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ENVIRONMENTAL RESTORATION NAVY ACCOUNT GRAY AREAS INVESTIGATION REPORT MILLINGTON SUPPACT TN
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ENSAFE INC

ERNA GRAY AREAS INVESTIGATION REPORT
NAVAL SUPPORT ACTIVITY MID-SOUTH
MILLINGTON, TENNESSEE

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The Contractor, EnSafe Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0318 is complete, accurate, and complies with all requirements of the contract.

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Acronyms

atm-m^3/mole	atmospheres-cubic meter per mole
BEHP	bis(2-ethylhexyl)phthalate
BEQ	Benzo(a)pyrene equivalent
bls	below land surface
BRAC	Base Closure and Realignment Act
BUPERS	Bureau of Personnel
CEC	Cation Exchange Capacity
cm/sec	centimeters per second
COPC	Chemical of potential concern
DI	Deionized
DPT	Direct push technology
DQO	Data Quality Objective
DRO	Diesel range organics
E/A&H	EnSafe/Allen & Hoshall
EBS	Environmental Baseline Survey
ERA	Ecological Risk Assessment
ERNA	Environmental Restoration Navy Account
f_{oc}	percent of the total solid and/or liquid volume
GRO	Gasoline range organics
HI	Hazard index
HQ	Hazard quotient
HSWA	Hazardous and Solid Waste Amendments
IDW	Investigation-derived waste
ILCR	Incremental lifetime cancer risk
K_d	distribution coefficient
K_{oc}	partition coefficient
MCLs	Maximum contaminant levels
MEK	Methyl ethyl ketone
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
mg/kg	milligrams per kilogram
ml/g	milliliters per gram

mm Hg	millimeters of mercury
MWR	Morale, Welfare, and Recreation
NFA	No further action
NSA	Naval Support Activity
oc	organic carbon
OSWER	Office of Solid Waste and Emergency Response
POLs	Petroleum, oils and lubricants
PRE	Preliminary Risk Evaluation
PWD Env. Div.	Public Works Department, Environmental Division
QA/QC	Quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-based concentration
RC	Reference concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SG	Specific gravity
SOUTHDIV	Southern Division
SSL	Soil screening level
SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
TDEC	Tennessee Department of Environment and Conservation
TPH	Total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
UST	Underground storage tank
VCA	Voluntary Corrective Action
VOC	Volatile organic compound

1.0 INTRODUCTION

As part of the U.S. Navy Installation Restoration Program, the following Gray Areas Investigation Report has been prepared for nine Gray Area facilities at Naval Support Activity (NAVSUPPACT or NSA) Mid-South, Millington, Tennessee. The Gray Areas Investigation, undertaken by EnSafe Inc. on behalf of the Navy, 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. Figure 1.1 provides a vicinity map of the investigated Gray Areas.

As a result of the Base Closure and Realignment Act of 1990 (BRAC), a portion of NSA Mid-South has been closed and is being prepared for transfer to the City of Millington. As part of the closure process, EnSafe/Allen & Hoshall (E/A&H) conducted an Environmental Baseline Survey (EBS) in September 1993 to determine the condition of all base facilities and to determine which ones require further investigation. In May 1994, the Draft EBS summary was submitted to Southern Division (SOUTHDIV), Naval Facilities Engineering Command. During the EBS, each facility at NSA Mid-South was surveyed via physical walk-throughs and a records search to determine its potential for a release of hazardous material, hazardous waste, and/or petroleum products to the environment. Based on its past and current potential for a release, each facility was then assigned one of seven possible classifications (using a number/color system) indicating its suitability for transfer. Classifications 1 through 4 are considered transferrable and classifications 5 through 7 are considered non-transferrable. The EBS identified several facilities at NSA Mid-South that need further evaluation, classifying them as "7/gray."

The *Verification Sampling Work Plan for Potential New Sites (Gray Areas Investigation Work Plan)* [E/A&H, October 1994], written to address sites recommended for further investigation, originally included sites covered by two Navy programs. The first program covered

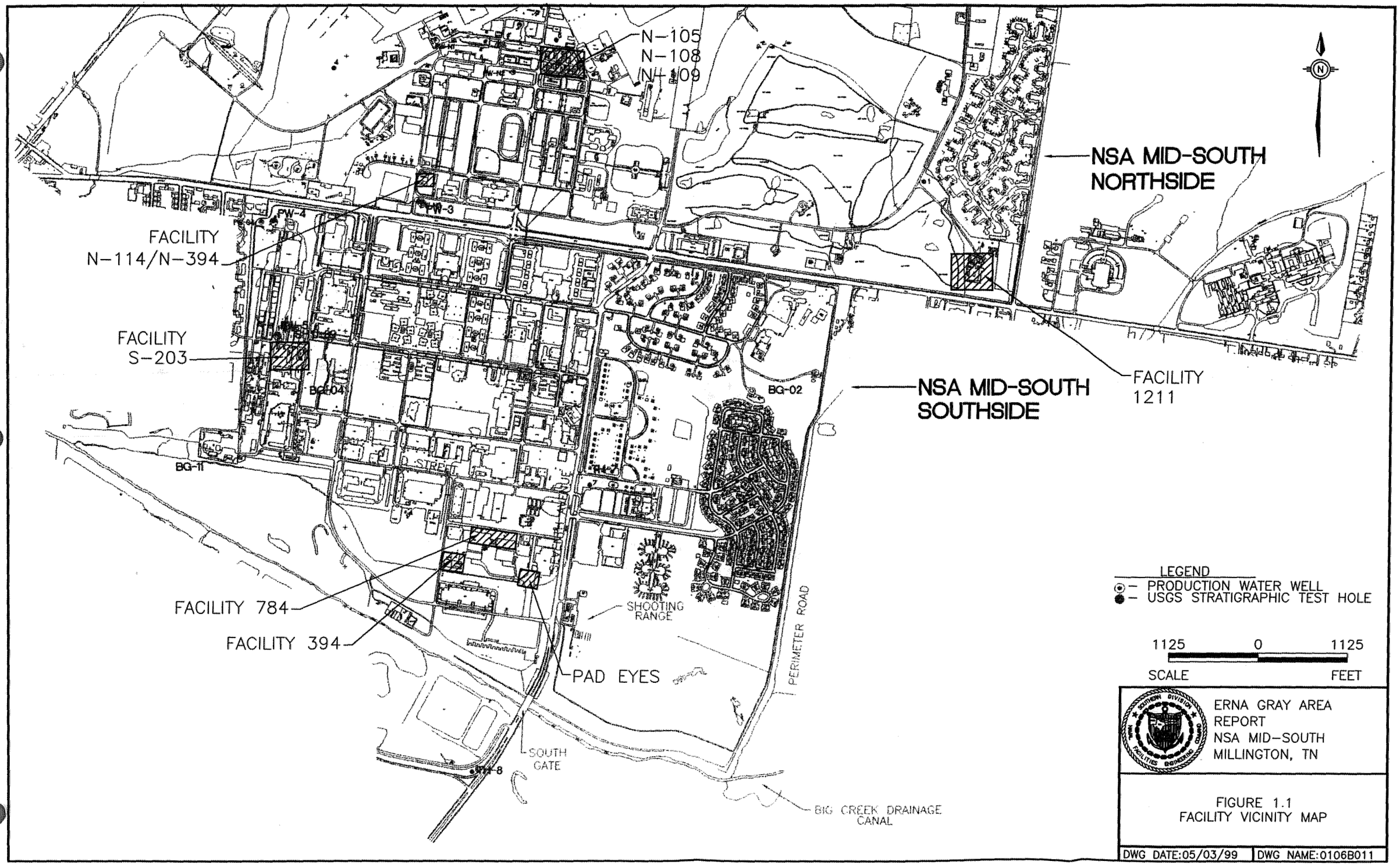
BRAC facilities slated for lease or transfer. The part of the work plan addressing these facilities was implemented and resulted in the *Gray Areas Investigation Report* (E/A&H, June 16, 1995) and the *Northside Follow-up Gray Areas Investigation Report* (E/A&H, September 16, 1997).

The second program addressed Environmental Restoration Navy Account (ERNA) facilities to be realigned and retained by the Navy. As a result of the EBS and the *Gray Areas Investigation Work Plan* (E/A&H, October 1994), 12 ERNA facilities were recommended for further investigation to determine whether hazardous contaminants had been released, and to determine suitability for lease.

The portion of the work plan covering 10 of the ERNA facilities (Table 1.1) was implemented in December 1997 and January 1998. This report summarizes the investigation findings. Of the two facilities not investigated during this sampling, one (Facility 306, Golf Course Lake) has been previously investigated and results can be found in Appendix B, *Technical Memorandum: Gray Area Lakes, Fish Tissue Sample Results* (E/A&H, December 1996), and the other (Facility 1278) was still an operational pistol/skeet range and will be investigated after its closure.

Table 1.1
ERNA Gray Areas Facilities

Facility	Facility Description
S-784	Russell Johnson AMS Training Complex
S-394	Mechanical Maintenance Shop
N-105	Quonset Hut — Storage
N-108	Quonset Hut — Maintenance Shop
N-109	Quonset Hut — Maintenance Shop
S-203	Quonset Hut — Storage
N-114 and N-397	Auto Hobby Shop
N-1211	Golf Course Maintenance Shop
Pad Eyes	Former Aircraft Tie-down Area


N-105
N-108
N-109
NSA MID-SOUTH NORTHSIDE
FACILITY N-114/N-394
FACILITY S-203
FACILITY 1211
NSA MID-SOUTH SOUTHSIDE
FACILITY 784
FACILITY 394
PAD EYES
SHOOTING RANGE
SOUTH GATE
PERIMETER ROAD
BIG CREEK DRAINAGE CANAL
PW-4
PW-3
BG-04
BG-02
BG-11
LEGEND
– PRODUCTION WATER WELL
– USGS STRATIGRAPHIC TEST HOLE
1125 0 1125
SCALE FEET
ERNA GRAY AREA REPORT
NSA MID-SOUTH
MILLINGTON, TN
FIGURE 1.1
FACILITY VICINITY MAP
DWG DATE:05/03/99
DWG NAME:0106B011

Sections 2 through 4 of this report describe the regional geology, background conditions, and general sampling and analysis methods used during the Gray Areas Investigation. Section 5 discusses the methods used to calculate risk estimates based on the contaminants detected. Section 6 describes chemical and physical properties that will affect the fate and transport of chemicals of potential concern (COPCs) detected at each facility. Detailed sampling schemes, analytical results, and conclusions/recommendations for each Facility are presented in Section 7. Section 8 discusses ecological risk, Section 9 summarizes conclusions and recommendations for each facility, and Section 10 contains references. Analytical data and other information for each Facility are presented in the appendices of this report.

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2.0 PHYSICAL SETTING

2.1 Regional Geology and Hydrogeology

The general hydrogeology of the Memphis area and a conceptual model of NSA Mid-South hydrogeology are presented in Sections 2.11 and 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) and in the *Hydrogeology and Groundwater Quality at Naval Support Activity Memphis, Millington, Tennessee* (Carmichael and others, 1997). On the basis of this updated information, the regional geology and hydrogeology of NSA Mid-South are summarized in this section.

The stratigraphic units of importance identified during the investigations at NSA Mid-South are, in descending order: the alluvium of Holocene and Pleistocene age, the loess of Pleistocene age, the fluvial deposits of Pleistocene to Pliocene age, and the Cockfield Formation, Cook Mountain Formation, and Memphis Sand of Eocene age. The loess — eolian deposits consisting of silt, silty clay, clay, and minor amounts of sand — is the principal unit at land surface within most of the NSA Mid-South Southside, except for areas near stream valleys where alluvium is present. The following sections discuss the geology and hydrogeology of each stratigraphic unit, except the Memphis Sand.

2.1.1 Alluvium

Alluvium, which is restricted to stream valleys, includes alluviated or reworked loess, which is underlain by sand and gravel, — possibly comprising some residual part of the fluvial deposits. The lateral and vertical extents of the alluvium at NSA Mid-South have not been determined because they are lithologically similar to the loess and fluvial deposits.

The lithology of the upper portion of the alluvium (informally referred to as the "upper alluvium") is similar to the loess and is composed primarily of silt with varying clay content and some fine sand. Near the Big Creek Drainage Canal (Figure 1.1), the upper alluvium is present from ground surface to depths between 22 and 41 feet below land surface (bls). Fine-grained, generally saturated sand lenses are common in the upper alluvium, but are encountered at greater depths than the first water-bearing zone in the loess outside the stream valleys. The lithology of the lower portion of the alluvium (called the "deep alluvium") is similar to the fluvial deposits and is composed of fine to very coarse-grained sand and gravel with varying clay and silt content. The sand coarsens and the gravel content increases with depth in the deep alluvium. Generally, a coarse sand and gravel mixture is present at the base of the alluvium just above the Cockfield Formation contact. Near the Big Creek Drainage Canal, the deep alluvium is between 6 and 34 feet thick.

As previously mentioned, the lateral extent of the alluvium has not been determined at NSA Mid-South. Because of the nature of alluvial deposition and the lithologic similarity of the lower part of the fluvial deposits and deep alluvium, it is reasonable to assume that the lower fluvial deposits and deep alluvium are hydraulically connected laterally. It has not been determined if the water-bearing zones of the loess and upper alluvium are hydraulically connected.

2.1.2 Loess

The loess is typically 0 to 65 feet thick in the Memphis area; at NSA Mid-South it ranges from 15 to 45 feet thick. Water-bearing zones in the loess (if present) are generally in the upper part of the unit; however, water yields are low (less than 1 gallon per minute), and groundwater from the loess does not meet select primary and secondary drinking-water standards (e.g., antimony, cadmium, chromium, iron, thallium, nickel, and turbidity) because suspended silt and clay are typically found in groundwater samples, based on water-quality analyses of samples from background monitoring wells throughout NSA Mid-South, and previous water-use surveys

performed during Northside Underground Storage Tank (UST) investigations. Refer to the *Reference Concentrations Technical Memorandum* (E/A&H, August 1996) for metals concentrations in loess background monitoring wells.

Previous investigations at NSA Mid-South have identified depth to water in the loess between 5 and 15 feet (bls), and vertical hydraulic conductivities of loess samples ranging from 10^{-6} to 10^{-8} centimeters per second (cm/sec). Although the loess may be considered an aquitard on the basis of the relatively low hydraulic conductivities, the shallowest water-bearing zone beneath NSA Mid-South commonly is present within this interval. In some areas of NSA Mid-South, there is no water-bearing zone in the loess; therefore, the zone is not laterally continuous throughout NSA Mid-South and may be considered a "perched zone" where present. Groundwater in the loess, when present, most likely moves primarily downward to recharge the underlying fluvial deposits, although locally, it may discharge to nearby streams, drainage ditches, and other surface-water bodies.

2.1.3 Fluvial Deposits

The fluvial deposits underlie the loess in upland areas and possibly comprise some of the lower parts of the deep alluvium. They consist of sand, gravel, and some clay, with thin layers of ferruginous sandstone and conglomerate, primarily at the base of the unit. This unit ranges from 0 to 100 feet thick in the Memphis area, and from 12 to 59 feet thick at NSA Mid-South. 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 become 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 base of the fluvial deposits.

The fluvial deposits represent the most significant component of the surficial aquifer. Some shallow domestic wells in rural areas of Memphis are completed in the fluvial deposits. Relative groundwater elevations between wells completed in the loess 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. Groundwater flow in the fluvial deposits is generally southwest beneath the NSA Mid-South Southside.

2.1.4 Cockfield Formation

The Cockfield Formation of Eocene age, part of the Jackson-upper Claiborne confining unit, is a heterogeneous formation of very fine silty sand interbedded with clay and silt lenses or clay with interbedded fine sand lenses. It underlies the fluvial deposits and deep alluvium, which are the preferential zones of groundwater flow and the primary route for groundwater contaminant transport beneath NSA Mid-South, based on their higher permeability compared to the overlying loess/upper alluvium and underlying Cockfield Formation.

2.1.5 Cook Mountain Formation

The Cook Mountain Formation of Eocene age, which underlies the Cockfield Formation, consists predominantly of clay and silt; however, minor lenses of silty fine sand may be present locally. The Cook Mountain Formation, which contains the most areally extensive clay in the upper part of the Claiborne Group in Shelby County, serves as the lower confining unit for the Cockfield aquifer and the upper confining unit for the Memphis aquifer, which is the principal source of public drinking water in the Memphis area.

2.2 Site-Specific Geology and Hydrogeology

Because of the objectives of this investigation and the predetermined soil-sampling depths (i.e., surface-soil and subsurface-soil sample depths), no further site-specific lithologic characterization was conducted during the investigation.

3.0 BACKGROUND REFERENCE CONCENTRATIONS

Thirteen background locations were sampled in 1995 and 1996 to assess ambient inorganic concentrations in soil and groundwater at NSA Mid-South. As discussed in Section 2.9 of the *Comprehensive RFI Work Plan* (E/A&H, 1994), 13 soil types are recognized at NSA Mid-South. Eleven are silty loam soils, and two are silty fill material. NSA Mid-South soil was assumed to be homogeneous, and the reference concentrations (RCs) were assumed to represent basewide conditions; however, RCs do not account for different soil types. Background data for soil were established from 18 samples collected from 13 borings shown on Figure 3.1. Background RCs for groundwater from the loess, fluvial deposits, alluvium, and upper part of the Cockfield Formation water-bearing zones were calculated from samples collected from the first and third quarterly groundwater-sampling events. The data from the second event was omitted because of metals concentrations that were elevated relative to the first and third quarters. Omitting the second-quarter data makes the background RC values more conservative.

Background RCs were established for inorganics detected in soil for comparison with samples collected during the Gray Areas investigation. Because of the scope of this investigation, groundwater samples were not submitted for inorganics analysis.

3.1 Inorganics

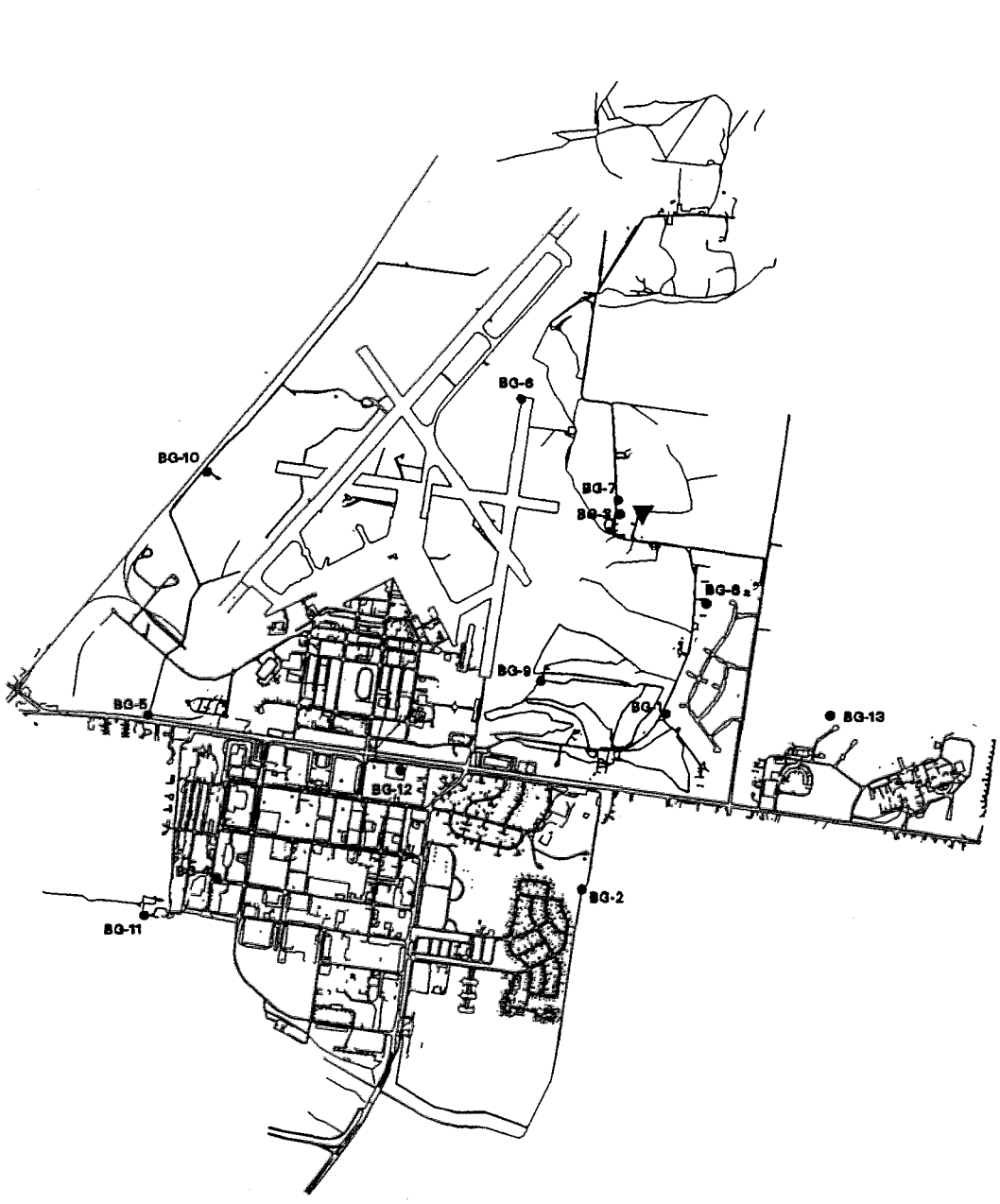
Background RCs were calculated by doubling (2x) the mean concentrations of analytes detected at all background locations, as recommended in *Guidance on Preliminary Risk Evaluation for the Purpose of Reaching a Finding of Suitability to Lease* (U.S. Environmental Protection Agency [USEPA] Region IV memorandum, November 1994). The RCs and methodologies used to calculate them are presented and described in *Reference Concentrations* (E/A&H, August 1996). Data-summary tables for each Facility (Section 7) compare inorganic concentrations to background RCs, Risk-Based Concentrations (RBCs), and soil screening levels (SSLs) for potential transfer of contaminants from soil to groundwater. Industrial and residential RBCs were taken from the

April 1999 Risk-Based Concentration Table (April 12, 1999, USEPA Region III RBC Memo) except for lead, where the soil action level (400 milligrams per kilogram [mg/kg]) was used for comparison because no RBC is available. SSLs were taken from the May 1996 Generic Screening Levels (May 1996, *USEPA/OSWER Soil Screening Guidance: Technical Background Document*, EPA/540/R-95/128).

3.2 Organics

Pesticides have been applied across NSA Mid-South throughout its history. Background samples were also analyzed for chlorinated pesticides to determine average concentrations from routine application for pest control. Background dieldrin sampling and evaluation were conducted as discussed in the technical memorandum *Background Dieldrin Concentrations in Surface Soils* (E/A&H, June 1997). This memorandum stated that dieldrin was ubiquitous at NSA Mid-South as a result of aerial applications during U.S. Department of Agriculture quarantines 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 Mid-South 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." Background samples exhibited dieldrin concentrations ranging from less than quantitation limits to 311 micrograms per kilogram (μg/kg), with a mean of 131 μg/kg. The 1997 technical memorandum established a 2x mean background RC for dieldrin in surface soil of 262 μg/kg at NSA Mid-South.

Dieldrin was detected in some surface samples collected during the Gray Areas investigation; however, most concentrations were less than the 262 μg/kg RC and most likely can be attributed to the applications discussed above.



LEGEND

▼ SOIL BACKGROUND DATA ONLY

BG-2 • BACKGROUND LOCATION 2

0 feet 6000

NOTES:

1. SURFACE SOIL BACKGROUND DATA COLLECTED FROM BACKGROUND LOCATIONS BG-1 THROUGH BG-13.
2. SUBSURFACE SOIL BACKGROUND DATA COLLECTED FROM BACKGROUND LOCATIONS BG-1 THROUGH BG-5.
3. LOESS AND LOWER FLUVIAL DEPOSITS GROUNDWATER DATA COLLECTED FROM BACKGROUND LOCATIONS BG-1, BG-2, BG-4 AND BG-5.
4. UPPER FLUVIAL DEPOSITS GROUNDWATER DATA COLLECTED FROM BACKGROUND LOCATIONS BG-1, BG-2, BG-4, BG-5, BG-8, BG-10, BG-12 AND BG-13.
5. MIDDLE FLUVIAL DEPOSITS GROUNDWATER DATA COLLECTED FROM BACKGROUND LOCATION BG-9.
6. MIDDLE ALLUVIUM GROUNDWATER DATA COLLECTED FROM BACKGROUND LOCATION BG-11.
7. UPPER COCKFIELD GROUNDWATER DATA COLLECTED FROM BACKGROUND LOCATIONS BG-6 AND BG-7.

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FIGURE 3.1
SOIL & GROUNDWATER
BACKGROUND LOCATIONS

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4.0 GENERAL FIELD INVESTIGATION METHODS AND RATIONALE

This section summarizes the general sampling and analytical tasks conducted during the Gray Areas Investigation. Field sampling followed procedures outlined in the USEPA and Tennessee Department of Environment and Conservation (TDEC)-approved *Comprehensive RFI Work Plan* (E/A&H, 1994) and *Verification Sampling Work Plan for Potential New Sites* (EnSafe, November 1997).

The work plan required collecting surface- and subsurface-soil and groundwater samples for chemical analysis by either onsite or offsite laboratories. The descriptions of sample locations and intervals, the rationale for laboratory analyses, and any deviations from the general investigation approach are discussed in detail in the Facility-specific discussions in Section 7. Deviations from the approved work plan were documented in the field logbook and are listed in the site-specific discussions. Table 4.1 summarizes sampling and analytical requirements for the first phase of the Gray Areas Investigation.

4.1 Sampling Rationale

Screening samples were collected to determine whether past activities have impacted surface soil, subsurface soil, or groundwater. Surface- and subsurface-soil samples were collected with a stainless-steel hand auger or direct push technology (DPT) sampling equipment. Groundwater samples were collected with a stainless-steel DPT groundwater sampler. The use of DPT sampling methods for subsurface-soil and groundwater sample collection is a relatively quick and inexpensive alternative to installing groundwater monitoring wells during preliminary investigations. If contamination is not detected in DPT samples, there are no wells left to abandon, and little, if any, investigation-derived waste (IDW) is generated requiring disposal. If a release is confirmed, the screening data will facilitate selection of monitoring-well locations and screen intervals.

Table 4.1
Gray Areas — Sampling and Analysis Summary

Facility	Description	Sampling Locations	Samples Collected	Medium Sampled	Interval Sampled	Laboratory Analyses	Sample Rationale
N-105	Quonset Hut Storage	2	2	Soil	0-1'	Group 1	0-1' (Check for surface releases/PRE*)
			2	Soil	12-15'	Group 2	12-15' (Check for subsurface releases)
N-108	Quonset Hut Maintenance Shop	2	2	Soil	0-1'	Group 1	0-1' (Check for surface releases/PRE)
			2	Soil	12-15'	Group 2	12-15' (Check for subsurface releases)
N-109	Quonset Hut Maintenance Shop	4	4	Soil	0-1'	Group 1	0-1' (Check for surface releases/PRE)
			4	Soil	12-15'	Group 2	12-15' (Check for subsurface releases)
N-114 /N-397	Auto Hobby Shop	2	2	Soil	0-1'	Group 3	0-1' (Check for surface releases/PRE)
			2	Soil	12-15'	VOCs	12-15' (Check for subsurface releases)
S-203	Quonset Hut Storage	3	3	Soil	0-1'	Group 4	0-1' (Check for surface releases/PRE)
			3	Soil	12-15'	VOCs	12-15' (Check for subsurface releases)
S-394	Mechanical Maintenance Shop	3	2	Soil	0-1'	Group 4	0-1' (Check for surface releases/PRE)
			1	Soil	12-15'	VOCs	12-15' (Check for subsurface releases)
S-784	Russell Johnson AMS Training Complex	4	4	Soil	12-15'	Group 5	12-15' (Check for subsurface releases)
N-1211	Golf Course Maintenance Shop	9	4	Soil	0-1'	Group 6	0-1' (Check for surface releases/PRE)
			1	Soil	12-15'	VOCs	12-15' (Check for subsurface releases)
			4	Groundwater, Fluvial		VOCs	Fluvial (Check for subsurface releases)
Pad Eyes	Former Aircraft Tie-down Area	1	1	Soil	12-15'	VOCs	12-15' (Check for subsurface releases)

Notes:

* — Preliminary Risk Evaluation

Group 1 — Appendix IX Metals = USEPA Method 6010/7000 Series; Semivolatile Organic Compounds (SVOCs) = USEPA Method 8270; Total Petroleum Hydrocarbons (TPH) = Tennessee Modified Method 8015 for Gasoline Range Organics and Diesel Range Organics and TPH = USEPA Method 418.1.

Group 2 — Appendix IX Metals; SVOCs; TPH; Volatile Organic Compounds (VOCs) = USEPA Method 5030/8240.

Group 3 — Appendix IX Metals; SVOCs (only on 114X0001); TPH; Ethylene Glycol = USEPA Modified Method 8014 (only on 114X0001).

Group 4 — Appendix IX Metals; TPH.

Group 5 — TPH; Diesel; Gasoline

Group 6 — Appendix IX Metals; SVOCs; TPH; Chlorinated pesticides/PCBs = USEPA Method 8080; Chlorinated herbicides = USEPA Method 8150.

All screening samples collected during the investigation were analyzed for volatile organic compounds (VOCs) because petroleum-related compounds are suspected at the facilities, and because chlorinated solvents and petroleum constituents have been the most common groundwater contaminants at other NSA Mid-South sites. VOC analyses should indicate the presence of either contaminant type in site soil or groundwater.

The chemical data obtained from the surface-soil samples were used to inspect for surface spills and to prepare preliminary risk evaluations (PREs) for each Facility. The specific methods and requirements for the referenced analyses are discussed in Section 4.2.

Subsurface-soil sampling intervals were 12to15 feet below land surface (bls) with the Geoprobe. The sampling depths correspond to the approximate depth of the particular former underground tanks or the water table. The lower-interval samples were collected to determine the vertical migration of contaminants released below the tanks or hazardous waste accumulation points.

Geoprobe soil samples were collected from the loess the approximate depth of the potential saturated zone (12 to15 feet bls). Groundwater screening samples were collected from the fluvial deposits, upper alluvium, and deep alluvium, which are the shallowest true aquifers and the most likely groundwater contaminant migration pathways beneath NSA Mid-South.

4.2 Analytical Requirements

Soil samples were collected for screening various analytical groups (Table 4.1), while groundwater samples were collected for VOC screening only. During the investigation, VOC screening samples were analyzed by an offsite laboratory, Savannah Analytical Laboratory of Savannah, Georgia. All the VOC screening-sample analyses were performed using Level III-equivalent Data Quality Objectives (DQOs), with duplicated samples using Level IV-equivalent DQOs.

The analysis list consisted of the following methods:

- VOCs, USEPA Method 5030/8240
- Semivolatile Organic Compounds (SVOCs), USEPA Method 8270
- Total Petroleum Hydrocarbons (TPH), USEPA Method 418.1
- TPH-Gasoline Range Organics (GRO), Tennessee (TN) Modified 8015/GRO
- TPH-Diesel Range Organics (DRO), TN Modified 8015/DRO
- Chlorinated pesticides/PCBs, USEPA Method 8080
- Chlorinated herbicides, USEPA Method 8150
- RCRA Part 264, Appendix IX Total Metals, USEPA Method 6010/7000 series
- Ethylene Glycol, USEPA Modified Method 8014

4.3 Sample Management

Sample management procedures during the investigation adhered to Sections 4.12 and 5 of the *Comprehensive RFI Work Plan* (E/A&H, 1994).

4.4 Sample Custody

Sample custody during the investigation adhered to Section 4.12.5 of the *Comprehensive RFI Work Plan* (E/A&H, 1994).

4.5 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures followed during the investigation adhered to Section 4.14 of the *Comprehensive RFI Work Plan* (E/A&H, 1994).

4.6 Decontamination Procedures

Decontamination procedures during the investigation adhered to Section 4.11 of the *Comprehensive RFI Work Plan* (E/A&H, 1994).

4.7 Investigation-Derived Waste

IDW was handled as specified in Section 4.13 of the *Comprehensive RFI Work Plan* (E/A&H, 1994) and the *NSA Memphis IDW Management Plan* (E/A&H, October 1995).

4.8 Sample Labeling

All samples were labeled as specified in Section 4.12.4 of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Sample labels showed a 10-digit alphanumeric code identifying the site, sample type, sample location, sample depth, and QA sample type (as appropriate).

The labeling format was as follows:

ABC-D-EFGH-IJ

- **Site Location (ABC)** The three-character code ABC identifies the site location as follows: 105-Facility N-105, 108-Facility N-108, 109-Facility N-109, 114-Facility N-114, etc.

- **Matrix/QC Code (D)** This character code identifies the sample matrix using the following letters:

Matrix Codes		QC Codes	
S	Soil (surface, borings, and trenches)	T	Trip blank
C	Soil duplicate sample	E	Equipment rinsate blank
M	Sediment (settled, fluid-borne solid)	D	Deionized (DI) system blank
N	Sediment duplicate sample	P	Potable water blank
G	Groundwater	F	Field blank
H	Groundwater duplicate sample	L	Filter blank
W	Surface water	B	USEPA blind spike sample

Matrix Codes		QC Codes	
R	Surface water duplicate sample	2	Cement blank
U	Sludge	3	Drilling mud
Y	Sludge duplicate sample	4	Grout blank
Z	Liquid waste (including IDW drums)	5	Bentonite blank
V	Solid waste (including IDW drums)	6	Sand blank

An "X" is used at the matrix code in this report for all references to sample location, including results tables, text, and maps.

- **Sample Location Identifier (EFGH)** This four-character code identifies the sample location within a specific Solid Waste Management Unit (SWMU), identified by the first three digits of the 10-digit labeling system. For example:

  0001: Indicates sample number 01.

- **Depth, Interval, Serial Number (IJ)** This two-character code identifies a sampling location according to vertical depth, sample interval, or sample serial number. The recorded sample depth is the deepest point of the sample interval; for example, a sample collected from 12 to 15 feet bls would be designated as 15.

  Example: 114S000115 = NSA Mid-South Facility N-114 soil sample from location number 01 at a depth of 15 feet (12 to 15-foot interval).

5.0 PRELIMINARY RISK EVALUATION

PREs are generally used to determine suitability for lease of a property, although these properties will not be transferred. Instead, PREs were conducted for each facility to determine if any human-health risk exists as a result of contaminants released at the site. Risk was estimated using surface-soil samples collected at each facility.

In accordance with Supplemental Guidance to Risk Assessment Guidance for Superfund (RAGS) *Bulletin 1, Data Collection and Evaluation* (USEPA, November 1995), COPCs were identified by comparing the maximum concentration of each detected chemical with its corresponding RBC value (April 12, 1999, Risk-Based Concentration Table, USEPA Region III). Inorganics were also compared to background RCs. If the maximum detected concentration was greater than both the RC and the corresponding RBC, the chemical was retained as a COPC. This methodology was employed to focus the PRE on source contaminants that may pose a human-health risk, while eliminating those that are naturally occurring (i.e., do not exceed the RC) or pose relatively low risk because of concentrations less than RBCs. The RBCs are based on a target ILCR of 1E-06 and a target hazard quotient (HQ) of 1.0. Noncarcinogenic-based RBCs were adjusted from a target HQ of 1.0 to 0.1 in accordance with the previously cited USEPA Region IV Supplemental Guidance to RAGS, Bulletin 1. The cumulative ILCR threshold is 1E-04 and the cumulative hazard threshold is 1.0, in accordance with the previously cited November 1994 USEPA Region IV Memorandum.

Risk-based screening, as opposed to calculating risk and hazard for each chemical present in site samples, should not affect PRE conclusions. Carcinogens eliminated based on the target ILCR of 1E-06 would not be expected to contribute significantly to cumulative ILCR because the cumulative threshold is 1E-04. Likewise, noncarcinogens would not be expected to significantly contribute to the hazard index (HI) because the target HQ of 0.1 is less than the cumulative threshold of 1.0. In effect, this method provides insight into which contaminants pose the most

significant threats to human receptors, helps to identify hot spots, and eliminates those chemicals that are naturally occurring, are not source contaminants, or would not significantly affect the conclusions of the PRE. Risk was estimated for each COPC using the ratio between the maximum reported concentration and the corresponding RBC. A risk ratio is calculated for each contaminant by one of the following equations:

Carcinogenic Risk Ratio:

$$RR = \frac{\text{media concentration} * TR}{\text{screening value}}$$

Noncarcinogenic Risk Ratio:

$$RR = \frac{\text{media concentration} * THQ}{\text{screening value}}$$

where:

RR	=	risk ratio
Media Concentration	=	maximum concentration of a site chemical
Screening Value	=	RBC value for that particular chemical
TR	=	target risk used to calculate RBCs for carcinogens (1E-6)
THQ	=	target hazard quotient used to calculate RBCs for noncarcinogens (0.1)

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

A residential scenario includes exposure during childhood and adulthood, and it assumes exposure for 350 days per year for at least 30 total years. The future site-resident scenario assumed dwellings would be constructed onsite. Site workers are assumed to contact the affected area for

eight hours each day, 250 days per year for 25 years. Current site workers' exposure would be less than that assumed for the hypothetical future site-worker scenario because their contact with soil is limited and shallow groundwater is not currently used onsite as drinking or process water. Construction or maintenance-worker exposure would be considered less than the hypothetical future-worker exposure assumed in this PRE because construction or maintenance workers would be exposed less frequently and for shorter durations. Consequently, future-worker assessment is considered protective of both current site use and future construction/maintenance events. As previously mentioned, an ILCR greater than 1E-04 (the USEPA cumulative upper-bound acceptable risk threshold) or an HI greater than 1 (the USEPA cumulative HI threshold) indicates the site may require additional investigation for the corresponding land-use scenario (USEPA Region IV Memorandum, November 1994). In accordance with the USEPA Region IV memorandum, the property is considered suitable to lease for the specified land-use scenario if neither threshold is exceeded.

Uncertainty

The PRE for each SWMU is based on the maximum reported concentrations of each COPC and a future residential and industrial scenario. The conservative approach includes these uncertainty assumptions:

- Exposure to maximum reported concentrations will be uniform, regardless of sample location, which theoretically creates a hot spot. The PRE was based on a minimum number of samples. Use of the maximum concentration potentially overestimates exposure, especially if the maximum detected concentration was in a hot spot. Likewise, exposure could be underestimated if a hot spot were missed during sampling.

- While the site will not be used for residential purposes, the residential scenario was incorporated into the PRE to conservatively represent potential risk or hazard.

- Cumulative effects will occur, regardless of target organs and mechanisms of action, which could either overestimated or underestimated risk.

- Shallow (loess and fluvial deposits) groundwater will be used for potable purposes. This is not likely, as the current potable water-supply sources are the much deeper Memphis and Fort Pillow aquifers.

- At each facility, only duplicate surface-soil samples were analyzed offsite with Level IV DQO or equivalent, which provides the most complete data package. Some data variability is inherent in Level III DQO or equivalent used to analyze the remaining soil or groundwater samples.

