoluene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
99-09-2	3-Nitroaniline	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
83-32-9	Acenaphthene	340.	U	370.	U	47.	J	120.	J	380.	U	370.	U
51-28-5	2,4-Dinitrophenol	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
100-02-7	4-Nitrophenol	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
132-64-9	Dibenzofuran	340.	U	370.	U	370.	U	61.	J	380.	U	370.	U

*** Validation Complete ***

NSA MEMPHIS
NSA MEMPHIS, RFI, ASSEMBLY D
SWMU 36 - ANALYTICAL DATA

SW846-SVOA																	
	SAMPLE ID ------->	036-S-0001-01		036-S-0002-01		036-S-0003-01		036-S-0004-01		036-S-0005-01		036-C-0005-01	
	ORIGINAL ID ----->	036S000101		036S000201		036S000301		036S000401		036S000501		036C000501	
	LAB SAMPLE ID --->	136608		136609		136610		136611		136607		136606	
	ID FROM REPORT -->	036S000101		036s000201		036s000301		036s000401		036s000501		036c000501	
	SAMPLE DATE ----->			10/11/95		10/11/95		10/11/95		10/11/95		10/11/95	
	DATE EXTRACTED -->	10/22/95		10/22/95		10/22/95		10/22/95		10/22/95		10/22/95	
	DATE ANALYZED --->	11/02/95		11/02/95		11/02/95		11/02/95		11/02/95		11/02/95	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
CAS #	Parameter	1564	VAL	1564	VAL	1564	VAL	1564	VAL	1564	VAL	1564	VAL
121-14-2	2,4-Dinitrotoluene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
84-66-2	Diethylphthalate	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
7005-72-3	4-Chlorophenylphenylether	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
86-73-7	Fluorene	340.	U	370.	U	40.	J	90.	J	380.	U	370.	U
100-01-6	4-Nitroaniline	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
86-30-6	N-Nitrosodiphenylamine	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
101-55-3	4-Bromophenyl-phenylether	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
118-74-1	Hexachlorobenzene	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
87-86-5	Pentachlorophenol	860.	U	920.	U	920.	U	940.	U	950.	U	920.	U
85-01-8	Phenanthrene	53.	J	49.	J	220.	J	660.		380.	U	370.	U
120-12-7	Anthracene	340.	U	370.	U	55.	J	140.	J	380.	U	370.	U
86-74-8	Carbazole	340.	U	370.	U	42.	J	150.	J	380.	U	370.	U
84-74-2	Di-n-butylphthalate	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
206-44-0	Fluoranthene	120.	J	77.	J	250.	J	810.		380.	U	370.	U
129-00-0	Pyrene	100.	J	71.	J	200.	J	680.		380.	U	370.	U
85-68-7	Butylbenzylphthalate	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
91-94-1	3,3'-Dichlorobenzidine	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
56-55-3	Benzo(a)anthracene	71.	J	42.	J	120.	J	410.		380.	U	370.	U
218-01-9	Chrysene	80.	J	46.	J	120.	J	450.		380.	U	370.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
117-84-0	Di-n-octyl phthalate	340.	U	370.	U	370.	U	370.	U	380.	U	370.	U
205-99-2	Benzo(b)fluoranthene	74.	J	45.	J	120.	J	410.		380.	U	370.	U
207-08-9	Benzo(k)fluoranthene	66.	J	40.	J	91.	J	340.	J	380.	U	370.	U
50-32-8	Benzo(a)pyrene	72.	J	41.	J	100.	J	380.		380.	U	370.	U
193-39-5	Indeno(1,2,3-cd)pyrene	60.	J	370.	U	75.	J	270.	J	380.	U	370.	U
53-70-3	Dibenz(a,h)anthracene	340.	U	370.	U	36.	J	120.	J	380.	U	370.	U
191-24-2	Benzo(g,h,i)perylene	110.	J	37.	J	84.	J	300.	J	380.	U	370.	U

*** Validation Complete ***

NSA MEMPHIS
NSA MEMPHIS, RFI, ASSEMBLY D
SWMU 36 - ANALYTICAL DATA

SW846-VOA

SAMPLE ID ------->	036-G-2006-43
ORIGINAL ID ----->	036G200643
LAB SAMPLE ID --->	137963
ID FROM REPORT -->	036G200643
SAMPLE DATE ----->	10/28/95
DATE ANALYZED --->	11/07/95
MATRIX ---------->	Water
UNITS ----------->	UG/L

