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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT ADDENDUM AREA OF CONCERN 642 (AOC 642) ZONE G CNC CHARLESTON SC

1/31/2002

CH2M HILL

RFI REPORT ADDENDUM

Area of Concern 642, Zone G

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

CH2M-Jones

January 2002

Contract N62467-99-C-0960

CH2M HILL
3011 S.W. Williston Road
Gainesville, FL
32608-3928
Mailing address:
P.O. Box 147009
Gainesville, FL
32614-7009
Tel 352.335.7991
Fax 352.335.2959

CH2MHILL

January 31, 2002

Mr. David Scaturo
Division of Hazardous and Infectious Wastes
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: RFI Report Addendum (Revision 0) – AOC 642, Zone G

Dear Mr. Scaturo:

Enclosed please find two copies of the RFI Report Addendum (Revision 0) for AOC 642 in Zone G of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Bill Elliott. Please contact him at 352/335-5877, extension 2477, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att
Tim Frederick/Gannett-Fleming, Inc.

RFI REPORT ADDENDUM

Area of Concern 642, Zone G

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

PREPARED BY
CH2M-Jones

January 2002

Revision 0
Contract N62467-99-C-0960
158814.ZG.PR.06

Certification Page for RFI Report Addendum (Revision 0) — AOC 642, Zone G

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428

Dean Williamson, P.E.

1/29/2002

Date

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A CH2M-Jones' Responses to SCDHEC Comments

B Excerpts from the *Zone G RFI Report, Revision 0* (EnSafe, 1998a), including *Figure 2-5, Shallow Groundwater Potentiometric Contours*

C *IM Completion Report for SWMU 008, Naval Base Charleston, Charleston SC* (EEG, 1999)

D Data Validation Reports from Additional Sampling performed by EnSafe

E Analytical Data and Data Validation Report Summaries from Additional Sampling performed by CH2M-Jones

Acronyms and Abbreviations

AOC	area of concern
AST	aboveground storage tank
BCT	BRAC Cleanup Team
BEQ	benzo(a)pyrene equivalent
BRAC	Base Realignment and Closure Act
BRC	background reference concentration
CA	corrective action
CMS	corrective measures study
CNC	Charleston Naval Complex
COC	chemical of concern
COPC	chemical of potential concern
CSI	confirmatory sampling investigation
DAF	dilution attenuation factor
EnSafe	Ensafe Inc.
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ft bls	feet below land surface
IM	interim measure
HHRA	human health risk assessment
HI	hazard index
MCL	maximum contaminant level
µg/kg	microgram per kilogram
µg/L	microgram per liter
mg/kg	milligram per kilogram
NAVBASE	Naval Base
NFA	no further action
NFI	no further investigation
OWS	oil/water separator

Acronyms and Abbreviations, Continued

PCB	polychlorinated biphenyl
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SCDHEC	South Carolina Department of Health and Environmental Control
SPLP	synthetic precipitation leaching procedure
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCLP	toxicity characteristic leachate procedure
UST	underground storage tank
VOC	volatile organic compound

Section 1.0

1.0 Introduction

In 1993, Naval Base (NAVBASE) Charleston was added to the list of bases scheduled for closure as part of the Defense Base Realignment and Closure Act (BRAC), which regulates closure and transition of property to the community. The Charleston Naval Complex (CNC) was formed as a result of the dis-establishment of the Charleston Naval Shipyard and NAVBASE on April 1, 1996.

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA) with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. All RCRA CA activities are performed in accordance with the Final Permit (Permit No. SC0 170 022 560).

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to complete the RCRA Facility Investigation (RFI) for Area of Concern (AOC) 642 in Zone G of the CNC. The site is recommended for No Further Action (NFA), due to the absence of any impact on human health or the environment. Figure 1-1 illustrates the location of AOC 642 within Zone G. Figure 1-2 is an aerial photograph of AOC 642, taken in 1997.

1.1 Background

AOC 642 is a former pistol range used during the 1940s. The CNC RCRA Facility Assessment (RFA) (EnSafe Inc. [EnSafe], 1995) reported the site to be located adjacent to and directly south of Building X-10, and west of Buildings X-12 and 1431. In the CNC RCRA permit, AOC 642 was listed as a Confirmatory Sampling Investigation (CSI) site.

In the *Zone G RFI Report, Revision 0* (EnSafe, 1998a), a Corrective Measures Study (CMS) for surface soil was recommended for chemicals that are not specifically related to small arms range activity: arsenic, beryllium, manganese, nickel, and thallium.