6.0 FATE AND TRANSPORT

This section provides guidance for evaluating the transport, transformation, and fate of contaminants in the environment. Specifically, fate and transport assessment seeks to evaluate a contaminant's ability to become mobile or change in the environment. To accomplish this, the chemical and physical properties that govern the interaction of contaminants in environmental media must be understood. Site characteristics such as, topography, geology, and hydrogeology combined with characteristics of site soil, sediment, and water, as well as the chemical and physical properties of the contaminants, play roles in evaluating the fate and transport process. In order to streamline the discussion, this section focuses on understanding the properties that affect fate and transport. Site- and contaminant-specific discussions for each facility are included in Section 7. Fate and transport evaluations will be predetermined for contaminants defined as COPCs in a PRE, any organic contaminant that exceeds its SSL (soil-to-groundwater), and any inorganic contaminant that exceeds both its SSL (soil-to-groundwater) and RC. Also, contaminants will be evaluated if they exceed the SSL for soil-to-air transport or if they are found in more than one medium (e.g., a contaminant is found in both soil and groundwater).

Evaluation of Gray Areas Facilities with regard to the above characteristics identified three *potential* routes of contaminant migration:

- Air emissions from VOCs released from surface soil.
- Leaching of contaminants from soil to groundwater.
- Surface-soil erosion and transport of contaminants sorbed to sediment.

6.1 Properties Affecting Fate and Transport

The persistence, transport, and fate of contaminants in the environment depend on individual chemical and physical properties as well as properties of the media in which the contaminants

reside. These properties are discussed briefly below, describing the significance of each to volatilization, sorption, diffusion, dispersion, biodegradation, and other attenuation processes.

6.1.1 Chemical and Physical Properties

Chemical and physical properties relevant to the fate and transport of organic contaminants include water solubility, vapor pressure, Henry's law constant, specific gravity, organic carbon partition coefficient, distribution coefficient, and half-life. Water solubility and adsorption coefficients are properties of interest for inorganic contaminants. After the properties are introduced, the impact on each relevant class of compounds is discussed. Table 6.1 provides an overview of chemical behavior based on these properties.

Water Solubility

The solubility of a chemical in water is the maximum amount that will dissolve in pure water at a specified temperature. Chemicals with high solubility are relatively mobile in water and are likely to leach from wastes and soils. These chemicals tend to have low volatilization potential, but tend to be biodegradable. Conversely, chemicals with low solubility tend to adsorb onto soil and sediment, are not readily biodegraded, and have a greater tendency to volatilize.

Vapor Pressure

Vapor pressure measures the tendency of a substance to pass from a solid or liquid to a vapor state. It is measured as the pressure of the gas in equilibrium with the liquid or solid at a given temperature. The vapor pressure determines volatilization of a given chemical from dry soil into the atmosphere. From surface water and moist soil, volatilization depends upon vapor pressure and the Henry's law constant (discussed below). A compound with a vapor pressure less than 10^{-6} millimeters of mercury (mm Hg) tends to associate with particulate matter; a compound with a higher vapor pressure tends to associate with the vapor phase. Highly water-soluble compounds

generally show little volatilization from water or moist soils unless they also have a high vapor pressure.

Table 6.1
Chemical and Physical Properties

Chemical Property	Critical Value[a]	A chemical with a higher value may....	A chemical with a lower value may....
Vapor Pressure	10^{-6} mmHg	be more volatile.	be less volatile.
Density[b]	water: 1.0 g/cm^3 air: 1.20 kg/m^3	sink in water or fall in the atmosphere.	float on water or rise in the atmosphere.
Solubility	0 to 100 mg/L	leach from soil, be more mobile in water, and may not readily volatilize from water.	adsorb to soil, be immobile in water and may volatilizes from water.
Henry's Law Constant	10^{-3} to 10^{-5} atm-m^3/mole	volatilize easily from water.	not volatilize easily from water.
Half-Life	biologically dependent	not degrade readily.	degrade readily.
Organic Carbon Partition Coefficient	10 to 10^5 ml/g	be more apt to remain in soil.	be more mobile and diffuse easily in water.

Notes:
[a] — Critical values are based on literature review and professional judgment.
[b] — Approximate density of air at standard temperature and pressure.
g/cm^3 — grams per cubic centimeter
kg/m^3 — kilograms per cubic meter
atm-m^3/mole — atmosphere-cubic meter per mole
ml/g — milliliters per gram

Henry's Law Constant

The Henry's law constant describes a linear relation between vapor pressure and water solubility, which measures the ability of a chemical to move from water or moist soil to air. Compounds with Henry's law constants greater than 10^{-3} atmospheres-cubic meter per mole (atm-m^3/mole) can be expected to readily volatilize from water. Compounds with values between 10^{-3} and 10^{-5} atm-m^3/mole exhibit moderate volatilization. Compounds with values less than 10^{-5} atm-m^3/mole show limited ability to volatilize from water or moist soil.

Specific Gravity

Specific gravity (SG) is the ratio of the weight of a given volume of a substance to the weight of the same volume of water. The water weight is usually measured at 4°C; the other substance is often measured at some other temperature, typically 20°C. If the SG of a substance is less than 1.0, that substance will float on water; if the SG is greater than 1.0, the substance will sink. The SG can sometimes be used to predict the vertical distribution of the immiscible or insoluble portion of a chemical within an aquifer or other body of water.

Organic Carbon Partition Coefficient

The organic carbon partition coefficient (K_{oc}) measures the degree to which a substance will preferentially adsorb to organic carbon. The typical range of K_{oc} values is from 1 to 10^5 milliliters per gram (ml/g), with higher values indicating a greater tendency to remain sorbed. Chemicals moving through the subsurface will alternately adsorb to or desorb from available organic matter in the soil matrix. The higher the K_{oc} values, the greater the tendency of a chemical to be attracted to the organic fraction of the soil and the lower its mobility in the subsurface environment.

Half-Life

A half-life is the time required for a substance to decrease from its initial concentration to one-half that level. The apparent decrease may be caused by various processes including biodegradation, reactions with other substances, or mass removal from the media in question.

Chemical Behaviors

VOCs can be expected to be mobile in the environment based on their physical and chemical properties. They have the potential to volatilize to the atmosphere and leach to groundwater; when sorbed to sediment, they can erode to surface water and move with groundwater flow. Relative to other categories of compounds, VOCs have low molecular weights and high water solubilities, vapor pressures, and Henry's law constants, along with corresponding low K_{oc} values. These

properties all enhance the mobility and degradability of VOCs. Relative to chemicals in other categories, many VOCs tend to have relatively short half-lives in groundwater and surface water. VOCs have a limited tendency to adsorb to solids and can be expected to be moderately to highly mobile in the environment. Especially in near-surface soil, VOCs can migrate via diffusion through soil-air pore spaces to the ground surface, where they can volatilize from the soil and be transported by wind.

SVOCs generally have higher molecular weights and lower solubilities, vapor pressures, and Henry's law constants than VOCs. Because of their higher K_{oc}, SVOCs tend to sorb to solids and are relatively immobile in the environment. Transport of SVOCs is more likely to occur in the solid phase than in the dissolved phase. These SVOC characteristics lead to a likelihood of greater persistence but lower mobility than VOCs in the environment.

Pesticides/PCBs have moderate molecular weights, generally high densities, high K_{oc} values and generally low solubilities, vapor pressures, and Henry's law constants. Typical fate and transport characteristics of pesticides/PCBs include a tendency to sorb to soil particles. They are hydrophobic (avoid water), immobile in the environment, and tend to degrade relatively slowly. Overall, pesticides/PCBs are anticipated to be immobile and persistent in the environment, not readily diffusing into groundwater.

Herbicides can leach from soil particles to groundwater and tend to be mobile in both media. They tend to degrade relatively slowly. The chemical property with the greatest influence on the fate and transport of herbicides is solubility. Herbicides have low Henry's law constants and vapor pressures and moderate molecular weights, K_{oc}, and solubilities. Overall, herbicides are expected to be moderately mobile in groundwater with some retention in soil.

Inorganic compounds do not degrade in the environment, but they may change chemical form or speciation. They are generally considered to be indefinitely persistent. Inorganic metals may interact with soil or other solids by ion exchange, adsorption, precipitation, or complexation and they can act as catalysts in biodegradation processes. These processes are affected by pH, composition of leachate or groundwater oxidation-reduction (redox) condition, and the type and amount of organic matter, minerals, clay, and hydrous oxides in the soil. In general, the solubility of metals in potable groundwater is low, which limits their mobility in the environment. However, groundwater with elevated concentrations of chloride, bicarbonate, sulfate, or phosphate can enhance the solubility and mobility of metals by forming aqueous complexes.

6.1.2 Media Properties

The properties of environmental media used to evaluate fate and transport are total organic carbon, soil sorptive capacity, cation exchange capacity (CEC), redox conditions, pH, and hydrogeology.

Total Organic Carbon

The abiotic process of sorption (accumulation of the contaminant on the surface of a solid) will slow the movement of the contaminant as it accumulates on the subsurface medium. For organic contaminants and subsurface materials with organic carbon, hydrophobic chemicals are commonly sorbed into the soil organic carbon content. As the organic carbon content of the subsurface material increases, the total capacity of the soil to sorb the contaminant increases. In fate and transport calculations, organic carbon is typically expressed as a percent of the total solid and/or liquid volume (f_{oc}).

Distribution Coefficient

The distribution coefficient (K_d) is a valid representation of the partitioning between liquid and solids, or the ratio of contaminant mass in soil to contaminant mass dissolved in groundwater. K_d is used to model contaminant movement through the subsurface. The larger the K_d value, the

greater the sorption to the solid phase. The simplest method for acquiring a K_d value for a specific contaminant is to obtain it from a K_{oc} value listed in literature sources. K_{oc} is analogous to K_d, except that the adsorbing material is considered to be the organic carbon (oc) in the soil as opposed to the entire soil matrix for K_d. By normalizing K_d on the basis of the oc content of the soil, a great deal of variation in K_d values for different soils can be eliminated; thus, K_d can be estimated from the K_{oc} of the chemical and the f_{oc} in the soil, e.g., $K_d = K_{oc} \, x \, f_{oc}$.

Cation Exchange Capacity

CEC reflects the capacity of a soil to adsorb ions by neutralizing an ionic deficiency on its surface. Certain compounds can either gain or lose a proton as a function of pH and thus transform from a neutral to an ionic form. For organic compounds, this ionization will greatly increase the solubility of the chemical in groundwater. The gain of a proton will yield a positive ion. In this case, the ionic compound may associate to a greater degree with the CEC of the clay minerals. The overall impact on sorption (mobility) will depend on the relative sorption of the neutral and ionic forms of the compound.

Redox Conditions

Redox refers to the transfer of electrons and species change of ions or compounds. Redox is the process that includes oxidation (the loss of electrons) and reduction (the gain of electrons). As an example, consider iron in groundwater. Groundwater that reaches the surface in a highly reduced state is exposed to the atmosphere (oxygen), which oxidizes the iron. Iron oxidation is a reverse process that causes the iron to transform from its soluble to insoluble form.

pH

pH is a logarithmic measure of hydrogen ions in soil and groundwater, indicating the acidity or basicity of a medium. Chemicals react significantly differently under different pHs. Low pH

conditions tend to mobilize chemicals, especially inorganics, while high pH conditions may form immobile metal hydroxides.

Hydrogeology

The physical properties of soil (mineralogical composition, particle size distribution, etc.) dictate how a contaminant is transported in the subsurface. Some of the properties are porosity, hydraulic gradient, hydraulic conductivity, unsaturated flow, and saturated flow.

Porosity is defined as the ratio of openings (voids) to the total volume of soil or rock. Typically, fine-grained materials tend to be better sorted and thus tend to have the largest porosities. Porosity indicates the maximum amount of water that a rock or soil can contain when it is saturated.

The direction of slope of the groundwater table or potentiometric surface indicates the direction of groundwater movement. All other factors being constant, the rate of groundwater movement depends on the hydraulic gradient, which is the change in head per unit distance in a given direction. The hydraulic gradient is important in the transport of contaminants because it may indicate the velocity and direction at which a contaminant may migrate in groundwater.

The factors controlling groundwater movement are largely dictated by the hydraulic conductivity of the aquifer media. Hydraulic conductivity depends on the size and arrangement of pores and on the dynamic characteristics of groundwater, such as viscosity and density. Hydraulic conductivity refers to the water-transmitting characteristics of soil and varies in different types of soil. If the hydraulic conductivity is essentially the same in any area of soil, the soil is said to be homogeneous, otherwise it is heterogeneous. Hydraulic conductivity tends to be greater in sand and reduced in material containing clay.

Most aquifer recharge occurs when water percolates through the unsaturated zone. Movement of water in the unsaturated zone is controlled by both gravitational and capillary forces. Capillarity is produced by two forces: the mutual attraction (cohesion) between water molecules and the molecular attraction (adhesion) between water and different solid materials. These two forces pull water upward into a capillary fringe above the water table. Flow in the unsaturated zone is important because contaminants released at the surface that percolate through the unsaturated zone may remain because of capillarity, or contaminants may arrive in the unsaturated zone because of a fluctuating water table.

In the saturated zone, all interconnected openings are full of water and the groundwater moves through these openings in the direction controlled by the hydraulic gradient. Movement in this zone may be either laminar or turbulent. In laminar flow, water particles move in an orderly manner along streamlines. In turbulent flow, water particles move in a disordered, highly irregular manner, which results in a complete mixing of the particles. Dispersion is an important transport process for contaminants in the saturated zone whereby solutes are mixed with uncontaminated water, diluted, and transported in a heterogeneous aquifer. Diffusion, the process by which solutes are transported from a region of high concentration to a region of low concentration, is also important. In very fine sediments, diffusive transport may be the dominant process, but contaminant movement is typically advective. Advective flow is the process by which dissolved substances migrate with flowing groundwater.

6.2 Fate and Transport Approach for Gray Areas

The fate and transport discussion for each facility begins by describing site characteristics that can promote or inhibit the of contaminant migration. As presented in Section 6.0, three potential routes of migration may exist. Each facility was evaluated for site conditions that affect these migration pathways.

The ability of an individual contaminant to migrate was evaluated based on the three cross-media transfer mechanisms — soil to groundwater, surface-soil to air, and surface-soil to sediment (erosion and transport of contaminants sorbed to sediments) — as described below in Sections 6.2.1 through 6.2.4. The chemical and physical properties of the contaminant were evaluated, where necessary, in support of each transfer mechanism. Table 6.2 presents the chemical and physical properties used to evaluate fate and transport for *all* contaminants detected at Gray Areas Facilities.

6.2.1 Soil-to-Groundwater Cross-Media Transport

To evaluate the potential for soil-to-groundwater migration of contaminants, a phased screening approach was used to focus on chemicals with the greatest potential for impacting the water-bearing zones. The screening process is summarized as follows:

- Qualitative — Analytical data for soil and groundwater were compared to determine which chemicals were present in both media.

- Quantitative — Soil results were compared to the leachability-based soil-to-groundwater SSLs as presented in *Soil Screening Guidance: Technical Background Document* (USEPA, May 1996). An organic contaminant was considered a threat to an underlying water-bearing zone if the maximum detected concentration exceeded its SSL. An inorganic contaminant was considered a threat to an underlying water-bearing zone if the maximum detected concentration exceeded its SSL ***and*** its background RC.

Table 6.2
Fate and Transport Properties for
Contaminants Detected in Soil and Groundwater
NSA Mid-South, Gray Area Facilities

Parameter	Group	MW[a] (g/mole)	Density[a] (g/cm^3)	Vapor Pressure[a,b] (mm Hg)	Solubility[a,b] (mg/L)	Henry's Law Constant[b,c] (atm-m^3/mole)	Koc[b,c] (ml/g)	SSL soil-to-gw[d] (μg/kg)	SSL soil-to-air[d] (μg/kg)
Acenaphthene	SVOC	154.21	1.02e+00	1.60e-03	3.50e+00	1.70e-04	1.78e+01	29,000	120,000
Acetone	VOC	58.08	7.90e-01	2.70e+02	1.00e+06	3.97e-05	3.70e-01	800	62,000,000
Anthracene	SVOC	178.24	1.30e+00	2.00e-04	4.50e-02	6.50e-05	1.86e+04	590,000	6,800
Benzo(a)anthracene	SVOC	228.30	1.27e+00	5.00e-09	1.20e-02	2.30e-06	1.38e+06	80	27 ,000
Benzo(a)pyrene	SVOC	252.32	1.40e+00	5.60e-09	3.90e-03	2.40e-06	1.77e+06	400	11 ,000
Benzo(b)fluoranthene	SVOC	252.30	NDA	5.00e-07	1.40e-02	1.20e-05	5.50e+05	200	23 ,000
Benzo(g,h,i)perylene	SVOC	276.34	NDA	1.00e-10	2.60e-04	1.40e-07	7.76e+06	210,000	NDA
Benzo(k)fluoranthene	SVOC	252.30	NDA	9.59e-11	5.50e-04	1.04e-03	4.37e+06	2,000	0
2-Butanone (MEK)	VOC	72.11	8.10e-01	7.80e+01	2.70e+05	4.66e-05	1.23e+00	NDA	NDA
Carbazole	SVOC	167.20	1.10e+00	4.00e+02	3.80e-03	NDA	NDA	30	11,000
Chrysene	SVOC	228.30	1.27e+00	6.30e-09	1.80e-03	7.26e-20	2.45e+05	8,000	3,600
2,4,5-TP (Silvex)	HERB	269.51	NDA	5.20e-06	1.40e+02	1.31e-07	2.57e+03	NDA	NDA
4,4'-DDT	PEST	354.49	1.60e+00	1.90e-07	5.00e-03	4.89e-05	3.87e+05	2,000	80,000
Dibenz(a,h)anthracene	SVOC	278.36	1.28e+00	1.00e-10	5.00e-03	7.33e-09	1.66e+06	80	7,200
Dieldrin	PEST	380.93	1.80e+00	1.80e-07	2.00e-01	2.00e-05	1.34e+04	0.2	2,000
Di-n-butylphthalate	SVOC	278.35	1.00e+00	1.00e-05	1.30e+01	6.30e-05	1.38e+03	NDA	100,000
Endosulfan I	PEST	406.92	1.70e+00	1.00e-05	5.30e-01	1.01e-04	2.04e+03	900	1,000
Endrin Aldehyde	PEST	380.92	NDA	2.00e-07	2.60e-01	3.86e-07	2.69e+04	50	NDA
bis(2-Ethylhexyl)phthalate (BEHP)	SVOC	340.57	9.90e-01	2.00e-07	3.00e-01	1.10e-05	1.00e+05	180,000	210,000

Table 6.2
Fate and Transport Properties for
Contaminants Detected in Soil and Groundwater
NSA Mid-South, Gray Area Facilities

Parameter	Group	MW[a] (g/mole)	Density[a] (g/cm^3)	Vapor Pressure[a,b] (mm Hg)	Solubility[a,b] (mg/L)	Henry's Law Constant[b,c] (atm-m^3/mole)	Koc[b,c] (ml/g)	SSL soil-to-gw[d] (μg/kg)	SSL soil-to-air[d] (μg/kg)
Fluoranthene	SVOC	202.26	1.30e+00	5.00e-06	2.40e-01	1.69e-02	4.17e+04	210,000	68,000
Fluorene	SVOC	166.22	1.20e+00	7.00e-03	1.70e+00	2.10e-04	5.01e+03	28,000	89,000
Indeno(123-cd)pyrene	SVOC	276.34	6.20e-02	1.00e-10	6.20e-02	2.96e-20	3.09e+07	700	280,000
Naphthalene	SVOC	128.18	1.10e+00	5.40e-02	3.00e+01	4.60e-04	7.92e+02	4,000	180,000
Phenanthrene	SVOC	178.24	1.20e+00	6.80e-04	1.00e+00	3.90e-05	2.29e+04	210,000	NDA
Pyrene	SVOC	202.26	1.30e+00	2.50e-06	1.40e-01	1.09e-05	6.46e+04	210,000	56,000
TPH	SVOC	NDA	NDA	NDA	NDA	NDA	NDA	NDA	NDA
Toluene	VOC	92.13	8.70e-01	2.20e+01	5.20e+02	6.70e-03	1.29e+02	600	520,000
Antimony	INOR	121.80		NDA	NDA	NDA	NDA	300	NDA
Arsenic	INOR	74.90	5.70e+00	NDA	insoluble	NDA	NDA	1,000	380,000
Barium	INOR	137.33	3.60e+00	NDA	NDA	NDA	NDA	82,000	350,000,000
Beryllium	INOR	9.01	1.85e+00	NDA	insoluble	NDA	NDA	3,000	690,000
Cadmium	INOR	112.40	8.64e+00	NDA	NDA	NDA	NDA	400	920,000
Chromium	INOR	52.00	7.14e+00	NDA	NDA	NDA	NDA	2,000	NDA
Cobalt	INOR	58.93	8.92e+00	NDA	NDA	NDA	NDA	NDA	NDA
Copper	INOR	63.55	8.94e+00	NDA	insoluble	NDA	NDA	NDA	NDA
Lead	INOR	207.20	1.13e+01	NDA	insoluble	NDA	NDA	NDA	NDA
Mercury	INOR	200.60	1.35e+01	NDA	insoluble	NDA	NDA	NDA	7,000
Nickel	INOR	58.71	8.90e+00	NDA	insoluble	NDA	NDA	NDA	6,900,000

Table 6.2
Fate and Transport Properties for
Contaminants Detected in Soil and Groundwater
NSA Mid-South, Gray Area Facilities

Parameter	Group	MW[a] (g/mole)	Density[a] (g/cm^3)	Vapor Pressure[a,b] (mm Hg)	Solubility[a,b] (mg/L)	Henry's Law Constant[b,c] (atm-m^3/mole)	Koc[b,c] (ml/g)	SSL soil-to-gw[d] (μg/kg)	SSL soil-to-air[d] (μg/kg)
Selenium	INOR	78.96	4.46e+00	NDA	NDA	NDA	NDA	300	NDA
Silver	INOR	107.90	1.05e+01	NDA	NDA	NDA	NDA	2,000	NDA
Tin	INOR	118.69	7.31e+00	NDA	NDA	NDA	NDA	NDA	NDA
Vanadium	INOR	50.94	6.11e+00	NDA	insoluble	NDA	NDA	300,000	NDA
Zinc	INOR	65.38	7.14e+00	NDA	NDA	NDA	NDA	620,000	NDA

Notes:

[a] — Merck & Co., *The Merck Index*, Merck & Co., Rahway, NJ, 1983.
— Lide, *CRC Handbook of Chemistry and Physics*, CRC Press, Boca Raton, Florida, 1994.
USEPA, *Treatability Database*, USEPA Risk Reduction Engineering Laboratory, Cincinnati, Ohio, 1992.
Resource Consultants, *Chemtox Release K*, 1985-1995.
[b] — Howard, *Fate and Exposure Data*, Lewis Publishers, Chelsea, Michigan, 1993.
[c] — Knox, Sabatini, Canter, *Subsurface Transport and Fate Processes*, Lewis Publishers, Chelsea, Michigan, 1993.
[d] — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128). Soil-to-air soil screening levels are from USEPA, *Risk-Based Concentration Table*, USEPA Region III, 1996.

atm-m^3/mole — atmosphere-cubic meter per mole
g/mole — grams per mole
g/cm^3 — gram per cubic centimeter
K_{oc} — organic carbon partition coefficient
ml/g — milliliters per gram
mmHg — millimeters of mercury
NDA — No Data Available
INSOL — Compound practically insoluble in water
VOC — Volatile organic compound
SVOC — Semivolatile organic compound
PEST — Pesticide
HERB — Herbicide
INOR — Inorganic
mg/L — milligrams per liter
mg/kg — milligrams per kilogram
MW — molecular weight
μg/kg — micrograms per kilogram
TPH — Total Petroleum Hydrocarbons

Because of the nature and age of most Gray Area operations, it was assumed that any impacts from compounds that could migrate from soil would be currently manifested in either the loess or fluvial deposits groundwater. The qualitative comparison was used to identify chemicals with reported concentrations in both media.

6.2.2 Soil-to-Air Cross-Media Transport

To evaluate the potential for soil-to-air migration of contaminants, a screening approach was used to focus on contaminants with the greatest potential to volatilize into ambient air in sufficient quantities to create a human-health threat. The screening process is summarized as follows:

- Quantitative — The maximum VOC concentrations detected in surface soil at each facility were compared to soil-to-air screening levels as presented in the USEPA Region III April 12, 1999 RBC Table.

No qualitative screening was performed because ambient air sampling was not part of the field sampling procedure at any of the Gray Area Facilities.

If soil concentrations did not exceed soil-to-air volatilization screening levels, it was assumed that no significant migration potential exists and that current surface-soil conditions are protective of human health relative to potential inhalation exposure pathways. Other factors included type of cover (vegetation, asphalt, etc.); physical properties of the surface soil that might limit or enhance mobility of contaminants; and physical/chemical properties of the class of contaminants (e.g., VOCs are more likely than SVOCs to volatilize from soil to air).

6.2.3 Surface Soil-to-Sediment Cross-Media Transport

To evaluate the potential for sorbed contaminants in near-surface soil to migrate by soil erosional processes, contaminants were identified that exhibited characteristics that would render them

mobile with sediment under erosional processes such as surface-water drainage and wind erosion. The most influential process by which sediments are formed involves erosion of surface soil containing no vegetation, which eventually collects in depositional areas. Therefore, topography at each facility is also used as a screening process in evaluating this transport mechanism as a migration pathway.

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7.0 SAMPLING INVESTIGATIONS

This section details the following aspects of each Gray Areas Facility investigated in December 1997 and January 1998:

- Available background information
- Sampling activities and analytical results
- Site-specific PRE
- Site-specific fate and transport
- Site-specific conclusions and recommendations

Analytical results for all screening samples are provided in Appendix A.

7.1 Facility N-105 — Quonset Hut (Storage)

This 4,000-square-foot steel-frame Quonset hut, with metal siding and concrete floors, was built in 1949. It is currently used to store office furniture and supplies. Figure 1.1 shows the location of Facility N-105.

Facility N-105 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site-specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.1.1 Previous Activities

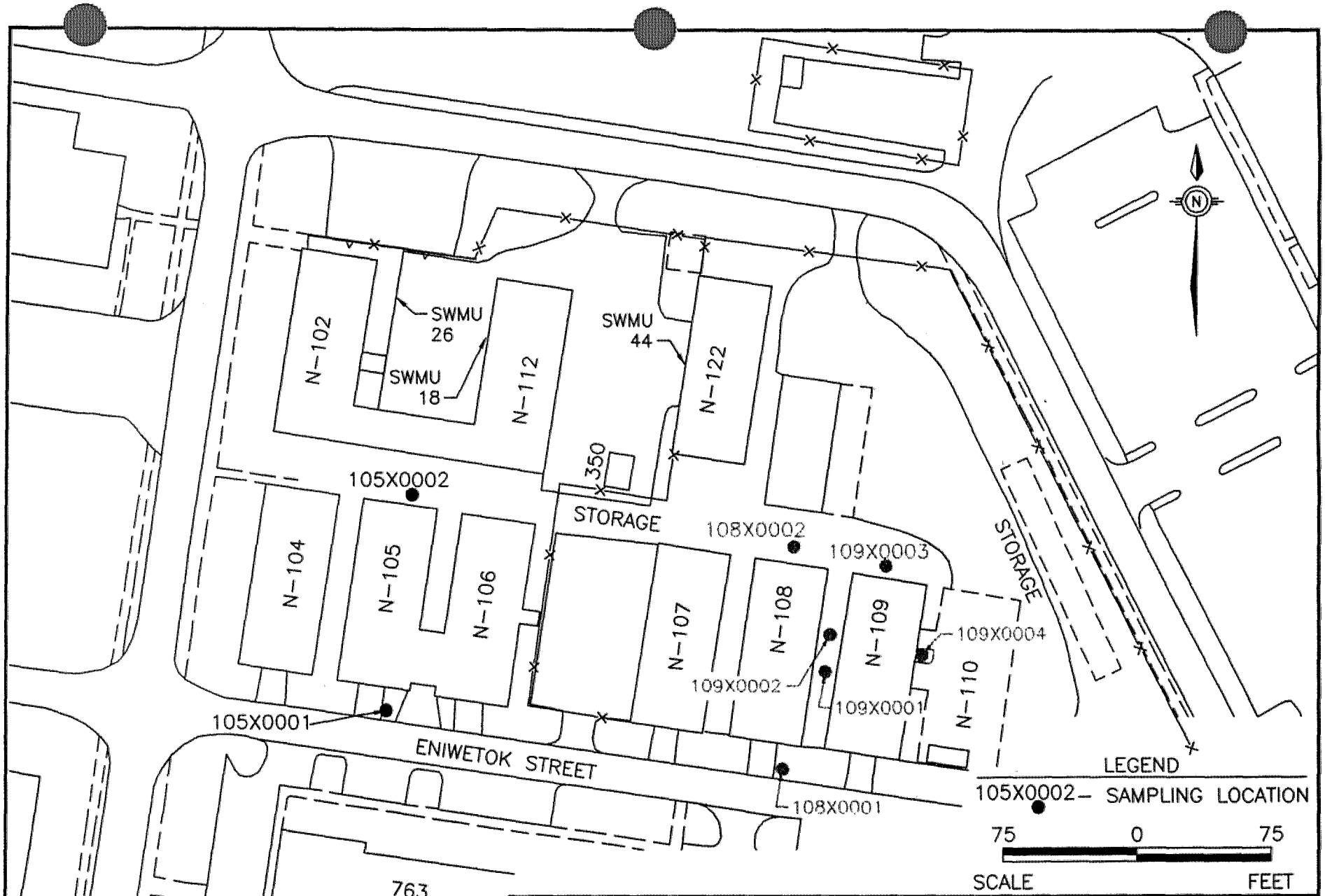
According to historical maps and interviews, Facility N-105 was used for corrosion control training in the past. Corrosion control is divided into two types of operations. One method is the application of anodes and cathodes to protect metals from oxidation/corrosion. The second method, which is the primary concern at Facility N-105, involves cleaning and painting metal aircraft or ship components, which generates waste solvents (VOCs) and paint wastes containing heavy metals. These operations often involved the use of chromic acid and various solvents (methyl ethyl ketone (MEK), methylene chloride, toluene, xylene, etc.) and produced considerable amounts of paint waste.

7.1.2 Field Investigation

Surface and subsurface soil were sampled to determine if hazardous materials/hazardous waste or petroleum products were released at Facility N-105. Two samples were collected from each of two locations. Two hand-auger soil samples (105X000101 and 105X000201) were collected from the surface (0 to 1 ft. bls) and two Geoprobe soil samples (105X000115 and 105X000215) were collected from the saturated zone in the loess (12 to 15 ft. bls). Because of low yields and slow recharge of the saturated zone in the loess, soil samples were collected from loess rather than groundwater. Sampling locations were selected based on the possibility of improper disposal practices (e.g., near back or side doors, adjacent drainage ditch, etc.). Samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia for VOCs, SVOCs, Appendix IX metals, and TPH. Figure 7.1 shows the sample locations.

7.1.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic soil analyses are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSL for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996). Inorganic results are compared to RCs from NSA Mid-South, residential and industrial RBCs, and SSLs.



ERNA GRAY AREAS
REPORT
NSA MID-SOUTH
MILLINGTON, TN

FIGURE 7.1
FACILITIES N105, 108 AND 109
SAMPLE LOCATION MAP

DWG DATE: 05/03/99 | DWG NAME: 0106B002

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Organics in Soil

Organic and TPH soil data for Facility N-105 samples are presented in Tables 7.1.1 and 7.1.2.

Table 7.1.1
Gray Areas — Facility N-105 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
105X000101	01'	Anthracene	—	61,000,000	2,300,000	590,000	5.3 J
		Benzo(a)anthracene	—	7,800	880	80	57 J
		Benzo(a)pyrene	565	780	88	400	66 J
		Benzo(b)fluoranthene	—	7,800	880	200	72 J
		Benzo(g,h,i)perylene	—	6,100,000	230,000	210,000	46 J
		Benzo(k)fluoranthene	—	78,000	8,800	2,000	68 J
		bis(2-Ethylhexyl) phthalate (BEHP)	—	410,000	46,000	180,000	84 J
		Chrysene	—	780,000	88,000	8,000	69 J
		Di-n-butylphthalate	—	20,000,000	780,000	DNE	600
		Fluoranthene	—	8,200,000	310,000	210,000	110 J
		Indeno(1,2,3-cd)pyrene	—	7,800	880	700	38 J
		Phenanthrene	—	6,100,000	230,000	210,000	40 J
		Pyrene	—	6,100,000	230,000	210,000	110 J
105X000201	01'	Anthracene	—	61,000,000	2,300,000	590,000	4.4 J
		Benzo(a)anthracene	—	**7,800**	**880**	**80**	**95 J**
		Benzo(a)pyrene	565	780	88	400	77 J
		Benzo(b)fluoranthene	—	7,800	880	200	83 J
		Benzo(g,h,i)perylene	—	6,100,000	230,000	210,000	48 J
		Benzo(k)fluoranthene	—	78,000	8,800	2,000	86 J
		BEHP	—	410,000	46,000	180,000	93 J
		Chrysene	—	780,000	88,000	8,000	89 J
		Di-n-butylphthalate	—	20,000,000	780,000	DNE	170 J
		Fluoranthene	—	8,200,000	310,000	210,000	130 J

Table 7.1.1
Gray Areas — Facility N-105 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
		Indeno(1,2,3-cd)pyrene	—	7,800	880	700	44 J
		Phenanthrene	—	6,100,000	230,000	210,000	17 J
		Pyrene	—	6,100,000	230,000	210,000	120 J

Notes:
a — Background Reference Concentration (RC) from the August 1996 *Technical Memorandum — Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12,1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
DNE — Does not exist.
J — Contaminant detected in concentrations less than the method reporting limit; value estimated.
Bold indicates samples that exceed any of the standard reference values.

As indicated in Table 7.1.1, a total of 13 organic contaminants were detected in N-105 soil samples, only one of which exceeded any standard reference values. Benzo(a)anthracene exceeded its soil-to-groundwater SSL (80 μg/kg) in sample 105X000201 at 95 μg/kg.

Table 7.1.2
Gray Areas — Facility N-105 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
105X000101	**01'**	**TPH**	**210**
105X000115	15'	TPH	21 J
105X000201	01'	TPH	77
105X000215	**15'**	**TPH**	**330 J**

Notes:
TPH — Total petroleum hydrocarbons.
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.
Bold indicates samples that exceed the TDEC cleanup value of 100 mg/kg.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil-cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH depending on soil permeability and aquifer classification: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg. As requested by the Public Works Department Environmental Division (PWD Env. Div.), surface soil exceeding the TDEC cleanup level of 100 mg/kg at this site will be removed to a depth of 5 feet or until a concentration of TPH equal to or less than 100 mg/kg is achieved, as described in the *Voluntary Corrective Action Work Plan — Petroleum Sites; Revision 2* (EnSafe, Pending 1999).

Inorganics in Soil

Inorganic soil-sample data are presented in Table 7.1.3.

Table 7.1.3
Gray Areas — Facility N-105 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
105X000101	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**6.7**
		Barium (Ba)	223	14,000	550	82	77.1
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.46 J**
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**0.76**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**10.9**
		Cobalt (Co)	16.0	12,000	470	DNE	7
		Copper (Cu)	24.2	8,200	310	DNE	14.7
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**28.7 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**12.5**
		Vanadium (V)	45.1	1,400	55	300	19.3
		Zinc (Zn)	98	61,000	2,300	620	65.9

Table 7.1.3
Gray Areas — Facility N-105 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
105X000115	15'	**Arsenic (As)**	**20.3**	—	—	**1**	**6.1**
		Barium (Ba)	265	—	—	82	66.3
		Beryllium (Be)	1.00	—	—	3	0.66
		Chromium (Cr)	**28.3**	—	—	**2**	**19.7**
		Cobalt (Co)	14.4	—	—	DNE	6.5
		Copper (Cu)	32.5	—	—	DNE	11.9
		Lead (Pb)	19.8	—	—	DNE	8.5
		Mercury (Hg)	0.18	—	—	DNE	0.04
		Nickel (Ni)	**DNE**	—	—	**7**	**11.2**
		Vanadium (V)	43.7	—	—	300	30.4
		Zinc (Zn)	109	—	—	620	23
105X000201	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**7.4**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**97.1**
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**2.4**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**17.4**
		Cobalt (Co)	16.0	12,000	470	DNE	6.8
		Copper (Cu)	**24.2**	**8,200**	**310**	DNE	**27.2**
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**47.5 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.05
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**16.3**
		Vanadium (V)	45.1	1,400	55	300	21.6
		Zinc (Zn)	98	61,000	2300	620	95.5

Table 7.1.3
Gray Areas — Facility N-105 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
105X000215	15'	**Antimony (Sb)**	**DNE**	—	—	**0.3**	**1 J**
		Arsenic (As)	**20.3**	—	—	**1**	**5.4**
		Barium (Ba)	265	—	—	82	75
		Beryllium (Be)	1.00	—	—	3	0.71
		Chromium (Cr)	**28.3**	—	—	**2**	**14.9**
		Cobalt (Co)	14.4	—	—	DNE	6.6
		Copper (Cu)	32.5	—	—	DNE	11.9
		Lead (Pb)	19.8	—	—	DNE	10.5
		Mercury (Hg)	0.18	—	—	DNE	0.02
		Nickel (Ni)	**DNE**	—	—	**7**	**12.3**
		Vanadium (V)	43.7	—	—	300	30.5
		Zinc (Zn)	109	—	—	620	28.7

Notes:
a — Background Reference Concentration (RC) from the August 1996 *Technical Memorandum — Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
DNE — Does not exist.
J — Constituent detected in concentrations less than the method reporting limit; value estimated.
Bold indicates samples that exceed any of the standard reference values.

As shown in Table 7.1.3, 12 inorganic constituents were detected in soil samples at Facility N-105. Of these:

- Arsenic exceeded its residential RBC (0.43 mg/kg) and industrial RBC (3.8 mg/kg) in both surface-soil samples 105X000101 (6.7 mg/kg) and 105X000201 (7.4 mg/kg). It also exceeded its soil-to-groundwater SSL (1 mg/kg) in all four samples.

- Barium exceeded its soil-to-groundwater SSL (82 mg/kg) in sample 105X000201 (97.1 mg/kg).

- Beryllium exceeded its residential RBC (0.15 mg/kg) in sample 105X000101 (0.46 mg/kg).

- Cadmium exceeded its soil-to-groundwater SSL (0.4 mg/kg) in samples 105X000101 (0.76 mg/kg) and 105X000201 (2.4 mg/kg). It also exceeded its RC (1.54 mg/kg) in sample 105X000201.

- Chromium and nickel exceeded their soil-to-groundwater SSLs (2 mg/kg and 7 mg/kg, respectively) in all samples.

- Copper exceeded its RC (24.2 mg/kg) in sample 105X000201 (27.2 mg/kg).

- Lead exceeded its RC (26.0 mg/kg) in samples 105X000101 (28.7 mg/kg) and 105X000201 (47.5 mg/kg).

7.1.4 Preliminary Risk Evaluation

In accordance with *Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV memorandum, November 1994), preliminary screening comparisons were made for Facility N-105 using data from surface-soil samples collected during the Gray Areas Investigation. Because no COPC was identified, a PRE is not likely to be necessary, although this is not absolutely certain because a fluvial deposits groundwater investigation was not undertaken for Facility N-105. The land should be suitable for either industrial or residential use based on analytical soil data. For more information on PRE methods, refer to Section 5.

7.1.5 Fate and Transport

The approach to evaluating the fate and transport of Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility N-105. Transport processes for contaminants other than those designated as COPCs are also discussed if they occur in multiple environmental media or have the potential to migrate to other media.

Potential migration pathways for contaminants at this facility include leaching from soil to groundwater, and erosion of surface soil containing sorbed contaminants from the unpaved, grass-covered areas, forming sediments in drainage ways. Surface-soil analytical data indicate that no contaminants exceeded their specific soil-to-air SSLs; therefore, the soil-to-air cross-media transport process is not discussed.