CAS #	Parameter	1596	VAL
74-87-3	Chloromethane	10.	U
74-83-9	Bromomethane	10.	U
75-01-4	Vinyl chloride	10.	U
75-00-3	Chloroethane	10.	U
75-09-2	Methylene chloride	10.	U
67-64-1	Acetone	33.	U
75-15-0	Carbon disulfide	10.	U
75-35-4	1,1-Dichloroethene	10.	U
75-34-3	1,1-Dichloroethane	10.	U
540-59-0	1,2-Dichloroethene (total)	10.	U
67-66-3	Chloroform	10.	U
107-06-2	1,2-Dichloroethane	10.	U
78-93-3	2-Butanone (MEK)	10.	U
71-55-6	1,1,1-Trichloroethane	10.	U
56-23-5	Carbon tetrachloride	10.	U
75-27-4	Bromodichloromethane	10.	U
78-87-5	1,2-Dichloropropane	10.	U
10061-01-5	cis-1,3-Dichloropropene	10.	U
79-01-6	Trichloroethene	10.	U
124-48-1	Dibromochloromethane	10.	U
79-00-5	1,1,2-Trichloroethane	10.	U
71-43-2	Benzene	10.	U
10061-02-6	trans-1,3-Dichloropropene	10.	U
75-25-2	Bromoform	10.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	10.	U
591-78-6	2-Hexanone	10.	U
127-18-4	Tetrachloroethene	10.	U
79-34-5	1,1,2,2-Tetrachloroethane	10.	U
108-88-3	Toluene	1.	J
108-90-7	Chlorobenzene	10.	U
100-41-4	Ethylbenzene	10.	U
100-42-5	Styrene	10.	U
1330-20-7	Xylene (Total)	10.	U

*** Validation Complete ***

NSA MEMPHIS
NSA MEMPHIS, RFI, ASSEMBLY D
SWMU 36 - ANALYTICAL DATA

TPH-DRO	SAMPLE ID ------->	036-S-0001-10		036-S-0002-11		036-S-0003-10		036-S-0004-10			
	ORIGINAL ID ----->	036S000110		036S000211		036S000310		036S000410			
	LAB SAMPLE ID --->	137602		137603		137831		137832			
	ID FROM REPORT -->	036S000110		036S000211		036S000310		036S000410			
	SAMPLE DATE ----->	10/23/95		10/23/95		10/26/95		10/26/95			
	DATE EXTRACTED -->	11/05/95		11/05/95		11/09/95		11/09/95			
	DATE ANALYZED --->	11/07/95		11/07/95		11/07/95		11/07/95			
	MATRIX ---------->	Soil		Soil		Soil		Soil			
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG			
CAS #	Parameter	1592	VAL	1592	VAL	1592	VAL	1592	VAL		
9999900-02-6	TPH - Diesel Range Organics	4100.	U	3700.	U	4700.	U	4500.	U		

*** Validation Complete ***

NSA MEMPHIS
NSA MEMPHIS, RFI, ASSEMBLY D
SWMU 36 - ANALYTICAL DATA

TPH-GRO	SAMPLE ID ------->	036-S-0001-10		036-S-0002-11		036-S-0003-10		036-S-0004-10			
	ORIGINAL ID ----->	036S000110		036S000211		036S000310		036S000410			
	LAB SAMPLE ID --->	137602		137603		137831		137832			
	ID FROM REPORT -->	036S000110		036S000211		036S000310		036S000410			
	SAMPLE DATE ----->	10/23/95		10/23/95		10/26/95		10/26/95			
	DATE ANALYZED --->	11/02/95		11/02/95							
	MATRIX ---------->	Soil		Soil		Soil		Soil			
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG			
CAS #	Parameter	1592	VAL	1592	VAL	1592	VAL	1592	VAL		
9999900-02-5	TPH - Gasoline Range Organics	62.	U	56.	U	59.		56.			