Subsequent to submittal of the RFI Report, the Base Realignment and Closure Act (BRAC) Cleanup Team (BCT) determined through review of aerial photos and historical maps that AOC 642 boundaries had been improperly located in the RFA and RFI. The AOC boundary was revised as is shown on Figure 1-2, moving the site to the west of the original location presented in the RFA.

The new AOC 642 location partially overlaps the eastern end of SWMU 8, an area where Interim Measures (IMs) were conducted to remediate waste oil pits. Evidence of reworked soils in this area from the SWMU 8 IM is also visible in Figure 1-2. This area also includes part of an asphalt-paved parking lot west of Building X-10.

SCDHEC RFI comments on AOC 642 were limited to whether spent bullets had ever been removed from the site. Based on the revised location, CH2M-Jones collected surface and subsurface soil samples in 2001 to assess whether past small arms activities had adversely affected this area. Appendix A of this RFI Report Addendum contains a copy of CH2M-Jones' responses to SCDHEC comments.

1.2 Purpose of the RFI Report Addendum

This RFI Report Addendum provides information about AOC 642 that documents the conclusions from the *Zone G RFI Report, Revision 0*, provides the results of additional sampling performed after the RFI Report was submitted, conclusions from the new data collected, and supports a recommendation of NFA for AOC 642.

Prior to changing the status of any site to NFA in the CNC RCRA CA permit, the BCT agreed that the following issues should be considered:

- Status of the RFI
- Presence of metals (inorganics) in groundwater
- Potential linkage to SWMU 37, Investigated Sanitary Sewers at the CNC
- Potential linkage to AOC 699, Investigated Storm Sewers at the CNC
- Potential linkage of AOC 504, Investigated Railroad Lines at the CNC
- Potential linkage to surface water bodies (Zone J)
- Potential contamination associated with oil/water separators (OWSs)
- Relevance or need for land use controls at the site

Information regarding these issues is provided in this RFI Report Addendum to expedite evaluation of closure of the site.

Provided that the information presented herein is adequate to address these site closeout items, it is expected that the BCT will concur that NFA is appropriate for the site. At that time, a Statement of Basis will be prepared that will be made available for public comment in accordance with SCDHEC policy. This will allow for public participation in the final remedy selection.

1.3 Report Organization

This RFI Report Addendum consists of the following sections, including this introductory section:

1.0 Introduction — Presents the purpose of and background information relating to this RFI Report Addendum.

2.0 Summary of RFI Conclusions for AOC 642 — Summarizes the conclusions from the RFI investigations and risk evaluations for AOC 642.

3.0 Interim Measures and UST/AST Removals — Summarizes any IMs or underground storage tank (UST)/aboveground storage tank (AST) removals conducted at the site.

4.0 Summary of Additional Investigations—Summarizes the data collected during and after the completion of the *Zone G RFI Report, Revision 0.*

5.0 COPC/COC Refinement—Evaluates and identifies chemicals of potential concern (COPCs) based on current screening criteria using all RFI data.

6.0 Summary of Information Related to Site Closeout Issues—Discusses the various site closeout issues that the BCT agreed to evaluate prior to site closeout.

7.0 Recommendations— Provides recommendations for proceeding with site closure.

8.0 References — Lists the references used in this document.

Appendix A contains CH2M-Jones' responses to SCDHEC comments on the *Zone G RFI Report, Revision 0,* in regard to AOC 642.