Facility N-105 had no COPCs, but did have some contaminants/constituents exceeding soil-to-groundwater SSLs:

- The organic benzo(a)anthracene exceeded its soil-to-groundwater SSL in surface soil at one location.

- The inorganics antimony, arsenic, barium, cadmium, chromium, and nickel exceeded their soil-to-groundwater SSLs in soil. Arsenic, cadmium, copper, and lead also exceeded their background RCs.

7.1.5.1 Soil-to-Groundwater Cross-Media Transport

Based on comparison of soil concentrations to groundwater-protection soil-screening criteria, Facility N-105 contaminants that exhibit the potential for soil-to-groundwater transport are the SVOC benzo(a)anthracene, and the inorganics arsenic and cadmium. Inorganics that exceeded their SSLs only, and not their background RCs, are not discussed since they may occur naturally.

Benzo(a)anthracene, arsenic, and cadmium were detected in surface-soil samples (0 to 1 foot bls). Based on the chemical and physical characteristics of SVOCs and inorganics, it is unlikely they will migrate further. Both of these contaminant classes are considered persistent in soil — SVOCs because of their relatively high K_{oc} values and low solubility, and inorganics because of their interaction with soil (inorganics associate with soil particles and are generally insoluble).

7.1.5.2 Soil-to-Sediment Cross-Media Transport

Contaminants in near-surface soil where vegetation or asphalt provides a ground cover were evaluated to determine their potential for transport by erosion, should these covers be removed. Drainage patterns and topography were also examined to determine whether site features would support contaminant transport.

Contaminants detected in surface soil consist of organics and inorganics. As discussed above, both SVOCs and inorganics do not migrate readily in soil. Transport is more likely to occur in the solid rather than the dissolved phase.

Drainage patterns and the vegetation/asphalt-concrete cover at Facility N-105 leave little potential for surface soil to erode and form sediments that can become mobile in surface water. Therefore, the soil-to-sediment transport process at this facility is not considered significant.

7.1.6 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Facility N-105 is suitable for industrial or residential land use.

- Thirteen organic compounds were detected in surface (0 to 1 foot) soil. Of these, only benzo(a)anthracene was detected in one sample at a concentration of 95 μg/kg, exceeding its SSL of 80 μg/kg. However, detected concentrations of the BEQ did not exceed the RC of 565 μg/kg established for NSA Mid-South and presented in *Reference Concentrations Technical Memorandum* (E/A&H, August 1996).

- TPH was detected in surface soil exceeding the TDEC cleanup value of 100 mg/kg.

- Twelve metals were detected in surface soil at Facility N-105. Of these:

  — Arsenic, barium, cadmium, chromium, and nickel exceeded their soil-to-groundwater SSLs.

  — Cadmium, chromium, and lead exceeded their RCs.

- A PRE was determined to be unnecessary for this site.

Recommendations

Based on surface-soil data, a VCA is recommended for Facility N-105 to address TPH contamination exceeding 100 mg/kg.

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7.2 Facility N-108 (Maintenance Shop)

This Quonset hut (identical to N-105) houses offices and a maintenance shop where electrical parts (generators) were repaired. According to the NSA Mid-South PWD Env. Div., the Marine Corps occupied this facility from 1981 to 1995. Figure 1.1 shows the location of Facility N-108.

Facility N-108 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site-specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.2.1 Previous Activities

Previous operations have reportedly included minor sandblasting and touch-up painting for vehicle maintenance. Before the Marine Corps occupied it, N-108 was listed only as a training facility.

7.2.2 Field Investigation

Surface and subsurface soil were sampled to determine if hazardous materials, hazardous waste, or petroleum products associated with painting and sandblasting have been released at Facility N-108. One surface sample was collected using a hand auger from each of two locations at 0 to 1 ft. bls and analyzed for SVOCs, Appendix IX metals, and TPH. A subsurface sample was also collected with a Geoprobe rig from the saturated portion of the loess at 12 to 15 ft. bls at the two locations and analyzed for VOCs, SVOCs, Appendix IX metals, and TPH. Sample locations were selected based on the possibility of improper disposal practices (e.g., near back and side doors, adjacent drainage ditch, etc.). Samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia. Figure 7.2 shows the site layout and surveyed sampling locations.

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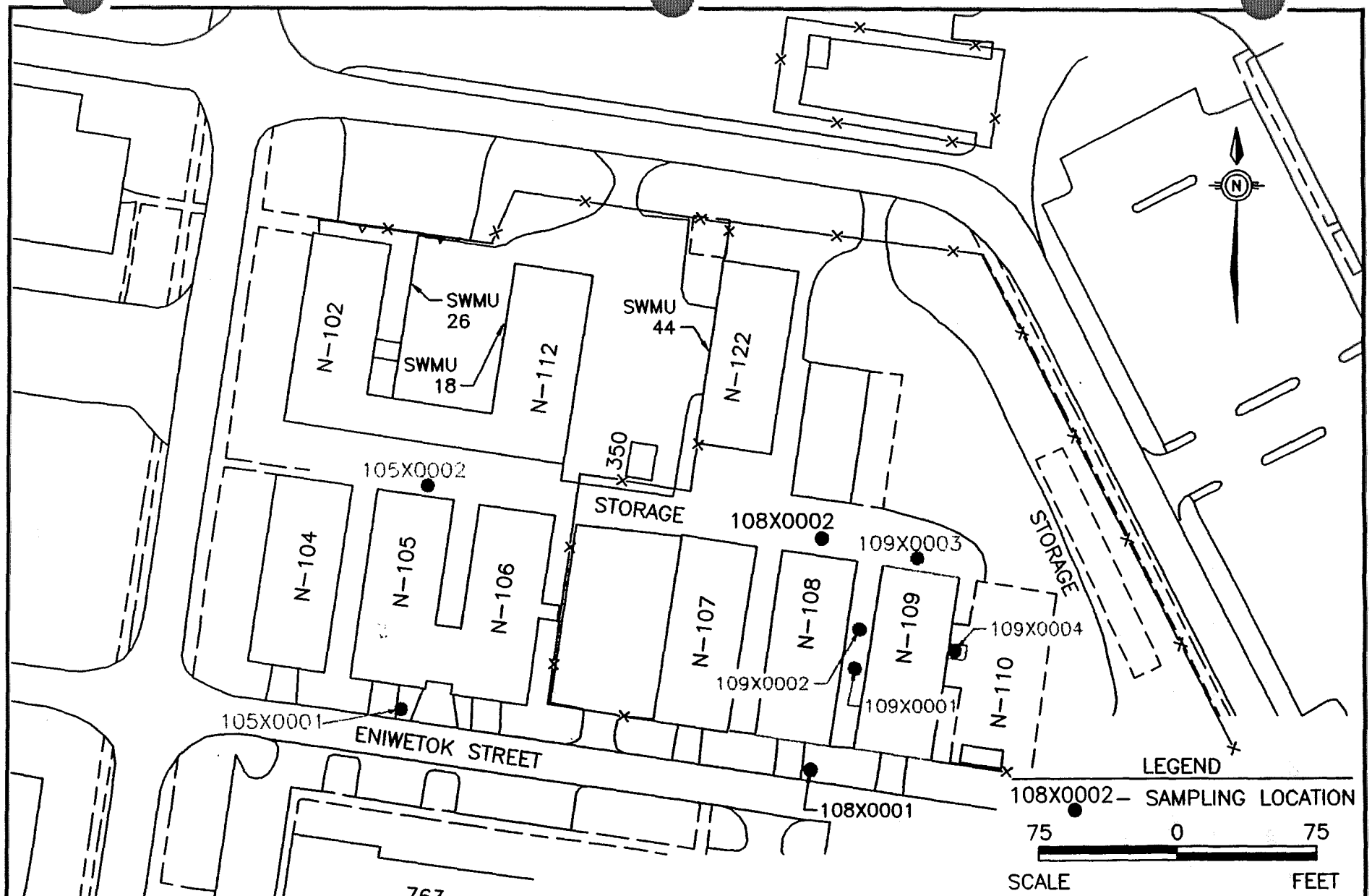

ERNA GRAY AREAS
REPORT
NSA MID-SOUTH
MILLINGTON, TN

FIGURE 7.2
FACILITIES N105, 108 AND 109
SAMPLE LOCATION MAP

DWG DATE: 05/03/99 | DWG NAME: 0106B009

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7.2.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic soil analyses are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSL for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996). Inorganic results are compared to RCs from NSA Mid-South, residential and industrial RBCs, and SSLs.

Organics in Soil

Organic and TPH soil data for Facility N-108 samples are presented in Tables 7.2.1 and 7.2.2.

Table 7.2.1
Gray Areas — Facility N-108 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
108X000101	01'	Benzo(a)anthracene	—	7,800	880	80	22 J
		Benzo(a)pyrene	565	780	88	400	20 J
		Benzo(b)fluoranthene	—	7,800	880	200	19 J
		Benzo(g,h,i)perylene	—	6,100,000	230,000	210,000	13 J
		Benzo(k)fluoranthene	—	78,000	8,800	2,000	24 J
		Chrysene	—	780,000	88,000	8,000	23 J
		Fluoranthene	—	8,200,000	310,000	210,000	34 J
		Phenanthrene	—	6,100,000	230,000	210,000	16 J
		Pyrene	—	6,100,000	230,000	210,000	34 J

Table 7.2.1
Gray Areas — Facility N-108 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
108X000201	01'	Acenaphthene	—	12,000,000	470,000	29,000	89 J
		Anthracene	—	61,000,000	2,300,000	590,000	290 J
		Benzo(g,h,i)perylene	—	6,100,000	230,000	210,000	2,000
		BEQ	***565***	***780***	***88***	***400***	***3,924***
		Benzo(a)anthracene	—	**7,800**	**880**	**80**	**2,200**
		Benzo(b)fluoranthene	—	**7,800**	**880**	**200**	**3,300**
		Benzo(k)fluoranthene	—	**78,000**	**8,800**	**2,000**	**2,200**
		Benzo(a)pyrene	—	**780**	**88**	**400**	**3,000**
		Chrysene	—	**780,000**	**88,000**	**8,000**	**2,400**
		Dibenz(a,h)anthracene	—	**780**	**88**	**80**	**160 J**
		Indeno(1,2,3-cd)pyrene	—	**7,800**	**880**	**700**	**1,900**
		bis(2-Ethylhexyl) phthalate (BEHP)	—	410,000	46,000	180,000	500
		Carbazole	—	**290,000**	**32,000**	**30**	**210 J**
		Fluoranthene	—	8,200,000	310,000	210,000	2,900
		Fluorene	—	8,200,000	310,000	28,000	60 J
		Naphthalene	—	8,200,000	310,000	4,000	66 J
		Phenanthrene	—	6,100,000	230,000	210,000	1,200
		Pyrene	—	6,100,000	230,000	210,000	2,900

Notes:

a — Background Reference Concentration (RC) from the August 1996 *Technical Memorandum — Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).

b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).

c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).

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

Bold indicates samples that exceed any of the standard reference values.

Bold/Italics indicate samples that are included in the PRE calculations.

As shown in Table 7.2.1, 17 organic compounds were detected in N-108 soil samples. Of these:

- BEQ was retained as a COPC because it exceeded its RC (565 μg/kg), industrial RBC (780 μg/kg), residential RBC (88 μg/kg), and soil-to-groundwater SSL (400 μg/kg) in sample 108X000201 (3,924 μg/kg).

- Carbazole exceeded its soil-to-groundwater SSL (30 μg/kg) in sample 108X000201 (210 μg/kg).

Table 7.2.2
Gray Areas — Facility N-108 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
108X000101	01'	TPH	37
108X000115	15'	TPH	31 J
108X000201	**01'**	**TPH**	**300**
108X000215	15'	TPH	34 J

Notes:
TPH — Total petroleum hydrocarbons
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.
Bold indicates samples that exceed any of the TDEC cleanup values.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil-cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH depending on soil permeability and aquifer classification: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg. As requested by the PWD Env. Div., soil exceeding the TDEC cleanup level of 100 mg/kg at this site will be removed to a depth of 5 feet or until a concentration of TPH equal to or less than 100 mg/kg is achieved, as described in the *Voluntary Corrective Action Work Plan — Petroleum Sites; Revision 2* (EnSafe, Pending 1999).

Inorganics in Soil

Inorganic soil sample data are presented in Table 7.2.3.

Table 7.2.3
Gray Areas — Facility N-108 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
108X000101	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**11.9**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**124**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.65**
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**0.52 J**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**17.2**
		Cobalt (Co)	16.0	12,000	470	DNE	8.4
		Copper (Cu)	24.2	8,200	310	DNE	17.2
		Lead (Pb)	26.0	400	400	DNE	22.8 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**15.2**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.53 J**
		Vanadium (V)	45.1	1,400	55	300	32.9
		Zinc (Zn)	98	61,000	2,300	620	66.7
108X000115	15'	**Arsenic (As)**	**20.3**	—	—	**1**	**7.8**
		Barium (Ba)	265	—	—	82	61.6
		Beryllium (Be)	1.00	—	—	3	0.38 J
		Chromium (Cr)	28.3	—	—	2	13.1
		Cobalt (Co)	14.4	—	—	DNE	6.9
		Copper (Cu)	32.5	—	—	DNE	15.6
		Lead (Pb)	19.8	—	—	DNE	9.1
		Mercury (Hg)	0.18	—	—	DNE	0.02
		Nickel (Ni)	**DNE**	—	—	**7**	**18**
		Vanadium (V)	43.68	—	—	300	19.2
		Zinc (Zn)	109	—	—	620	50.3

Table 7.2.3
Gray Areas — Facility N-108 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
108X000201	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**8.8**
		Barium (Ba)	**223**	**265.12**	**550**	**82**	**116**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.42 J**
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**2.3**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**26.9**
		Cobalt (Co)	16.0	12,000	470	DNE	7
		Copper (Cu)	**24.2**	**8,200**	**310**	**DNE**	**32.2**
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**87 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.09
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**14**
		Vanadium (V)	45.1	1,400	55	300	20
		Zinc (Zn)	**98**	**61,000**	**2,300**	**620**	**137**
108X000215	15'	Arsenic (As)	20.3	—	—	1	6.1
		Barium (Ba)	265	—	—	82	69.2
		Beryllium (Be)	1.00	—	—	3	0.4 J
		Chromium (Cr)	28.3	—	—	2	12.9
		Cobalt (Co)	14.4	—	—	DNE	6.9
		Copper (Cu)	32.5	—	—	DNE	14.1
		Lead (Pb)	19.8	—	—	DNE	7.9
		Mercury (Hg)	0.18	—	—	DNE	0.02
		Nickel (Ni)	NA	—	—	7	15.7
		Vanadium (V)	43.7	—	—	300	23.6
		Zinc (Zn)	109	—	—	620	40.2

Notes:

a — Background Reference Concentration (RC) from the August 1996 *Technical Memorandum — Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).

b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).

c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).

DNE — Does not exist.

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

Bold indicates samples that exceed any of the standard reference values.

As shown in Table 7.2.3, 13 inorganic constituents were detected in soil samples at Facility N-108. Of these:

- Arsenic exceeded its residential RBC (0.43 mg/kg) and industrial RBC (3.8 mg/kg) in samples 108X000101 (11.9 mg/kg) and 108X000201 (8.8 mg/kg). It also exceeded its soil-to-groundwater SSL (1 mg/kg) in all samples.

- Barium exceeded its soil-to-groundwater SSL (82 mg/kg) in samples 108X000101 (124 mg/kg) and 108X000201 (116 mg/kg).

- Beryllium exceeded its residential RBC (0.15 mg/kg) in samples 108X000101 (0.65 mg/kg) and 108X000201 (0.42 mg/kg).

- Cadmium exceeded its soil-to-groundwater SSL (0.4 mg/kg) in samples 108X000101 (0.52 mg/kg) and 108X000201 (2.3 mg/kg). It also exceeded its RC (1.54 mg/kg) in sample 108X000201.

- Chromium exceeded its soil-to-groundwater SSL (2 mg/kg) in all samples, and exceeded its RC (23.9 mg/kg) in sample 108X000201 (26.9 mg/kg).

- Nickel exceeded its soil-to-groundwater SSL (7 mg/kg) in all samples.

- Selenium exceeded its soil-to-groundwater SSL (0.3 mg/kg) in sample 108X000101 (0.53 mg/kg).

7.2.4 Preliminary Risk Evaluation

In accordance with *Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV memorandum, November 1994), preliminary screening comparisons were made for Facility N-108 using data from surface-soil samples collected during the Gray Areas Investigation. Because BEQ was identified as a COPC, a PRE was conducted based on the analytical data from surface soil. The extent of the contamination in all media is somewhat uncertain because a fluvial deposits groundwater investigation was not undertaken for Facility N-108. For more information on PRE methods, refer to Section 5. Table 7.2.4 shows the calculated risk associated with residential and industrial land use.

Table 7.2.4
Facility N-108 — Preliminary Risk Evaluation

					Residential			Industrial	
Chemical	Maximum Reported Concentration	Units	RC	RBC	Hazard Quotient	ILCR	RBC	Hazard Quotient	ILCR
BEQ	3.924	µg/kg	565	88C	NA	4.5E-5	780C	NA	5.03E-6
Sum					NA	4.5E-5		NA	5.03E-6

Notes:
RBC — Risk-based concentration from the USEPA Region III's April 1999 RBC Table; in accordance with USEPA Region IV's Supplemental Guidance to RAGS Bulletin 1.
RC — Reference concentration
N — Noncarcinogen
C — Carcinogen
NA — Not applicable
ILCR — Incremental lifetime (excess) cancer risk

The following conclusions have been reached based on a PRE for surface-soil data:

Residential Land Use

- Carcinogens: The excess cancer risk for the residential scenario was estimated to be 4.5E-5, which is less than the cumulative PRE risk threshold value of 1E-4. This is

considered below the excess cancer risk for the residential land-use scenario and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

- Noncarcinogens: No noncarcinogens were identified as COPCs at Facility N-108.

Industrial Land Use

- Carcinogens: The excess cancer risk for the industrial scenario was estimated to be 5.03E-6, which is less than the cumulative PRE risk threshold value of 1E-4. This is considered below the excess cancer risk for the industrial land-use scenario and indicates suitability of the property for lease as established in USEPA Region IV November 1994 memorandum.

- Noncarcinogens: No noncarcinogens were identified as COPCs at Facility N-108.

7.2.5 Fate and Transport

The approach to evaluating the fate and transport of Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility N-108. Transport processes for contaminants other than those designated as COPCs are also discussed if they occur in multiple environmental media or have the potential to migrate to other media.

Potential migration pathways for contaminants at this facility include leaching from soil to groundwater, and erosion of surface soil containing sorbed contaminants from the unpaved, grass-covered areas, forming sediments in drainage ways. Surface-soil analytical data indicate that no VOCs exceeded their specific soil-to-air SSLs; therefore, the soil-to-air cross-media transport process is not discussed.

Facility N-108 had one COPC and some contaminants/constituents exceeding soil-to-groundwater SSLs:

- BEQ, the only COPC, exceeded its RC, residential RBC, industrial RBC, and soil-to-groundwater SSL in surface soil at one location.

- The inorganics arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in soil. Cadmium, chromium, copper, lead, and zinc also exceeded their background RCs in one surface-soil sample.

7.2.5.1 Soil-to-Groundwater Cross-Media Transport

Based on comparison of soil concentrations to groundwater-protection soil-screening criteria, the Facility N-108 contaminants that exhibit the potential for soil-to-groundwater transport are the SVOCs BEQ and carbazole, and the inorganics cadmium and chromium. Other inorganics, which exceeded their soil-to-groundwater SSLs but not their background RCs, are not discussed because they may occur naturally, with no association to Facility N-108.

BEQ, carbazole, cadmium, and chromium could impact the soil-to-groundwater pathway at the 0 to 1 foot depth interval, but it is very unlikely that groundwater will be impacted in appreciable quantities, if at all, given the depth and nature of these contaminants. SVOCs and inorganics have an affinity for soil particles but are generally not soluble in liquid. Any downward percolation of water through the soil column where these contaminants exist is not likely to produce contaminant migration, and thus the soil-to-groundwater transport mechanism at this facility is not significant.

7.2.5.2 Soil-to-Sediment Cross-Media Transport

Contaminants in near-surface soil where vegetation or asphalt provides a ground cover were evaluated to determine their potential for transport by erosion, should these covers be removed. Drainage patterns and topography were also examined to determine whether site features would support contaminant transport.

Contaminants detected in surface soil consist of organics and inorganics. Inorganic chemicals do not degrade, but may change chemical form or speciation in the environment. Like pesticides, inorganics tend to sorb to soil particles, rendering them relatively immobile apart from the soil particles.

Drainage patterns and the vegetation/asphalt-concrete cover at Facility N-108 leave little potential for surface soil to erode and form sediments that can become mobile in surface water. Therefore, the soil-to-sediment transport process at this facility is not considered significant.

7.2.6 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Facility N-108 is suitable for industrial or residential land use.

- Seventeen organic compounds were detected in surface (0 to 1 foot) soil. Of these, BEQ was detected in one sample at a concentration of 3,924 μg/kg, exceeding its RC (565 μg/kg), residential RBC (88 μg/kg), industrial RBC (780 μg/kg), and SSL (400 μg/kg).

- TPH was detected in surface soil exceeding the TDEC cleanup value of 100 mg/kg.

- Thirteen metals were detected in surface soil at Facility N-108. Of these:

  — Arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs.

  — Cadmium, chromium, copper, lead, and zinc exceeded their RCs.

- A site PRE determined that:

  — Noncarcinogens pose no threat to residential or industrial land-use scenarios.

  — Carcinogen BEQ poses no threat to residential and industrial land-use scenarios.

Recommendations

Based on surface-soil data, a VCA is recommended for Facility N-108 to address TPH contamination exceeding 100 mg/kg.

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7.3 Facility N-109 — Quonset Hut (Maintenance Shop)

This facility is a 4,000-square-foot steel-framed Quonset hut (identical to N-105 and N-108), with metal siding and a concrete floor. Built in 1949, it housed offices and a maintenance shop used for painting, equipment corrosion control, and other miscellaneous mechanical repairs. Figure 1.1 shows the location of Facility N-109.

Facility N-109 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site-specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.3.1 Previous Activities

According to the EBS, the facility was used for welding shop training before 1980. Welding tables were located on the west side of the building and classrooms on the east.

7.3.2 Field Investigation

Surface and subsurface soil were sampled to determine if hazardous materials, hazardous waste, or petroleum products have been released at Facility N-109. Hand-auger samples were collected from two intervals each at four locations: surface samples at 0 to 1 ft. bls (109X000101, 109X000201, 109X000301, and 109X000401), and Geoprobe subsurface samples from the saturated portion of the loess at 12 to 15 ft. bls (109X000115, 109X000215, 109X000315, and 109X000415). Sample locations were selected based on the possibility of improper disposal practices (e.g., near back or side doors, adjacent to drainage ditch, etc.). Surface samples were analyzed for SVOCs, Appendix IX metals, and TPH. Subsurface samples were analyzed for SVOCs, Appendix IX metal, TPH, and VOCs. All samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia. Figure 7.3 shows the site layout and surveyed sampling locations.

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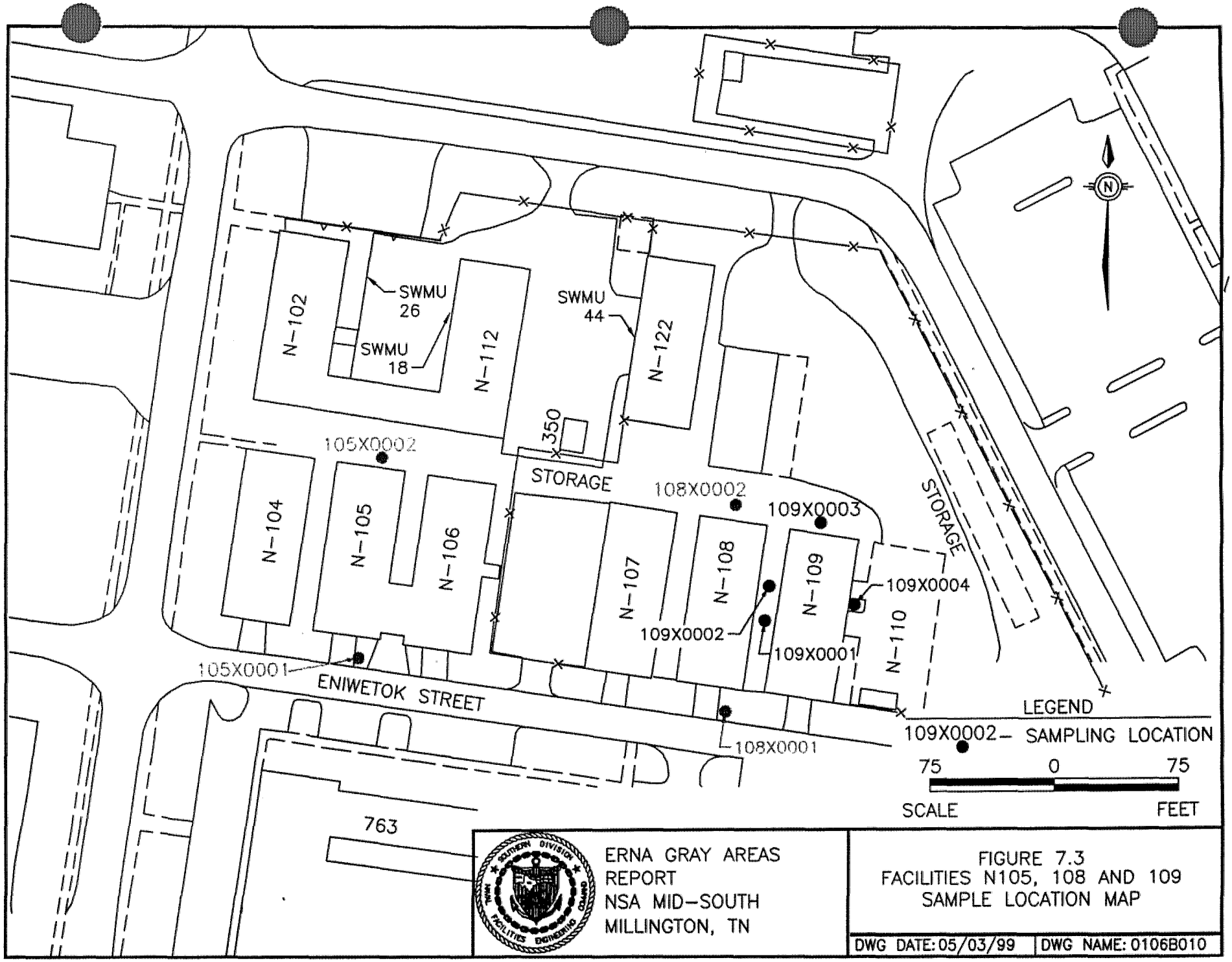
N-102
SWMU 26
SWMU 18
N-112
SWMU 44
N-122
350
STORAGE
105X0002
N-104
N-105
N-106
N-107
108X0002
N-108
109X0003
N-109
109X0004
109X0002
109X0001
N-110
STORAGE
105X0001
ENIWETOK STREET
108X0001
763
N
LEGEND
109X0002 – SAMPLING LOCATION
75 0 75
SCALE FEET
ERNA GRAY AREAS
REPORT
NSA MID-SOUTH
MILLINGTON, TN
FIGURE 7.3
FACILITIES N105, 108 AND 109
SAMPLE LOCATION MAP
DWG DATE: 05/03/99
DWG NAME: 0106B010

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7.3.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic soil analyses are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSL for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996). Inorganic results are compared to RCs from NSA Mid-South, residential and industrial RBCs, and SSLs.

Organics in Soil

Organic and TPH soil-sample data for Facility N-109 are presented in Tables 7.3.1 and 7.3.2.

Table 7.3.1
Gray Areas — Facility N-109 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
109S000101	01'	Benzo(a)anthracene	—	7,800	880	80	34 J
		Benzo(a)pyrene	565	780	88	400	34 J
		Benzo(b)fluoranthene	—	7,800	880	200	33 J
		Benzo(g,h,i)perylene	—	6,100,000	230,000	210,000	21 J
		Benzo(k)fluoranthene	—	78,000	8,800	2,000	30 J
		bis(2-ethylhexyl)phthalate (BEHP)	—	410,000	46,000	180,000	66 J
		Chrysene	—	780,000	88,000	8,000	38 J
		Fluoranthene	—	8,200,000	310,000	210,000	49 J
		Indeno(1,2,3-cd)pyrene	—	7,800	880	700	17 J
		Phenanthrene	—	6,100,000	230,000	210,000	38 J
		Pyrene	—	6,100,000	230,000	210,000	49 J
109S000201	01'	Di-n-butylphthalate	—	20,000,000	780,000	DNE	89 J
		Fluoranthene	—	8,200,000	310,000	210,000	40 J
		Phenanthrene	—	6,100,000	230,000	210,000	47 J
		Pyrene	—	6,100,000	230,000	210,000	41 J

Table 7.3.1
Gray Areas — Facility N-109 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
109S000401	01'	Pyrene	—	6,100,000	230,000	210,000	28 J
109S000415	15'	2-Butanone (MEK)	—	—	—	DNE	14 J

Notes:
a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
J — Contaminant detected in concentrations less than the method reporting limit; value estimated.

As shown in Table 7.3.1, 13 organic compounds were detected in Facility N-109 soil samples, none of which exceeded any standard reference values.

Table 7.3.2
Gray Areas — Facility N-109 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
109S000115	15'	TPH	27 J
109S000201	01'	TPH	16
109S000215	15'	TPH	31 J
109S000301	01'	TPH	18
109S000315	15'	TPH	39 J
109S000401	01'	TPH	16
109S000415	15'	TPH	46 J

Notes:
TPH — Total Petroleum Hydrocarbons
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil-cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH depending on soil permeability and aquifer classification: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg. There currently are no permeability data for Facility N-109, although as shown in Table 7.3.2, no Facility N-109 sample detections exceeded the TDEC soil-cleanup values.

Inorganics in Soil

Inorganic soil-sample data are presented in Table 7.3.3.

Table 7.3.3
Gray Areas — Facility N-109 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
109X000101	01'	Arsenic (As)	14.6	3.8	0.43	1	6.4
		Barium (Ba)	223	14,000	550	82	98.2
		Beryllium (Be)	1	1.3	0.15	3	0.73
		Cadmium (Cd)	1.54	100	3.9	0.4	0.57 J
		Chromium (Cr)	23.9	1,000	39	2	13
		Cobalt (Co)	16.0	120.00	470	DNE	6.9
		Copper (Cu)	24.2	8,200	310	DNE	17.8
		Lead (Pb)	26.0	400	400	DNE	26.7 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	20.6	4,100	160	7	12
		Vanadium (V)	45.1	1,400	55	300	20.8
		Zinc (Zn)	98	61,000	2,300	620	60.3

Table 7.3.3
Gray Areas — Facility N-109 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
109X000115	15'	**Arsenic (As)**	**20.3**	—	—	**1**	**8.7**
		Barium (Ba)	265	—	—	82	72.2
		Beryllium (Be)	1.00	—	—	3	0.43 J
		Chromium (Cr)	**28.3**	—	—	**2**	**15.8**
		Cobalt (Co)	14.4	—	—	DNE	8.5
		Copper (Cu)	32.5	—	—	DNE	16
		Lead (Pb)	19.8	—	—	DNE	9.7
		Mercury (Hg)	0.18	—	—	DNE	0.03
		Nickel (Ni)	**DNE**	—	—	**7**	**21.3**
		Vanadium (V)	43.7	—	—	300	23.4
		Zinc (Zn)	109	—	—	620	52.2
109X000201	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**5**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**112**
		Beryllium (Be)	***1***	***1.3***	***0.15***	***3***	***1.7***
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**0.61**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**13**
		Cobalt (Co)	16.0	12,000	470	DNE	4.9
		Copper (Cu)	24.2	8,200	310	DNE	22.7
		Lead (Pb)	26.0	400	400	DNE	17.7 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.05
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**9.4**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.36 J**
		Vanadium (V)	45.1	100	55	300	21.9
		Zinc (Zn)	98	61,000	2,300	620	53

Table 7.3.3
Gray Areas — Facility N-109 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
109X000215	15'	**Arsenic (As)**	**20.3**	—	—	**1**	**8.8**
		Barium (Ba)	265	—	—	82	76.4
		Beryllium (Be)	1.00	—	—	3	0.46 J
		Chromium (Cr)	**28.3**	—	—	**2**	**15.8**
		Cobalt (Co)	14.4	—	—	DNE	8.3
		Copper (Cu)	32.5	—	—	DNE	16.8
		Lead (Pb)	19.8	—	—	DNE	10
		Mercury (Hg)	0.18	—	—	DNE	0.02
		Nickel (Ni)	**DNE**	—	—	**7**	**20.8**
		Vanadium (V)	43.7	—	—	300	25.4
		Zinc (Zn)	109	—	—	620	55.3
109X000301	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**5**
		Barium (Ba)	223	14,000	550	82	54.9
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**0.61**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**8.3**
		Cobalt (Co)	16.0	12,000	470	DNE	2.8
		Copper (Cu)	24.2	8,200	310	DNE	7.7
		Lead (Pb)	26.0	400	400	DNE	14.3 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.02
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**8.2**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**2.2 J**
		Vanadium (V)	45.1	1,400	55	300	10.4
		Zinc (Zn)	98	61,000	2,300	620	60.6

Table 7.3.3
Gray Areas — Facility N-109 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
109X000315	15'	**Arsenic (As)**	**20.3**	—	—	**1**	**5.5**
		Barium (Ba)	265	—	—	82	57.6
		Beryllium (Be)	1.00	—	—	3	0.39 J
		Chromium (Cr)	**28.3**	—	—	**2**	**11.9**
		Cobalt (Co)	14.4	—	—	DNE	6.1
		Copper (Cu)	32.5	—	—	DNE	13
		Lead (Pb)	19.8	—	—	DNE	7.1
		Mercury (Hg)	0.18	—	—	DNE	0.02
		Nickel (Ni)	**DNE**	—	—	**7**	**15.4**
		Vanadium (V)	43.7	—	—	300	19.1
		Zinc (Zn)	109	—	—	620	36.3
109X000401	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**11**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**92.5**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.49 J**
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**0.46 J**
		Chromium (Cr)	**23.89**	**1,000**	**39**	**2**	**16**
		Cobalt (Co)	15.98	12,000	470	DNE	8.4
		Copper (Cu)	24.19	8,200	310	DNE	18.1
		Lead (Pb)	26.03	400	400	DNE	14.6 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	**20.62**	**4,100**	**160**	**7**	**15.7**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.56 J**
		Vanadium (V)	45.11	1,400	55	300	27.8
		Zinc (Zn)	98	61,000	2,300	620	58.9

Table 7.3.3
Gray Areas — Facility N-109 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
109X000415	15'	**Arsenic (As)**	**20.3**	—	—	**1**	**6.8**
		Barium (Ba)	265	—	—	82	58.8
		Beryllium (Be)	1.00	—	—	3	0.36 J
		Chromium (Cr)	**28.3**	—	—	**2**	**12.2**
		Cobalt (Co)	14.4	—	—	DNE	6.2
		Copper (Cu)	32.5	—	—	DNE	14.2
		Lead (Pb)	19.8	—	—	DNE	7.9
		Mercury (Hg)	0.18	—	—	DNE	0.02
		Nickel (Ni)	**DNE**	—	—	**7**	**15.7**
		Vanadium (V)	43.7	—	—	300	20.6
		Zinc (Zn)	109	—	—	620	38.6

Notes:
a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
DNE — Does not exist.
J — Constituent detected in concentrations less than the method reporting limit; value estimated.
Bold indicates samples that exceed any of the standard reference values.
Bold/Italics indicate samples included in the PRE calculations.

As shown in Table 7.3.3, 13 inorganic constituents were detected in soil samples at Facility N-109. Of these:

- Arsenic exceeded its industrial RBC (3.8 mg/kg), residential RBC (0.43 mg/kg) in all surface soil, and exceeded its soil-to-groundwater SSL (1 mg/kg) in all samples.

- Barium exceeded its soil-to-groundwater SSL (82 mg/kg) in three samples: 109X000101 (98.2 mg/kg), 109X000201 (112 mg/kg), and 109X000401 (92.5 mg/kg).

- Beryllium was retained as a COPC because its concentration exceeded its RC (1 mg/kg), residential RBC (0.15 mg/kg), and industrial RBC (1.3 mg/kg) in sample 109X000201 (1.7 mg/kg).

- Cadmium exceeded its soil-to-groundwater SSL (0.4 mg/kg) in all surface-soil samples.

- Chromium and nickel exceeded their soil-to-groundwater SSLs (2 mg/kg and 7 mg/kg, respectively) in all samples.

- Lead exceeded its RC (26.0 mg/kg) in surface-soil sample 109X000101 (26.7 mg/kg).

- Selenium exceeded its soil-to-groundwater SSL (0.3 mg/kg) in samples 109X000201 (0.36 mg/kg) and 109X000301 (2.2 mg/kg).

7.3.4 Preliminary Risk Evaluation

In accordance with *Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV memorandum, November 1994), preliminary screening comparisons were made for Facility N-109 using data from surface-soil samples collected during the Gray Areas Investigation. Because beryllium was identified as a COPC, a PRE was conducted based on the analytical data from surface soil. There is some uncertainty of risk because a fluvial deposits groundwater investigation was not undertaken for Facility N-109. For more information on PRE methods, refer to Section 5. Table 7.3.4 shows the calculated risk associated with residential and industrial land use.

Table 7.3.4
Facility N-109 — Preliminary Risk Evaluation

					Residential			Industrial	
Chemical	**Maximum Reported Concentration**	**Units**	**RC**	**RBC**	**Hazard Quotient**	**ILCR**	**RBC**	**Hazard Quotient**	**ILCR**
Beryllium	1.7	mg/kg	1	0.15C	NA	1.1E-5	1.3C	NA	1.3E-6
Sum					NA	1.1E-5		NA	1.3E-6

Notes:

RBC — Risk-based concentration from the USEPA Region III April 1999 RBC Table; in accordance with the USEPA Region IV Supplemental Guidance to RAGS Bulletin 1, noncarcinogen RBCs were conservatively adjusted to reflect a hazard quotient of 0.1.
RC — Reference concentration
N — Noncarcinogen
C — Carcinogen
NA — Not applicable
ILCR — Incremental lifetime (excess) cancer risk

The following conclusions have been reached based on a PRE for surface-soil data:

Residential Land Use

- Carcinogens: The excess cancer risk for the residential scenario was estimated to be 1.1E-5, which is less than the cumulative PRE risk threshold value of 1E-4. This is considered below the excess cancer risk for the residential land-use scenario and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

- Noncarcinogens: No noncarcinogens were identified as COPCs at Facility N-109.

Industrial Land Use

- Carcinogens: The excess cancer risk for the industrial scenario was estimated to be 1.3E-6, which is less than the cumulative PRE risk threshold value of 1E-4. This is considered below the excess cancer risk for the industrial land-use scenario and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

- Noncarcinogens: No noncarcinogens were identified as COPCs at Facility N-109.

7.3.5 Fate and Transport

The approach to evaluating the fate and transport of the Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility N-109. Transport processes for contaminants other than those designated as COPCs are also discussed if they occur in multiple environmental media or have the potential to migrate to other media.

Potential migration pathways for contaminants at this facility include leaching from soil to groundwater, and erosion of surface soil containing sorbed contaminants from the unpaved, grass-covered areas, forming sediments in drainage ways. Surface-soil analytical data indicate that no VOCs exceeded their specific soil-to-air SSLs; therefore, the soil-to-air cross-media transport process is not discussed.