*** Validation Complete ***

Appendix D
Closure Documentation/PCB Memorandum

DEPARTMENT OF THE NAVY
NAVAL AIR STATION MEMPHIS (84)
MILLINGTON, TENNESSEE 38054

IN REPLY REFER TO:
5090
TN2170022600
Code 18400

03 MAY 1989

Mr. Tom Tiesler, Director
Division of Solid Waste Management
Tennessee Department of Health
and Environment
Customs House, Fourth Floor
701 Broadway
Nashville, TN 37219-5403

Dear Mr. Tiesler,

On January 10, 1989, the Naval Air Station Memphis completed the closure requirements for the Hazardous Waste Interim Storage Yard in accordance with the Part B RCRA permit issued by your office. Mr. Harry Little of Environmental Resources Management Southeast, Inc. was the professional engineer on site during the closure operation. Enclosed are the results of the soil and rinse water sampled at the time of closure.

All samples, with the exception of one, were well below the allowable limits. The one exception is the Soil B sample, which contained 2900 ug/kg. We acknowledge the fact that this limit is above the background level of 20 ug/kg collected in April, 1987. This sample, however, contains xylene in levels below the action level outlined in the Tennessee Department of Health and Environment Division of Ground Water Protection Policy on Cleanup Levels for Gasoline and Other Petroleum Hydrocarbons, (UST 001-1), dated March 18, 1987. This policy allows soil that contains less than a total of 10 part per million benzene, toluene, and xylene (BXT) to remain in place in the soil. Based on this policy, NAS Memphis requests permission to allow the soil in the interim storage to remain in place without further action.

Could you please advise of the status of our Part "B" permit modification. It has been 10 months since our request for the modification was made.

If you have any questions, please contact Ms. Diane Lancaster at (901) 873-5462.

Sincerely,

R. G. CARPENTER
CDR, CEC, USN
PUBLIC WORKS OFFICER
BY DIRECTION OF THE COMMANDING OFFICER
NAVAL AIR STATION MEMPHIS

Encl:
(1) ERM-Southeast, Inc ltr of 09 Mar 89

Copy to:
Commanding Officer, Southern Division
Naval Facilities Engineering Command (Code 114)
P. O. Box 10068
Charleston, SC 29411-0068

Mr. Charles Patterson
Division of Solid Waste Management
Tennessee Department of Health
and Environment
State Office Building, Room 1101
170 North Mid-America Mall
Memphis, TN 38103

ATTACHMENT 8

CLOSURE PLAN

EXISTING CONTAINER STORAGE UNIT

closure plan is approved
by phone with Wayne
Gregory 2/3/87.

CLOSURE PLAN FOR THE

HAZARDOUS WASTE STORAGE FACILITY NEAR THE AIMD

NAVAL AIR STATION MEMPHIS

SWMU 53

MILLINGTON, TENNESSEE

This closure plan was developed to ensure that the interim status container storage facility near the AIMD at Naval Air Station (NAS) Memphis, Millington, Tennessee will not require further maintenance and controls to prevent environmental contamination. It minimizes or eliminates threats to human health and the environment. It ensures that escape of hazardous waste, hazardous waste constituents, leachate, contaminated rainfall, or waste decomposition products to soil, ground water, surface waters or atmosphere will not occur. The container storage facility which is located near Building N-12 consists of a 70' by 45' storage yard and an adjacent quonset building. This site was identified on the original Part A Hazardous Waste Permit Application submitted to the EPA and the Tennessee Department of Health and Environment (TDHE). This facility will be replaced by the proposed container storage facility described in the Permit. Upon occupancy of the new permitted container storage facility, all hazardous waste in storage at this interim status facility will either be moved to the new building or transported off-site to an approved treatment, storage, or disposal facility.

PARTIAL CLOSURE

NAS Memphis plans to discontinue the use of the quonset building prior to final closure of the interim status facility. The initiation of closure activities is expected to be 6 months after issuance of the permit for the new container storage facility. The procedures for inventory removal, disposal and decontamination of equipment described for final closure will be followed to close the unit.

FINAL CLOSURE

NAS Memphis expects to close the interim status facility upon occupancy of the new permitted container storage facility. Procedures for final closure, including clean-up and decontamination procedures are described below.

MAXIMUM INVENTORY

The maximum permitted inventory of water stored at this site during its operational life is 3,850 gallons (seventy 55- gallon drums) of hazardous waste.