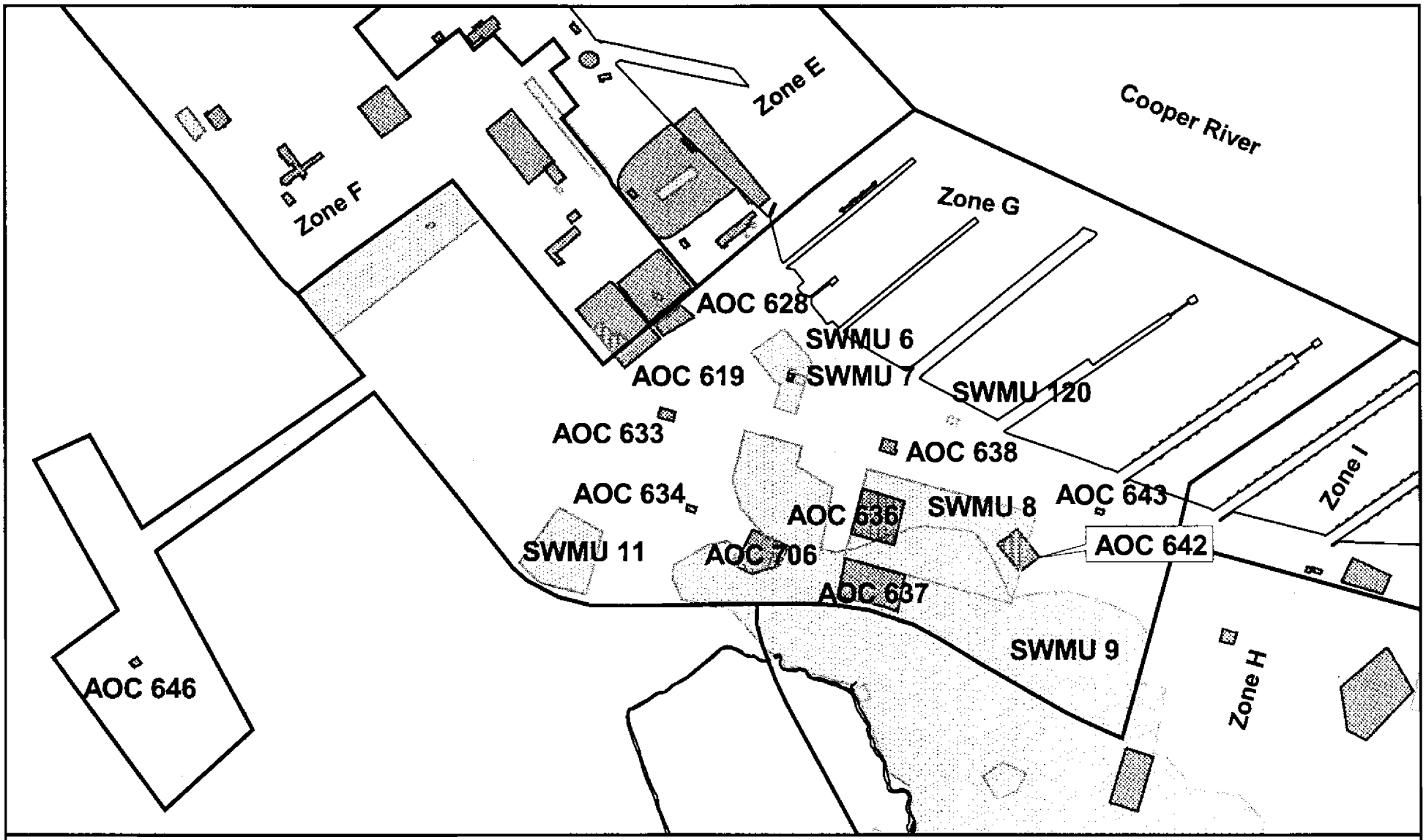
Appendix B contains excerpts from the *Zone G RFI Report, Revision 0,* including Figure 2.5, *Shallow Groundwater Potentiometric Contours.*

Appendix C contains the *IM Completion Report for SWMU 008, Naval Base Charleston, Charleston SC* (EEG, 1999).

Appendix D contains data validation reports from the additional sampling performed by EnSafe.

Appendix E contains analytical data and data validation report summaries from CH2M-Jones' sampling subsequent to the *Zone G RFI Report, Revision 0.*

All tables and figures appear at the end of their respective sections.