Facility N-109 had one COPC and some contaminants/constituents exceeding soil-to-groundwater SSLs:

- Beryllium, the only COPC, exceeded its RC, residential RBC, and industrial RBC in surface soil at one location.

- The inorganics arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in soil, but none exceeded their background RCs.

7.3.5.1 Soil-to-Groundwater Cross-Media Transport

Based on comparison of soil concentrations to the groundwater protection soil-screening criteria, no Facility N-109 contaminant exhibits the potential for soil-to-groundwater transport. Inorganics

that exceeded their SSLs are not discussed because they were detected at concentrations less than their background RCs, and may occur naturally.

In addition to exceeding their soil-to-groundwater SSLs in surface soil, arsenic, chromium, and nickel also exceeded their SSLs in samples collected from 15 feet bls. The 15-foot depth interval samples were collected from the saturated portion of the loess. Although this interval is considered the first groundwater encountered, it should be noted that inorganics sorb to the surface of mineral grains, which limits their mobility.

7.3.5.2 Soil-to-Sediment Cross-Media Transport

Contaminants in near-surface soil where vegetation or asphalt provides a ground cover were evaluated to determine their potential for transport by erosion, should these covers be removed. Drainage patterns and topography were also examined to determine whether site features would support contaminant transport.

Contaminants detected in surface soil consist of organics (SVOCs) and inorganics. Inorganic chemicals do not degrade, but may change chemical form or speciation in the environment. Inorganics tend to sorb to soil particles, rendering them relatively immobile apart from the soil particles. SVOCs, like inorganics, tend to associate with soil particles and can be mobilized with sediment when exposed surface soil is eroded during precipitation or runoff events.

Drainage patterns and the vegetation/asphalt-concrete cover at Facility N-109 leave little potential for surface soil to erode and form sediments that can become mobile in surface water. Therefore, the soil-to-sediment transport process at this facility is not considered significant.

7.3.6 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Facility N-109 is suitable for industrial or residential land use.

- Thirteen organic compounds were detected in surface (0 to 1 foot) soil. Of these, none exceeded any standard reference values.

- TPH in surface soil was detected in concentrations less than the TDEC cleanup value of 100 mg/kg.

- Thirteen metals were detected in surface soil at Facility N-109. Of these:

  — Beryllium was retained as a COPC because it exceeded its RC, residential RBC and industrial RBC.

  — Arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs.

  — Lead exceeded its RC in one sample.

- A site PRE determined that:

  — Noncarcinogens pose no threat to residential or industrial land-use scenarios.
  — Carcinogen beryllium poses no threat to residential or industrial land-use scenarios.

Recommendations

Based on surface and subsurface-soil data, no further action is recommended for Facility N-109.

7.4 Facility N-114/N-397 (Auto Hobby Shop)

Facility N-114 is a 40,000-square foot, covered garage area at the auto hobby shop facility, which was used by base personnel to maintain personal automobiles. The sheet-metal building is floored with concrete. Facility N-397, another covered garage area east of Facility N-114, was included in this investigation because of apparent poor housekeeping practices in the past. It was reported by former site personnel that the site was strewn with automotive debris, and that some soil was stained. Figure 1.1 shows the location of Facility N-114/N-397.

Facility N-114/N-397 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete, asphalt, or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.4.1 Previous Activities

A large caustic dip tank formerly in one corner of Facility N-114, used to degrease engine blocks, contained a drain-valve and an overflow pipe that drained to an outside catch basin. An outdoor sump with a grate and concrete pad was used to drain and flush radiators. This water/antifreeze mixture also drained into the catch basin, which is shown on a 1981 drawing as part of an old oil/water separator that drains directly to the sanitary-sewer system. A follow-up site visit during the RFA found the catch basin full of water and overflowing onto the surrounding soil (ERC/EDGe, 1990).

7.4.2 Field Investigation

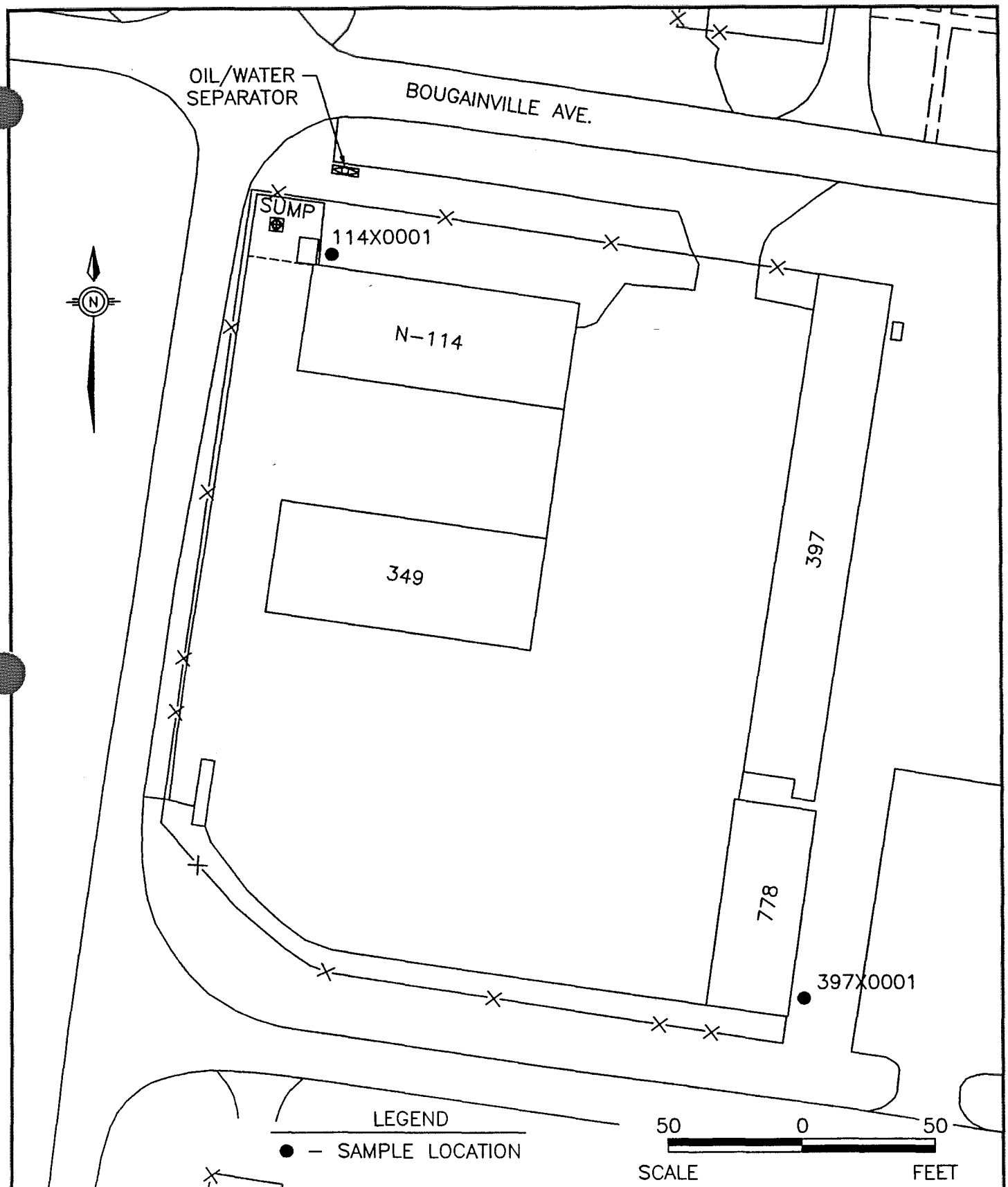
Surface and subsurface soils were sampled in both areas to determine if hazardous materials or hazardous waste had been released from past site activities. Two samples were collected with a Geoprobe rig at each of two locations, one each from the surface at 0 to 1 ft. bls (114X000101 and 397X000101) and the saturated portion of the loess at 12 to 15 ft. bls (114X000115 and 397X000115). Saturated loess samples at each location were analyzed only for VOCs. Surface-soil samples collected at Facility N-114 were analyzed for VOCs, SVOCs, Appendix IX metals, TPH, and ethylene glycol. Surface-soil samples collected at Facility N-397 were analyzed for VOCs, Appendix IX metals, and TPH. Figure 7.4 shows the site layout and surveyed sampling locations. All samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia.

7.4.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic soil analyses are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSLs for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996). Inorganic results are compared to RCs from NSA Mid-South, residential and industrial RBCs, and SSLs.

Organics in Soil

Organic and TPH soil-sample data for Facility N-114/N-397 are presented in Tables 7.4.1 and 7.4.2.



ERNA GRAY AREAS REPORT
NSA MID-SOUTH
MILLINGTON, TN

FIGURE 7.4
FACILITY N-114
SAMPLE LOCATION MAP

DWG DATE: 05/03/99 | DWG NAME: 0106B006

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Table 7.4.1
Gray Areas — Facility N-114/N-397 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
114X000101	01'	Fluoranthene	—	8,200,000	310,000	210,000	23 J
		Phenanthrene	—	6,100,000	230,000	210,000	12 J
114X000115	15'	Acetone	—	—	—	800	37 J

Notes:
a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
J — Contaminant detected in concentrations less than the method reporting limit; value estimated.
Bold indicates samples that exceed any of the standard reference values.

As shown in Table 7.4.1, three organic compounds were detected in N-114/N-397 soil samples, none of which exceeded any standard reference values.

Table 7.4.2
Gray Areas — Facility N-114/N-397 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
114X000101	***01'***	***TPH***	***1,900***
397X000101	01'	TPH	53

Notes:
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.
Bold/Italics indicate sample exceeds TDEC cleanup values of 500 to 1,000 mg/kg.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil-cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH depending on soil permeability and aquifer classification: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg. As requested by the PWD Env. Div., soil exceeding the TDEC cleanup level of 100 mg/kg at this site will be removed to a depth of 5 feet or until a concentration of TPH equal to or less than 100 mg/kg is

achieved, as described in the *Voluntary Corrective Action Work Plan – Petroleum Sites; Revision 2* (EnSafe, Pending 1999). As shown in Table 7.4.2, one detection exceeded the 1,000 mg/kg standard in sample 114X000101 at 1,900 mg/kg of TPH.

Inorganics in Soil

Inorganic soil-sample data are presented in Table 7.4.3.

Table 7.4.3
Gray Areas — Facility N-114/N-397 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
114X000101	01'	Antimony (Sb)	DNE	82	3.1	0.3	2 J
		Arsenic (As)	14.6	3.8	0.43	1	11.4
		Barium (Ba)	223	14,000	550	82	359
		Beryllium (Be)	*1*	*1.3*	*0.15*	*3*	*1.3*
		Cadmium (Cd)	*1.54*	*100*	*3.9*	*0.4*	*5.1*
		Chromium (Cr)	23.9	1,000	39	2	27.3
		Cobalt (Co)	16.0	12,000	470	DNE	5.5
		Copper (Cu)	24.2	8,200	310	DNE	93.6
		Lead (Pb)	*26.0*	*400*	*400*	*DNE*	*2,000 J*
		Mercury (Hg)	0.46	61	2.3	DNE	0.3
		Nickel (Ni)	20.6	4,100	160	7	17.4
		Silver (Ag)	2.05	1,000	39	2	0.76 J
		Tin (Sn)	33.6	100,000	4,700	DNE	15.9
		Vanadium (V)	45.1	1,400	55	300	17.5
		Zinc (Zn)	98	61,000	2,300	620	358

Table 7.4.3
Gray Areas — Facility N-114/N-397 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
397X000101	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**8.9**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**149**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.52 J**
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**0.81**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**15.7**
		Cobalt (Co)	16.0	12,000	470	DNE	8.1
		Copper (Cu)	24.2	8,200	310	DNE	20.3
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**160 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**18.9**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.35 J**
		Vanadium (V)	45.1	1,400	55	300	25.3
		Zinc (Zn)	**98**	**61,000**	**2,300**	**620**	**155**

Notes:
a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
DNE — Does not exist.
J — Constituent detected at concentrations less than the method reporting limit; value estimated.
Bold indicates samples that exceed any of the standard reference values.
Bold/Italics indicate samples included in the PRE or risk calculations.

As shown in Table 7.4.3, 16 inorganic constituents were detected in soil samples at Facility N-114/N-397. Of these:

- Antimony exceeded its soil-to-groundwater SSL (0.3 mg/kg) in sample 114X000101 (2 mg/kg).

- Arsenic exceeded its residential RBC (0.43 mg/kg), industrial RBC (3.8 mg/kg), and its soil-to-groundwater SSL (1 mg/kg) in both surface-soil samples.

- Barium exceeded its soil-to-groundwater SSL (82 mg/kg) in both surface-soil samples, and its RC (223 mg/kg) in sample 114X000101 (359 mg/kg).

- Beryllium was retained as a COPC because it exceeded its RC (1 mg/kg) and residential RBC (0.15 mg/kg) in sample 114X000101 (1.3 mg/kg). Beryllium also met but did not exceed its industrial RBC (1.3 mg/kg) in sample 114X000101.

- Cadmium was retained as a COPC because it exceeded its RC (1.54 mg/kg) and residential RBC (3.9 mg/kg) in sample 114X000101 (5.1 mg/kg). It also exceeded its soil-to-groundwater SSL (0.4 mg/kg) in both samples.

- Chromium exceeded its soil-to-groundwater SSL (2 mg/kg) in both samples, and its RC (23.9 mg/kg) in sample 114X000101 (27.3 mg/kg).

- Copper exceeded its RC (24.2 mg/kg) in sample 114X000101 (93.6 mg/kg).

- Lead was retained as a COPC because it exceeded its RC (26.0 mg/kg) and the USEPA/ Office of Solid Waste and Emergency Response (OSWER) (Directive 9355.4-12) residential soil cleanup level of 400 mg/kg in sample 114X000101 (2,000 mg/kg).

- Nickel exceeded its soil-to-groundwater SSL (7 mg/kg) in both surface-soil samples.

- Selenium exceeded its soil-to-groundwater SSL (0.3 mg/kg) in sample 397X000101 (0.35 mg/kg).

- Zinc exceeded its RC (98 mg/kg) in sample 397X000101 (155 mg/kg).

7.4.4 Preliminary Risk Evaluation/Lead in Soil

In accordance with *Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV memorandum, November 1994), preliminary screening comparisons were made for Facility N-114/N-397 using data from surface-soil samples collected during the Gray Areas Investigation. Because beryllium and cadmium were identified as COPCs, a PRE was conducted based on the analytical data from surface soil. Because a groundwater investigation was not undertaken at this site, there is some uncertainty as to whether fluvial deposits groundwater has been impacted at Facility N-114/N-397. For more information on PRE methods, refer to Section 5. Table 7.4.4 shows the calculated risk associated with residential and industrial land use.

Table 7.4.4
Facility N-114/N-397 — Preliminary Risk Evaluation

					Residential			Industrial	
Chemical	Maximum Reported Concentration	Units	RC	RBC	Hazard Quotient	ILCR	RBC	Hazard Quotient	ILCR
Beryllium	1.3	mg/kg	1	0.15C	NA	8.7E-6	1.3C	NA	1.0E-6
Cadmium	5.1	mg/kg	1.54	3.9N	1.3	NA	100N	0.05	NA
Sum					1.3	8.7E-6		0.05	1.0E-6

Notes:

RBC — Risk-based concentration from the USEPA Region III April 1999 RBC Table; in accordance with the USEPA Region IV Supplemental Guidance to RAGS Bulletin 1, noncarcinogen RBCs were conservatively adjusted to reflect a hazard quotient of 0.1.
RC — Reference concentration
N — Noncarcinogen
C — Carcinogen
NA — Not applicable
ILCR — Incremental lifetime (excess) cancer risk

The following conclusions have been reached based on a PRE for surface-soil data:

Residential Land Use

- Carcinogens: The excess cancer risk for the residential scenario was estimated to be 8.7E-6, which is less than the cumulative PRE risk threshold value of 1E-4. This is considered below the excess cancer risk for the residential land-use scenario and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

- Noncarcinogens: Risk for the residential scenario was estimated to be 1.3, which is greater than the cumulative PRE non-cancer risk threshold value of 1. This is considered above the noncarcinogen risk for residential land use and indicates a lack of suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

Industrial Land Use

- Carcinogens: The excess cancer risk for the industrial scenario was estimated to be 1.0E-6, which is less than the cumulative PRE risk threshold value of 1E-4. This is considered below the excess cancer risk for the industrial land-use scenario and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

- Noncarcinogens: Risk for the industrial scenario was estimated to be 0.05, which is less than the cumulative PRE non-cancer risk threshold value of 1. This is considered below the noncarcinogen risk for industrial land use and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

Lead in Soil

Lead is evaluated by comparing concentrations in the blood with an established exposure percentage. Lead was detected in sample 114X000101 at 2,000 mg/kg, which exceeds its RC of 26.0 mg/kg and the soil lead action level of 400 mg/kg. This concentration far exceeds the regulatory risk threshold. Even though metals have a tendency to sorb to soil particles, rendering them immobile apart from these particles, additional soil samples should be taken in this area to address the extent of lead contamination and aid in the risk assessment.

7.4.5 Fate and Transport

The approach to evaluating the fate and transport of the Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility N-114/N-397. Transport processes for contaminants/constituents other than those designated as COPCs are also discussed if they occur in multiple environmental media or have the potential to migrate to other media.

Potential migration pathways for contaminants at this facility include leaching from soil to groundwater, and erosion of surface soil containing sorbed contaminants from the unpaved, grass-covered areas, forming sediments in drainage ways. Surface-soil analytical data indicate that no VOCs exceeded their specific soil-to-air SSLs; therefore, the soil-to-air cross-media transport process is not discussed.

Facility N-114/N-397 samples had three COPCs — beryllium, cadmium, and lead – which were retained as COPCs because they exceeded their RCs, residential and industrial RBCs, or standard reference values in soil at one location. Facility samples also had some contaminants/constituents that exceeded soil-to-groundwater SSLs: antimony, arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in soil. Of these inorganics, only barium, cadmium, and chromium also exceeded their background RCs.

7.4.5.1 Soil-to-Groundwater Cross-Media Transport

Based on comparison of soil concentrations to the groundwater protection soil-screening criteria, the Facility N-114/N-397 contaminants that exhibit the potential for soil-to-groundwater transport are the inorganics barium, cadmium, and chromium. Since the inorganics beryllium, cadmium, and lead were retained as COPCs, they will also be discussed.

Inorganics do not readily degrade and are generally considered to persist indefinitely in the environment. Interaction with soil occurs by ion exchange, adsorption, precipitation, or complexation. These processes are affected by soil pH, and the type and amount of organic matter, minerals, and clay in the soil. Only near-surface soil samples (0 to 1 foot bls) were analyzed for inorganics, and thus subsurface concentrations are not known. Inorganics at this site would not be expected to travel vertically through the soil column, given their affinity for soil particles.

7.4.5.2 Soil-to-Sediment Cross-Media Transport

Contaminants in near-surface soil where vegetation or asphalt provides a ground cover were evaluated to determine their potential for transport by erosion, should these covers be removed. Drainage patterns and topography were also examined to determine whether site features would support contaminant transport.

Contaminants detected in surface soil consist of organics and inorganics. Inorganics tend to sorb to soil particles, rendering them relatively immobile apart from these particles. The only organics detected in surface soil were the SVOCs fluoranthene, phenanthrene, and TPH. Relative to VOCs, SVOCs have higher K_{oc} values, meaning they tend to associate with soil rather than water which makes them relatively immobile. Thus contaminant transport is more likely to occur if the soil particles become mobile.

Drainage patterns and the vegetation/asphalt-concrete cover at Facility N-114/N-397 leave little potential for surface soil to erode and form sediments that can become mobile in surface water. Therefore, the soil-to-sediment transport process at this facility is not considered significant.

7.4.6 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Three organic compounds were detected in surface (0 to 1 foot) soil. Of these, none exceeded any standard reference values.

- TPH was detected in the Facility N-114 surface-soil sample at concentrations exceeding all of the TDEC cleanup values.

- Thirteen metals were detected in surface soil at Facility N-114/N-397. Of these:

  — Beryllium, cadmium, and lead were retained as COPCs because they exceeded their RCs, residential and industrial RBCs, or standard reference values.

  — Antimony, arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs.

  — Barium, beryllium, cadmium, chromium, copper, lead and zinc exceeded their RCs in the Facility N-114 sample. Lead and zinc exceeded their RCs in the Facility N-397 sample.

- A site PRE determined that:

  - Carcinogen beryllium poses no threat to residential or industrial land-use scenarios.
  - Noncarcinogen cadmium does pose a threat to the residential land-use scenario.

Recommendations

Based on surface and subsurface-soil data, a full RCRA Facility Investigation (RFI) is recommended to determine the extent of lead and TPH contamination at Facility N-114/N-397.

7.5 Facility S-203 — Quonset Hut (Storage)

This 9,000-square-foot Quonset hut, with a concrete slab floor and sheet-metal walls, was built in 1947. The nearby Facility S-219 is a small (546 square feet) brick structure, built in 1949, that was used to store petroleum, oils, and lubricants (POLs). Facility 1470, another nearby structure, is a metal cage on top of a 3-foot-high concrete slab (121 square feet) which is currently not in use. Facilities S-219 and 1470 are associated with Facility S-203 because of their proximity and similar uses. According to the PWD Env. Div., Facility S-203 is currently used as the Hazardous Material Minimization Center and the Hazardous Waste Accumulation Area of the Base Operations Services (BOS) Contractor. Figure 1.1 shows the location of Facility S-203.

Facility S-203 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site-specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.5.1 Previous Activities

According to the Environmental Baseline Survey (EBS; E/A&H, 1993), Facilities S-203/S-219/1470 have been used to store various supplies, including flammable liquids.

7.5.2 Field Investigation

Surface and subsurface soils were sampled to determine if petroleum products, hazardous materials, or hazardous waste have been released from past or current site operations. Samples were collected from two intervals at three locations: from 0 to 1 ft. bls (203X000101, 203X000201, and 203X000301) and from the saturated portion of the loess at 12 to 15 ft. bls

(203X000115, 203X000215, and 203X000315). Sample locations were selected based on the possibility of improper disposal practices (e.g., near back and side doors, adjacent to a drainage ditch, etc.). Surface-soil samples were analyzed for Appendix IX metals and TPH. Subsurface samples were analyzed for VOCs. Figure 7.5 shows the site layout and surveyed sampling locations. All samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia.

7.5.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic analyses of soil are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSLs for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996). Inorganic results are compared to RCs from NSA Mid-South, residential and industrial RBCs, and SSLs.

Organics in Soil

Organic and TPH soil-sample data for Facility S-203 are presented in Tables 7.5.1 and 7.5.2.

Table 7.5.1
Gray Areas — Facility S-203 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
203X000115	15'	Acetone	—	—	—	800	40 J
203X000315	15'	Acetone	—	—	—	800	72

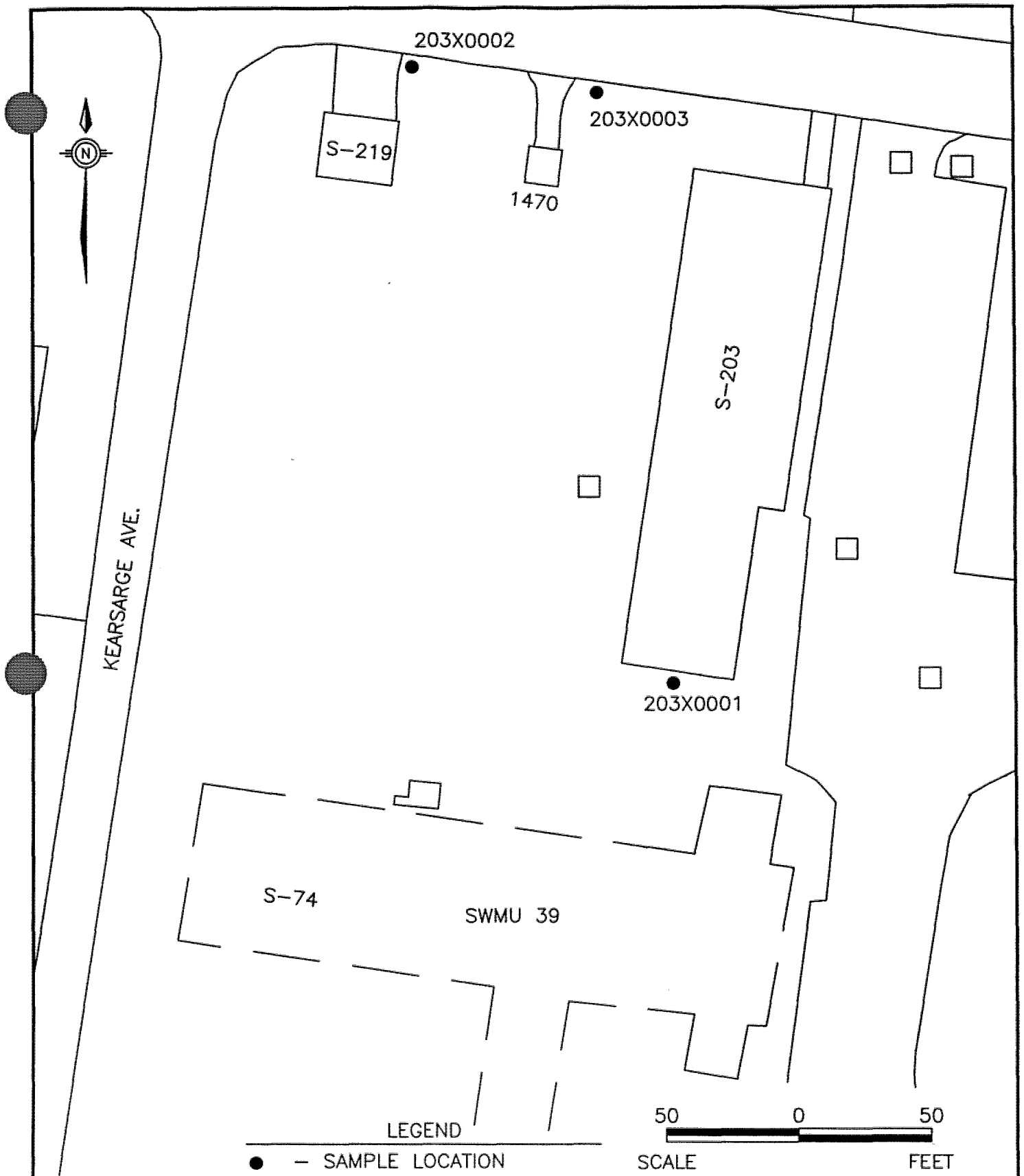
Notes:

a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).

b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).

c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).

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


203X0002
203X0003
S-219
1470
S-203
KEARSARGE AVE.
203X0001
S-74
SWMU 39
LEGEND
● – SAMPLE LOCATION
50 0 50
SCALE FEET
ERNA GRAY AREAS
REPORT
NSA MID-SOUTH
MILLINGTON, TN
FIGURE 7.5
FACILITY S203
SAMPLE LOCATION MAP
DWG DATE: 05/03/99
DWG NAME: 0106B003

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As shown in Table 7.5.1, acetone was the only organic detected in Facility S-203 soil samples. Acetone is a common laboratory artifact, and both samples showed detections considerably less than the soil-to-groundwater SSL of 800 μg/kg.

Table 7.5.2
Gray Areas — Facility S-203 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
203X000101	01'	TPH	65
203X000201	01'	TPH	36
203X000301	**01'**	**TPH**	**230**

Notes:
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.
Bold indicates sample exceeds TDEC soil cleanup value.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil-cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH depending on soil permeability and aquifer classification: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg. As requested by the PWD Env. Div., soil exceeding the TDEC cleanup level of 100 mg/kg at this site will be removed to a depth of 5 feet or until a concentration of TPH equal to or less than 100 mg/kg is achieved, as described in the *Voluntary Corrective Action Work Plan — Petroleum Sites; Revision 2* (EnSafe, Pending 1999). As shown in Table 7.5.2, one sample detection exceeded the 100 mg/kg standard at Facility S-203 .

Inorganics in Soil

Inorganic soil-sample data are presented in Table 7.5.3.

Table 7.5.3
Gray Areas — Facility S-203 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
203X000101	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**9.2**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**151**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.61**
		Cadmium (Cd)	**1.54**	**100**	**3.9**	**0.4**	**0.46 J**
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**18.9**
		Cobalt (Co)	16.0	12,000	470	DNE	9.2
		Copper (Cu)	24.2	8,200	310	DNE	16.0
		Lead (Pb)	26.0	400	400	DNE	25.6 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**20.5**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.37 J**
		Vanadium (V)	45.1	1,400	55	300	27.5
		Zinc (Zn)	98	61,000	2,300	620	79.7
203X000201	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**8.5**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**102**
		Cadmium (Cd)	1.54	100	3.9	0.4	0.19 J
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**14.0**
		Cobalt (Co)	16.0	12,000	470	DNE	5.5
		Copper (Cu)	24.2	8,200	310	DNE	18.9
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**28.6 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**9.9**
		Vanadium (V)	45.1	1,400	55	300	25.2
		Zinc (Zn)	98	61,000	2,300	620	54.1

Table 7.5.3
Gray Areas — Facility S-203 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
203X000301	01'	Arsenic (As)	14.6	3.8	0.43	1	**11.1**
		Barium (Ba)	223	14,000	550	82	**86.2**
		Beryllium (Be)	1	1.3	0.15	3	**0.51 J**
		Cadmium (Cd)	1.54	100	3.9	0.4	**0.73**
		Chromium (Cr)	23.9	1,000	39	2	**17.3**
		Cobalt (Co)	16.0	12,000	470	DNE	5.9
		Copper (Cu)	24.2	8,200	310	DNE	**30.3**
		Lead (Pb)	26.0	400	400	DNE	**176 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.09
		Nickel (Ni)	20.6	4,100	160	7	**12.0**
		Selenium (Se)	DNE	1,000	39	0.3	**0.59 J**
		Vanadium (V)	45.1	1,400	55	300	27.3
		Zinc (Zn)	98	61,000	2,300	620	**126**

Notes:
a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
DNE — Does not exist.
J — Constituent detected at concentrations less than the method reporting limit; value estimated.
Bold indicates samples that exceed any of the standard reference values.

As shown in Table 7.5.3, 13 inorganics were detected in soil samples at Facility S-203. Of these:

- Arsenic exceeded its industrial RBC (3.8 mg/kg), residential RBC (0.43 mg/kg), and soil-to-groundwater SSL (1 mg/kg) in all three surface-soil samples.

- Barium exceeded its soil-to-groundwater SSL (82 mg/kg) in all three surface-soil samples.

- Beryllium exceeded its residential RBC (0.15 mg/kg) in sample 203X000101 (0.61 mg/kg) and 203X000301 (0.51 mg/kg).

- Cadmium exceeded its soil-to-groundwater SSL (0.4 mg/kg) in samples 203X000101 (0.46 mg/kg) and 203X000301 (0.73 mg/kg).

- Chromium and nickel exceeded their soil-to-groundwater SSLs (2 mg/kg and 7 mg/kg, respectively) in all three samples.

- Copper and zinc exceeded their RCs (24.2 mg/kg and 98 mg/kg, respectively) in sample 203X000301 (30.3 mg/kg and 126 mg/kg, respectively).

- Lead exceeded its RC (26.0 mg/kg) in samples 203X000201 (28.6 mg/kg) and 203X000301 (176 mg/kg).

- Selenium exceeded its soil-to-groundwater SSL (0.3 mg/kg) in samples 203X000101 (0.37 mg/kg) and 203X000301 (0.59 mg/kg).

7.5.4 Preliminary Risk Evaluation

In accordance with *Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV memorandum, November 1994), preliminary screening comparisons were made for Facility S-203 using data from surface-soil samples collected during the Gray Areas Investigation. Because no COPC was identified, a PRE is not likely to be necessary, although this is not absolutely certain because a fluvial deposits groundwater investigation was not undertaken for Facility S-203. The land should be suitable for either industrial or residential use based on analytical soil data. For more information on PRE methods, refer to Section 5.

7.5.5 Fate and Transport

The approach to evaluating the fate and transport of the Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility S-203. Transport processes for contaminants/constituents other than those designated as COPCs are also discussed if they occur in multiple environmental media or have the potential to migrate to other media.

Potential migration pathways for contaminants at Facility S-203 include leaching from soil-to-groundwater, and erosion of surface soil containing sorbed contaminants from the unpaved, grass-covered areas, forming sediments in drainage ways. Surface-soil analytical data indicate that no contaminants exceeded their specific soil-to-air SSLs; therefore, the soil-to-air cross-media transport process is not discussed.

Facility S-203 had no COPCs, but some contaminants/constituents exceeded soil-to-groundwater SSLs:

- The inorganics arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in soil. None of these inorganics exceeded their background RCs, and may be considered naturally occurring.

Lead, copper, and zinc exceeded their background RCs, but not their soil-to-groundwater SSLs.

Acetone was the only VOC detected at Facility S-203. It was detected at two sample locations at concentrations considerably less than its soil-to-groundwater SSL, and is not considered a threat to underlying groundwater.

7.5.5.1 Soil-to-Groundwater Cross-Media Transport

Based on comparison of soil concentrations to groundwater-protection soil-screening criteria, no Facility S-203 contaminants exhibit the potential for soil-to-groundwater transport. The inorganics that exceeded their SSLs are not discussed since they were detected at concentrations less than their background RCs.

7.5.5.2 Soil-to-Sediment Cross-Media Transport

Contaminants in near-surface soil where vegetation or asphalt provides a ground cover were evaluated to determine their potential for transport by erosion, should these covers be removed. Drainage patterns and topography were also examined to determine whether site features would support contaminant transport.

Contaminants detected in surface soil consist of organics and inorganics. Inorganic chemicals do not degrade, but may change chemical form or speciation in the environment. Like pesticides, inorganics tend to sorb to soil particles, rendering them relatively immobile apart from these particles. The only organic detected in surface soil was TPH, at concentrations considerably less than the 500 mg/kg level discussed in Section 7.5.3. TPH is considered part of the SVOC contaminant class and, like inorganics, transport is limited in the subsurface as SVOCs tend to associate preferentially with soil particles, which leads to a likelihood of greater persistence in soil.

Drainage patterns and the vegetation/asphalt-concrete cover at Facility S-203 leave little potential for surface soil to erode and form sediments that can become mobile in surface water. Therefore, the soil-to-sediment transport process at Facility S-203 is not considered significant.

7.5.6 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Facility S-203 is suitable for industrial or residential land use.

- Acetone was the only organic compound detected in surface (0 to 1 foot) soil. It did not exceed any standard reference values.

- TPH was detected in one surface-soil sample exceeding the 100 mg/kg TDEC cleanup value.

- Thirteen metals were detected in surface soil at and near Facility S-203. Of these:

  — Arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs.

  — Beryllium exceeded its residential RBC in two samples.

  — Copper, lead, and zinc exceeded their RCs in surface soil samples.

Recommendations

Based on surface-soil data, a VCA is recommended for Facility S-203 to address TPH contamination exceeding 100 mg/kg.

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7.6 Facility 394 (Mechanical Maintenance Shop)

This 8,400-square-foot metal-frame structure was built on a concrete slab in 1967. In the past, it was used as the Air Support Maintenance School and housed the mechanical maintenance shop that supported the mechanical schools on base. Facility 394 is currently used as a storage area for the base. Figure 1.1 shows the location of Facility 394.

Facility 394 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.6.1 Previous Activities

Facility 394 is associated with Facility S-197, which was originally built as a battery storage shed. Batteries were reportedly stored and possibly drained in a metal shed west of Facility S-197. A muriatic acid and 1,1,1-trichloroethane spill reportedly occurred on August 27, 1993 at the rear of Facility S-197. A letter submitted to Mark Thomas of the TDEC Memphis field office states that the spill was cleaned up to the state's satisfaction. Contaminated soil and debris were sent to Fischer Industrial of Gadsden, Alabama.

7.6.2 Field Investigation

Surface and subsurface soils were sampled to determine if hazardous materials/hazardous waste or petroleum products have been released. As shown in Figure 7.6, samples were collected from three locations where a release could have occurred, based on previous site activities. Two surface-soil samples (394X000101 and 394X000201) were collected from 0 to 1 foot bls and

analyzed for Appendix IX metals and TPH. One subsurface-soil sample (394X000315) was collected from 12 to 15 feet bls and analyzed for VOCs. All samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia.

7.6.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic soil analyses are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSLs for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996). Inorganic results are compared to RCs from NSA Mid-South, residential and industrial RBCs, and SSLs.

Organics in Soil

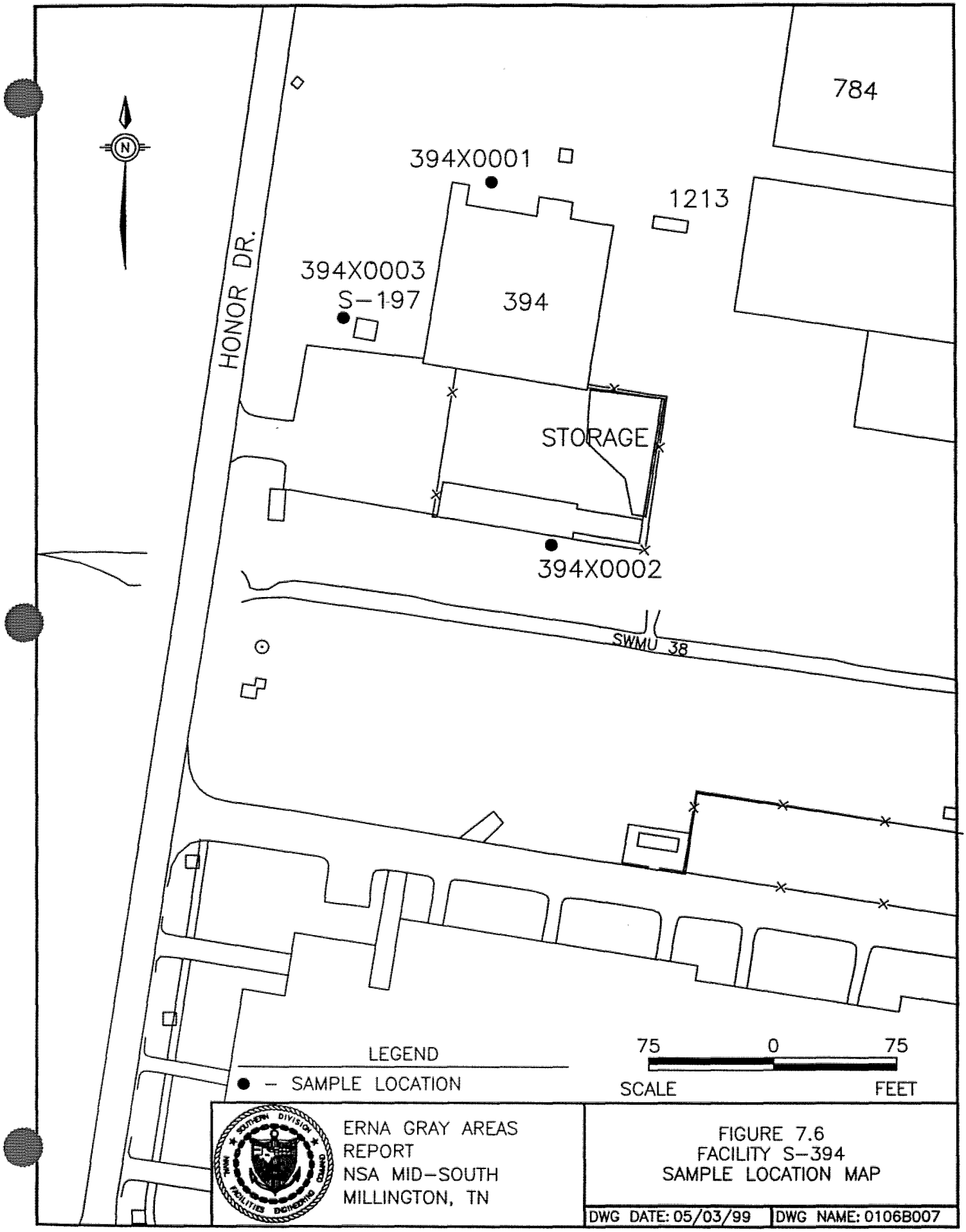
No VOCs were detected in subsurface soil. The TPH soil-sample data are presented in Table 7.6.1.