INVENTORY REMOVAL, DISPOSAL, AND DECONTAMINATION OF EQUIPMENT

Decontamination of Quonset Building

After the final inventory of wastes has been removed from the quonset building, the Hazardous Waste Coordinator will inspect the site and have all loose items, i.e., papers, pallets, or empty containers, removed and packaged for disposal as hazardous waste.

Under the direction of the Hazardous Waste Coordinator, trained employees wearing rubber gloves, rubber boots, and protective coveralls will scrape and brush the concrete pad to remove any material adhering to it. This material will be containerized for disposal as a hazardous waste. The pad shall then be washed with an ionic surfactant and rinsed three times with clean, fresh water. The waste and rinse waters will be contained, collected, and drummed for disposal as hazardous waste.

The third rinse will be collected and separately contained and drummed. A sample will be taken from the third rinse and analyzed for the characteristics of hazardous waste and for total organic halogens (TOX). If results indicate that the rinse water contained more than 25 mg/l of TOX and/or failed one or more characteristic tests, then an additional rinse will be performed and rinse waters tested as above. The wash-rinse will be performed and rinse waters tested as above. The wash-rinse procedure will be repeated until the rinse waters are non-hazardous. All rinse and wash waters will be drummed and disposed of as hazardous waste.

A minimum of three samples of the top six inches of soil will be collected at the location of cracks of joints in the concrete pad. In addition, a composite soil sample will be collected from an unoccupied area at least one mile from the storage facility to be used as background data for determining soil contamination. The three samples and the background sample will be analyzed for the characteristics of hazardous waste and for the following constituents: xylene, toluene, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, ethylene dichloride, trichloroethane, trichlorotrifluoroethane (freon), formaldehyde, and methanol. If any sample fails the characteristic test or contains constituents of concern significantly higher than the background, the Hazardous Waste Coordinator will establish a sampling grid to determine the extent of contamination. (For purposes of the closure plan, concentrations of constituents of concern more than 15% above background or higher than 0.01 mg/kg, whichever is greater, will be considered significant). An area extending five feet beyond the limits of contamination will be excavated to a depth of six inches. Contaminated soil will be transported to a commercial hazardous waste disposal facility and the excavation will be backfilled with uncontaminated material.

7 ex. if bk = .005 and sample = .008 > 1.15(.005) but < .01 ppm so OK

Decontamination of Storage Yard

After the final inventory of wastes has been removed from the storage yard, the Hazardous Waste Coordinator will inspect the site and have all loose items, i.e., papers, pallets, or empty containers, removed and packaged for disposal as ~~and~~ hazardous waste.

Under the direction of the Hazardous Waste Coordinator, trained employees wearing rubber gloves, rubber boots, and protective coveralls will remove the polyethylene sheet which provided containment for the canopied area. The sheet will then be folded and placed in a drum for disposal off-site as hazardous waste. The employees will then scrape and brush the asphalt pavement to remove any material adhering to it. This material will be containerized for disposal as a hazardous waste. The pad shall then be washed with an ionic surfactant and

pick or bar for asphalt for sampling

Time of chart

3 or 4 people to do the work

mop early because of evaporation

rinsed three times with clean, fresh water. The wash and rinse waters will be contained, collected, and drummed for disposal as hazardous waste.

The third rinse will be collected and separately contained and drummed. A sample will be taken from the third rinse and analyzed for the characteristics of hazardous waste and for total organic halogens (TOX). If results indicate that the rinse water contained more than 25 mg/l of TOX and/or failed one or more characteristic tests, then an additional rinse will be performed and rinse waters tested as above. The wash-rinse procedure will be repeated until the rinse waters are non-hazardous. All rinse and wash waters will be drummed and disposed of as hazardous waste.