Zone Boundary
AOC Boundary
SWMU Boundary
Zone G
Shoreline

N

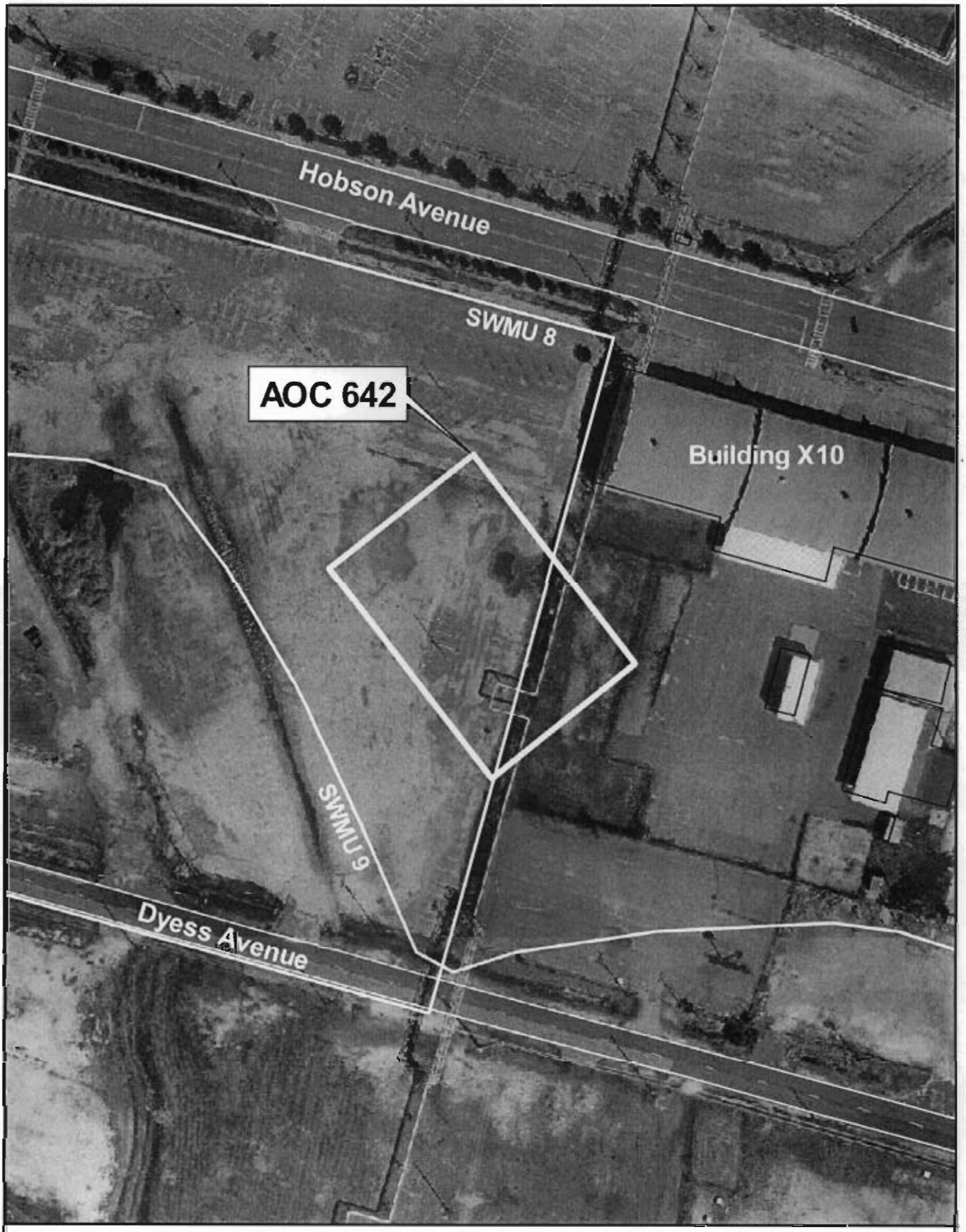
0 500 1000 Feet

Figure 1-1
Location of AOC 642
Zone G
Charleston Naval Complex

CH2MHILL

File Path: C:\18gis\Projects\Zone_G\aoc_642\aprs\aoc_642.apr, Date: 17 Dec 2001 11:54, User: ASWINFOR, Figure 1-1 - Figure 1-1 Location of AOC 642

NOTE: Aerial Photo Date is 1997



Roads
AOC Boundary
SWMU Boundary
Buildings

N

0 80 160 Feet

Figure 1-2
Aerial View of AOC 642
Zone G
Charleston Naval Complex

CH2MHILL

File Path: C:\18gis\Projects\Zone_G\aoc_642\aprs\aoc_642.apr, Date: 17 Dec 2001 12:09, User: ASWINFOR, Figure 1-2 - Figure 1-2 Aerial View of AOC 642

Section 2.0

2.0 Summary of RFI Conclusions for AOC 642

As part of the CNC Zone G RFI, soil investigations were conducted in the area where the former pistol range was reportedly located, based on RFA information. Figure 2-1 illustrates the relationship between the area south of Building X-10 investigated during the RFI, and the present AOC 642 boundary immediately to the west. The figure also shows the SWMU 8 boundary and locations of samples collected in 1993 to investigate SWMU 8 soils.

In 1993 prior to the Zone G RFI field work, a soil characterization sampling effort ("pre-RFI sampling") was conducted by the Navy/EnSafe team for all of SWMU 8, including the area now believed to be the location of the former AOC 642 pistol range. Results of this work were presented in Section 10.6 of the RFI, along with SWMU 8 RFI results.