Table 7.6.1
Gray Areas — Facility 394 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
394X000201	***01'***	***TPH***	***700***

Notes:
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.
Bold/italics indicate sample exceeds TDEC cleanup value of 500 to 1,000 mg/kg.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg, depending on soil permeability. There currently are no permeability data for Facility 394 although, based on requests from the PWD Env. Div., site soil will be excavated until the 100 mg/kg cleanup standard is reached. As shown in Table 7.6.2, one Facility 394 sample detection exceeded the 100 mg/kg and 500 mg/kg cleanup values.


784
394X0001
1213
394X0003
S-197
394
HONOR DR.
STORAGE
394X0002
SWMU 38
LEGEND
● – SAMPLE LOCATION
75 0 75
SCALE FEET
ERNA GRAY AREAS
REPORT
NSA MID-SOUTH
MILLINGTON, TN
FIGURE 7.6
FACILITY S-394
SAMPLE LOCATION MAP
DWG DATE: 05/03/99
DWG NAME: 0106B007

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Inorganics in Soil

Inorganic soil-sample data for Facility 394 are presented in Table 7.6.2.

Table 7.6.2
Gray Areas — Facility 394 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
394X000101	01'	Arsenic (As)	14.6	3.8	0.43	1	7.1
		Barium (Ba)	223	14,000	550	82	135
		Beryllium (Be)	1	1.3	0.15	3	0.54 J
		Cadmium (Cd)	1.54	100	3.9	0.4	0.74
		Chromium (Cr)	23.9	1,000	39	2	14.3
		Cobalt (Co)	16.0	12,000	470	DNE	7.1
		Copper (Cu)	24.2	8,200	310	DNE	37.1
		Lead (Pb)	26.0	400	400	DNE	23.3 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	20.6	4,100	160	7	13.4
		Selenium (Se)	DNE	1,000	39	0.3	0.34 J
		Vanadium (V)	45.1	1,400	55	300	24.3
		Zinc (Zn)	98	61,000	2,300	620	252

Table 7.6.2
Gray Areas — Facility 394 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
394X000201	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**7.3**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**91.1**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.41 J**
		Cadmium (Cd)	1.54	100	3.9	0.4	0.29 J
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**12.0**
		Cobalt (Co)	16.0	12,000	470	DNE	8.5
		Copper (Cu)	24.2	8,200	310	DNE	10.1
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**89.7 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.03
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**9.1**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.85 J**
		Vanadium (V)	45.1	1,400	55	300	23.6
		Zinc (Zn)	98	61,000	2,300	620	45.5

Notes:
a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).
b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).
DNE — Does not exist.
J — Constituent detected in concentrations less than the method reporting limit; value estimated.
Bold indicates samples that exceed any of the standard reference values.

As shown in Table 7.6.2, 13 inorganics were detected in soil samples at Facility 394. Of these:

- Arsenic exceeded its industrial RBC (3.8 mg/kg), residential RBC (0.43 mg/kg), and soil-to-groundwater SSL (1 mg/kg) in both surface-soil samples.

- Barium exceeded its soil-to-groundwater SSL (82 mg/kg) in both surface-soil samples.

- Beryllium exceeded its residential RBC (0.15 mg/kg) in both surface-soil samples.

- Cadmium exceeded its soil-to-groundwater SSL (0.4 mg/kg) in sample 394X000101 (0.74 mg/kg).

- Chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs (2 mg/kg, 7 mg/kg, and 0.3 mg/kg, respectively) in both surface-soil samples.

- Copper and zinc exceeded their RCs (24.2 mg/kg and 98 mg/kg, respectively) in sample 394X000101 (37.1 mg/kg and 252 mg/kg, respectively).

- Lead exceeded its RC (26.0 mg/kg) in sample 394X000201 (89.7 mg/kg).

7.6.4 Preliminary Risk Evaluation

In accordance with *Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV memorandum, November 1994), preliminary screening comparisons were made for Facility 394 using data from surface-soil samples collected during the Gray Areas Investigation. Because no COPC was identified, a PRE is not likely to be necessary, although this is not absolutely certain because a fluvial deposits groundwater investigation was not undertaken for Facility 394. The land should be suitable for either industrial or residential use based on analytical soil data. For more information on PRE methods, refer to Section 5.

7.6.5 Fate and Transport

The approach to evaluating the fate and transport of the Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility 394. Transport processes for contaminants/constituents other than those designated as COPCs are also

discussed if they occur in multiple environmental media or have the potential to migrate to other media.

Potential migration pathways for contaminants at Facility 394 include leaching from soil to groundwater, and erosion of surface soil containing sorbed contaminants from the unpaved, grass-covered areas, forming sediments in drainage ways. Surface-soil analytical data indicate that no contaminants exceeded their specific soil-to-air SSLs; therefore, the soil-to-air cross-media transport process is not discussed.

Facility 394 had no COPCs, but some contaminants/constituents exceeded soil-to-groundwater SSLs:

- The inorganics arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in soil. However, none of these contaminants also exceeded their background RCs.

7.6.5.1 Soil-to-Groundwater Cross-Media Transport

Based on comparison of soil concentrations to groundwater-protection soil-screening criteria, the Facility 394 contaminants that exhibit the potential for soil-to-groundwater transport are the inorganics arsenic, barium, cadmium, chromium, nickel, and selenium. However, these inorganics were detected at concentrations less than their background RCs, and may occur naturally.

Since the predominant contaminants in soil at Facility 394 are inorganics, which are generally considered indefinitely persistent in soil, it is unlikely that leaching to underlying groundwater has or will occur. Therefore, the soil-to-groundwater cross-media transport process is not significant at Facility 394.

7.6.5.2 Soil-to-Sediment Cross-Media Transport

Contaminants in near-surface soil where vegetation or asphalt provides a ground cover were evaluated to determine their potential for transport by erosion, should these covers be removed. Drainage patterns and topography were also examined to determine whether site features would support contaminant transport.

Contaminants detected in surface soil are mostly inorganics. Inorganic chemicals do not degrade, but may change chemical form or speciation in the environment. They tend to sorb to soil particles, rendering them relatively immobile apart from these particles.

Drainage patterns and the vegetation/asphalt-concrete cover at Facility 394 leave little potential for surface soil to erode and form sediments that can become mobile in surface water. Therefore, the soil-to-sediment transport process at this facility is not considered significant.

7.6.6 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Facility 394 is suitable for industrial or residential land use.

- No VOCs were detected in subsurface (12 to15 ft. bls) soil.

- TPH was detected in surface-soil sample 394X000201 (700 mg/kg), exceeding the TDEC cleanup values of 100 mg/kg and 500 mg/kg.

- Thirteen metals were detected in surface soil at Facility 394. Of these:

  — Arsenic, barium, cadmium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in at least one sample.

  — Beryllium exceeded its residential RBC in both surface-soil samples.

  — Copper, lead, and zinc exceeded their RCs in at least one sample.

Recommendations

Based on surface-soil data, a VCA is recommended for Facility 394 to address TPH contamination exceeding 100 mg/kg.

7.7 Facility 784 (Russell Johnson AMS Training Complex)

This 90,000-square-foot, three-story concrete and brick structure is part of the Russell Johnson AMS Training Complex built in 1984. It housed the Aviation Structure Mechanic Training school which was used primarily to train personnel in sheet metal and composite construction. Currently, the structure is used by the Bureau of Personnel (BUPERS). Figure 1.1 shows the location of Facility 784.

Facility 784 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site-specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.7.1 Previous Activities

The facility's hazardous materials/hazardous waste program was efficient and posed no apparent threat to the environment. However, before Facility 784 and adjacent Facility 785 were built, Facilities S-205, S-206, S-207 and S-208 were located in this area alongside a now-demolished runway. These facilities were used by the Navy for engine testing, and were demolished prior to construction of Facilities 784 and 785. Former Facilities S-205 through S-208 are the subject of this investigation, and Facility 784 was chosen to represent sample identification for these former facilities. It is not known if they were at the current elevation of Facilities 784 and 785.

7.7.2 Field Investigation

Subsurface soil was sampled to determine if any petroleum products, hazardous materials, or hazardous waste from past operations were released at the site. Only subsurface soil was

examined because fill material underlies the building and surrounding grounds. Because the elevations of the engine testing facilities are not known, four locations (784X000115, 784X000215, 784X000315, and 784X000415) were selected from which samples were collected at approximately 15 feet bls in the saturated loess. Samples were collected using Geoprobe equipment at the four locations shown on Figure 7.7 and analyzed for TPH, TPH-GRO, and TPH-DRO. All samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia.

7.7.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic analyses of soil are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSL for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996).

Organics in Soil

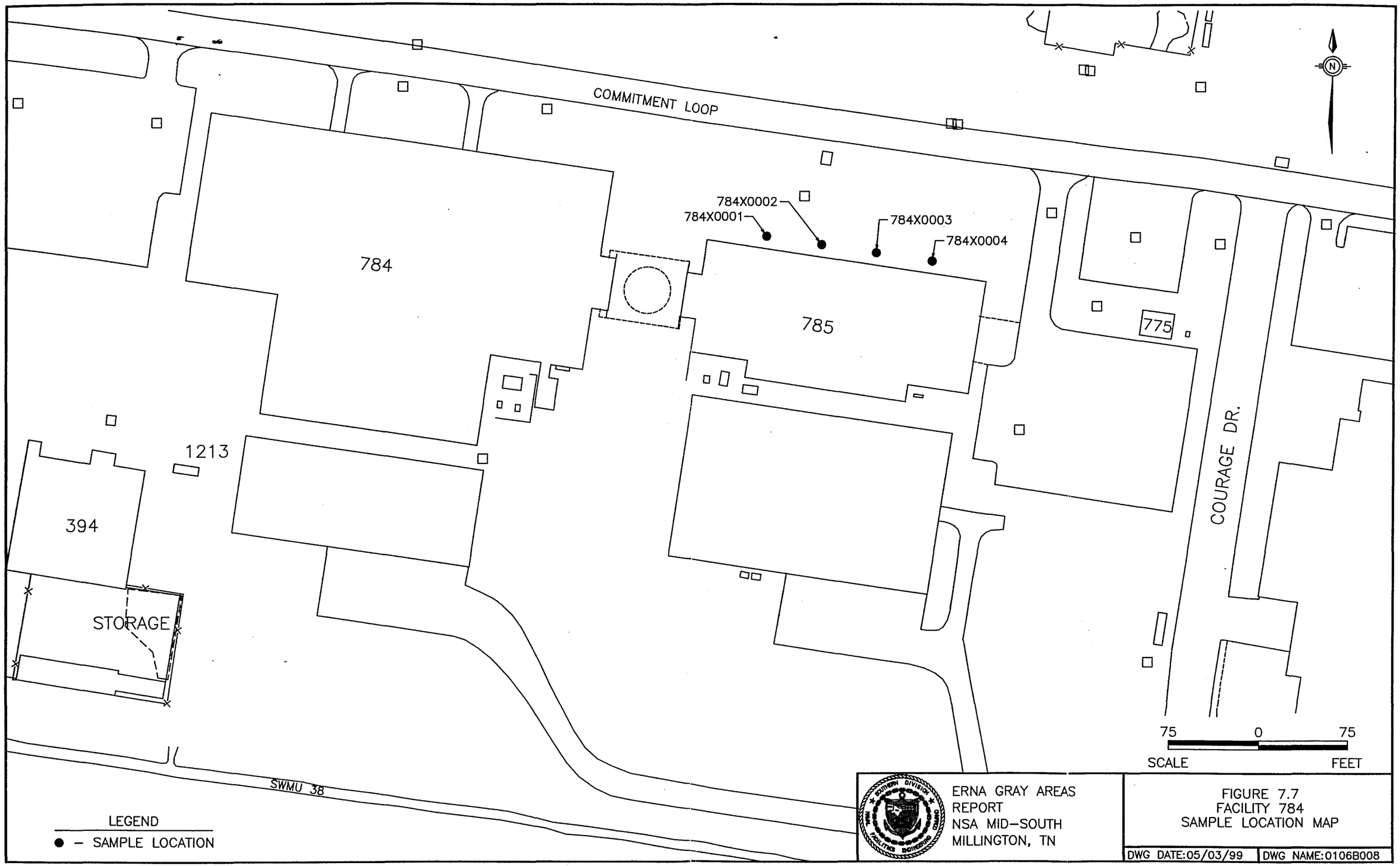
TPH soil-sample data for Facility 784 are presented in Table 7.7.1.

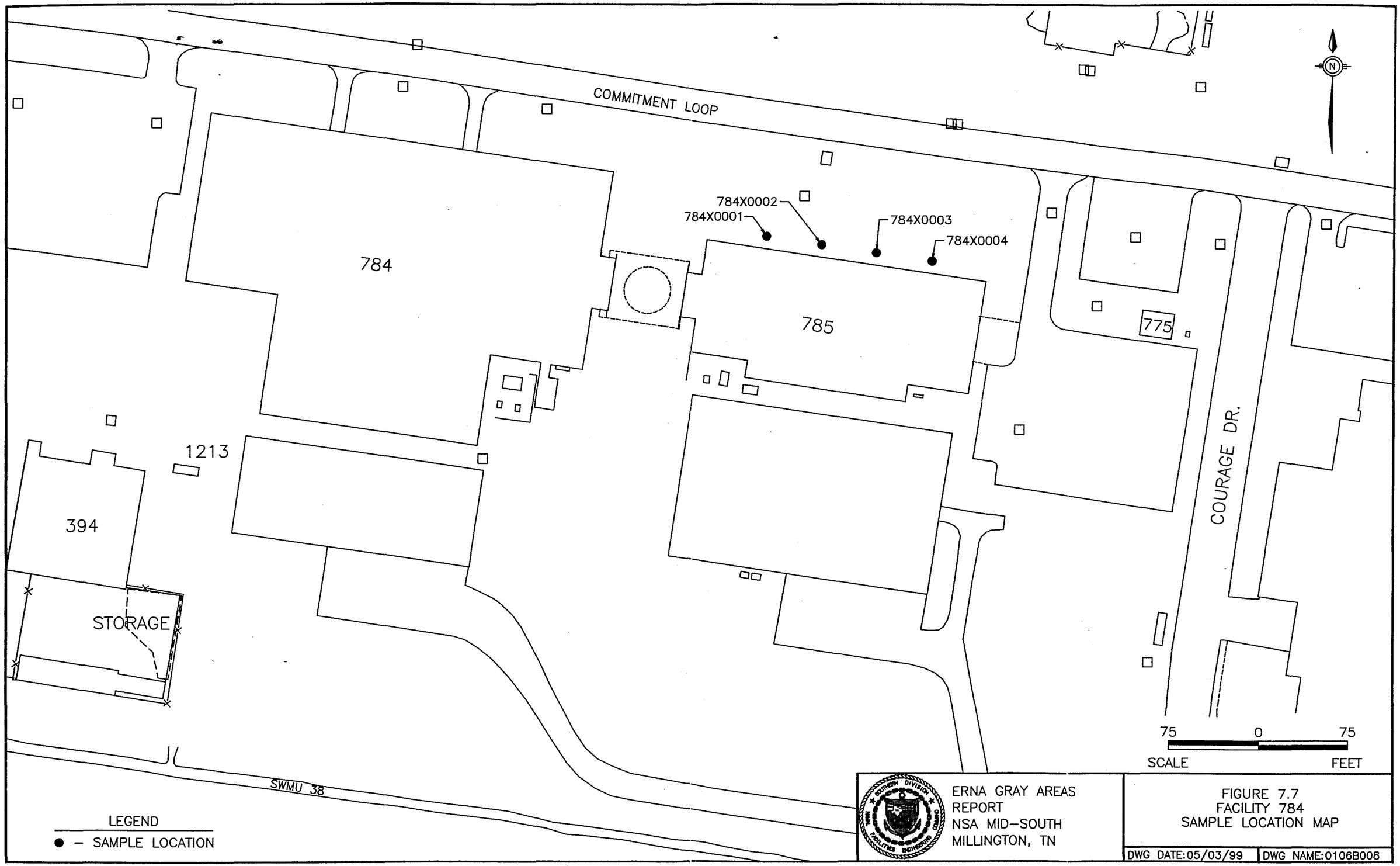
Table 7.7.1
Gray Areas — Facility 784 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
784X000315	15'	TPH-DRO	1.9 J
784X000415	15'	TPH	26 J

Note:
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil-cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH depending on soil permeability and aquifer classification: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg. There currently are no permeability data for Facility 784; however, as shown in Table 7.7.1, no sample detections exceeded the TDEC soil-cleanup values.


COMMITMENT LOOP
784
785
775
1213
394
STORAGE
COURAGE DR.
SWMU 38
784X0001
784X0002
784X0003
784X0004
N
75 0 75
SCALE FEET
LEGEND
● – SAMPLE LOCATION
ERNA GRAY AREAS REPORT
NSA MID-SOUTH
MILLINGTON, TN
FIGURE 7.7
FACILITY 784
SAMPLE LOCATION MAP
DWG DATE:05/03/99
DWG NAME:0106B008


COMMITMENT LOOP
784
785
775
1213
394
STORAGE
COURAGE DR.
SWMU 38
784X0001
784X0002
784X0003
784X0004
N
75 0 75
SCALE FEET
LEGEND
● – SAMPLE LOCATION
ERNA GRAY AREAS REPORT
NSA MID-SOUTH
MILLINGTON, TN
FIGURE 7.7
FACILITY 784
SAMPLE LOCATION MAP
DWG DATE:05/03/99
DWG NAME:0106B008

7.7.4 Fate and Transport

The approach to evaluating the fate and transport of the Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility 784. Transport processes for contaminants other than those designated as COPCs are also discussed if they occur in multiple environmental media or have the potential to migrate to other media.

The potential migration pathway for contaminants at Facility 784 include leaching from soil to groundwater. No surface-soil samples were collected, and thus the soil-to-sediment and soil-to-air migration pathways are not discussed. No COPCs were identified for Facility 784.

7.7.4.1 Soil-to-Groundwater Cross-Media Transport

Since no soil-to-groundwater SSL exists for TPH, TDEC soil-cleanup values are used for comparison. As discussed earlier, either the 500 mg/kg or the 1,000 mg/kg cleanup standard would most likely apply to Facility 784. Analytical results indicate that no sample concentration exceeded even the 100 mg/kg cleanup standard.

TPH is considered part of the SVOC class of contaminants. Based on higher K_{oc} values than those for VOCs, SVOCs tend to sorb to solids and are relatively immobile in soil. Based on the properties inherent to SVOCs and the concentrations detected at Facility 784, TPH in unsaturated soil would not be expected to leach to underlying groundwater in appreciable quantities, if at all. However, samples at this facility were collected from the saturated portion of the loess. If this depth of sample collection is considered a water-bearing zone, TPH transport, like other SVOCs, depends primarily on the solubility and organic content of the soil. Typically, TPH is relatively immobile in groundwater, which may be caused by its adsorption onto soil particles or high retardation factors based on a high K_d. In general, TPH would not be expected to extend great distances beyond a source area in the loess.

7.7.5 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Facility 784 is suitable for industrial or residential land use.
- TPH was detected in subsurface soil but did not exceed any TDEC cleanup values.

Recommendations

Based on subsurface-soil data, no further action is recommended for Facility 784.

7.8 Facility 1211 (Golf Course Maintenance Shop)

This facility is a 4,320-square-foot wood-frame structure built on a concrete slab floor in 1958. It is used for storage by the Morale, Welfare, and Recreation (MWR) department, and as a maintenance shop for golf course equipment. Figure 1.1 shows the location of Facility 1211.

Facility 1211 and the surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site-specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.8.1 Previous Activities

From 1958 to 1968, this building was used for welding, limited sand blasting, vehicle maintenance, and storage of petroleum products such as oil, gasoline, transmission fluid, diesel fuel, and grease. At the time of the 1993 EBS, used oil and Freon were stored in a waste-oil facility onsite (E/A&H, 1993). Facility 1740, associated with Facility 1211, is used by MWR as a pest-control supply building. Also associated with this facility was an abandoned 1,000-gallon UST reported to contain fuel oil. According to the NSA Mid-South PWD Env. Div., this tank has been addressed and removed under the UST program.

7.8.2 Field Investigation

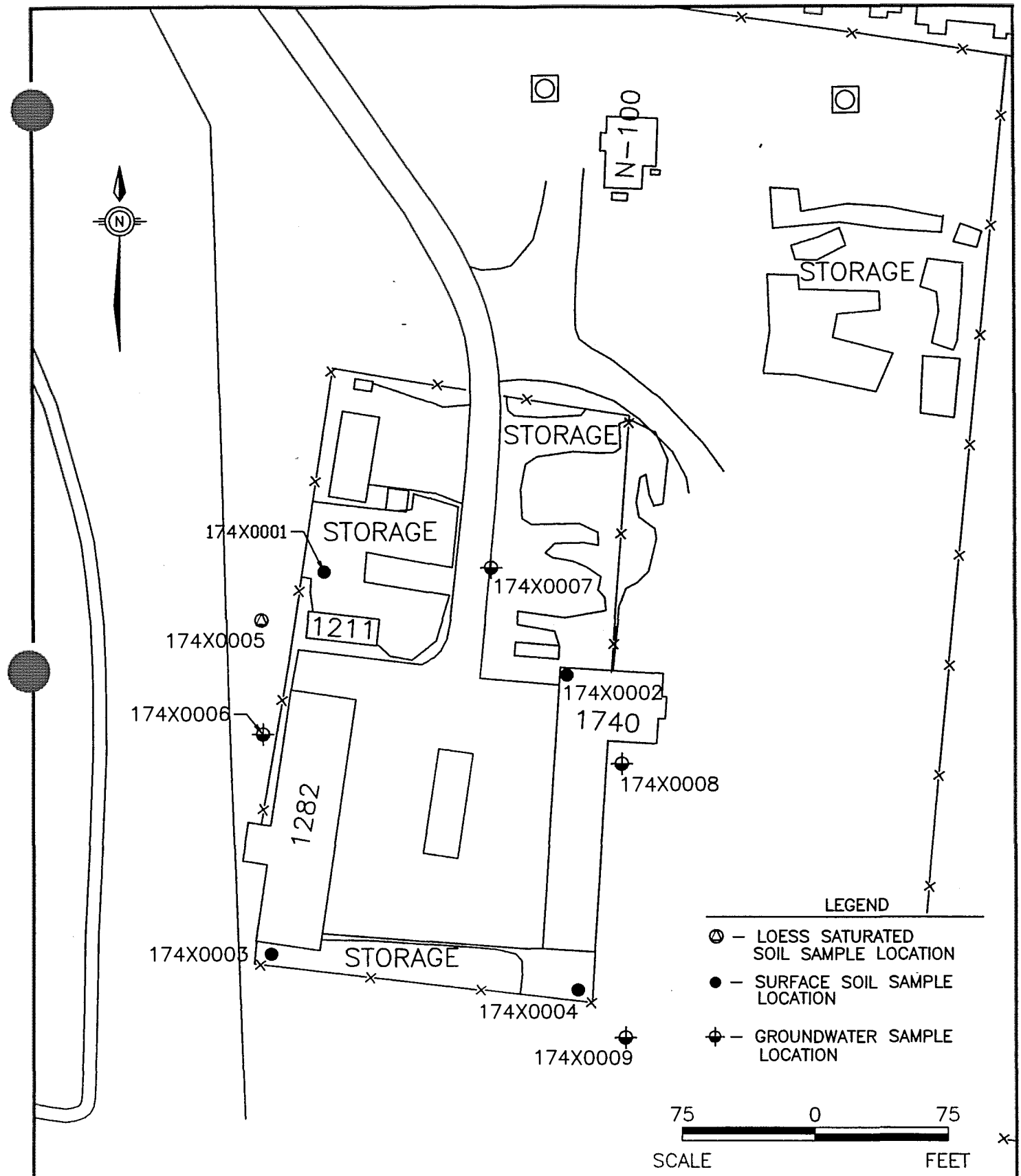
Surface soils were sampled to determine if petroleum products, hazardous materials, or hazardous waste have been released at this site. Four samples (174X000101, 174X000201, 174X000301, 174X000401) were collected from around doorways and ditches at the 0 to 1-foot depth interval.

Because of the low groundwater yield of the loess, one subsurface-soil sample was collected from the saturated zone at one location.

Groundwater from the upper part of the fluvial deposits was sampled at four locations and analyzed for VOCs. Surface-soil samples were analyzed for metals, pesticides, herbicides, and TPH. The saturated loess sample was analyzed for VOCs and TPH. Figure 7.8 shows the site layout and surveyed sampling locations. All soil and groundwater samples were analyzed at Savannah Analytical Laboratory in Savannah, Georgia.

7.8.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic soil analyses are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSLs for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996). Inorganic results are compared to RCs from NSA Mid-South, residential and industrial RBCs, and SSLs. Groundwater results are compared to tap-water RBCs from the USEPA Region III tables, and to maximum contaminant levels (MCLs) published in the *Drinking Water Regulations and Health Advisories Table* (USEPA, October 1996).



ERNA GRAY AREAS REPORT
NSA MID-SOUTH
MILLINGTON, TN

FIGURE 7.8
FACILITY 1211
SAMPLE LOCATION MAP

DWG DATE: 05/03/99 | DWG NAME: 0106B005

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Organics in Soil

Organic and TPH soil-sample data for Facility 1211 are presented in Tables 7.8.1 and 7.8.2.

Table 7.8.1
Gray Areas — Facility 1211 Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
174X000101	01'	2,4,5-TP (Silvex)	—	1,600,000	63,000	DNE	2.4 J
		4,4'-DDT	—	17,000	1,900	2,000	22 NJ
		Dieldrin	***262***	***360***	***40***	***0.2***	***430***
		Endrin aldehyde	—	61,000	2,300	50	17 J
		MCPA	—	100,000	3,900	DNE	1100 J
174X000201	01'	4,4'-DDT	—	17,000	1,900	2,000	0.51 NJ
		Dieldrin	**262**	**360**	**40**	**0.2**	**16 J**
		Endosulfan I	—	1,200,000	47,000	900	1.9 NJ
		Endosulfan sulfate	—	1,200,000	47,000	900	0.42 NJ
		Methoxychlor	—	1,000,000	39,000	8,000	0.68 J
174X000301	01'	4,4'-DDT	—	17,000	1,900	2,000	6.2 NJ
		Dieldrin	**262**	**360**	**40**	**0.2**	**250**
		Endrin aldehyde	—	61,000	2,300	50	3 J
174X000401	**01'**	**Dieldrin**	**262**	**360**	**40**	**0.2**	**72 JD**
		Endosulfan I	—	1,200,000	47,000	900	240 D
		Endosulfan sulfate	—	1,200,000	47,000	900	5.3
		Endrin	—	61,000	2,300	50	0.84 NJ
174X000515	15'	Acetone	—	—	—	800	30 J

Notes:

a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).

b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).

c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).

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

D — Sample diluted to receive value.

N — Sample analysis indicates presences of an analyte for which there is presumptive evidence to make a " tentative identification" and the associated numerical value represents its approximate concentration.

Bold indicates samples that exceed any of the standard reference values.

Bold/Italics indicate samples included in the PRE calculations.

As shown in Table 7.8.1, 10 organics were detected in Facility 1211 soil samples. Of these:

- Dieldrin was retained as a COPC because it exceeded its RC (262 μg/kg), residential RBC (40 μg/kg), and/or industrial RBC (360 μg/kg) in three samples: 174X000101 (430 μg/kg), 174X000301 (250 μg/kg), and 174X000401 (72 μg/kg).

Table 7.8.2
Gray Areas — Facility 1211 Petroleum Hydrocarbon Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Contaminant	Result
174X000101	01'	TPH	24
174X000201	***01'***	***TPH***	***750***
174X000301	01'	TPH	28
174X000401	***01'***	***TPH***	***14,000***
174X000515	15'	TPH	23 J

Notes:
TDEC TPH cleanup level ranges from 100 mg/kg to 1,000 mg/kg.
Bold/Italics indicate sample exceeds TDEC cleanup values of 500 to 1,000 mg/kg.

Since no RBC values exist for TPH or TPH-GRO/DRO, TDEC soil-cleanup values were used for comparison. TDEC has established three cleanup concentrations for TPH depending on soil permeability and aquifer classification: 100 mg/kg, 500 mg/kg, and 1,000 mg/kg. As requested by the PWD Env. Div., soil exceeding the TDEC cleanup level of 100 mg/kg at this site will be removed to a depth of 5 feet or until a concentration of TPH equal to or less than 100 mg/kg is achieved, as described in the *Voluntary Corrective Action Work Plan — Petroleum Sites; Revision 2* (EnSafe, Pending 1999). As shown in Table 7.8.2, two sample locations exceeded the TDEC standards:

- 174X000201 had a TPH detection of 750 mg/kg
- 174X000401 had a TPH detection of 14,000 mg/kg.

Inorganics in Soil

Inorganic soil-sample data for Facility 1211 are presented in Table 7.8.3.

Table 7.8.3
Gray Areas — Facility 1211 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
174X000101	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**7.5**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**139**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.5 J**
		Cadmium (Cd)	1.54	100	3.9	0.4	0.34 J
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**13.2**
		Cobalt (Co)	16.0	12,000	470	DNE	8.1
		Copper (Cu)	24.2	8,200	310	DNE	17.9
		Lead (Pb)	26.0	400	400	DNE	16.8 J
		Mercury (Hg)	0.46	61	2.3	DNE	0.19
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**14.0**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.58 J**
		Silver (Ag)	2.05	1,000	39	2	1.1 J
		Vanadium (V)	45.1	1,400	55	300	23.7
		Zinc (Zn)	98	61,000	2,300	620	82.6

Table 7.8.3
Gray Areas — Facility 1211 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
174X000201	01'	**Arsenic (As)**	**14.6**	**3.8**	**0.43**	**1**	**6.4**
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**130**
		Beryllium (Be)	**1**	**1.3**	**0.15**	**3**	**0.5 J**
		Cadmium (Cd)	1.54	100	3.9	0.4	0.32 J
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**16.2**
		Cobalt (Co)	16.0	12,000	470	DNE	6.7
		Copper (Cu)	24.2	8,200	310	DNE	22.2
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**27.5 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.04
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**11.8**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.5 J**
		Vanadium (V)	45.1	1,400	55	300	22.3
		Zinc (Zn)	98	61,000	2,300	620	56.8
174X000301	01'	***Arsenic (As)***	***14.6***	***3.8***	***0.43***	***1***	***21.2***
		Barium (Ba)	223	14,000	550	82	60.5
		Cadmium (Cd)	1.54	100	3.9	0.4	0.26 J
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**28.2**
		Cobalt (Co)	16.0	12,000	470	DNE	4.3
		Copper (Cu)	24.2	8,200	310	DNE	16
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**34.5 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.05
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**8.5**
		Silver (Ag)	2.05	1,000	39	2	0.48 J
		Vanadium (V)	45.1	1,400	55	300	21.1
		Zinc (Zn)	98	61,000	2,300	620	72.2

Table 7.8.3
Gray Areas — Facility 1211 Inorganic Detections in Soil by Location (mg/kg)

Location	Depth (in feet)	Constituent	RC[a] Surface	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
174X000401	01'	***Arsenic (As)***	***14.6***	***3.8***	***0.43***	***1***	***54.6***
		Barium (Ba)	**223**	**14,000**	**550**	**82**	**113**
		Cadmium (Cd)	***1.54***	***100***	***3.9***	***0.4***	***4.4***
		Chromium (Cr)	**23.9**	**1,000**	**39**	**2**	**28.4**
		Cobalt (Co)	16.0	12,000	470	DNE	5.5
		Copper (Cu)	**24.2**	**8,200**	**310**	**DNE**	**51.3**
		Lead (Pb)	**26.0**	**400**	**400**	**DNE**	**290 J**
		Mercury (Hg)	0.46	61	2.3	DNE	0.38
		Nickel (Ni)	**20.6**	**4,100**	**160**	**7**	**12.8**
		Selenium (Se)	**DNE**	**1,000**	**39**	**0.3**	**0.88 J**
		Silver (Ag)	2.05	1,000	39	2	0.87 J
		Vanadium (V)	45.1	1,400	55	300	14.7
		Zinc (Zn)	**98**	**61,000**	**2,300**	**620**	**293**

Notes:

a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).

b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).

c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).

DNE — Does not exist.

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

Bold indicates samples that exceed any of the standard reference values.

Bold/Italics indicate samples that are considered for the PRE calculations.

As shown in Table 7.8.3, 15 inorganics were detected in Facility 1211 soil samples. Of these:

- Arsenic was retained as a COPC because it exceeded its RC (14.6 mg/kg), residential RBC (0.43 mg/kg), and industrial RBC (3.8 mg/kg) in samples 174X000301 (21.2 mg/kg) and 174X000401 (54.6 mg/kg). It also exceeded its soil-to-groundwater SSL (1 mg/kg) in all samples.

- Barium exceeded its soil-to-groundwater SSL (82 mg/kg) in samples 174X000101 (139 mg/kg), 174X000201 (130 mg/kg), and 174X000401 (113 mg/kg).

- Beryllium exceeded its residential RBC (0.15 mg/kg) in samples 174X000101 (0.5 mg/kg) and 174X000201 (0.5 mg/kg).

- Cadmium was retained as a COPC because it exceeded its RC (1.54 mg/kg) and residential RBC (3.9 mg/kg) in sample 174X000401 (4.4 mg/kg). It also exceeded its soil-to-groundwater SSL (0.4 mg/kg) in this sample.

- Chromium exceeded its soil-to-groundwater SSL (2 mg/kg) in all samples, and exceeded its RC (23.9 mg/kg) in samples 174X000301 (28.2 mg/kg) and 174X000401 (28.4 mg/kg).

- Copper exceeded its RC (24.2 mg/kg) in sample 174X000201 (27.5 mg/kg), 174X000301 (34.5 mg/kg), and 174X000401 (51.3 mg/kg).

- Lead exceeded its RC (26.0 mg/kg) in samples 174X000201 (27.5 mg/kg), 174X000301 (34.5 mg/kg), and 174X000401 (290 mg/kg).

- Nickel exceeded its soil-to-groundwater SSL (7 mg/kg) in all samples.

- Selenium exceeded its soil-to-groundwater SSL (0.3 mg/kg) in samples 174X000101 (0.58 mg/kg), 174X000201 (0.5 mg/kg), and 174X000401 (0.88 mg/kg).

- Zinc exceeded its RC (98 mg/kg) in sample 174X000401 (293 mg/kg).

Groundwater Results

The only VOC detection from groundwater samples at Facility 1211 is shown in Table 7.8.4.

Table 7.8.4
Gray Areas — Detections in Facility 1211 Groundwater by Location (μg/L)

Location	Depth (in feet)	Contaminant	RBC[a]	MCL[b]	Result
174X000653	53'	Toluene	750	1,000	1.3 J

Notes:
a — Tap-water RBC from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).
b — MCL (Maximum Contaminant Level) from *USEPA National Primary Drinking Water Standards* (October 1996, USEPA Office of Water, Drinking Water Regulations and Health Advisories).
J — Contaminant detected in concentrations less than the method reporting limit; value estimated.

7.8.4 Preliminary Risk Evaluation

In accordance with *Guidance on Preliminary Risk Evaluations for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA Region IV memorandum, November 1994), preliminary screening comparisons were made for Facility 1211 using data from surface-soil samples collected during the Gray Areas Investigation. Because dieldrin, arsenic, and cadmium were identified as COPCs, a PRE was conducted based on the analytical data for surface soil. For more information on PRE methods, refer to Section 5. Table 7.8.5 shows the calculated risk associated with residential and industrial land use.

Table 7.8.5
Facility 1211 — Preliminary Risk Evaluation

					Residential			Industrial	
Chemical	**Maximum Reported Concentration**	**Units**	**RC**	**RBC**	**Hazard Quotient**	**ILCR**	**RBC**	**Hazard Quotient**	**ILCR**
Dieldrin	430	µg/kg	262	40C	NA	1.1E-5	360C	NA	1.2E-6
Arsenic	54.6	mg/kg	14.7	2,300N	0.02	NA	61,000N	8.95E-4	NA
Arsenic (Carcinogen)	54.6	mg/kg	14.7	0.43C	NA	1.3E-4	3.8C	NA	1.4E-5
Cadmium	4.4	mg/kg	1.54	3.9N	1.1	NA	100N	0.04	NA
Sum					1.1	1.4E-4		0.04	1.5E-5

Notes:
RBC — Risk-based concentration from the *USEPA Region III April 1999 RBC Table*; in accordance with the *USEPA Region IV Supplemental Guidance to RAGS Bulletin 1*, noncarcinogen RBCs above were conservatively adjusted to reflect a hazard quotient of 0.1.
RC — Reference concentration
N — Noncarcinogen
C — Carcinogen
NA — Not applicable
ILCR — Incremental lifetime (excess) cancer risk

The following conclusions have been reached based on a PRE for surface-soil data:

Residential Land Use

- Carcinogens: Excess cancer risk for the residential scenario was estimated to be 1.4E-4, which is greater than the cumulative PRE risk threshold value of 1E-4. This is considered above the excess cancer risk for the residential land-use scenario and indicates a lack of suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

- Noncarcinogens: Risk for the residential scenario was estimated to be 1.1, which is greater than the cumulative PRE non-cancer risk threshold value of 1. This is considered above the noncarcinogen risk for the residential land-use scenario and indicates a lack

of suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

Industrial Land Use

- Carcinogens: Excess cancer risk for the industrial scenario was estimated to be 1.5E-5, which is less than the cumulative PRE risk threshold value of 1E-4. This is considered below the excess cancer risk for the industrial land-use scenario and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

- Noncarcinogens: Risk for the industrial scenario was estimated to be 0.04, which is less than the cumulative PRE non-cancer risk threshold value of 1. This is considered below the noncarcinogen risk for the industrial land-use scenario and indicates suitability of the property for lease as established in the USEPA Region IV November 1994 memorandum.

Assuming random exposure across the site, there is some uncertainty about the magnitude of risk because the extent of the lower-bound concentration is not well defined by the present data. Because sampling areas were selected as those most likely to contain contamination, the upper-bound concentrations are likely to represent maximum contaminant concentrations at the site. Upper-bound risk estimates, such as those shown in Table 7.8.5, are thus sufficient to support risk-management decisions. The mean concentration for each contaminant/constituent across the site is as follows:

	Dieldrin (μg/kg)	Cadmium (mg/kg)	Arsenic (mg/kg)
	430	4.4	54.6
	250	0.34	21.2
	72	0.32	7.5
	16	0.26	6.4
Mean:	192 μg/kg	1.33 mg/kg	22.4 mg/kg
RC:	262 μg/kg	1.54 mg/kg	14.7 mg/kg

The mean concentrations of dieldrin and cadmium across the site are less than their respective RCs. Assuming random exposure, arsenic would account for most of the risk at this site. The cancer risk posed by the mean arsenic concentration is 5.2E-5, which is less than the PRE cancer risk threshold and would result in a cumulative cancer risk estimate less than 1E-4. Based on available toxicological and epidemiological studies on carcinogenic risk from ingestion of arsenic, cancer risk for arsenic can be modified by an order of magnitude by adjusting the acceptable risk range from 1E-6 to 1E-4 down to 1E-5 to 1E-3 (USEPA, 1988).