A minimum of three samples of the top six inches of soil will be collected at the location of cracks or breaks in the asphalt. In addition, a composite soil sample will be collected from an unoccupied area at least one mile from the storage facility to be used as background data for determining soil contamination. The three samples and the background sample will be analyzed for the characteristics of hazardous waste and for the following constituents: xylene, toluene, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, ethylene dichloride, trichloroethane, trichlorotrifluoroethane (freon), formaldehyde, and methanol. If any sample fails the characteristic test or contains constituents of concern significantly higher than the background, the Hazardous Waste Coordinator will establish a sampling grid to determine the extent of contamination. (For purposes of the closure plan concentrations of constituents of concern more than 15% above background or higher than 0.01 mg/kg, whichever is greater, will be considered significant). An area extending five feet beyond the limits of contamination will be excavated to a depth of six inches. Contaminated soil will be transported to a commercial hazardous waste disposal facility and the excavation will be backfilled with uncontaminated material.

Alr. hd

Equipment Decontamination

All equipment used in the closure of the facility, including shovels, sampling tools, and buckets will be washed and rinsed in containers following the procedures used to decontaminate the facility. All wash and rinse waters will be disposed as hazardous waste. Expendable items used in the decontamination process such as mops, brooms, gloves, coveralls, and boots will be containerized and disposed as hazardous waste.

Excavation vehicles used to remove any contaminated soils at the facility will be decontaminated by scraping and/or brushing solids from the blades and tires which contacted the contaminated soil. The scrapings will be handled and disposed as hazardous waste.

CLOSURE SCHEDULE

The closure schedules for the quonset building and the storage yard are presented in Figures 1 and 2 respectively.

EXTENSION OF CLOSURE TIME

NAS Memphis does not anticipate a need for an extension at this time.