During the RFI in 1997, ten soil borings (G642SB001 through G642SB010) were installed at AOC 642 to determine if the former range activities had impacted surrounding surface (0 to 1 foot below land surface [ft bls]) and subsurface (3 to 5 ft bls) soil. However, only one subsurface soil sample was actually collected, reportedly because the water table was encountered in most borings before the proposed 3 to 5-ft depth sampling interval was reached.

In accordance with the approved RFI work plan, these samples were analyzed for metals. One surface soil sample was also analyzed for Appendix IX constituents. The *Zone G RFI Report, Revision 0* (EnSafe, 1998a) presented the analytical results for these samples, as well as conclusions concerning contamination and risk. Conclusions from the RFI Report regarding site soil are summarized below.

2.1 Soil Sampling and Analysis

Results of surface soil analyses were compared in the *Zone G RFI Report, Revision 0* to the applicable screening criteria (U.S. Environmental Protection Agency [EPA] Region III residential (unrestricted use) risk-based concentrations [RBCs] with a Hazard Index (HI) equal to 0.1, EPA soil screening levels [SSLs] with a dilution-attenuation factor [DAF]=20, and the Zone G background reference concentrations [BRCs] for surface and subsurface soil.

Analytes that exceeded these screening criteria were considered to be COPCs in the RFI, and were retained for further evaluation in the risk assessment to determine which were

considered chemicals of concern (COCs). Tables showing the site's detected constituents in surface and subsurface soil, which were reported in the *Zone G RFI Report, Revision 0*, are presented in Appendix B of this RFI Report Addendum.

2.1.1 Surface Soil Results

The Nature and Extent of Contamination section (10.5.3.1) of the *Zone G RFI Report, Revision 0* presented the following conclusions regarding the surface soil samples collected and analyzed at the original AOC 642 location:

- Arsenic, manganese, nickel and thallium were present in surface soils at concentrations that exceeded their RBCs and/or BRCs in at least one sample.
- Arsenic exceeded its RBC (0.43 milligrams per kilogram [mg/kg] with HI=0.1) and the Zone G RFI BRC (17.2 mg/kg) in four samples, with a maximum concentration in sample 642SB00601 at 82 mg/kg.
- Beryllium was detected in surface soil at concentrations between 0.24 and 1.2 mg/kg, exceeding the RBC of 0.15 mg/kg; however, all concentrations were at or below the RFI BRC of 1.2 mg/kg for beryllium, and were below the SSL (63 mg/kg).
- Manganese exceeded its RBC (180 mg/kg [HI=0.1]) and BRC (320 mg/kg) in sample 642SB00901 at 350 mg/kg.
- Nickel exceeded its RBC (160 mg/kg[HI=0.1]) and BRC (20.6 mg/kg) in sample 642SB00701 at 253 mg/kg.
- Thallium was detected in five surface soil samples, with concentrations ranging from 0.4 to 1 mg/kg, with some "J" flagged concentrations slightly exceeding the RBC (0.63 mg/kg) and BRC (0.85 mg/kg).

The Human Health Risk Assessment (HHRA) section (10.5.6) of the *Zone G RFI Report, Revision 0* concluded that arsenic, beryllium, nickel, and thallium were COCs in surface soil at AOC 642. With the exception of arsenic, which was also identified as a dermal contact route COC, the other inorganics were identified as COCs solely based on the their contributions to an unrestricted incidental ingestion pathway lifetime projected risk.

2.1.2 Subsurface Soil Results

Only one of the ten planned subsurface soil samples (642SB00802) was collected as part of the RFI due to the shallow depth at which the water table was encountered. No chemicals

were detected in the subsurface soil sample at concentrations exceeding SSLs and BRCs. No COPCs or COCs were identified in the RFI for subsurface soils.

2.2 Groundwater Sampling and Analysis

Groundwater was not sampled at AOC 642. However, the new location of AOC 642 places existing SWMU 8 monitoring well 008GW005 within the present AOC boundary. This well was sampled four times during the Zone G RFI, and lead was not detected in any of the four sampling events. Potentiometric maps from the RFI Report of the shallow groundwater in this part of Zone G indicate flow locally to the north, with regional flow to the east to Cooper River (see Appendix B). Groundwater data from the site are discussed further in Section 4.2.