7.8.5 Fate and Transport

The approach to evaluating the fate and transport of the Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at Facility 1211. Transport processes for contaminants/constituents other than those designated as COPCs are also discussed if they occur in multiple environmental media or have the potential to migrate to other media.

Potential migration pathways for contaminants at Facility 1211 include leaching from soil to groundwater, and erosion of surface soil containing sorbed contaminants from the unpaved, grass-covered areas, forming sediments in drainage ways. Surface-soil analytical data indicate that

no VOCs exceeded their individual soil-to-air SSLs; therefore, the soil-to-air cross-media transport process is not discussed.

Facility 1211 had three COPCs, as well as some contaminants/constituents exceeding soil-to-groundwater SSLs:

- Dieldrin and arsenic, identified as COPCs, exceeded their RCs, residential RBCs, and industrial RBCs in one and two surface-soil samples, respectively. They also exceeded their soil-to-groundwater SSLs in all surface-soil samples, where detected.
- Cadmium, identified as a COPC, exceeded its RC, residential RBC, and soil-to-groundwater SSL in one surface-soil sample.

- The inorganics barium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in surface soil. Chromium, copper, lead, and zinc also exceeded their RCs in several samples.

7.8.5.1 Soil-to-Groundwater Cross-Media Transport

Four contaminants pose a potential soil-to-groundwater migration concern as determined by soil concentrations exceeding groundwater protection SSLs: one pesticide (dieldrin), and three inorganics (arsenic, chromium, cadmium). For inorganics, the potential exists if the maximum concentration exceeds the SSL *and* the background RC. None of these contaminants were detected in groundwater at Facility 1211.

The tendency of pesticides to sorb to soil particles is a typical characteristics influencing fate and transport. Most pesticides are hydrophobic (avoid water), relatively immobile in the environment, and tend to degrade slowly. Overall, pesticides are anticipated to be immobile and persistent in the environment, not readily diffusing into groundwater. Inorganic chemicals do not degrade in

the environment but may change chemical form or speciation. Like pesticides, they are generally considered indefinitely persistent.

Although pesticides and inorganics were detected in surface soil at Facility 1211, their properties do not indicate that soil to groundwater would be a significant migration pathway.

TPH was detected in surface soil at concentrations exceeding TDEC soil-cleanup values. TPH is considered part of the SVOC class of contaminants. Based on the physical and chemical properties of SVOCs, TPH is not expected to migrate vertically through the soil column and reach groundwater in appreciable quantities, if at all.

Toluene was detected in groundwater at one sample location at a concentration of 1.3 μg/L, which is less than its RBC and MCL. The persistence of toluene in groundwater is primarily governed by contaminant migration, and to a lesser degree degradation. Relative to other categories of compounds, toluene (and VOCs in general) has a low molecular weight and high water solubility, vapor pressure, and Henry's law constant, along with a corresponding low K_{oc}. These properties all enhance the potential degradability of VOCs, which have a limited tendency to adsorb to solids and can be expected to be moderately to highly mobile in the environment. Without additional groundwater sample data from the surrounding area, it is difficult to predict the migration and fate of toluene in groundwater.

7.8.5.2 Soil-to-Sediment Cross-Media Transport

Contaminants in near-surface soil where vegetation or asphalt provides a ground cover were evaluated to determine their potential for transport by erosion, should these covers be removed. Drainage patterns and topography at Facility 1211 were also examined to determine whether site features would support contaminant transport.

Contaminants detected in surface soil consist of pesticides, inorganics, and TPH. Inorganic chemicals do not degrade, but may change chemical form or speciation in the environment. Like pesticides, inorganics tend to sorb to soil particles, rendering them relatively immobile apart from these particles. As discussed previously, TPH is considered an SVOC. Since the fate of SVOCs in soil is similar to inorganics and pesticides, the mobility of TPH depends on the mobility of the soil particles.

Drainage patterns and the vegetation/asphalt-concrete cover at Facility 1211 leave little potential for surface soil to erode and form sediments that can become mobile in surface water. Therefore, the soil-to-sediment transport process at this facility is not considered significant.

7.8.6 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- Facility 1211 is suitable for industrial land use.

- Ten organic compounds were detected in surface (0 to 1 foot) soil. Of these, dieldrin was retained as a COPC because it exceeded its RC, residential RBC, and industrial RBC in one sample.

- TPH detected in surface soil exceeded TDEC cleanup values. Of these detections:

  — 174X000201 (750 mg/kg) exceeded the 500 mg/kg value.
  — 174X000401 (14,000 mg/kg) exceeded the 1,000 mg/kg value.

- Fifteen metals were detected in surface soil at Facility 1211. Of these:
  - Arsenic was retained as a COPC because it exceeded its RC, residential RBC and industrial RBC in two samples.
  - Cadmium was retained as a COPC because it exceeded its RC and residential RBC in one sample.
  - Barium, chromium, nickel, and selenium exceeded their soil-to-groundwater SSLs in several samples.
  - Beryllium exceeded its residential RBC in two samples.
  - Chromium, copper, lead, and zinc exceeded their RCs in at least one sample each.
- A site PRE determined that:
  - Carcinogens pose no threat to the industrial land-use scenario, although arsenic slightly exceeded the risk threshold of 1E-4 for the residential land-use scenario.
  - Noncarcinogens pose no threat to the industrial land-use scenario, although cadmium slightly exceeded the residential risk threshold of 1.

Recommendations

Based on surface-soil data, a VCA is recommended for Facility 1211 to address TPH contamination exceeding 100 mg/kg. Risk will be re-evaluated based on data obtained after the removal action.

7.9 Pad Eyes (Former Aircraft Tie-down Area)

The area designated as the Pad Eyes was identified on aerial photographs and through interviews with former employees. The area was used as a tie-down area for aircraft dating back to as early as 1952 and as late as the early 1970s. Figure 1.1 shows the Pad Eyes location.

The Pad Eyes and surrounding area are characterized by relatively low-relief topography. Surrounding areas are covered with concrete or grass. Regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan* (E/A&H, 1994). Site-specific geologic and hydrogeologic information and references are in Section 2 of this report. Because soil samples were collected by pushing DPT sampling tools to a predetermined depth without lithologic characterization, no additional site-specific lithologic information was collected during this investigation.

7.9.1 Previous Activities

Although background information is limited, it has been reported that the area was used for aircraft maintenance, which may have caused a release of petroleum products and/or chlorinated solvents.

7.9.2 Field Investigation

Because of the limited information available for this site and its reported period of operations, the sampling approach focused on the shallow (loess) groundwater to determine whether a release had occurred. One soil sample (PADX000115) was collected from the saturated loess at 12 to 15 ft. bls and analyzed for VOCs. Figure 7.9 shows the site layout and surveyed sampling location. The sample was analyzed at Savannah Analytical Laboratory in Savannah, Georgia.

7.9.3 Investigation Sampling Results

Tables and figures in this section present the analytical results for all soil samples collected during this investigation. Values from organic analyses of soil are compared to the corresponding RBC for each compound detected for both residential and industrial scenarios, as published in the USEPA Region III RBC Table (April 12, 1999), and compared to their SSL for protection of groundwater. SSLs were taken from EPA/540/R-95/128 (May 1996).

Organics in Soil

Organic soil-sample data are presented in Table 7.9.1.

Table 7.9.1
Gray Areas — Pad Eyes Organic Detections in Soil by Location (μg/kg)

Location	Depth (in feet)	Contaminant	RC[a]	RBC[b] Industrial	RBC[b] Residential	SSL[c]	Result
PADX000115	15'	Acetone	—	—	—	800	22.1

Notes:

a — Background Reference Concentration (RC) from the August 1996 Technical Memorandum — *Reference Concentrations* (August 27, 1996, E/A&H Tech Memo).

b — Industrial and Residential RBCs from the April 1999 *Risk-Based Concentration Table* (April 12, 1999, USEPA Region III RBC Memo).

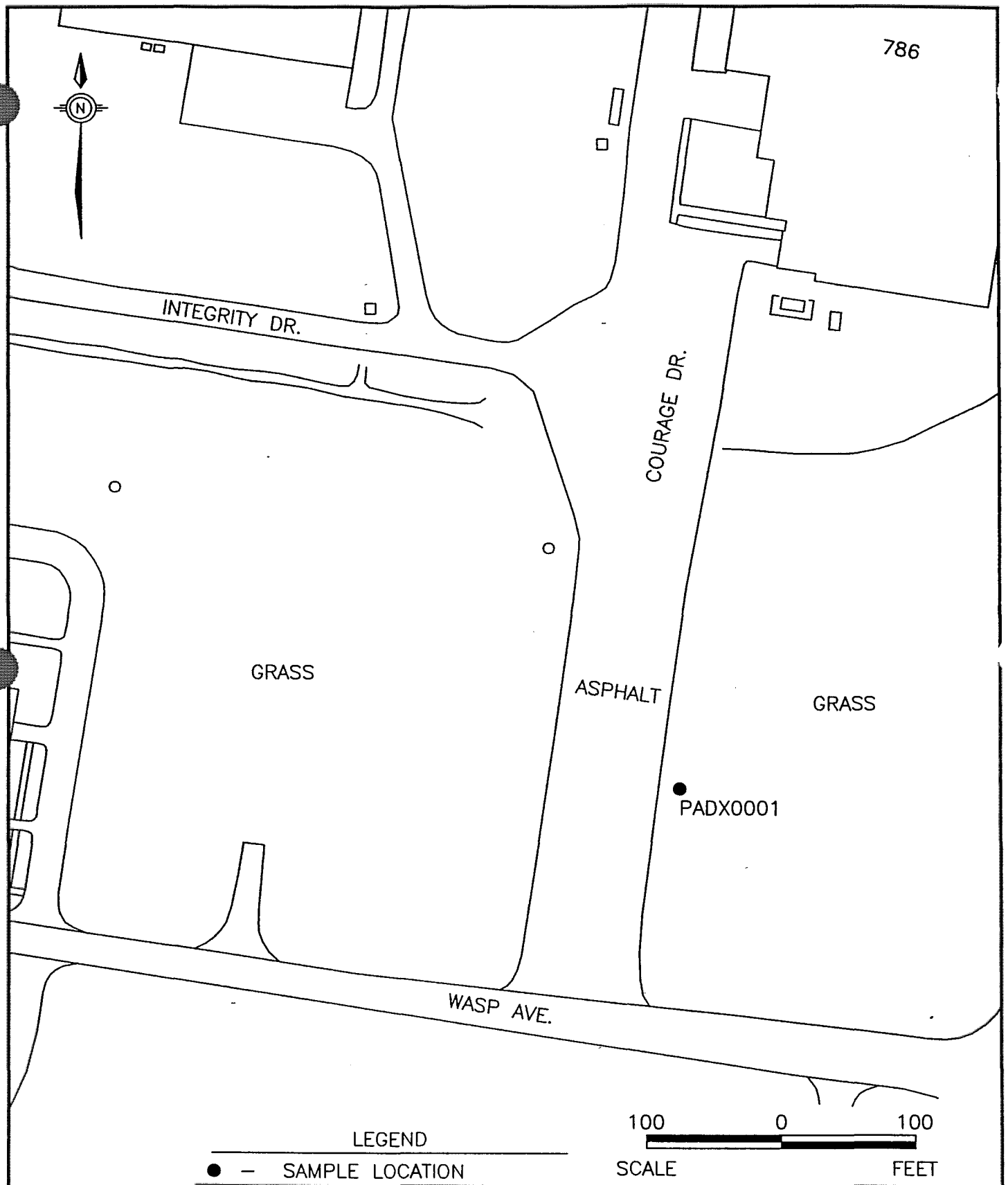
c — Soil Screening Level (SSL) from the May 1996 *Generic Screening Levels* (May 1996, USEPA/OSWER SSL Guidance Document, EPA/540/R-95/128).

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

7.9.4 Fate and Transport

The approach to evaluating the fate and transport of the Gray Areas contaminants was discussed in Section 6.2. This section applies that approach to contaminants detected at the Pad Eyes.

The only identifiable potential migration pathway for contaminants at the Pad Eyes is leaching from soil to groundwater. No COPCs were identified at the Pad Eyes.



ERNA GRAY AREAS
REPORT
NSA MID-SOUTH
MILLINGTON, TN

FIGURE 7.9
PAD EYES
SAMPLE LOCATION MAP

DWG DATE: 05/03/99 | DWG NAME: 0106B004

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7.9.4.1 Soil-to-Groundwater Cross-Media Transport

The soil sample was analyzed for VOCs only, and the only contaminant detected was acetone. The detected concentration of 22 μg/kg is much less than the soil-to-groundwater SSL of 800 μg/kg, and thus acetone is not considered a threat to underlying groundwater.

7.9.4.2 Soil-to-Sediment Cross-Media Transport

Drainage patterns and the vegetation/asphalt-concrete cover at the Pad Eyes leave little potential for surface soil to erode and form sediments that can become mobile via surface water. Therefore, the soil-to-sediment transport process at this facility is not considered significant.

7.9.5 Conclusions and Recommendations

Based on the data from this investigation, the following conclusions and recommendations have been reached:

Conclusions

- The Pad Eyes area is suitable for industrial or residential land use.

- Acetone was the only organic compound detected in subsurface (12 to 15 ft. bls) soil. It did not exceed any standard reference values.

Recommendations

Based on subsurface-soil data, no further action is recommended for the Pad Eyes area.

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8.0 ECOLOGICAL RISK ASSESSMENT

An ecological risk assessment (ERA) assesses the actual or potential adverse effects on ecological receptors based on contamination. This ERA will address the terrestrial ecosystem associated with the facilities of the Gray Areas investigation at NSA Mid-South. This assessment considers exposure pathways that could result in unacceptable levels of exposure to ecological receptors now or in the future. The assessment approach is based on the USEPA *Risk Assessment Guidance for Superfund Volume 2 — Environmental Evaluation Manual* (1989), USEPA *Framework for Ecological Risk Assessment* (1992; USEPA/630/R-92/001), and USEPA *Ecological Risk Guidance for Superfund: Process for Designing and Conducting Ecological Risk Interim Final* (1997).

Evaluating potential exposure pathways is one of the primary tasks of the site screening-level ecological characterization. For an exposure pathway to be complete, a contaminant must be able to travel from the source to ecological receptors and be taken up by the receptors through one or more exposure routes.

Facilities N-105, N-108, N-109, N-114/N-397, S-203, S-394, S-784, N-1211, and the Pad Eyes

No complete exposure pathways exist at these sites because there are no potential receptors. All sites are in developed and/or industrialized areas of the base, and consist of graveled, paved, and fenced areas surrounded by streets or small grass areas, with no quality habitat available. Therefore, no further action is recommended based on potential ecological risk at these sites. No connection between storm-water runoff and nearby ditches was observed at most sites. At sites where storm-water runoff could impact receptors, ecological risk was addressed in the SWMU 38 assessment.

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9.0 CONCLUSIONS AND RECOMMENDATIONS SUMMARY

A follow-up VCA is recommended for Facilities N-105, N-108, N-114/N-397, S-203, S-394, and N-1211. Table 9.1 summarizes the investigation findings and recommended work for the VCAs. Also provided is a brief overview of COPCs, PRE results, contaminant exceedances, and recommendations and rationale based on these findings.

Table 9.1
Gray Areas Investigation
Conclusions and Recommendations Summary

Facility	COPCs[a]	Media Affected[b]	PRE Results Residential	PRE Results Industrial	Screening Criteria Exceeded[c]	Voluntary Corrective Action (VCA) Recommendations[d]	Rationale
N-105	TPH	Surface Soil	NA	NA	5	Initially remove soil around sample location 105X0001 to approximately 2' deep, screening with TPH analyzer to direct excavation. Collect samples for benzene analysis as confirmatory samples from the pit bottom.	Soil excavation — remove TPH-contaminated soil. Samples — confirm that all soil exceeding acceptable limits has been removed.
N-108	BEQ TPH	Surface Soil	Suitable for lease	Suitable for lease	1, 2, 3, 4, 5	Initially remove soil around sample location 108X0002 to approximately 2' deep, screening with TPH analyzer to direct excavation. Collect samples for benzene analysis as confirmatory samples from the pit bottom.	Soil excavation — remove TPH-contaminated soil. Samples — confirm that all soil exceeding acceptable limits has been removed.
N-109	Beryllium	Surface Soil	Suitable for lease	Suitable for lease	1, 2, 4	No further action	No COPC poses excess risk.
N-114/N-397	Beryllium Cadmium Lead TPH	Surface Soil	Not suitable for lease	Suitable for lease	1, 2, 3, 4, 5	Initially remove soil around sample location 114X0001 to approximately 2' deep, screening with TPH analyzer to direct excavation. Collect samples for lead and benzene analysis as confirmatory samples from the pit bottom.	Soil excavation — remove lead- and TPH-contaminated soil. Samples — confirm that all soil exceeding acceptable limits has been removed.
S-203	TPH	Surface Soil	NA	NA	5	Initially remove soil around sample location 203X0003 to approximately 2' deep, screening with TPH analyzer to direct excavation. Collect samples for benzene analysis as confirmatory samples from the pit bottom.	Soil excavation — remove TPH-contaminated soil. Samples — confirm that all soil exceeding acceptable limits has been removed.

Table 9.1
Gray Areas Investigation
Conclusions and Recommendations Summary

Facility	COPCs [a]	Media Affected [b]	PRE Results Residential	PRE Results Industrial	Screening Criteria Exceeded [c]	Voluntary Corrective Action (VCA) Recommendations [d]	Rationale
S-394	TPH	Surface Soil	NA	NA	5	Initially remove soil around sample location 394X0002 to approximately 2' deep, screening with TPH analyzer to direct excavation. Collect samples for benzene analysis as confirmatory samples from the pit bottom.	Soil excavation — remove TPH-contaminated soil. Samples — confirm that all soil exceeding acceptable limits has been removed.
S-784	None	NA	NA	NA	NA	No further action	No COPCs were identified.
N-1211	Arsenic Cadmium Dieldrin TPH	Surface Soil	Not suitable for lease	Suitable for lease	1, 2, 3, 4, 5	Initially remove soil around sample locations 174X0002, 174X0003, and 174X0004 to approximately 2' deep, screening with TPH analyzer to direct excavation. Collect samples for Appendix IX metals and benzene analysis as confirmatory samples from the pit bottoms.	Soil excavation — remove TPH-contaminated soil. Samples — confirm that all soil exceeding acceptable limits has been removed.
Pad Eyes	None	NA	NA	NA	NA	No further action	No COPCs were identified.

Notes:
a — Contaminant of Potential Concern identified in the PRE
b — Media in which the COPC was identified
c — Indicates that a contaminant(s) exceeded a screening criteria, and which criteria were exceeded (see corresponding numbers below)
d — Recommendation based on screening criteria exceedances
1 — residential RBC
2 — industrial RBC
3 — soil-to-groundwater SSL
4 — background RCs
5 — TDEC soil-cleanup levels for TPH
NA — not applicable

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10.0 REFERENCES

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Appendix A

Analytical Data

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-105

APX9-METAL													
	SAMPLE ID ------->	105-S-0001-01		105-S-0001-15		105-S-0002-01		105-S-0002-15					
	ORIGINAL ID ----->	105S000101		105S000115		105S000201		105S000215					
	LAB SAMPLE ID --->	S776828*6		S880337*2		S776828*7		S880337*3					
	ID FROM REPORT -->	105S000101		105S000115		105S000201		105S000215					
	SAMPLE DATE ----->	12/03/97		01/19/98		12/03/97		01/19/98					
	DATE EXTRACTED -->	12/10/97		01/27/98		12/10/97		01/27/98					
	DATE ANALYZED --->	12/11/97		01/29/98		12/11/97		01/29/98					
	MATRIX ---------->	Soil		Soil		Soil		Soil					
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG					
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL				
7439-97-6	Mercury	0.03		0.04		0.05		0.02					
7440-36-0	Antimony	0.67	UR	0.39	UR	0.8	UR	1.	J				
7440-38-2	Arsenic	6.7		6.1		7.4		5.4					
7440-39-3	Barium	77.1		66.3		97.1		75.					
7440-41-7	Beryllium	0.46	J	0.66		0.39	U	0.71					
7440-43-9	Cadmium	0.76		0.03	UJ	2.4		0.04	UJ				
7440-47-3	Chromium	10.9		19.7		17.4		14.9					
7440-48-4	Cobalt	[illegible]		6.5		6.8		6.6					
7440-50-8	Copper	14.7		11.9		27.2		11.9					
7439-92-1	Lead	28.7	J	8.5		47.5	J	10.5					
7440-02-0	Nickel	12.5		11.2		16.3		12.3					
7782-49-2	Selenium	0.3	U	0.38	U	0.32	U	0.73	U				
7440-22-4	Silver	0.35	U	0.11	U	0.37	U	0.12	U				
7440-28-0	Thallium	0.54	UJ	0.7	U	0.59	UJ	0.72	U				
7440-62-2	Vanadium	19.3		30.4		21.6		30.5					
7440-66-6	Zinc	65.9		23.		95.5		28.7					
7440-31-5	Tin	1.1	U	1.4	U	1.4	U	2.2	U				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-105

SW846-SVOA													
	SAMPLE ID ------->	105-S-0001-01		105-S-0001-15		105-S-0002-01		105-S-0002-15					
	ORIGINAL ID ----->	105S000101		105S000115		105S000201		105S000215					
	LAB SAMPLE ID --->	S776828*6		S880337*2		S776828*7		S880337*3					
	ID FROM REPORT -->	105S000101		105S000115		105S000201		105S000215					
	SAMPLE DATE ----->	12/03/97		01/19/98		12/03/97		01/19/98					
	DATE EXTRACTED -->	12/08/97		01/23/98		12/08/97		01/23/98					
	DATE ANALYZED --->	12/29/97		02/08/98		12/30/97		02/09/98					
	MATRIX ---------->	Soil		Soil		Soil		Soil					
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG					
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL				
108-95-2	Phenol	380.	U	400.	U	410.	U	410.	U				
111-44-4	bis(2-Chloroethyl)ether	380.	U	400.	U	410.	U	410.	U				
95-57-8	2-Chlorophenol	380.	U	400.	U	410.	U	410.	U				
541-73-1	1,3-Dichlorobenzene	380.	U	400.	U	410.	U	410.	U				
106-46-7	1,4-Dichlorobenzene	380.	U	400.	U	410.	U	410.	U				
95-50-1	1,2-Dichlorobenzene	380.	U	400.	U	410.	U	410.	U				
95-48-7	2-Methylphenol (o-Cresol)	380.	U	400.	U	410.	U	410.	U				
108-60-1	2,2'-oxybis(1-Chloropropane)	380.	U	400.	U	410.	U	410.	U				
9999900-32-2	3-Methylphenol/4-Methylphenol	380.	U	400.	U	410.	U	410.	U				
621-64-7	N-Nitroso-di-n-propylamine	380.	U	400.	U	410.	U	410.	U				
67-72-1	Hexachloroethane	380.	U	400.	U	410.	U	410.	U				
98-95-3	Nitrobenzene	380.	U	400.	U	410.	U	410.	U				
78-59-1	Isophorone	380.	U	400.	U	410.	U	410.	U				
88-75-5	2-Nitrophenol	380.	U	400.	U	410.	U	410.	U				
105-67-9	2,4-Dimethylphenol	380.	U	400.	U	410.	U	410.	U				
120-83-2	2,4-Dichlorophenol	380.	U	400.	U	410.	U	410.	U				
120-82-1	1,2,4-Trichlorobenzene	380.	U	400.	U	410.	U	410.	U				
91-20-3	Naphthalene	380.	U	400.	U	410.	U	410.	U				
106-47-8	4-Chloroaniline	770.	U	800.	U	820.	U	810.	U				
87-68-3	Hexachlorobutadiene	380.	U	400.	U	410.	U	410.	U				
111-91-1	bis(2-Chloroethoxy)methane	380.	U	400.	U	410.	U	410.	U				
59-50-7	4-Chloro-3-methylphenol	380.	U	400.	U	410.	U	410.	U				
91-57-6	2-Methylnaphthalene	380.	U	400.	U	410.	U	410.	U				
77-47-4	Hexachlorocyclopentadiene	380.	UJ	400.	U	410.	UJ	410.	U				
88-06-2	2,4,6-Trichlorophenol	380.	U	400.	U	410.	U	410.	U				
95-95-4	2,4,5-Trichlorophenol	380.	U	400.	U	410.	U	410.	U				
91-58-7	2-Chloronaphthalene	380.	U	400.	U	410.	U	410.	U				
88-74-4	2-Nitroaniline	2000.	U	2000.	U	2100.	U	2100.	U				
131-11-3	Dimethylphthalate	380.	U	400.	U	410.	U	410.	U				
208-96-8	Acenaphthylene	380.	U	400.	U	410.	U	410.	U				
606-20-2	2,6-Dinitrotoluene	380.	U	400.	U	410.	U	410.	U				
99-09-2	3-Nitroaniline	2000	U	2000.	U	2100.	U	2100.	U				
83-32-9	Acenaphthene	38[illegible]	U	400.	U	410.	U	410.	U				
51-28-5	2,4-Dinitrophenol	2000.	U	2000.	U	2100.	U	2100.	U				
100-02-7	4-Nitrophenol	2000.	U	2000.	U	2100.	U	2100.	U				
132-64-9	Dibenzofuran	380.	U	400.	U	410.	U	410.	U				

*** Valida[illegible] Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-105

SW846-SVOA

	SAMPLE ID ------->	105-S-0001-01		105-S-0001-15		105-S-0002-01		105-S-0002-15					
	ORIGINAL ID ----->	105S000101		105S000115		105S000201		105S000215					
	LAB SAMPLE ID --->	S776828*6		S880337*2		S776828*7		S880337*3					
	ID FROM REPORT -->	105S000101		105S000115		105S000201		105S000215					
	SAMPLE DATE ----->	12/03/97		01/19/98		12/03/97		01/19/98					
	DATE EXTRACTED -->	12/08/97		01/23/98		12/08/97		01/23/98					
	DATE ANALYZED --->	12/29/97		02/08/98		12/30/97		02/09/98					
	MATRIX ---------->	Soil		Soil		Soil		Soil					
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG					
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL				
121-14-2	2,4-Dinitrotoluene	380.	U	400.	U	410.	U	410.	U				
84-66-2	Diethylphthalate	380.	U	400.	U	410.	U	410.	U				
7005-72-3	4-Chlorophenylphenyl ether	380.	U	400.	U	410.	U	410.	U				
86-73-7	Fluorene	380.	U	400.	U	410.	U	410.	U				
100-01-6	4-Nitroaniline	2000.	U	2000.	U	2100.	U	2100.	U				
534-52-1	2-Methyl-4,6-Dinitrophenol	2000.	U	2000.	U	2100.	U	2100.	U				
86-30-6	N-Nitrosodiphenylamine	380.	U	NR		410.	U	NR					
101-55-3	4-Bromophenyl-phenylether	380.	U	400.	U	410.	U	410.	U				
118-74-1	Hexachlorobenzene	380.	U	400.	U	410.	U	410.	U				
87-86-5	Pentachlorophenol	2000.	U	2000.	U	2100.	U	2100.	U				
85-01-8	Phenanthrene	40.	J	400.	U	17.	J	410.	U				
120-12-7	Anthracene	5.3	J	400.	U	4.4	J	410.	U				
86-74-8	Carbazole	380.	U	400.	U	410.	U	410.	U				
84-74-2	Di-n-butylphthalate	600.		400.	U	170.	J	410.	U				
206-44-0	Fluoranthene	110.	J	400.	U	130.	J	410.	U				
129-00-0	Pyrene	110.	J	400.	U	120.	J	410.	U				
85-68-7	Butylbenzylphthalate	380.	U	400.	U	410.	U	410.	U				
91-94-1	3,3'-Dichlorobenzidine	770.	UJ	800.	U	820.	UJ	810.	U				
56-55-3	Benzo(a)anthracene	57.	J	400.	U	95.	J	410.	U				
218-01-9	Chrysene	69.	J	400.	U	89.	J	410.	U				
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	84.	J	400.	U	93.	J	410.	U				
117-84-0	Di-n-octylphthalate	380.	U	400.	U	410.	U	410.	U				
205-99-2	Benzo(b)fluoranthene	72.	J	400.	U	83.	J	410.	U				
207-08-9	Benzo(k)fluoranthene	68.	J	400.	U	86.	J	410.	U				
50-32-8	Benzo(a)pyrene	66.	J	400.	U	77.	J	410.	U				
193-39-5	Indeno(1,2,3-cd)pyrene	38.	J	400.	U	44.	J	410.	U				
53-70-3	Dibenz(a,h)anthracene	380.	U	400.	U	410.	U	410.	U				
191-24-2	Benzo(g,h,i)perylene	46.	J	400.	U	48.	J	410.	U				
122-39-4	Diphenylamine	NR		400.	U	NR		410.	U				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-105

SW846-VOA									
	SAMPLE ID ------->	105-S-0001-15		105-S-0002-15					
	ORIGINAL ID ----->	105S000115		105S000215					
	LAB SAMPLE ID --->	S880337*2		S880337*3					
	ID FROM REPORT -->	105S000115		105S000215					
	SAMPLE DATE ----->	01/19/98		01/19/98					
	DATE ANALYZED --->	01/28/98		01/26/98					
	MATRIX ---------->	Soil		Soil					
	UNITS ---------->	UG/KG		UG/KG					
CAS #	Parameter	EM1G06	VAL	EM1G06	VAL				
74-87-3	Chloromethane	12.	U	12.	U				
74-83-9	Bromomethane	12.	U	12.	U				
75-01-4	Vinyl chloride	12.	U	12.	U				
75-00-3	Chloroethane	12.	UJ	12.	U				
75-35-4	1,1-Dichloroethene	6.	U	6.2	U				
75-09-2	Methylene chloride	6.	U	6.2	U				
75-34-3	1,1-Dichloroethane	6.	U	6.2	U				
67-66-3	Chloroform	6.	U	6.2	U				
71-55-6	1,1,1-Trichloroethane	6.	U	6.2	U				
56-23-5	Carbon tetrachloride	6.	U	6.2	U				
71-43-2	Benzene	6.	U	6.2	U				
107-06-2	1,2-Dichloroethane	6.	U	6.2	U				
79-01-6	Trichloroethene	6.	U	6.2	U				
78-87-5	1,2-Dichloropropane	6.	U	6.2	U				
75-27-4	Bromodichloromethane	6.	U	6.2	U				
108-88-3	Toluene	6.	U	6.2	U				
79-00-5	1,1,2-Trichloroethane	6.	U	6.2	U				
127-18-4	Tetrachloroethene	6.	U	6.2	U				
124-48-1	Dibromochloromethane	6.	U	6.2	U				
108-90-7	Chlorobenzene	6.	U	6.2	U				
100-41-4	Ethylbenzene	6.	U	6.2	U				
100-42-5	Styrene	6.	U	6.2	U				
75-25-2	Bromoform	6.	U	6.2	U				
79-34-5	1,1,2,2-Tetrachloroethane	6.	U	6.2	U				
67-64-1	Acetone	60.	U	62.	U				
75-15-0	Carbon disulfide	6.	U	6.2	U				
78-93-3	2-Butanone (MEK)	30.	U	31.	U				
108-10-1	4-Methyl-2-Pentanone (MIBK)	30.	U	31.	U				
10061-01-5	cis-1,3-Dichloropropene	6.	U	6.2	U				
10061-02-6	trans-1,3-Dichloropropene	6.	U	6.2	U				
591-78-6	2-Hexanone	30.	U	31.	U				
1330-20-7	Xylene (Total)	6.	U	6.2	U				
540-59-0	1,2-Dichloroethene (total)	6.	U	6.2	U				

*** Valida[illegible] Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-105

TPH									
	SAMPLE ID ------->	105-S-0001-01		105-S-0001-15		105-S-0002-01		105-S-0002-15	
	ORIGINAL ID ----->	105S000101		105S000115		105S000201		105S000215	
	LAB SAMPLE ID --->	S776828*6		S880337*2		S776828*7		S880337*3	
	ID FROM REPORT -->	105S000101		105S000115		105S000201		105S000215	
	SAMPLE DATE ----->	12/03/97		01/19/98		12/03/97		01/19/98	
	DATE EXTRACTED -->	12/26/97		02/09/98		12/26/97		02/09/98	
	DATE ANALYZED --->	12/29/97		02/10/98		12/29/97		02/10/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	210.		21.	J	77.		330.	J

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-108

APX9-METAL													
	SAMPLE ID ------->	108-S-0001-01		108-S-0001-15		108-C-0001-15		108-S-0002-01		108-S-0002-15			
	ORIGINAL ID ----->	108S000101		108S000115		108C000115		108S000201		108S000215			
	LAB SAMPLE ID --->	S776828*8		S880337*1		S880337A*1		S776828*9		S880356*5			
	ID FROM REPORT -->	108S000101		108S000115		108C000115		108S000201		108S000215			
	SAMPLE DATE ----->	12/03/97		01/19/98		01/19/98		12/03/97		01/20/98			
	DATE EXTRACTED -->	12/10/97		01/27/98		01/27/98		12/10/97		01/27/98			
	DATE ANALYZED --->	12/11/97		01/29/98		01/28/98		12/11/97		01/28/98			
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil			
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG			
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G07	VAL	EM1G01	VAL	EM1G06	VAL		
7439-97-6	Mercury	0.03		0.02		0.02	J	0.09		0.02			
7440-36-0	Antimony	0.71	UR	0.43	UR	1.5	J	0.88	UR	0.43	UR		
7440-38-2	Arsenic	11.9		7.8		8.3		8.8		6.1			
7440-39-3	Barium	124.		61.6		63.1		116.		69.2			
7440-41-7	Beryllium	0.65		0.38	J	0.43	J	0.42	J	0.4	J		
7440-43-9	Cadmium	0.52	J	0.04	UJ	0.04	UJ	2.3		0.04	UJ		
7440-47-3	Chromium	17.2		13.1		13.7		26.9		12.9			
7440-48-4	Cobalt	8.4		6.9		7.		7.		6.9			
7440-50-8	Copper	17.2		15.6		15.8		32.2		14.1			
7439-92-1	Lead	22.8	J	9.1		8.8		87.	J	7.9			
7440-02-0	Nickel	15.2		18.		18.4	J	14.		15.7			
7782-49-2	Selenium	0.53	J	1.1	U	0.43	U	0.32	U	0.54	U		
7440-22-4	Silver	0.37	U	0.13	U	0.13	UJ	0.37	U	0.12	U		
7440-28-0	Thallium	0.59	UJ	0.78	U	0.78	UJ	0.59	UJ	0.77	U		
7440-62-2	Vanadium	32.9		19.2		20.6		20.		23.6			
7440-66-6	Zinc	66.7		50.3		49.2		137.		40.2			
7440-31-5	Tin	0.71	U	1.6	U	2.6	U	1.9	U	1.7	U		

*** Valida[illegible] Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-108

SW846-SVOA													
	SAMPLE ID ------->	108-S-0001-01		108-S-0001-15		108-C-0001-15		108-S-0002-01		108-S-0002-15			
	ORIGINAL ID ----->	108S000101		108S000115		108C000115		108S000201		108S000215			
	LAB SAMPLE ID --->	S776828*8		S880337*1		S880337A*1		S776828*9		S880356*5			
	ID FROM REPORT -->	108S000101		108S000115		108C000115		108S000201		108S000215			
	SAMPLE DATE ----->	12/03/97		01/19/98		01/19/98		12/03/97		01/20/98			
	DATE EXTRACTED -->	12/08/97		01/23/98		01/23/98		12/08/97		01/23/98			
	DATE ANALYZED --->	12/30/97		02/08/98		02/08/98		12/30/97		02/08/98			
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil			
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG			
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G07	VAL	EM1G01	VAL	EM1G06	VAL		
108-95-2	Phenol	410.	U	440.	U	440.	U	410.	U	430.	U		
111-44-4	bis(2-Chloroethyl)ether	410.	U	440.	U	440.	U	410.	U	430.	U		
95-57-8	2-Chlorophenol	410.	U	440.	U	440.	U	410.	U	430.	U		
541-73-1	1,3-Dichlorobenzene	410.	U	440.	U	440.	U	410.	U	430.	U		
106-46-7	1,4-Dichlorobenzene	410.	U	440.	U	440.	U	410.	U	430.	U		
95-50-1	1,2-Dichlorobenzene	410.	U	440.	U	440.	U	410.	U	430.	U		
95-48-7	2-Methylphenol (o-Cresol)	410.	U	440.	U	440.	U	410.	U	430.	U		
108-60-1	2,2'-oxybis(1-Chloropropane)	410.	U	440.	U	440.	U	410.	U	430.	U		
9999900-32-2	3-Methylphenol/4-Methylphenol	410.	U	440.	U	440.	U	410.	U	430.	U		
621-64-7	N-Nitroso-di-n-propylamine	410.	U	440.	U	440.	U	410.	U	430.	U		
67-72-1	Hexachloroethane	410.	U	440.	U	440.	U	410.	U	430.	U		
98-95-3	Nitrobenzene	410.	U	440.	U	440.	U	410.	U	430.	U		
78-59-1	Isophorone	410.	U	440.	U	440.	U	410.	U	430.	U		
88-75-5	2-Nitrophenol	410.	U	440.	U	440.	U	410.	U	430.	U		
105-67-9	2,4-Dimethylphenol	410.	U	440.	U	440.	U	410.	U	430.	U		
120-83-2	2,4-Dichlorophenol	410.	U	440.	U	440.	U	410.	U	430.	U		
120-82-1	1,2,4-Trichlorobenzene	410.	U	440.	U	440.	U	410.	U	430.	U		
91-20-3	Naphthalene	41 .	U	440.	U	440.	U	66.	J	430.	U		
106-47-8	4-Chloroaniline	820.	U	880.	U	880.	U	820.	U	870.	U		
87-68-3	Hexachlorobutadiene	410.	U	440.	U	440.	U	410.	U	430.	U		
111-91-1	bis(2-Chloroethoxy)methane	410.	U	440.	U	440.	U	410.	U	430.	U		
59-50-7	4-Chloro-3-methylphenol	410.	U	440.	U	440.	U	410.	U	430.	U		
91-57-6	2-Methylnaphthalene	410.	U	440.	U	440.	U	410.	U	430.	U		
77-47-4	Hexachlorocyclopentadiene	410.	UJ	440.	U	440.	U	410.	UJ	430.	U		
88-06-2	2,4,6-Trichlorophenol	410.	U	440.	U	440.	U	410.	U	430.	U		
95-95-4	2,4,5-Trichlorophenol	410.	U	440.	U	440.	U	410.	U	430.	U		
91-58-7	2-Chloronaphthalene	410.	U	440.	U	440.	U	410.	U	430.	U		
88-74-4	2-Nitroaniline	2100.	U	2300.	U	2300.	U	2100.	U	2200.	U		
131-11-3	Dimethylphthalate	410.	U	440.	U	440.	U	410.	U	430.	U		
208-96-8	Acenaphthylene	410.	U	440.	U	440.	U	410.	U	430.	U		
606-20-2	2,6-Dinitrotoluene	410.	U	440.	U	440.	U	410.	U	430.	U		
99-09-2	3-Nitroaniline	2100.	U	2300.	U	2300.	U	2100.	U	2200.	U		
83-32-9	Acenaphthene	410.	U	440.	U	440.	U	89.	J	430.	U		
51-28-5	2,4-Dinitrophenol	2100.	U	2300.	U	2300.	U	2100.	U	2200.	U		
100-02-7	4-Nitrophenol	2100.	U	2300.	U	2300.	U	2100.	U	2200.	U		
132-64-9	Dibenzofuran	410.	U	440.	U	440.	U	410.	U	430.	U		