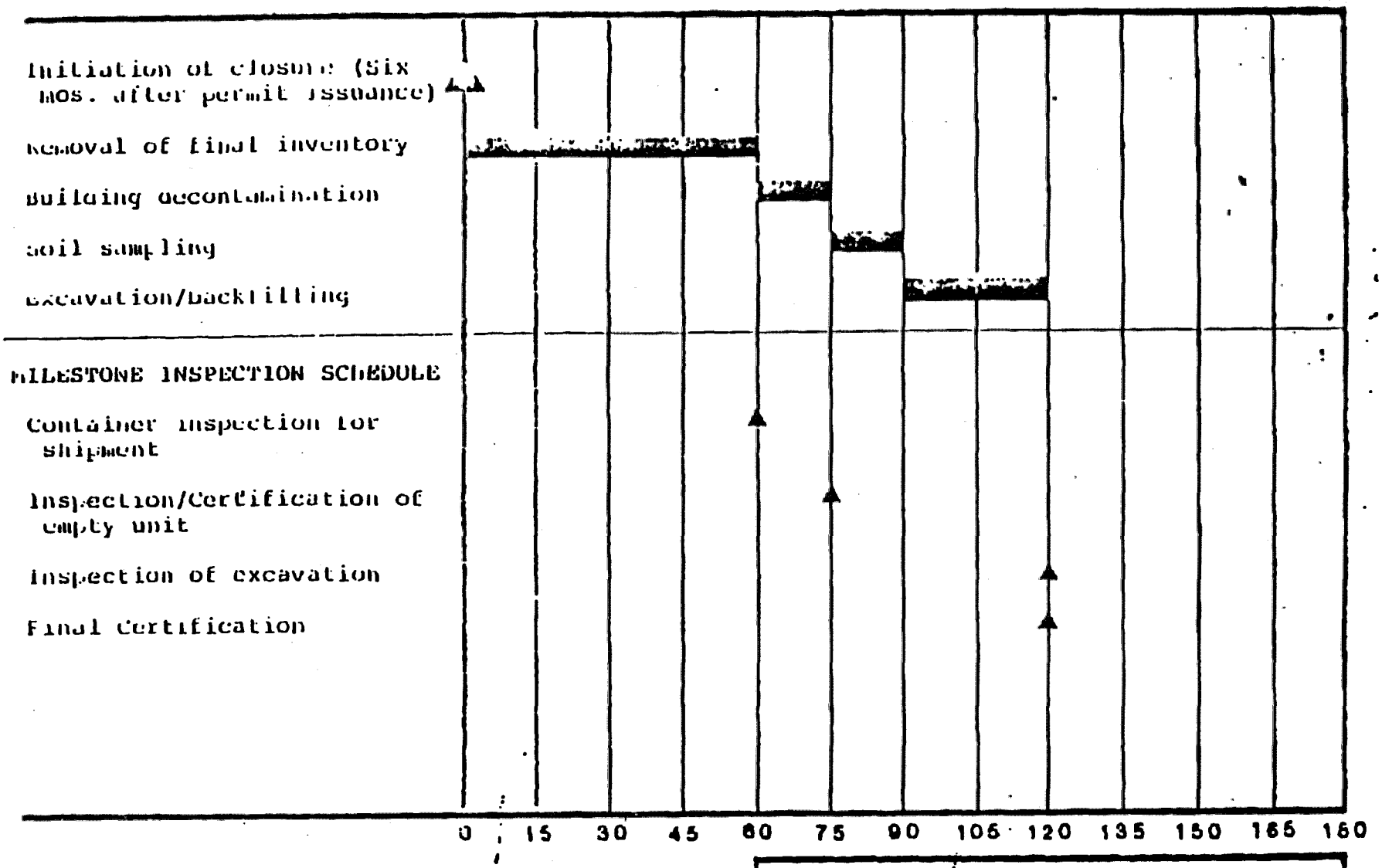

FIGURE 1

QUONSET BUILDING

NAS MEMPHIS

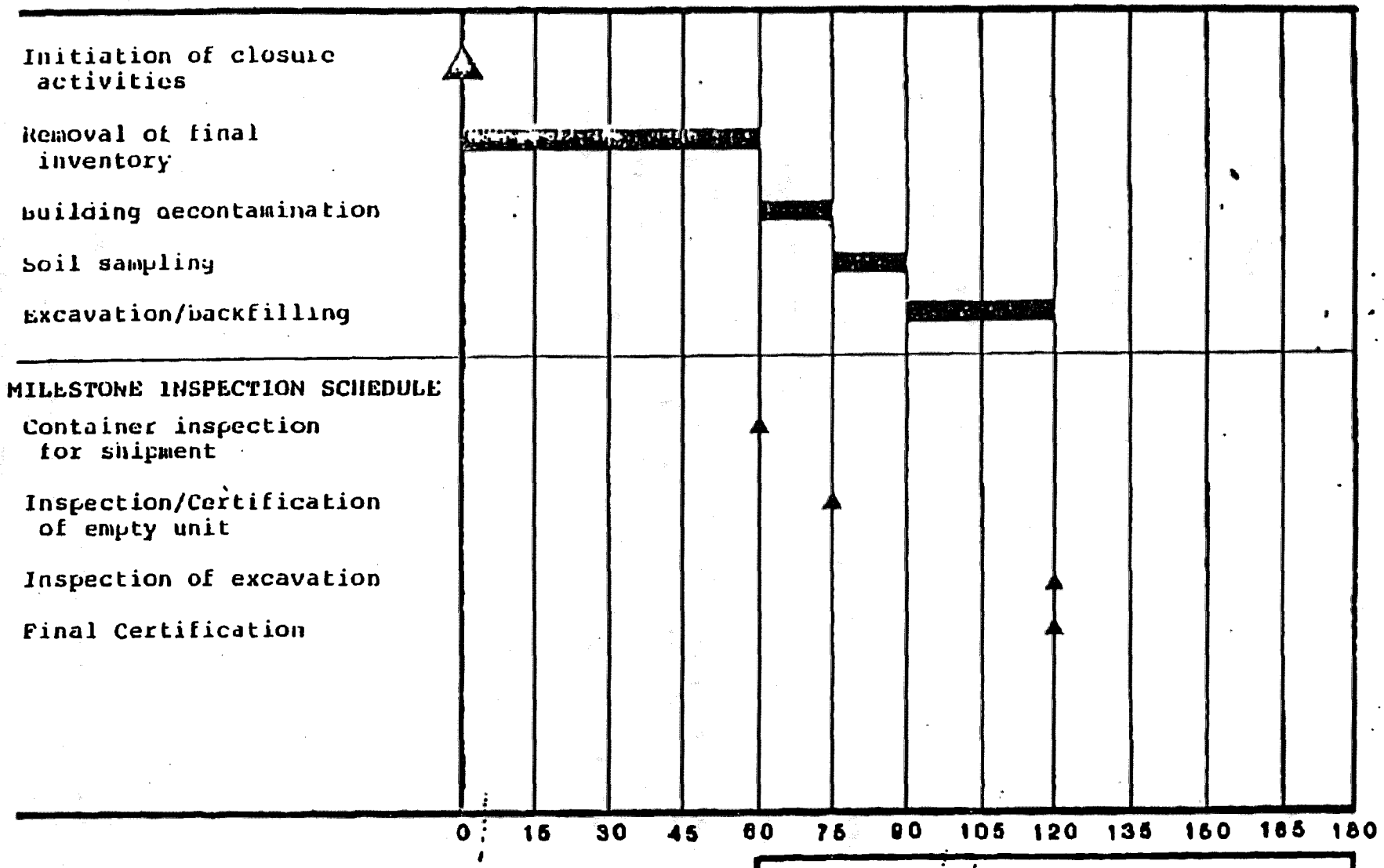

FIGURE 2

STORAGE YARD

NAS MEMPHIS

ERM-Southeast, Inc.
Environmental Resources Management

Suite 110 • 215 Centerview Drive • P.O. Box 881 • Brentwood, Tennessee 37027 ☎ (615) 373-3350
Suite 201 • 2629 Sandy Plains Road • Marietta, Georgia 30066 ☎ (404) 971-4671
Suite 200 • 9101 Southern Pines Boulevard • Charlotte, North Carolina 28210 ☎ (704) 522-1409

10 June, 1987

Commanding Officer
ATTN: Code 1143
Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, SC 29411-0068

Ref: Contract N 62467-87-D-0133

Dear Sir:

Attached is the Closure Certification for the Quonset Building Facility, NAS, Memphis. The certification was signed and sealed by a registered professional engineer licensed in the State of Tennessee. The Certification states that closure of the facility was completed in accordance with the approved closure plan dated 15 Sept 86 and therefore no further closure actions are needed at the site at this time.

By copy of this letter we are forwarding two copies of this submittal to the Commanding Officer, NAS Memphis.

If you have any questions concerning this information, please call me.

Sincerely,

ERM-SOUTHEAST, INC.

Harry L. Little, PE
Principal

cc: Commanding Officer
Naval Air Station
Memphis
Millington, TN 38054

Fred Ziegler - ERM-Southeast
Emmett Beers - ERM-Southeast

ERM-Southeast, Inc.
Environmental Resources Management

Suite 110 • 215 Centerview Drive • P.O. Box 881 • Brentwood, Tennessee 37027 ☎ (615) 373-3350
Suite 201 • 2629 Sandy Plains Road • Marietta, Georgia 30066 ☎ (404) 971-4671