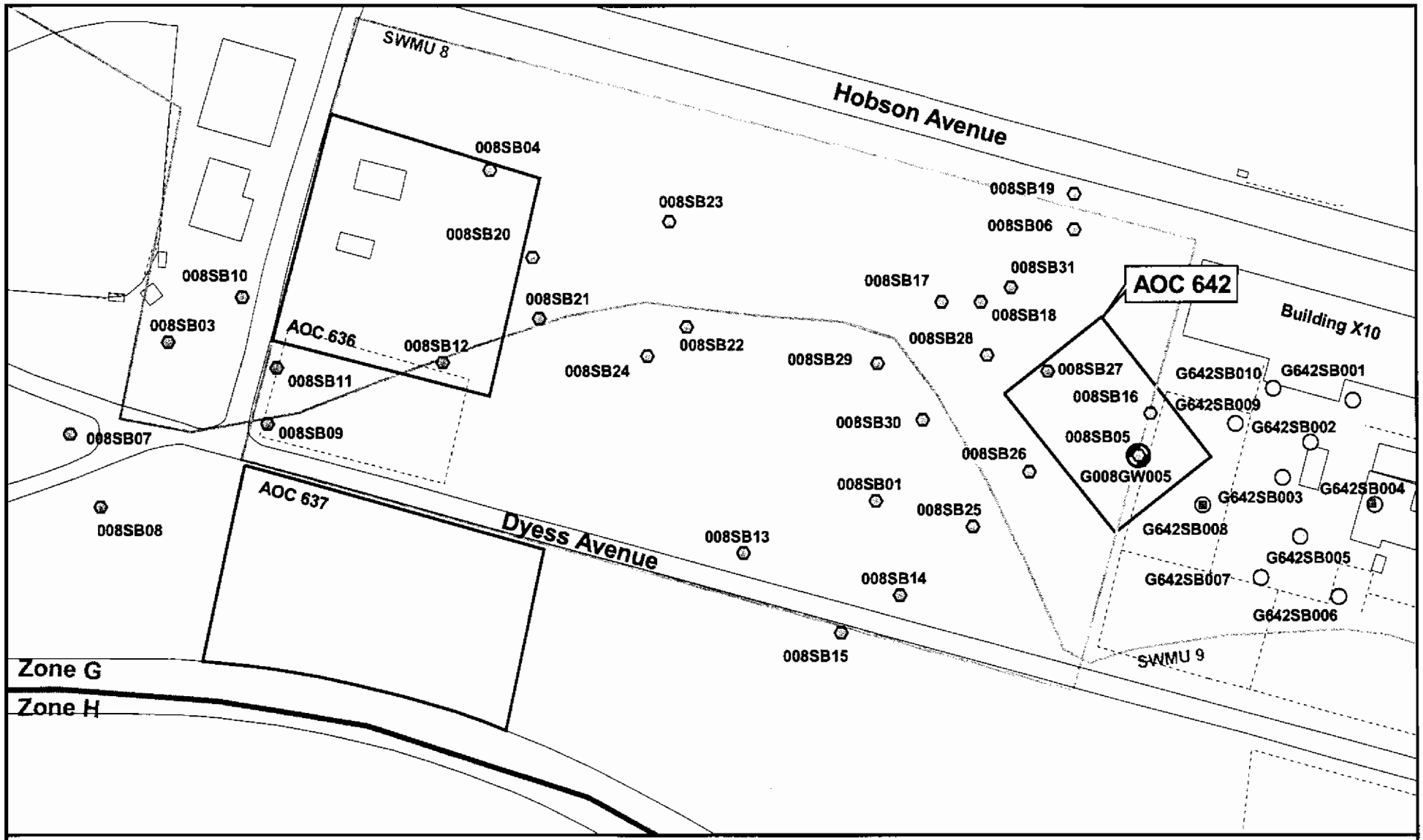
2.3 COPC/COC Summary

The *Zone G RFI Report, Revision 0* concluded that, based on the analytical results and the HHRA, the following COCs were identified for surface soil at AOC 642, under an unrestricted (residential) land use scenario:

- Arsenic
- Beryllium
- Nickel
- Thallium

Arsenic was also identified as a COC for an industrial land use (site worker) scenario for the ingestion and dermal pathways.The RFI Report recommended a CMS in surface soil for chemicals that are not specifically related to small arms range activity: arsenic, beryllium, manganese, nickel, and thallium.