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-108

SW846-SVOA

	SAMPLE ID ------->	108-S-0001-01		108-S-0001-15		108-C-0001-15		108-S-0002-01		108-S-0002-15	
	ORIGINAL ID ----->	108S000101		108S000115		108C000115		108S000201		108S000215	
	LAB SAMPLE ID --->	S776828*8		S880337*1		S880337A*1		S776828*9		S880356*5	
	ID FROM REPORT -->	108S000101		108S000115		108C000115		108S000201		108S000215	
	SAMPLE DATE ----->	12/03/97		01/19/98		01/19/98		12/03/97		01/20/98	
	DATE EXTRACTED -->	12/08/97		01/23/98		01/23/98		12/08/97		01/23/98	
	DATE ANALYZED --->	12/30/97		02/08/98		02/08/98		12/30/97		02/08/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G07	VAL	EM1G01	VAL	EM1G06	VAL
121-14-2	2,4-Dinitrotoluene	410.	U	440.	U	440.	U	410.	U	430.	U
84-66-2	Diethylphthalate	410.	U	440.	U	440.	U	410.	U	430.	U
7005-72-3	4-Chlorophenylphenyl ether	410.	U	440.	U	440.	U	410.	U	430.	U
86-73-7	Fluorene	410.	U	440.	U	440.	U	60.	J	430.	U
100-01-6	4-Nitroaniline	2100.	U	2300.	U	2300.	U	2100.	U	2200.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	2100.	U	2300.	U	2300.	U	2100.	U	2200.	U
86-30-6	N-Nitrosodiphenylamine	410.	U	NR		NR		410.	U	NR	
101-55-3	4-Bromophenyl-phenylether	410.	U	440.	U	440.	U	410.	U	430.	U
118-74-1	Hexachlorobenzene	410.	U	440.	U	440.	U	410.	U	430.	U
87-86-5	Pentachlorophenol	2100.	U	2300.	U	2300.	U	2100.	U	2200.	U
85-01-8	Phenanthrene	16.	J	440.	U	440.	U	1200.		430.	U
120-12-7	Anthracene	410.	U	440.	U	440.	U	290.	J	430.	U
86-74-8	Carbazole	410.	U	440.	U	440.	U	210.	J	430.	U
84-74-2	Di-n-butylphthalate	410.	U	440.	U	440.	U	410.	U	430.	U
206-44-0	Fluoranthene	34.	J	440.	U	440.	U	2900.		430.	U
129-00-0	Pyrene	34.	J	440.	U	440.	U	2900.		430.	U
85-68-7	Butylbenzylphthalate	410.	U	440.	U	440.	U	410.	U	430.	U
91-94-1	3,3'-Dichlorobenzidine	820.	UJ	880.	U	880.	U	820.	UJ	870.	U
56-55-3	Benzo(a)anthracene	22.	J	440.	U	440.	U	2200.		430.	U
218-01-9	Chrysene	23.	J	440.	U	440.	U	2400.		430.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	410.	U	440.	U	440.	U	500.		430.	U
117-84-0	Di-n-octylphthalate	410.	U	440.	U	440.	U	410.	U	430.	U
205-99-2	Benzo(b)fluoranthene	19.	J	440.	U	440.	U	3300.		430.	U
207-08-9	Benzo(k)fluoranthene	24.	J	440.	U	440.	U	2200.		430.	U
50-32-8	Benzo(a)pyrene	20.	J	440.	U	440.	U	3000.		430.	U
193-39-5	Indeno(1,2,3-cd)pyrene	410.	U	440.	U	440.	U	1900.		430.	U
53-70-3	Dibenz(a,h)anthracene	410.	U	440.	U	440.	U	160.	J	430.	U
191-24-2	Benzo(g,h,i)perylene	13.	J	440.	U	440.	U	2000.		430.	U
122-39-4	Diphenylamine	NR		440.	U	440.	U	NR		430.	U

*** Validated Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-108

SW846-VOA										
	SAMPLE ID ------->	108-S-0001-15		108-C-0001-15		108-S-0002-15				
	ORIGINAL ID ----->	108S000115		108C000115		108S000215				
	LAB SAMPLE ID --->	S880337*1		S880337A*1		S880356*5				
	ID FROM REPORT -->	108S000115		108C000115		108S000215				
	SAMPLE DATE ----->	01/19/98		01/19/98		01/20/98				
	DATE ANALYZED --->	01/26/98		01/26/98		01/28/98				
	MATRIX ---------->	Soil		Soil		Soil				
	UNITS ---------->	UG/KG		UG/KG		UG/KG				
CAS #	Parameter	EM1G06	VAL	EM1G07	VAL	EM1G06	VAL			
74-87-3	Chloromethane	13.	U	13.	U	13.	U			
74-83-9	Bromomethane	13.	U	13.	U	13.	U			
75-01-4	Vinyl chloride	13.	U	13.	U	13.	U			
75-00-3	Chloroethane	13.	U	13.	U	13.	UJ			
75-35-4	1,1-Dichloroethene	6.7	U	6.7	U	6.6	U			
75-09-2	Methylene chloride	6.7	U	6.7	U	6.6	U			
75-34-3	1,1-Dichloroethane	6.7	U	6.7	U	6.6	U			
67-66-3	Chloroform	6.7	U	6.7	U	6.6	U			
71-55-6	1,1,1-Trichloroethane	6.7	U	6.7	U	6.6	U			
56-23-5	Carbon tetrachloride	6.7	U	6.7	U	6.6	U			
71-43-2	Benzene	6.7	U	6.7	U	6.6	U			
107-06-2	1,2-Dichloroethane	6.7	U	6.7	U	6.6	U			
79-01-6	Trichloroethene	6.7	U	6.7	U	6.6	U			
78-87-5	1,2-Dichloropropane	6.7	U	6.7	U	6.6	U			
75-27-4	Bromodichloromethane	6.7	U	6.7	U	6.6	U			
108-88-3	Toluene	6.7	U	6.7	U	6.6	U			
79-00-5	1,1,2-Trichloroethane	6.7	U	6.7	U	6.6	U			
127-18-4	Tetrachloroethene	6.7	U	6.7	U	6.6	U			
124-48-1	Dibromochloromethane	6.7	U	6.7	U	6.6	U			
108-90-7	Chlorobenzene	6.7	U	6.7	U	6.6	U			
100-41-4	Ethylbenzene	6.7	U	6.7	U	6.6	U			
100-42-5	Styrene	6.7	U	6.7	U	6.6	U			
75-25-2	Bromoform	6.7	U	6.7	U	6.6	U			
79-34-5	1,1,2,2-Tetrachloroethane	6.7	U	6.7	U	6.6	U			
67-64-1	Acetone	67.	U	67.	U	66.	U			
75-15-0	Carbon disulfide	6.7	U	6.7	U	6.6	U			
78-93-3	2-Butanone (MEK)	33.	U	30.	J	33.	U			
108-10-1	4-Methyl-2-Pentanone (MIBK)	33.	U	33.	U	33.	U			
10061-01-5	cis-1,3-Dichloropropene	6.7	U	6.7	U	6.6	U			
10061-02-6	trans-1,3-Dichloropropene	6.7	U	6.7	U	6.6	U			
591-78-6	2-Hexanone	33.	U	33.	U	33.	U			
1330-20-7	Xylene (Total)	6.7	U	6.7	U	6.6	U			
540-59-0	1,2-Dichloroethene (total)	6.7	U	6.7	U	6.6	U			

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-108

TPH											
	SAMPLE ID ------->	108-S-0001-01		108-S-0001-15		108-C-0001-15		108-S-0002-01		108-S-0002-15	
	ORIGINAL ID ----->	108S000101		108S000115		108C000115		108S000201		108S000215	
	LAB SAMPLE ID --->	S776828*8		S880337*1		S880337A*1		S776828*9		S880356*5	
	ID FROM REPORT -->	108S000101		108S000115		108C000115		108S000201		108S000215	
	SAMPLE DATE ----->	12/03/97		01/19/98		01/19/98		12/03/97		01/20/98	
	DATE EXTRACTED -->	12/26/97		02/09/98		02/09/98		12/26/97		02/09/98	
	DATE ANALYZED --->	12/29/97		02/10/98		02/10/98		12/29/97		02/10/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G07	VAL	EM1G01	VAL	EM1G06	VAL
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	37.		31.	J	35.	J	300.		34.	J

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

APK9-METAL													
	SAMPLE ID ------->	109-S-0001-01		109-S-0001-15		109-S-0002-01		109-S-0002-15		109-S-0003-01		109-S-0003-15	
	ORIGINAL ID ----->	109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
	LAB SAMPLE ID --->	S776828*10		S880356*4		S776828*11		S880356*3		S776828*12		S880356*2	
	ID FROM REPORT -->	109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
	SAMPLE DATE ----->	12/03/97		01/20/98		12/03/97		01/20/98		12/03/97		01/20/98	
	DATE EXTRACTED -->	12/10/97		01/27/98		12/10/97		01/27/98		12/10/97		01/27/98	
	DATE ANALYZED --->	12/11/97		01/28/98		12/11/97		01/28/98		12/11/97		01/28/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL
7439-97-6	Mercury	0.03		0.03		0.05		0.02		0.02		0.02	
7440-36-0	Antimony	0.58	UR	0.43	UR	0.38	UR	0.43	UR	0.57	UR	0.43	UR
7440-38-2	Arsenic	6.4		8.7		5.		8.8		5.		5.5	
7440-39-3	Barium	98.2		72.2		112.		76.4		54.9		57.6	
7440-41-7	Beryllium	0.73		0.43	J	1.7		0.46	J	0.2	U	0.39	J
7440-43-9	Cadmium	0.57	J	0.04	UJ	0.61		0.04	UJ	0.61		0.04	UJ
7440-47-3	Chromium	1[illegible]		15.8		13.		15.8		8.3		11.9	
7440-48-4	Cobalt	6.9		8.5		4.9		8.3		2.8		6.1	
7440-50-8	Copper	17.8		16.		22.7		16.8		7.7		13.	
7439-92-1	Lead	26.7	J	9.7		17.7	J	10.		14.3	J	7.1	
7440-02-0	Nickel	12.		21.3		9.4		20.8		8.2		15.4	
7782-49-2	Selenium	0.32	U	0.61	U	0.36	J	0.43	U	2.2	J	0.43	U
7440-22-4	Silver	0.36	U	0.12	U	0.36	U	0.13	U	0.34	U	0.13	U
7440-28-0	Thallium	0.57	UJ	0.77	U	0.56	UJ	0.78	U	0.54	UJ	0.78	U
7440-62-2	Vanadium	20.8		23.4		21.9		25.4		10.4		19.1	
7440-66-6	Zinc	60.3		52.2		53.		55.3		60.6		38.3	
7440-31-5	Tin	1.3	U	1.6	U	1.6	U	1.3	U	0.88	U	1.5	U

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

APX9-METAL											
	SAMPLE ID ------->	109-S-0004-01		109-S-0004-15		109-C-0004-15					
	ORIGINAL ID ----->	109S000401		109S000415		109C000415					
	LAB SAMPLE ID --->	8776828*13		S880356*1		S880356A*1					
	ID FROM REPORT -->	109S000401		109S000415		109C000415					
	SAMPLE DATE ----->	12/03/97		01/20/98		01/20/98					
	DATE EXTRACTED -->	12/10/97		01/27/98		01/27/98					
	DATE ANALYZED --->	12/11/97		01/28/98		01/28/98					
	MATRIX ---------->	Soil		Soil		Soil					
	UNITS ---------->	MG/KG		MG/KG		MG/KG					
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G07	VAL				
7439-97-6	Mercury	0.03		0.02		0.02	J				
7440-36-0	Antimony	0.77	UR	0.43	UR	0.42	U				
7440-38-2	Arsenic	11.		6.8		6.9					
7440-39-3	Barium	92.5		58.8		68.3					
7440-41-7	Beryllium	0.49	J	0.36	J	0.4	J				
7440-43-9	Cadmium	0.46	J	0.04	UJ	0.04	UJ				
7440-47-3	Chromium	16.		12.2		12.9					
7440-48-4	Cobalt	8.4		6.2		7.					
7440-50-8	Copper	18.1		14.2		13.8					
7439-92-1	Lead	14.6	J	7.9		7.8					
7440-02-0	Nickel	15.7		15.7		15.7	J				
7782-49-2	Selenium	0.56	J	0.85	U	0.41	U				
7440-22-4	Silver	0.37	U	0.12	U	0.12	UJ				
7440-28-0	Thallium	0.59	UJ	0.77	U	0.76	UJ				
7440-62-2	Vanadium	27.8		20.6		24.2					
7440-66-6	Zinc	58.9		38.6		37.6					
7440-31-5	Tin	1.1	U	1.8	U	1.8	U				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

SW846-SVOA													
	SAMPLE ID ------->	109-S-0001-01		109-S-0001-15		109-S-0002-01		109-S-0002-15		109-S-0003-01		109-S-0003-15	
	ORIGINAL ID ----->	109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
	LAB SAMPLE ID --->	S776828*10		S880356*4		S776828*11		S880356*3		S776828*12		S880356*2	
	ID FROM REPORT -->	109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
	SAMPLE DATE ----->	12/03/97		01/20/98		12/03/97		01/20/98		12/03/97		01/20/98	
	DATE EXTRACTED -->	12/08/97		01/23/98		12/08/97		01/23/98		12/08/97		01/23/98	
	DATE ANALYZED --->	12/30/97		02/10/98		12/31/97		02/10/98		01/03/98		02/10/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL
108-95-2	Phenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
111-44-4	bis(2-Chloroethyl)ether	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
95-57-8	2-Chlorophenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
541-73-1	1,3-Dichlorobenzene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
106-46-7	1,4-Dichlorobenzene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
95-50-1	1,2-Dichlorobenzene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
95-48-7	2-Methylphenol (o-Cresol)	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
9999900-32-2	3-Methylphenol/4-Methylphenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
621-64-7	N-Nitroso-di-n-propylamine	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
67-72-1	Hexachloroethane	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
98-95-3	Nitrobenzene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
78-59-1	Isophorone	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
88-75-5	2-Nitrophenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
105-67-9	2,4-Dimethylphenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
120-83-2	2,4-Dichlorophenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
120-82-1	1,2,4-Trichlorobenzene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
91-20-3	Naphthalene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
106-47-8	4-Chloroaniline	800.	U	870.	U	780.	U	880.	U	760.	U	880.	U
87-68-3	Hexachlorobutadiene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
111-91-1	bis(2-Chloroethoxy)methane	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
59-50-7	4-Chloro-3-methylphenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
91-57-6	2-Methylnaphthalene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
77-47-4	Hexachlorocyclopentadiene	400.	UJ	430.	U	390.	U	440.	U	380.	U	440.	U
88-06-2	2,4,6-Trichlorophenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
95-95-4	2,4,5-Trichlorophenol	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
91-58-7	2-Chloronaphthalene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
88-74-4	2-Nitroaniline	2100.	U	2200.	U	2000.	U	2300.	U	2000.	U	2300.	U
131-11-3	Dimethylphthalate	400	U	430.	U	390.	U	440.	U	380.	U	440.	U
208-96-8	Acenaphthylene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
606-20-2	2,6-Dinitrotoluene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
99-09-2	3-Nitroaniline	2100.	U	2200.	U	2000.	U	2300.	U	2000.	U	2300.	U
83-32-9	Acenaphthene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
51-28-5	2,4-Dinitrophenol	2100.	U	2200.	U	2000.	U	2300.	U	2000.	U	2300.	U
100-02-7	4-Nitrophenol	2100.	U	2200.	U	2000.	U	2300.	U	2000.	U	2300.	U
132-64-9	Dibenzofuran	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

SW846-SVOA

SAMPLE ID ------->		109-S-0001-01		109-S-0001-15		109-S-0002-01		109-S-0002-15		109-S-0003-01		109-S-0003-15	
ORIGINAL ID ----->		109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
LAB SAMPLE ID --->		S776828*10		S880356*4		S776828*11		S880356*3		S776828*12		S880356*2	
ID FROM REPORT -->		109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
SAMPLE DATE ----->		12/03/97		01/20/98		12/03/97		01/20/98		12/03/97		01/20/98	
DATE EXTRACTED -->		12/08/97		01/23/98		12/08/97		01/23/98		12/08/97		01/23/98	
DATE ANALYZED --->		12/30/97		02/10/98		12/31/97		02/10/98		01/03/98		02/10/98	
MATRIX ---------->		Soil		Soil		Soil		Soil		Soil		Soil	
UNITS ---------->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL
121-14-2	2,4-Dinitrotoluene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
84-66-2	Diethylphthalate	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
7005-72-3	4-Chlorophenylphenyl ether	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
86-73-7	Fluorene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
100-01-6	4-Nitroaniline	2100.	U	2200.	U	2000.	U	2300.	U	2000.	U	2300.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	2100.	U	2200.	U	2000.	U	2300.	U	2000.	U	2300.	U
86-30-6	N-Nitrosodiphenylamine	400.	U	NR		390.	U	NR		380.	U	NR	
101-55-3	4-Bromophenyl-phenylether	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
118-74-1	Hexachlorobenzene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
87-86-5	Pentachlorophenol	2100.	U	2200.	U	2000.	U	2300.	U	2000.	U	2300.	U
85-01-8	Phenanthrene	38.	J	430.	U	47.	J	440.	U	380.	U	440.	U
120-12-7	Anthracene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
86-74-8	Carbazole	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
84-74-2	Di-n-butylphthalate	400.	U	430.	U	89.	J	440.	U	380.	U	440.	U
206-44-0	Fluoranthene	49.	J	430.	U	40.	J	440.	U	380.	U	440.	U
129-00-0	Pyrene	49.	J	430.	U	41.	J	440.	U	380.	U	440.	U
85-68-7	Butylbenzylphthalate	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
91-94-1	3,3'-Dichlorobenzidine	800.	UJ	870.	U	780.	UJ	880.	U	760.	U	880.	U
56-55-3	Benzo(a)anthracene	34.	J	430.	U	390.	U	440.	U	380.	U	440.	U
218-01-9	Chrysene	38.	J	430.	U	390.	U	440.	U	380.	U	440.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	66.	J	430.	U	390.	U	440.	U	380.	U	440.	U
117-84-0	Di-n-octylphthalate	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
205-99-2	Benzo(b)fluoranthene	33.	J	430.	U	390.	U	440.	U	380.	U	440.	U
207-08-9	Benzo(k)fluoranthene	30.	J	430.	U	390.	U	440.	U	380.	U	440.	U
50-32-8	Benzo(a)pyrene	34.	J	430.	U	390.	U	440.	U	380.	U	440.	U
193-39-5	Indeno(1,2,3-cd)pyrene	17.	J	430.	U	390.	U	440.	U	380.	U	440.	U
53-70-3	Dibenz(a,h)anthracene	400.	U	430.	U	390.	U	440.	U	380.	U	440.	U
191-24-2	Benzo(g,h,i)perylene	21.	J	430.	U	390.	U	440.	U	380.	U	440.	U
122-39-4	Diphenylamine	NR		430.	U	NR		440.	U	NR		440.	U

*** Valida . Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

SW846-SVOA											
	SAMPLE ID ------->	109-S-0004-01		109-S-0004-15		109-C-0004-15					
	ORIGINAL ID ----->	109S000401		109S000415		109C000415					
	LAB SAMPLE ID --->	S776828*13		S880356*1		S880356A*1					
	ID FROM REPORT -->	109S000401		109S000415		109C000415					
	SAMPLE DATE ----->	12/03/97		01/20/98		01/20/98					
	DATE EXTRACTED -->	12/08/97		01/23/98		01/23/98					
	DATE ANALYZED --->	12/30/97		02/10/98		02/08/98					
	MATRIX ---------->	Soil		Soil		Soil					
	UNITS ---------->	UG/KG		UG/KG		UG/KG					
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G07	VAL				
108-95-2	Phenol	410.	U	430.	U	430.	U				
111-44-4	bis(2-Chloroethyl)ether	410.	U	430.	U	430.	U				
95-57-8	2-Chlorophenol	410.	U	430.	U	430.	U				
541-73-1	1,3-Dichlorobenzene	410.	U	430.	U	430.	U				
106-46-7	1,4-Dichlorobenzene	410.	U	430.	U	430.	U				
95-50-1	1,2-Dichlorobenzene	410.	U	430.	U	430.	U				
95-48-7	2-Methylphenol (o-Cresol)	410.	U	430.	U	430.	U				
108-60-1	2,2'-oxybis(1-Chloropropane)	410.	U	430.	U	430.	U				
9999900-32-2	3-Methylphenol/4-Methylphenol	410.	U	430.	U	430.	U				
621-64-7	N-Nitroso-di-n-propylamine	410.	U	430.	U	430.	U				
67-72-1	Hexachloroethane	410.	U	430.	U	430.	U				
98-95-3	Nitrobenzene	410.	U	430.	U	430.	U				
78-59-1	Isophorone	410.	U	430.	U	430.	U				
88-75-5	2-Nitrophenol	410.	U	430.	U	430.	U				
105-67-9	2,4-Dimethylphenol	410.	U	430.	U	430.	U				
120-83-2	2,4-Dichlorophenol	410.	U	430.	U	430.	U				
120-82-1	1,2,4-Trichlorobenzene	410.	U	430.	U	430.	U				
91-20-3	Naphthalene	410.	U	430.	U	430.	U				
106-47-8	4-Chloroaniline	820.	U	870.	U	860.	U				
87-68-3	Hexachlorobutadiene	410.	U	430.	U	430.	U				
111-91-1	bis(2-Chloroethoxy)methane	410.	U	430.	U	430.	U				
59-50-7	4-Chloro-3-methylphenol	410.	U	430.	U	430.	U				
91-57-6	2-Methylnaphthalene	410.	U	430.	U	430.	U				
77-47-4	Hexachlorocyclopentadiene	410.	U	430.	U	430.	U				
88-06-2	2,4,6-Trichlorophenol	410.	U	430.	U	430.	U				
95-95-4	2,4,5-Trichlorophenol	410.	U	430.	U	430.	U				
91-58-7	2-Chloronaphthalene	410.	U	430.	U	430.	U				
88-74-4	2-Nitroaniline	2100.	U	2200.	U	2200.	U				
131-11-3	Dimethylphthalate	410.	U	430.	U	430.	U				
208-96-8	Acenaphthylene	410.	U	430.	U	430.	U				
606-20-2	2,6-Dinitrotoluene	410.	U	430.	U	430.	U				
99-09-2	3-Nitroaniline	2100.	U	2200.	U	2200.	U				
83-32-9	Acenaphthene	410.	U	430.	U	430.	U				
51-28-5	2,4-Dinitrophenol	2100.	U	2200.	U	2200.	U				
100-02-7	4-Nitrophenol	2100.	U	2200.	U	2200.	U				
132-64-9	Dibenzofuran	410.	U	430.	U	430.	U				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

SW846-SVOA

	SAMPLE ID ------->	109-S-0004-01		109-S-0004-15		109-C-0004-15							
	ORIGINAL ID ----->	109S000401		109S000415		109C000415							
	LAB SAMPLE ID --->	S776828*13		S880356*1		S880356A*1							
	ID FROM REPORT -->	109S000401		109S000415		109C000415							
	SAMPLE DATE ----->	12/03/97		01/20/98		01/20/98							
	DATE EXTRACTED -->	12/08/97		01/23/98		01/23/98							
	DATE ANALYZED --->	12/30/97		02/10/98		02/08/98							
	MATRIX ---------->	Soil		Soil		Soil							
	UNITS ---------->	UG/KG		UG/KG		UG/KG							
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G07	VAL						
121-14-2	2,4-Dinitrotoluene	410.	U	430.	U	430.	U						
84-66-2	Diethylphthalate	410.	U	430.	U	430.	U						
7005-72-3	4-Chlorophenylphenyl ether	410.	U	430.	U	430.	U						
86-73-7	Fluorene	410.	U	430.	U	430.	U						
100-01-6	4-Nitroaniline	2100.	U	2200.	U	2200.	U						
534-52-1	2-Methyl-4,6-Dinitrophenol	2100.	U	2200.	U	2200.	U						
86-30-6	N-Nitrosodiphenylamine	410.	U	NR		NR							
101-55-3	4-Bromophenyl-phenylether	410.	U	430.	U	430.	U						
118-74-1	Hexachlorobenzene	410.	U	430.	U	430.	U						
87-86-5	Pentachlorophenol	2100.	U	2200.	U	2200.	U						
85-01-8	Phenanthrene	410.	U	430.	U	430.	U						
120-12-7	Anthracene	410.	U	430.	U	430.	U						
86-74-8	Carbazole	410.	U	430.	U	430.	U						
84-74-2	Di-n-butylphthalate	410.	U	430.	U	430.	U						
206-44-0	Fluoranthene	410.	U	430.	U	430.	U						
129-00-0	Pyrene	28.	J	430.	U	430.	U						
85-68-7	Butylbenzylphthalate	410.	U	430.	U	430.	U						
91-94-1	3,3'-Dichlorobenzidine	820.	UJ	870.	U	860.	U						
56-55-3	Benzo(a)anthracene	410.	U	430.	U	430.	U						
218-01-9	Chrysene	410	U	430.	U	430.	U						
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	410.	U	430.	U	430.	U						
117-84-0	Di-n-octylphthalate	410.	U	430.	U	430.	U						
205-99-2	Benzo(b)fluoranthene	410.	U	430.	U	430.	U						
207-08-9	Benzo(k)fluoranthene	410.	U	430.	U	430.	U						
50-32-8	Benzo(a)pyrene	410.	U	430.	U	430.	U						
193-39-5	Indeno(1,2,3-cd)pyrene	410.	U	430.	U	430.	U						
53-70-3	Dibenz(a,h)anthracene	410.	U	430.	U	430.	U						
191-24-2	Benzo(g,h,i)perylene	410.	U	430.	U	430.	U						
122-39-4	Diphenylamine	NR		430.	U	430.	U						

*** Valida . Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

SW846-VOA	SAMPLE ID -------->	109-S-0001-15		109-S-0002-15		109-S-0003-15		109-S-0004-15		109-C-0004-15	
	ORIGINAL ID ----->	109S000115		109S000215		109S000315		109S000415		109C000415	
	LAB SAMPLE ID --->	S880356*4		S880356*3		S880356*2		S880356*1		S880356A*1	
	ID FROM REPORT -->	109S000115		109S000215		109S000315		109S000415		109C000415	
	SAMPLE DATE ----->	01/20/98		01/20/98		01/20/98		01/20/98		01/20/98	
	DATE ANALYZED --->	01/28/98		01/27/98		01/27/98		01/26/98		01/28/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	EM1G06	VAL	EM1G06	VAL	EM1G06	VAL	EM1G06	VAL	EM1G07	VAL
74-87-3	Chloromethane	13.	U	13.	U	13.	U	13.	U	13.	U
74-83-9	Bromomethane	13.	U	13.	U	13.	U	13.	U	13.	U
75-01-4	Vinyl chloride	13.	U	13.	U	13.	U	13.	U	13.	U
75-00-3	Chloroethane	13.	UJ	13.	U	13.	U	13.	U	13.	UJ
75-35-4	1,1-Dichloroethene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
75-09-2	Methylene chloride	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
75-34-3	1,1-Dichloroethane	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
67-66-3	Chloroform	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
71-55-6	1,1,1-Trichloroethane	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
56-23-5	Carbon tetrachloride	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
71-43-2	Benzene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
107-06-2	1,2-Dichloroethane	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
79-01-6	Trichloroethene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
78-87-5	1,2-Dichloropropane	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
75-27-4	Bromodichloromethane	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
108-88-3	Toluene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
79-00-5	1,1,2-Trichloroethane	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
127-18-4	Tetrachloroethene	6 6	U	6.7	U	6.7	U	6.6	U	6.5	U
124-48-1	Dibromochloromethane	.6	U	6.7	U	6.7	U	6.6	U	6.5	U
108-90-7	Chlorobenzene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
100-41-4	Ethylbenzene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
100-42-5	Styrene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
75-25-2	Bromoform	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
79-34-5	1,1,2,2-Tetrachloroethane	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
67-64-1	Acetone	66.	U	67.	U	67.	U	66.	U	65.	U
75-15-0	Carbon disulfide	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
78-93-3	2-Butanone (MEK)	33.	U	33.	U	33.	U	14.	J	32.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	33.	U	33.	U	33.	U	33.	U	32.	U
10061-01-5	cis-1,3-Dichloropropene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
10061-02-6	trans-1,3-Dichloropropene	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
591-78-6	2-Hexanone	33.	U	33.	U	33.	U	33.	U	32.	U
1330-20-7	Xylene (Total)	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U
540-59-0	1,2-Dichloroethene (total)	6.6	U	6.7	U	6.7	U	6.6	U	6.5	U

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

TPH													
	SAMPLE ID ------->	109-S-0001-01		109-S-0001-15		109-S-0002-01		109-S-0002-15		109-S-0003-01		109-S-0003-15	
	ORIGINAL ID ----->	109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
	LAB SAMPLE ID --->	S776828*10		S880356*4		S776828*11		S880356*3		S776828*12		S880356*2	
	ID FROM REPORT -->	109S000101		109S000115		109S000201		109S000215		109S000301		109S000315	
	SAMPLE DATE ----->	12/03/97		01/20/98		12/03/97		01/20/98		12/03/97		01/20/98	
	DATE EXTRACTED -->	12/26/97		02/09/98		12/26/97		02/09/98		12/26/97		02/09/98	
	DATE ANALYZED --->	12/29/97		02/10/98		12/29/97		02/10/98		12/29/97		02/10/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL	EM1G01	VAL	EM1G06	VAL
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	12.	U	27.	J	16.		31.	J	18.		39.	J

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-109

TPN												
		SAMPLE ID ------->	109-S-0004-01		109-S-0004-15		109-C-0004-15					
		ORIGINAL ID ----->	109S000401		109S000415		109C000415					
		LAB SAMPLE ID --->	$776828*13		S880356*1		S880356A*1					
		ID FROM REPORT -->	109S000401		109S000415		109C000415					
		SAMPLE DATE ----->	12/03/97		01/20/98		01/20/98					
		DATE EXTRACTED -->	12/26/97		02/09/98		02/09/98					
		DATE ANALYZED --->	12/29/97		02/10/98		02/10/98					
		MATRIX ---------->	Soil		Soil		Soil					
		UNITS ---------->	MG/KG		MG/KG		MG/KG					
CAS #	Parameter		EM1G01	VAL	EM1G06	VAL	EM1G07	VAL				
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS		16.		46.	J	27.	J				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-114 AND 397

APX9-METAL

	SAMPLE ID ------->	114-S-0001-01		114-C-0001-01		397-S-0001-01							
	ORIGINAL ID ----->	114S000101		114C000101		397S000101							
	LAB SAMPLE ID --->	$776864*5		$776864A*2		$776864*6							
	ID FROM REPORT -->	114S000101		114C000101		397S000101							
	SAMPLE DATE ----->	12/04/97		12/04/97		12/04/97							
	DATE EXTRACTED -->	12/10/97		12/10/97		12/10/97							
	DATE ANALYZED --->	12/11/97		12/10/97		12/11/97							
	MATRIX ---------->	Soil		Soil		Soil							
	UNITS ---------->	MG/KG		MG/KG		MG/KG							
CAS #	Parameter	EM1G01	VAL	EM1G02	VAL	EM1G01	VAL						
7439-97-6	Mercury	0.3		0.24	J	0.03							
7440-36-0	Antimony	2.	J	2.9	J	0.41	UR						
7440-38-2	Arsenic	11.4		15.3		8.9							
7440-39-3	Barium	359.		418.		149.							
7440-41-7	Beryllium	1.3		0.58	J	0.52	J						
7440-43-9	Cadmium	5.1		6.7		0.81							
7440-47-3	Chromium	27.3		54.8		15.7							
7440-48-4	Cobalt	[illegible]		8.4		8.1							
7440-50-8	Copper	93.6		167.	J	20.3							
7439-92-1	Lead	2000.	J	2810.		160.	J						
7440-02-0	Nickel	17.4		29.3		18.9							
7782-49-2	Selenium	0.32	U	0.32	U	0.35	J						
7440-22-4	Silver	0.76	J	5.9		0.38	U						
7440-28-0	Thallium	0.58	UJ	0.58	UJ	0.59	UJ						
7440-62-2	Vanadium	17.5		21.8		25.3							
7440-66-6	Zinc	358.		482.		155.							
7440-31-5	Tin	15.9		21.9		1.2	U						

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-114 AND 397

GLYCOL	SAMPLE ID ------->	114-S-0001-01	114-C-0001-01				
	ORIGINAL ID ----->	114S000101	114C000101				
	LAB SAMPLE ID --->	S776864*5	S776864A*2				
	ID FROM REPORT -->	114S000101	114C000101				
	SAMPLE DATE ----->	12/04/97	12/04/97				
	DATE ANALYZED --->	12/08/97	12/08/97				
	MATRIX ---------->	Soil	Soil				
	UNITS ---------->	MG/KG	MG/KG				
CAS #	Parameter	EM1G01 VAL	EM1G02 VAL				
107-21-1	Ethylene Glycol	6.2 U	6.2 U				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-114 AND 397

SW846-SVOA

SAMPLE ID ------->	114-S-0001-01		114-C-0001-01				
ORIGINAL ID ----->	114S000101		114C000101				
LAB SAMPLE ID --->	S776864*5		S776864A*2				
ID FROM REPORT -->	114S000101		114C000101				
SAMPLE DATE ----->	12/04/97		12/04/97				
DATE EXTRACTED -->	12/08/97		12/09/97				
DATE ANALYZED --->	12/31/97		12/15/97				
MATRIX ---------->	Soil		Soil				
UNITS ---------->	UG/KG		UG/KG				
CAS # Parameter	EM1G01	VAL	EM1G02	VAL			
108-95-2 Phenol	410.	U	410.	U			
111-44-4 bis(2-Chloroethyl)ether	410.	U	410.	U			
95-57-8 2-Chlorophenol	410.	U	410.	U			
541-73-1 1,3-Dichlorobenzene	410.	U	410.	U			
106-46-7 1,4-Dichlorobenzene	410.	U	410.	U			
95-50-1 1,2-Dichlorobenzene	410.	U	410.	U			
95-48-7 2-Methylphenol (o-Cresol)	410.	U	410.	U			
108-60-1 2,2'-oxybis(1-Chloropropane)	410.	U	410.	U			
9999900-32-2 3-Methylphenol/4-Methylphenol	410.	U	410.	U			
621-64-7 N-Nitroso-di-n-propylamine	410.	U	410.	U			
67-72-1 Hexachloroethane	410.	U	410.	U			
98-95-3 Nitrobenzene	410.	U	410.	U			
78-59-1 Isophorone	410.	U	410.	U			
88-75-5 2-Nitrophenol	410.	U	410.	U			
105-67-9 2,4-Dimethylphenol	410.	U	410.	U			
120-83-2 2,4-Dichlorophenol	410.	U	410.	U			
120-82-1 1,2,4-Trichlorobenzene	410.	U	410.	U			
91-20-3 Naphthalene	410.	U	410.	U			
106-47-8 4-Chloroaniline	810.	U	810.	U			
87-68-3 Hexachlorobutadiene	410.	U	410.	U			
111-91-1 bis(2-Chloroethoxy)methane	410.	U	410.	U			
59-50-7 4-Chloro-3-methylphenol	410.	U	410.	U			
91-57-6 2-Methylnaphthalene	410.	U	410.	U			
77-47-4 Hexachlorocyclopentadiene	410.	U	410.	U			
88-06-2 2,4,6-Trichlorophenol	410.	U	410.	U			
95-95-4 2,4,5-Trichlorophenol	410.	U	410.	U			
91-58-7 2-Chloronaphthalene	410.	U	410.	U			
88-74-4 2-Nitroaniline	2100.	U	2100.	U			
131-11-3 Dimethylphthalate	410.	U	410.	U			
208-96-8 Acenaphthylene	410.	U	410.	U			
606-20-2 2,6-Dinitrotoluene	41[illegible].	U	410.	U			
99-09-2 3-Nitroaniline	2100.	U	2100.	U			
83-32-9 Acenaphthene	410.	U	410.	U			
51-28-5 2,4-Dinitrophenol	2100.	U	2100.	U			
100-02-7 4-Nitrophenol	2100.	U	2100.	U			
132-64-9 Dibenzofuran	410.	U	410.	U			

*** Valida[illegible] Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-114 AND 397

SW846-SVOA									
	SAMPLE ID ------->	114-S-0001-01		114-C-0001-01					
	ORIGINAL ID ----->	114S000101		114C000101					
	LAB SAMPLE ID --->	S776864*5		S776864A*2					
	ID FROM REPORT -->	114S000101		114C000101					
	SAMPLE DATE ----->	12/04/97		12/04/97					
	DATE EXTRACTED -->	12/08/97		12/09/97					
	DATE ANALYZED --->	12/31/97		12/15/97					
	MATRIX ---------->	Soil		Soil					
	UNITS ---------->	UG/KG		UG/KG					
CAS #	Parameter	EM1G01	VAL	EM1G02	VAL				
121-14-2	2,4-Dinitrotoluene	410.	U	410.	U				
84-66-2	Diethylphthalate	410.	U	410.	U				
7005-72-3	4-Chlorophenylphenyl ether	410.	U	410.	U				
86-73-7	Fluorene	410.	U	410.	U				
100-01-6	4-Nitroaniline	2100.	U	2100.	U				
534-52-1	2-Methyl-4,6-Dinitrophenol	2100.	U	2100.	U				
86-30-6	N-Nitrosodiphenylamine	410.	U	410.	U				
101-55-3	4-Bromophenyl-phenylether	410.	U	410.	U				
118-74-1	Hexachlorobenzene	410.	U	410.	U				
87-86-5	Pentachlorophenol	2100.	U	2100.	U				
85-01-8	Phenanthrene	12.	J	410.	U				
120-12-7	Anthracene	410.	U	410.	U				
86-74-8	Carbazole	410.	U	410.	U				
84-74-2	Di-n-butylphthalate	410.	U	410.	U				
206-44-0	Fluoranthene	23.	J	410.	U				
129-00-0	Pyrene	410.	U	410.	U				
85-68-7	Butylbenzylphthalate	410.	U	410.	U				
91-94-1	3,3'-Dichlorobenzidine	810.	UJ	810.	U				
56-55-3	Benzo(a)anthracene	410.	U	410.	U				
218-01-9	Chrysene	410.	U	410.	U				
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	410.	U	410.	U				
117-84-0	Di-n-octylphthalate	410.	U	410.	U				
205-99-2	Benzo(b)fluoranthene	410.	U	69.	J				
207-08-9	Benzo(k)fluoranthene	410.	U	22.	J				
50-32-8	Benzo(a)pyrene	410.	U	55.	J				
193-39-5	Indeno(1,2,3-cd)pyrene	410.	U	410.	U				
53-70-3	Dibenz(a,h)anthracene	410.	U	410.	U				
191-24-2	Benzo(g,h,i)perylene	410	U	410.	U				
122-39-4	Diphenylamine	NR		NR					