Suite 200 • 9101 Southern Pines Boulevard • Charlotte, North Carolina 28210 ☎ (704) 522-1409

Closure Certification
for
Interim Status Storage Facility
(Quonset Building)
Naval Air Station, Memphis
Millington, TN

I certify that I have personally reviewed the approved closure plan for the facility, dated 15 September 1986, and understand the closure procedures specified in that plan.

On 24 April 1987, soil and rinse water samples were collected as specified in the approved plan. Samples were collected under my supervision. Samples were analyzed by Industrial & Environmental Analysts laboratories, Researh Triangle Park, NC, in accordance with the approved plan. The results of the analyses are attached herewith.

Based upon my inquiry and review of the sampling and analysis and my personal observation of the decontamination activities, I certify that the facility was closed in accordance with the 15 September 1986 closure plan.

Date: 6/10/87

Engineer: Harry L. Little Owner: _____
Harry L. Little, PE
Certificate No. 12,714

Enclosure

HARRY L. LITTLE
REGISTERED ENGINEER
AGRICULTURE
No. 12714
STATE OF TENNESSEE

5/10/87

Industrial & Environmental Analysts, Inc.
P.O. Box 12846 • Research Triangle Park, NC 27709 • 919-467-9919

May 21, 1987

Harry Little
ERM-Southeast, Inc.
Suite 200
9101 Southern Pines Blvd.
Charlotte, NC 28210

Reference: IEA Report No. 538-30

Dear Mr. Little:

Transmitted herewith are the results of analyses on five samples submitted to our laboratory on April 27, 1987.

Please see the enclosed report for your results.

Very truly yours,

INDUSTRIAL & ENVIRONMENTAL ANALYSTS, INC.

Joseph B. Adamovic
Senior Chemist

JBA/djf