No COPCs, and consequently no COCs, were identified for subsurface soil, sediment, or groundwater at the original AOC 642 location. Although lead typically is an indicator analyte for a former pistol range, it was not identified as a concern at this AOC.



1993 Sample Locations
RFI Subsurface Soil Samples
RFI Surface Soil Samples
Groundwater Well
Zone Boundary
SWMU Boundary
Buildings
AOC Boundary
Roads
Fence

N

0 90 180 Feet

Figure 2-1
RFI and 1993 Sample Locations
AOC 642, Zone G
Charleston Naval Complex

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File Path: C:\18gis\Projects\Zone_G\aoc_642\aprs\aoc_642.apr, Date: 17 Dec 2001 13:28, User: ASWINFOR, Figure 2-1 - Figure 2-1 RFI and 1993 Sample Locations

Section 3.0

3.0 Interim Measures and UST/AST Removals

There are no USTs or ASTs associated with either the past or current AOC 642 locations.

No IMs have been conducted at AOC 642 to date. However, an IM was conducted by the Environmental Enterprise Group (EEG) at SWMU 8 in 1999 to address waste oil pits located near the current location of AOC 642. Aerial photos and site photos from the IM Completion Report (IMCR) indicate that significant reworking and disturbance of surface soils occurred during this IM in the area where AOC 642 is now believed to have been located (EEG, November, 1999).

Visual inspections made by BCT members during 2001 indicated that no physical evidence of the former pistol range operations (conducted more than 50 years ago) remains at the site. The locations of the former SWMU 8 waste oil pits near AOC 642 are depicted as Area 1 on Figure 1 of the SWMU 8 IM Completion Report, presented as Appendix C to this RFI Report Addendum.

Section 4.0

4.0 Summary of Additional Investigations

During the latter part of 1999 and early 2000, additional field activities were conducted by the Navy/EnSafe team in Zone G subsequent to the *Zone G RFI Report, Revision 0* (EnSafe, 1998a) in general accordance with the *Zone G RFI Work Plan Addendum* (EnSafe, 2000). As part of this effort, one Synthetic Precipitation Leaching Procedure (SPLP) soil sample was collected at AOC 642 to support SSL calculations. No additional delineation sampling or other field work was conducted at AOC 642 at that time. The data validation report for this collection is presented in Appendix D of this RFI Report Addendum.

Subsequent to the submittal of the RFI Report, members of the BCT determined through review of historical maps and aerial photos that the location of AOC 642 as investigated and presented in the RFI Report was incorrect.

The new AOC 642 boundary is west of Building X-10, and partially overlaps the eastern end of SWMU 8, including an area within the SWMU 8 IM location, as discussed in Section 3.0 of this RFI Report Addendum. This area also encompasses the locations of several SWMU 8 characterization soil samples which were collected in 1993, prior to the Zone G RFI and IM (G008SB05, G008SB016, and G008SB27). Monitoring well G008GW005, installed as part of the SWMU 8 RFI, also lies within the current AOC 642 boundary.

Relevant 1993 SWMU 8 soil data and the RFI data for monitoring well G008GW005 are being utilized in the current evaluation of the new AOC 642 location, because these samples are representative of site conditions prior to the 1999 SWMU 8 IM, which disturbed the surface soils at the new AOC 642 location.

To further evaluate the AOC 642 site based on the revised AOC boundary, CH2M-Jones developed and implemented a sampling plan for surface and subsurface soils in 2001, using lead as the indicator parameter for contamination from AOC 642 range operations. This sampling work and the results compared to screening criteria are also presented and discussed further below.

Surface soil sampling results were screened against EPA Region III RBCs (non-carcinogen at HI=0.1) and the generic soil–to-groundwater SSLs (DAF=1 for volatile organic compounds [VOCs], DAF=10 for all other parameters); results for lead were also compared to its Zone G surface soil background range. When both the RBC value and Zone G background range

maximum value were exceeded, the chemical was selected as a COPC and is discussed further in Section 5.0 of this RFI Report Addendum.

Similarly, subsurface soil results were compared to the Zone G background concentrations and SSLs. When both criteria were exceeded, the chemical was selected as a COPC for the soil-to-groundwater leachability pathway. Tables 4-1 and 4-2 present the analytical result summaries for the additional samples for surface and subsurface soils, respectively.