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-114 AND 397

SW846-VOA

SAMPLE ID ------->	114-S-0001-15		397-S-0001-15					
ORIGINAL ID ----->	114S000115		397S000115					
LAB SAMPLE ID --->	S880212*1		S880212*2					
ID FROM REPORT -->	114S000115		397S000115					
SAMPLE DATE ----->	01/13/98		01/13/98					
DATE ANALYZED --->	01/20/98		01/20/98					
MATRIX ---------->	Soil		Soil					
UNITS ---------->	UG/KG		UG/KG					
CAS # Parameter	EM1G05	VAL	EM1G05	VAL				
74-87-3 Chloromethane	12.	U	12.	U				
74-83-9 Bromomethane	12.	U	12.	U				
75-01-4 Vinyl chloride	12.	U	12.	U				
75-00-3 Chloroethane	12.	U	12.	U				
75-35-4 1,1-Dichloroethene	6.2	U	6.2	U				
75-09-2 Methylene chloride	6.2	U	6.2	U				
75-34-3 1,1-Dichloroethane	6.2	U	6.2	U				
67-66-3 Chloroform	6.2	U	6.2	U				
71-55-6 1,1,1-Trichloroethane	6.2	U	6.2	U				
56-23-5 Carbon tetrachloride	6.2	U	6.2	U				
71-43-2 Benzene	6.2	U	6.2	U				
107-06-2 1,2-Dichloroethane	6.2	U	6.2	U				
79-01-6 Trichloroethene	6.2	U	6.2	U				
78-87-5 1,2-Dichloropropane	6.2	U	6.2	U				
75-27-4 Bromodichloromethane	6.2	U	6.2	U				
108-88-3 Toluene	6.2	U	6.2	U				
79-00-5 1,1,2-Trichloroethane	6.2	U	6.2	U				
127-18-4 Tetrachloroethene	6.2	U	6.2	U				
124-48-1 Dibromochloromethane	6.2	U	6.2	U				
108-90-7 Chlorobenzene	6.2	U	6.2	U				
100-41-4 Ethylbenzene	6.2	U	6.2	U				
100-42-5 Styrene	6.2	U	6.2	U				
75-25-2 Bromoform	6.2	U	6.2	U				
79-34-5 1,1,2,2-Tetrachloroethane	6.2	U	6.2	U				
67-64-1 Acetone	37.	J	62.	U				
75-15-0 Carbon disulfide	6.2	U	6.2	U				
78-93-3 2-Butanone (MEK)	31.	U	31.	U				
108-10-1 4-Methyl-2-Pentanone (MIBK)	31.	U	31.	U				
10061-01-5 cis-1,3-Dichloropropene	6.2	U	6.2	U				
10061-02-6 trans-1,3-Dichloropropene	6.2	U	6.2	U				
591-78-6 2-Hexanone	31.	U	31.	U				
1330-20-7 Xylene (Total)	6.2	U	6.2	U				
540-59-0 1,2-Dichloroethene (total)	6.2	U	6.2	U				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY N-114 AND 397

TPH	SAMPLE ID ------->	114-S-0001-01		114-C-0001-01		397-S-0001-01				
	ORIGINAL ID ----->	114S000101		114C000101		397S000101				
	LAB SAMPLE ID --->	S776864*5		S776864A*2		S776864*6				
	ID FROM REPORT -->	114S000101		114C000101		397S000101				
	SAMPLE DATE ----->	12/04/97		12/04/97		12/04/97				
	DATE EXTRACTED -->	12/23/97		12/10/97		12/23/97				
	DATE ANALYZED --->	12/26/97		12/16/97		12/26/97				
	MATRIX ---------->	Soil		Soil		Soil				
	UNITS ---------->	MG/KG		MG/KG		MG/KG				
CAS #	Parameter	EM1G01	VAL	EM1G02	VAL	EM1G01	VAL			
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	1900.		880.		53.				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY S-203

APX9-METAL												
	SAMPLE ID ------->	203-S-0001-01		203-S-0002-01		203-S-0003-01						
	ORIGINAL ID ----->	203S000101		203S000201		203S000301						
	LAB SAMPLE ID --->	S776828*3		S776828*5		S776828*4						
	ID FROM REPORT -->	203S000101		203S000201		203S000301						
	SAMPLE DATE ----->	12/03/97		12/03/97		12/03/97						
	DATE EXTRACTED -->	12/10/97		12/10/97		12/10/97						
	DATE ANALYZED --->	12/10/97		12/11/97		12/10/97						
	MATRIX ---------->	Soil		Soil		Soil						
	UNITS ---------->	MG/KG		MG/KG		MG/KG						
CAS #	Parameter	EM1G01	VAL	EM1G01	VAL	EM1G01	VAL					
7439-97-6	Mercury	0.03		0.03		0.09						
7440-36-0	Antimony	0.67	UR	0.77	UR	1.1	UR					
7440-38-2	Arsenic	9.2		8.5		11.1						
7440-39-3	Barium	151.		102.		86.2						
7440-41-7	Beryllium	0.61		0.38	U	0.51	J					
7440-43-9	Cadmium	0.46	J	0.19	J	0.73						
7440-47-3	Chromium	18.9		14.		17.3						
7440-48-4	Cobalt	9.2		5.5		5.9						
7440-50-8	Copper	16.		18.9		30.3						
7439-92-1	Lead	25.6	J	28.6	J	176.	J					
7440-02-0	Nickel	20.5		9.9		12.						
7782-49-2	Selenium	0.37	J	0.32	U	0.59	J					
7440-22-4	Silver	0.36	U	0.37	U	0.37	U					
7440-28-0	Thallium	0.56	UJ	0.59	UJ	0.58	UJ					
7440-62-2	Vanadium	27.5		25.2		27.3						
7440-66-6	Zinc	79.7		54.1		126.						
7440-31-5	Tin	2.3	U	1.1	U	3.	U					

*** Valida . Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY S-203

SW846-VOA

	SAMPLE ID ------->	203-S-0001-15		203-S-0002-15		203-S-0003-15				
	ORIGINAL ID ----->	203S000115		203S000215		203S000315				
	LAB SAMPLE ID --->	S880193*3		S880193*4		S880193*5				
	ID FROM REPORT -->	203S000115		203S000215		203S000315				
	SAMPLE DATE ----->	01/11/98		01/11/98		01/11/98				
	DATE ANALYZED --->	01/20/98		01/20/98		01/20/98				
	MATRIX ---------->	Soil		Soil		Soil				
	UNITS ---------->	UG/KG		UG/KG		UG/KG				
CAS #	Parameter	EM1G05	VAL	EM1G05	VAL	EM1G05	VAL			
74-87-3	Chloromethane	13.	U	13.	U	13.	U			
74-83-9	Bromomethane	13.	U	13.	U	13.	U			
75-01-4	Vinyl chloride	13.	U	13.	U	13.	U			
75-00-3	Chloroethane	13.	U	13.	U	13.	U			
75-35-4	1,1-Dichloroethene	6.4	U	6.6	U	6.4	U			
75-09-2	Methylene chloride	6.4	U	6.6	U	6.4	U			
75-34-3	1,1-Dichloroethane	6.4	U	6.6	U	6.4	U			
67-66-3	Chloroform	6.4	U	6.6	U	6.4	U			
71-55-6	1,1,1-Trichloroethane	6.4	U	6.6	U	6.4	U			
56-23-5	Carbon tetrachloride	6.4	U	6.6	U	6.4	U			
71-43-2	Benzene	6.4	U	6.6	U	6.4	U			
107-06-2	1,2-Dichloroethane	6.4	U	6.6	U	6.4	U			
79-01-6	Trichloroethane	6.4	U	6.6	U	6.4	U			
78-87-5	1,2-Dichloropropane	6.4	U	6.6	U	6.4	U			
75-27-4	Bromodichloromethane	6.4	U	6.6	U	6.4	U			
108-88-3	Toluene	6.4	U	6.6	U	6.4	U			
79-00-5	1,1,2-Trichloroethane	6.4	U	6.6	U	6.4	U			
127-18-4	Tetrachloroethene	6.4	U	6.6	U	6.4	U			
124-48-1	Dibromochloromethane	6.4	U	6.6	U	6.4	U			
108-90-7	Chlorobenzene	6.4	U	6.6	U	6.4	U			
100-41-4	Ethylbenzene	6.4	U	6.6	U	6.4	U			
100-42-5	Styrene	6.4	U	6.6	U	6.4	U			
75-25-2	Bromoform	6.4	U	6.6	U	6.4	U			
79-34-5	1,1,2,2-Tetrachloroethane	6.4	U	6.6	U	6.4	U			
67-64-1	Acetone	40.	J	66.	U	72.				
75-15-0	Carbon disulfide	6.4	U	6.6	U	6.4	U			
78-93-3	2-Butanone (MEK)	32.	U	33.	U	32.	U			
108-10-1	4-Methyl-2-Pentanone (MIBK)	32.	U	33.	U	32.	U			
10061-01-5	cis-1,3-Dichloropropene	6.4	U	6.6	U	6.4	U			
10061-02-6	trans-1,3-Dichloropropene	6.4	U	6.6	U	6.4	U			
591-78-6	2-Hexanone	32.	U	33.	U	32.	U			
1330-20-7	Xylene (Total)	6.4	U	6.6	U	6.4	U			
540-59-0	1,2-Dichloroethene (total)	6.4	U	6.6	U	6.4	U			

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY S-203

TPN								
	SAMPLE ID ------->	203-S-0001-01		203-S-0002-01		203-S-0003-01		
	ORIGINAL ID ----->	203S000101		203S000201		203S000301		
	LAB SAMPLE ID --->	S776828*3		S776828*5		S776828*4		
	ID FROM REPORT -->	203S000101		203S000201		203S000301		
	SAMPLE DATE ----->	12/03/97		12/03/97		12/03/97		
	DATE EXTRACTED -->	12/26/97		12/26/97		12/26/97		
	DATE ANALYZED --->	12/29/97		12/29/97		12/29/97		
	MATRIX ---------->	Soil		Soil		Soil		
	UNITS ---------->	MG/KG		MG/KG		MG/KG		
CAS #	Parameter	EM1G01	VAL	EM1G01	VAL	EM1G01	VAL	
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	65.		36.		230.		

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 394

APX9-METAL								
	SAMPLE ID ------->	394-S-0001-01		394-S-0002-01				
	ORIGINAL ID ----->	394S000101		394S000201				
	LAB SAMPLE ID --->	S776828*1		S776828*2				
	ID FROM REPORT -->	394S000101		394S000201				
	SAMPLE DATE ----->	12/03/97		12/03/97				
	DATE EXTRACTED -->	12/10/97		12/10/97				
	DATE ANALYZED --->	12/10/97		12/10/97				
	MATRIX ---------->	Soil		Soil				
	UNITS ---------->	MG/KG		MG/KG				
CAS #	Parameter	EM1G01	VAL	EM1G01	VAL			
7439-97-6	Mercury	0.03		0.03				
7440-36-0	Antimony	0.64	UR	0.72	UR			
7440-38-2	Arsenic	7.1		7.3				
7440-39-3	Barium	135.		91.1				
7440-41-7	Beryllium	0.54	J	0.41	J			
7440-43-9	Cadmium	0.74		0.29	J			
7440-47-3	Chromium	14.3		12.				
7440-48-4	Cobalt	7.1		8.5				
7440-50-8	Copper	37.1		10.1				
7439-92-1	Lead	23.3	J	89.7	J			
7440-02-0	Nickel	13.4		9.1				
7782-49-2	Selenium	0.34	J	0.85	J			
7440-22-4	Silver	0.39	U	0.38	U			
7440-28-0	Thallium	0.61	UJ	0.59	UJ			
7440-62-2	Vanadium	24.3		23.6				
7440-66-6	Zinc	252.		45.5				
7440-31-5	Tin	1.4	U	1.5	U			

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 394

SW846-VOA

SAMPLE ID ------->	394-S-0003-15
ORIGINAL ID ----->	394S000315
LAB SAMPLE ID --->	S880193*2
ID FROM REPORT -->	394S000315
SAMPLE DATE ----->	01/11/98
DATE ANALYZED --->	01/20/98
MATRIX ---------->	Soil
UNITS ---------->	UG/KG

CAS #	Parameter	EM1G05	VAL
74-87-3	Chloromethane	13.	U
74-83-9	Bromomethane	13.	U
75-01-4	Vinyl chloride	13.	U
75-00-3	Chloroethane	13.	U
75-35-4	1,1-Dichloroethene	6.7	U
75-09-2	Methylene chloride	6.7	U
75-34-3	1,1-Dichloroethane	6.7	U
67-66-3	Chloroform	6.7	U
71-55-6	1,1,1-Trichloroethane	6.7	U
56-23-5	Carbon tetrachloride	6.7	U
71-43-2	Benzene	6.7	U
107-06-2	1,2-Dichloroethane	6.7	U
79-01-6	Trichloroethene	6.7	U
78-87-5	1,2-Dichloropropane	6.7	U
75-27-4	Bromodichloromethane	6.7	U
108-88-3	Toluene	6.7	U
79-00-5	1,1,2-Trichloroethane	6.7	U
127-18-4	Tetrachloroethene	6.7	U
124-48-1	Dibromochloromethane	6.7	U
108-90-7	Chlorobenzene	6.7	U
100-41-4	Ethylbenzene	6.7	U
100-42-5	Styrene	6.7	U
75-25-2	Bromoform	6.7	U
79-34-5	1,1,2,2-Tetrachloroethane	6.7	U
67-64-1	Acetone	67.	U
75-15-0	Carbon disulfide	6.7	U
78-93-3	2-Butanone (MEK)	33.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	33.	U
10061-01-5	cis-1,3-Dichloropropene	6.7	U
10061-02-6	trans-1,3-Dichloropropene	6.7	U
591-78-6	2-Hexanone	33.	U
1330-20-7	Xylene (Total)	6.7	U
540-59-0	1,2-Dichloroethene (total)	6.7	U

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 394

TPH							
	SAMPLE ID ------->	394-S-0002-01					
	ORIGINAL ID ----->	394S000201					
	LAB SAMPLE ID --->	S776828*2					
	ID FROM REPORT -->	394S000201					
	SAMPLE DATE ----->	12/03/97					
	DATE EXTRACTED -->	12/26/97					
	DATE ANALYZED --->	12/29/97					
	MATRIX ---------->	Soil					
	UNITS ---------->	MG/KG					
CAS #	Parameter	EM1G01	VAL				
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS 700.						

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 784

TPH													
		SAMPLE ID ------->	784-S-0001-15		784-S-0002-15		784-S-0003-15		784-S-0004-15				
		ORIGINAL ID ----->	784S000115		784S000215		784S000315		784S000415				
		LAB SAMPLE ID --->	S880193*6		S880193*7		S880193*8		S880193*9				
		ID FROM REPORT -->	784S000115		784S000215		784S000315		784S000415				
		SAMPLE DATE ----->	01/11/98		01/11/98		01/11/98		01/11/98				
		DATE EXTRACTED -->	01/29/98		01/29/98		01/29/98		01/29/98				
		DATE ANALYZED --->	01/29/98		01/29/98		01/29/98		01/29/98				
		MATRIX ---------->	Soil		Soil		Soil		Soil				
		UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG				
CAS #	Parameter		EM1G05	VAL	EM1G05	VAL	EM1G05	VAL	EM1G05	VAL			
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS		13.	UJ	13.	UJ	13.	UJ	26.	J			

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 784

TPH-DRO													
		SAMPLE ID ------->	784-S-0001-15		784-S-0002-15		784-S-0003-15		784-S-0004-15				
		ORIGINAL ID ----->	784S000115		784S000215		784S000315		784S000415				
		LAB SAMPLE ID --->	S880193*6		S880193*7		S880193*8		S880193*9				
		ID FROM REPORT -->	784S000115		784S000215		784S000315		784S000415				
		SAMPLE DATE ----->	01/11/98		01/11/98		01/11/98		01/11/98				
		DATE EXTRACTED -->	01/16/98		01/16/98		01/16/98		01/16/98				
		DATE ANALYZED --->	01/20/98		01/20/98		01/20/98		01/20/98				
		MATRIX ---------->	Soil		Soil		Soil		Soil				
		UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG				
CAS #	Parameter		EM1G05	VAL	EM1G05	VAL	EM1G05	VAL	EM1G05	VAL			
9999900-02-6	TPH - Diesel Range Organics		NR		NR		NR		NR				
68334-30-5	Diesel		5.1	U	5.1	U	1.9	J	5.1	U			
86290-81-5	Gasoline		NR		NR		NR		NR				

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 784

TPH-GRO							
	SAMPLE ID ------->	784-S-0001-15	784-S-0002-15	784-S-0003-15	784-S-0004-15		
	ORIGINAL ID ----->	784S000115	784S000215	784S000315	784S000415		
	LAB SAMPLE ID --->	S880193*6	S880193*7	S880193*8	S880193*9		
	ID FROM REPORT -->	784S000115	784S000215	784S000315	784S000415		
	SAMPLE DATE ----->	01/11/98	01/11/98	01/11/98	01/11/98		
	DATE ANALYZED --->	01/15/98	01/15/98	01/15/98	01/15/98		
	MATRIX ---------->	Soil	Soil	Soil	Soil		
	UNITS ---------->	MG/KG	MG\KG	MG/KG	MG/KG		
CAS #	Parameter	EM1G05 VAL	EM1G05 VAL	EM1G05 VAL	EM1G05 VAL		
86290-81-5	Gasoline	0.23 U	0.23 U	0.23 U	0.23 U		
9999900-02-5	TPH - Gasoline Range Organics	NR	NR	NR	NR		

*** Validat Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 1211

APX9-METAL													
	SAMPLE ID ------->	174-S-0001-01		174-S-0002-01		174-C-0002-01		174-S-0003-01		174-S-0004-01			
	ORIGINAL ID ----->	174S000101		174S000201		174C000201		174S000301		174S000401			
	LAB SAMPLE ID --->	S776864*1		S776864*2		S776864A*1		S776864*3		S776864*4			
	ID FROM REPORT -->	174S000101		174S000201		174C000201		174S000301		174S000401			
	SAMPLE DATE ----->	12/04/97		12/04/97		12/04/97		12/04/97		12/04/97			
	DATE EXTRACTED -->	12/10/97		12/10/97		12/10/97		12/10/97		12/10/97			
	DATE ANALYZED --->	12/11/97		12/11/97		12/10/97		12/11/97		12/11/97			
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil			
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG			
CAS #	Parameter	EM1G01	VAL	EM1G01	VAL	EM1G02	VAL	EM1G01	VAL	EM1G01	VAL		
7439-97-6	Mercury	0.19		0.04		0.04	J	0.05		0.38			
7440-36-0	Antimony	0.41	UR	0.64	UR	0.5	J	0.89	UR	1.2	UR		
7440-38-2	Arsenic	7.5		6.4		6.5		21.2		54.6			
7440-39-3	Barium	139.		130.		108.		60.5		113.			
7440-41-7	Beryllium	0.5	J	0.5	J	0.39	J	0.38	U	0.3	U		
7440-43-9	Cadmium	0.34	J	0.32	J	0.39	J	0.26	J	4.4			
7440-47-3	Chromium	13.2		16.2		10.6		28.2		28.4			
7440-48-4	Cobalt	8.1		6.7		7.1		4.3		5.5			
7440-50-8	Copper	17.9		22.2		33.	J	16.		51.3			
7439-92-1	Lead	16.8	J	27.5	J	40.2		34.5	J	290.	J		
7440-02-0	Nickel	14.		11.8		11.1		8.5		12.8			
7782-49-2	Selenium	0.58	J	0.5	J	0.3	U	0.29	U	0.88	J		
7440-22-4	Silver	1.1	J	0.35	U	0.34	U	0.48	J	0.87	J		
7440-28-0	Thallium	0.57	UJ	0.54	UJ	0.53	UJ	0.53	UJ	0.66	UJ		
7440-62-2	Vanadium	23.7		22.3		18.8		21.1		14.7			
7440-66-6	Zinc	82.6		56.8		47.9		72.2		293.			
7440-31-5	Tin	2.2	U	1.8	U	1.9	U	2.4	U	4.5	U		

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 1211

SW846-MERB													
	SAMPLE ID ------->	174-S-0001-01		174-S-0002-01		174-C-0002-01		174-S-0003-01		174-S-0004-01			
	ORIGINAL ID ----->	174S000101		174S000201		174C000201		174S000301		174S000401			
	LAB SAMPLE ID --->	S776864*1		S776864*2		S776864A*1		S776864*3		S776864*4			
	ID FROM REPORT -->	174S000101		174S000201		174C000201		174S000301		174S000401			
	SAMPLE DATE ----->	12/04/97		12/04/97		12/04/97		12/04/97		12/04/97			
	DATE EXTRACTED -->	12/10/97		12/10/97		12/10/97		12/10/97		12/10/97			
	DATE ANALYZED --->	12/16/97		12/16/97		12/16/97		12/16/97		12/16/97			
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil			
	UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG			
CAS #	Parameter	EM1G01	VAL	EM1G01	VAL	EM1G02	VAL	EM1G01	VAL	EM1G01	VAL		
75-99-0	Dalapon	2400.	U	2300.	U	2300.	U	2200.	U	2800.	U		
93-65-2	MCPP	2400.	U	2300.	U	2300.	U	2200.	U	2800.	U		
1918-00-9	Dicamba	24.	U	23.	U	23.	U	22.	U	28.	U		
94-74-6	MCPA	1100.	J	2300.	U	1000.	J	2200.	U	2800.	U		
120-36-5	Dichlorprop	120.	U	120.	U	110.	U	110.	U	140.	U		
94-75-7	2,4-D	10.	U	9.6	U	4.3	J	9.3	U	12.	U		
93-72-1	2,4,5-TP (Silvex)	2.4	J	9.6	U	3.2	J	9.3	U	12.	U		
93-76-5	2,4,5-T	10.	U	9.6	U	9.4	U	9.3	U	2.	U		
88-85-7	Dinoseb	120.	U	120.	U	110.	U	110.	U	2.2	U		
94-82-6	2,4-DB	10.	U	9.6	U	9.4	U	9.3	U	12.	U		
9999000-84-0	2-(4-CHLORO-2-METHYLPHENOXY)-PROPANOIC A	NR		NR		NR		NR		NR			

*** Validat Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 1211

SW846-PEST

SAMPLE ID ------->	174-S-0001-01		174-S-0002-01		174-C-0002-01		174-S-0003-01		174-S-0004-01		
ORIGINAL ID ----->	174S000101		174S000201		174C000201		174S000301		174S000401		
LAB SAMPLE ID --->	S776864*1		S776864*2		S776864A*1		S776864*3		S776864*4		
ID FROM REPORT -->	174S000101		174S000201		174C000201		174S000301		174S000401		
SAMPLE DATE ----->	12/04/97		12/04/97		12/04/97		12/04/97		12/04/97		
DATE EXTRACTED -->	12/10/97		12/10/97		12/10/97		12/10/97		12/10/97		
DATE ANALYZED --->	12/22/97		12/22/97		12/22/97		12/22/97		12/18/97		
MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		
UNITS ---------->	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		
CAS # Parameter	EM1G01	VAL	EM1G01	VAL	EM1G02	VAL	EM1G01	VAL	EM1G01	VAL	
319-84-6 alpha-BHC	100.	U	2.	U	1.9	U	38.	U	2.4	U	
319-85-7 beta-BHC	100.	U	2.	U	1.9	U	38.	U	2.4	U	
319-86-8 delta-BHC	100.	U	2.	U	1.9	U	38.	U	2.4	U	
58-89-9 gamma-BHC (Lindane)	100.	U	2.	U	1.9	U	38.	U	2.4	U	
76-44-8 Heptachlor	100.	U	2.	U	1.9	U	38.	U	0.24	U	
309-00-2 Aldrin	100.	U	2.	U	1.9	U	38.	U	0.43	U	
1024-57-3 Heptachlor epoxide	100.	U	1.	U	1.9	U	38.	U	2.1	U	
959-98-8 Endosulfan I	100.	U	1.9	NJ	1.9	U	38.	U	240.	D	
60-57-1 Dieldrin	430.		16.	J	1.7	J	250.		72.	JD	
72-55-9 4,4'-DDE	200.	U	3.8	UJ	0.8	J	74.	U	4.6	U	
72-20-8 Endrin	200.	U	0.22	U	3.7	U	74.	U	0.84	NJ	
33213-65-9 Endosulfan II	200.	U	3.8	U	3.7	U	74.	U	4.6	U	
72-54-8 4,4'-DDD	200.	U	3.8	U	3.7	U	74.	U	19.	U	
1031-07-8 Endosulfan sulfate	200.	U	0.42	NJ	3.7	U	74.	U	5.3		
50-29-3 4,4'-DDT	22.	NJ	0.51	NJ	4.4	J	6.2	NJ	7.6	U	
72-43-5 Methoxychlor	1000	U	0.68	J	19.	U	380.	U	24.	U	
7421-93-4 Endrin aldehyde	1..	J	0.21	U	3.7	U	3.	J	4.6	U	
8001-35-2 Toxaphene	10000.	U	200.	U	190.	U	3800.	U	240.	U	
12674-11-2 Aroclor-1016	2000.	U	38.	U	38.	U	740.	U	46.	U	
11104-28-2 Aroclor-1221	4100.	U	78.	U	76.	U	1500.	U	94.	U	
11141-16-5 Aroclor-1232	2000.	U	38.	U	38.	U	740.	U	46.	U	
53469-21-9 Aroclor-1242	2000.	U	38.	U	38.	U	740.	U	46.	U	
12672-29-6 Aroclor-1248	2000.	U	38.	U	38.	U	740.	U	46.	U	
11097-69-1 Aroclor-1254	2000.	U	38.	U	38.	U	740.	U	46.	U	
11096-82-5 Aroclor-1260	2000.	U	38.	U	38.	U	740.	U	46.	U	
57-74-9 Chlordane	1000.	U	20.	U	19.	U	380.	U	24.	U	

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 1211

SW846-VOA

SAMPLE ID ----->	174-S-0005-15
ORIGINAL ID ----->	174S000515
LAB SAMPLE ID --->	S880193*10
ID FROM REPORT -->	174S000515
SAMPLE DATE ----->	01/12/98
DATE ANALYZED --->	01/20/98
MATRIX ---------->	Soil
UNITS ---------->	UG/KG

CAS #	Parameter	EM1G05	VAL
74-87-3	Chloromethane	13.	U
74-83-9	Bromomethane	13.	U
75-01-4	Vinyl chloride	13.	U
75-00-3	Chloroethane	13.	U
75-35-4	1,1-Dichloroethene	6.5	U
75-09-2	Methylene chloride	6.5	U
75-34-3	1,1-Dichloroethane	6.5	U
67-66-3	Chloroform	6.5	U
71-55-6	1,1,1-Trichloroethane	6.5	U
56-23-5	Carbon tetrachloride	6.5	U
71-43-2	Benzene	6.5	U
107-06-2	1,2-Dichloroethane	6.5	U
79-01-6	Trichloroethene	6.5	U
78-87-5	1,2-Dichloropropane	6.5	U
75-27-4	Bromodichloromethane	6.5	U
108-88-3	Toluene	6.5	U
79-00-5	1,1,2-Trichloroethane	6.5	U
127-18-4	Tetrachloroethene	6.5	U
124-48-1	Dibromochloromethane	6.5	U
108-90-7	Chlorobenzene	6.5	U
100-41-4	Ethylbenzene	6.5	U
100-42-5	Styrene	6.5	U
75-25-2	Bromoform	6.5	U
79-34-5	1,1,2,2-Tetrachloroethane	6.5	U
67-64-1	Acetone	30.	J
75-15-0	Carbon disulfide	6.5	U
78-93-3	2-Butanone (MEK)	32.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	32.	U
10061-01-5	cis-1,3-Dichloropropene	6.5	U
10061-02-6	trans-1,3-Dichloropropene	6.5	U
591-78-6	2-Hexanone	32.	U
1330-20-7	Xylene (Total)	6.5	U
540-59-0	1,2-Dichloroethene (total)	6.5	U

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 1211

TPH													
	SAMPLE ID ------->	174-S-0001-01		174-S-0002-01		174-C-0002-01		174-S-0003-01		174-S-0004-01		174-S-0005-15	
	ORIGINAL ID ----->	174S000101		174S000201		174C000201		174S000301		174S000401		174S000515	
	LAB SAMPLE ID --->	S776864*1		S776864*2		S776864A*1		S776864*3		S776864*4		S880193*10	
	ID FROM REPORT -->	174S000101		174S000201		174C000201		174S000301		174S000401		174S000515	
	SAMPLE DATE ----->	12/04/97		12/04/97		12/04/97		12/04/97		12/04/97		01/12/98	
	DATE EXTRACTED -->	12/23/97		12/23/97		12/10/97		12/23/97		12/23/97		01/29/98	
	DATE ANALYZED --->	12/26/97		12/26/97		12/16/97		12/26/97		12/26/97		01/29/98	
	MATRIX ---------->	Soil		Soil		Soil		Soil		Soil		Soil	
	UNITS ---------->	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	EM1G01	VAL	EM1G01	VAL	EM1G02	VAL	EM1G01	VAL	EM1G01	VAL	EM1G05	VAL
9999000-83-9	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	24.		750.		1000.		28.		14000.		23.	J

*** Validation Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
FACILITY 1211

SW846-VOA

	SAMPLE ID ------->	174-G-0006-53		174-H-0006-53		174-G-0007-60		174-G-0008-61		174-G-0009-57		
	ORIGINAL ID ----->	174G000153		174H000153		174G000260		174G000361		174G000457		
	LAB SAMPLE ID --->	S880193A*2		S880193B*1		S880193A*1		S880212A*1		S880193A*3		
	ID FROM REPORT -->	174G000153		174H000153		174G000260		174G000361		174G000457		
	SAMPLE DATE ----->	01/12/98		01/12/98		01/12/98		01/13/98		01/12/98		
	DATE ANALYZED --->	01/19/98		01/19/98		01/19/98		01/19/98		01/19/98		
	MATRIX ---------->	Water		Water		Water		Water		Water		
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		
CAS #	Parameter	EM1G04	VAL	EM1G03	VAL	EM1G04	VAL	EM1G04	VAL	EM1G04	VAL	
74-87-3	Chloromethane	10.	U	10.	U	10.	U	10.	U	10.	U	
74-83-9	Bromomethane	10.	U	10.	U	10.	U	10.	U	10.	U	
75-01-4	Vinyl chloride	10.	U	10.	U	10.	U	10.	U	10.	U	
75-00-3	Chloroethane	10.	U	10.	U	10.	U	10.	U	10.	U	
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	
67-66-3	Chloroform	5	U	5.	U	5.	U	5.	U	5.	U	
71-55-6	1,1,1-Trichloroethane	.	U	5.	U	5.	U	5.	U	5.	U	
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	
108-88-3	Toluene	1.3	J	5.	U	5.	U	5.	U	5.	U	
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	
100-42-5	Styrene	5.	UR	5.	UR	5.	UR	5.	UR	5.	UR	
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	
67-64-1	Acetone	50.	U	50.	U	50.	U	50.	U	50.	U	
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	
78-93-3	2-Butanone (MEK)	25.	U	25.	U	25.	U	25.	U	25.	U	
108-10-1	4-Methyl-2-Pentanone (MIBK)	25.	U	25.	U	25.	U	25.	U	25.	U	
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	
591-78-6	2-Hexanone	25.	U	25.	U	25.	U	25.	U	25.	U	
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	
540-59-0	1,2-Dichloroethene (total)	5.	U	5.	U	5.	U	5.	U	5.	U	

*** Validat Complete ***

NSA MEMPHIS
GRAY AREA INVESTIGATION
PAD EYES

SW846-VOA

SAMPLE ID ------->	PAD-S-0001-15
ORIGINAL ID ----->	PADS000115
LAB SAMPLE ID --->	S880193*1
ID FROM REPORT -->	PADS000115
SAMPLE DATE ----->	01/11/98
DATE ANALYZED --->	01/20/98
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	EM1G05	VAL
74-87-3	Chloromethane	13.	U
74-83-9	Bromomethane	13.	U
75-01-4	Vinyl chloride	13.	U
75-00-3	Chloroethane	13.	U
75-35-4	1,1-Dichloroethene	6.4	U
75-09-2	Methylene chloride	.4	U
75-34-3	1,1-Dichloroethane	6.4	U
67-66-3	Chloroform	6.4	U
71-55-6	1,1,1-Trichloroethane	6.4	U
56-23-5	Carbon tetrachloride	6.4	U
71-43-2	Benzene	6.4	U
107-06-2	1,2-Dichloroethane	6.4	U
79-01-6	Trichloroethene	6.4	U
78-87-5	1,2-Dichloropropane	6.4	U
75-27-4	Bromodichloromethane	6.4	U
108-88-3	Toluene	6.4	U
79-00-5	1,1,2-Trichloroethane	6.4	U
127-18-4	Tetrachloroethene	6.4	U
124-48-1	Dibromochloromethane	6.4	U
108-90-7	Chlorobenzene	6.4	U
100-41-4	Ethylbenzene	6.4	U
100-42-5	Styrene	6.4	U
75-25-2	Bromoform	6.4	U
79-34-5	1,1,2,2-Tetrachloroethane	6.4	U
67-64-1	Acetone	22.	J
75-15-0	Carbon disulfide	6.4	U
78-93-3	2-Butanone (MEK)	32.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	32.	U
10061-01-5	cis-1,3-Dichloropropene	6.4	U
10061-02-6	trans-1,3-Dichloropropene	6.4	U
591-78-6	2-Hexanone	32.	U
1330-20-7	Xylene (Total)	6.4	U
540-59-0	1,2-Dichloroethene (total)	6.4	U

*** Validation Complete ***

Appendix B

Technical Memorandum
Revision 1, Gray Areas Lakes, Fish Tissue Sample Results

EnSafe / Allen & Hoshall

a joint venture for professional services

TECHNICAL MEMORANDUM

TO: Mark Taylor/David Porter, SOUTHDIV
Tonya Barker/Rob Williamson, NSA Memphis
Jack Carmichael, USGS
Brian Donaldson, EPA
Jim Morrison, TDEC
Brenda Duggar, MSCHD
E/A&H Project Team

FROM: Brian Mulhearn and Fred Swan, EnSafe/Allen & Hoshall

DATE: December 16, 1996

RE: Revision 1, Gray Area Lakes, Fish Tissue Sample Results
CTOs - 106 and 094

During the July 24 BRAC Cleanup Team (BCT) meeting, the BCT decided that fish tissue analysis would be conducted at the recreational waterbodies at NSA Memphis. This decision was made because sediment data from the water bodies might not indicate chemical concentrations in sediment below detection limits, possibly resulting in quantifiable tissue levels from bioaccumulation or areas of sediment that were not sampled. For example, these limitations were evident in sediment and fish tissue data collected at SWMU 9 (i.e., Sewage Lagoons).

On August 28 through 30 and September 4 through 6, EnSafe/Allen & Hoshall personnel sampled fish from four Northside waterbodies (Golf Course, Navy, Tanya Lakes and the MWR Pond) using trotlines, rod and reel, and shoreline seining. The target species for these lakes were bass and catfish. Bluegill were also target species at Golf Course Lake in addition to bass and catfish. Samples were eviscerated before sending them to GP Environmental Services, Inc., in Cary, North Carolina, for analyses.

At the end of the sixth day of sampling, sufficient tissue volume and number of species had been collected from each lake for a representative sample to calculate risk. However, target species were not collected from all the lakes due to adverse weather and other factors. Table 1 summarizes analytical results, number and species sampled from each lake, and preparation methods. Table 2 presents corresponding human health risk estimates, which are based on a subsistence fishing scenario. A subsistence scenario assumes a fisherman consumes 54 grams of fish tissue per day, 350 days per year, for 30 years.

Table 1
Tissue Data Summary
NSA Memphis Lake Study
Millington, TN

				Reported Chemicals and RBC Exceedances *					
Lake Sampled	*Tissue Type*	*Preparation Method* **	*Sample Designation*	*Dieldrin*	*RBC = 0.0002*	*DDD*	*RBC = 0.0013*	*DDE*	*RBC = 0.0093*
Golf Course Lake	Catfish	filet only	GLFJ000201	0.032	X	ND		0.011	X
	Bluegill	scaled, edible portions only with skin on	GLFJ000301	0.0025 JP	X	ND		0.0022 J	
	Bluegill	whole fish **	GLFJ000302	0.003 J	X	ND		0.0054 J	
MWR Pond	Catfish	filet only	MWRJ000201	ND		ND		0.0039 J	
Navy Lake	Bass	filet only	NAVJ000101	ND		ND		ND	
	Bluegill	scaled, edible portions only with skin on	NAVJ000301	0.0027 JP	X	0.0019 JP	X	0.011	X
	Crappie	scaled, edible portions only with skin on	NAVJ000401	ND		ND		ND	
Tanya Lake (West)	Bass	filet only	TYWJ000101	ND		ND		ND	

Notes:

* = All units are mg/kg
** = Except for whole fish analysis, organisms were eviscerated the same day they were collected
ND = Not detected
X = RBC exceeded
J = Laboratory estimated the concentration because it is below the detection limit
P = Concentration was not confirmed by the laboratory's instruments
- The USEPA human health risk based PRE risk threshold is one in ten thousand incidences of cancer. Based on the PRE methods recommended by USEPA, corresponding risk estimates for the chemicals above would be below USEPA's PRE risk threshold, except for catfish in Golf Course Lake. Excess risk from dieldrin in Golf course Lake catfish would be approximately 1.6 in ten thousand (see Table 2), which is slightly greater than USEPA's 1E-4 PRE threshold.

Table 2
Preliminary Risk Evaluation*
NSA Memphis Lake Study
Millington, TN

Lake Sampled	*Tissue Type*	*Sample Designation*	*Dieldrin*	*Dieldrin ILCR Based on RBC = 0.0002*	*DDD*	*DDD ILCR Based on RBC = 0.0013*	*DDE*	*DDE ILCR Based on RBC = 0.0093*	*SUM ILCR*
Golf Course Lake	Catfish	GLFJ000201	0.032	1.60E-04	ND		0.011	1.18E-06	1.61E-04
	Bluegill	GLFJ000301	0.0025 JP	1.25E-05	ND		0.0022 J	2.37E-07	1.27E-05
	Bluegill	GLFJ000302	0.003 J	1.50E-05	ND		0.0054 J.	5.81E-07	1.56E-05
MWR Pond	Catfish	MWRJ000201	ND		ND		0.0039 J	4.19E-07	4.19E-07
Navy Lake	Bass	NAVJ000101	ND		ND		ND		
	Bluegill	NAVJ000301	0.0027 JP	1.35E-05	0.0019 JP	1.46E-06	0.011	1.18E-06	1.61E-05
	Crappie	NAVJ000401	ND		ND		ND		
Tanya Lake (West)	Bass	TYWJ000101	ND		ND		ND		

Notes:

RBC Risk-based concentrations for tissue ingestion, obtained from USEPA Region III's 1996 Risk-Based Concentration Table

ILCR Incremental excess lifetime cancer risk

ND Not detected

J = Laboratory estimated the concentration because it is below the detection limit

P = Concentration was not confirmed by the laboratory's instruments

* all tissue concentrations and RBCs are reported in mg/kg

Nagy, K.A., 1987. *Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds.* Ecol. Mono. 57: 111-128.

U.S. Environmental Protection Agency, 1993. *Wildlife Exposure Factors Handbook, Volume I.* Office of Research and Development, Washington, D.C., EPA/600-R-93/187a. pp. 2-173 through 2-181.

U.S. Environmental Protection Agency Region IV Memorandum, November, 1994, *Guidance on Preliminary Risk Evaluations (PREs) for the Purpose of Reaching a Finding of Suitability to Lease (FOSL).*