4.1 Additional Soil Sampling and Analysis

In July 1999 a subsurface soil sample (642SB01102) was collected by EnSafe and analyzed for metals and SPLP characteristics. The location of soil boring G642SB011 is shown on Figure 4-1. The SPLP data was intended to provide information for the calculation of site-specific SSLs. This sample was collected approximately 180 ft to the east of the revised location of AOC 642 inside the footprint of Building 1431 (south of Building X-12). Table 4-3 presents the analytical results for this sample.

In October 2001 CH2M-Jones collected 17 surface soil and 17 subsurface soil delineation samples. The analytical data summaries and data validation reports for this collection is found in Appendix E of this RFI Report Addendum. The samples were collected using a grid which extended past the current AOC boundary in all directions, using stations G642SB012 through G642SB028. All samples were analyzed for lead. The locations of the soil borings are illustrated on Figure 4-1.

Based on the new site knowledge that SWMU 8 and AOC 642 were co-located, a delineation indicator parameter was needed that would have been exclusive to AOC 642 operations. Lead is the major constituent of spent small arms ammunition, and was not identified in the *Zone G RFI Report, Revision 0* as a COC for SWMU 8. Therefore, lead was used as the indicator analytical parameter for the CH2M-Jones AOC 642 soil delineation samples.

CH2M-Jones surface and subsurface soil samples analyzed for lead (total) by EPA methods were compared to the EPA lead screening level of 400 mg/kg (EPA, 1996). If this screening level was exceeded in a sample, lead was identified as a COPC, and would be discussed further in Section 5.0 of this RFI Report Addendum as a potential COC.

4.1.1 Surface Soil Results

The analytical results for the samples collected in 2001 are presented in Table 4-1. The results indicate that lead concentrations in surface soil samples collected at the new AOC 642 location ranged from 1.5 mg/kg to 270 mg/kg. None of the 17 surface soil samples

collected contained lead at a concentration exceeding the EPA lead screening level of 400 mg/kg (EPA, 1996). Based on this additional information, lead was not identified as a COPC for AOC 642 surface soil.

4.1.2 Subsurface Soil Results

The analytical results for the subsurface soil samples collected in 2001 are presented in Table 4-2. The results indicate that lead concentrations in subsurface soil samples collected at the new AOC 642 location ranged from 1.7 mg/kg to 120 mg/kg. None of the subsurface soil samples contained lead at a concentration that exceeded the EPA lead screening level of 400 mg/kg (EPA, 1996). Based on this information, lead was not identified as a COPC for AOC 642 subsurface soil.

4.1.3 SPLP Sampling Results

Analytical data from the SPLP sample collected at boring location G642SB011 in 1999 are presented in Table 4-3. The sample (642SB01102) was collected from the subsurface (3 to 5 ft bls) interval, and analyzed for total metals and Toxicity Characteristic Leachate Procedure (TCLP) metals. The results for totals analyses show that no inorganic parameter was detected at a concentration that exceeded both its respective range of background concentrations and its SSL (DAF=10).

4.2 SWMU 8 Soil and Groundwater Sampling within AOC 642 Boundary

The results of the 1993 pre-RFI SWMU 8 soil sampling were presented in Section 10.6 of the *Zone G RFI Report, Revision 0*. Map comparisons indicate that SWMU 8 soil samples 008SB05, 008SB16, and 008SB27 were collected from inside the current AOC 642 boundary (see Figure 2-1). The samples were analyzed for metals, VOCs, semivolatile organic compounds (SVOCs), and pesticides/polychlorinated biphenyls (PCBs). The analytical results for these three samples (for COPCs identified for SWMU 8) are presented in Table 4-4. As shown in the table, most SWMU 8 COPC compounds were not detected in these three samples. Lead is not shown because it was not a COPC for SWMU 8, but lead concentrations in these samples did not exceed the 400 mg/kg in any sample.

4.2.1 Surface Soil Results

Compounds detected in SWMU 8 surface soils during the 1993 sampling event are arsenic, chromium, benzo(a)pyrene, benzo(b)fluoranthene, and chrysene. A chromium concentration of 11 mg/kg in sample 008SB2701 is the only detection not reported with a

"J" flag lab data qualifier. None of the results exceed the current screening criteria, as shown in Table 4-4. No new COPCs are indicated for AOC 642 surface soil based on re-screening of the 1993 SWMU 8 sample results located in this area.

4.2.2 Subsurface Soil Results

Of the three 1993 soil borings located inside of AOC642, a subsurface soils sample was collected from only boring 008SB27, due to shallow water table occurrence. Because no COPCs were identified for SWMU 8 subsurface soil in the RFI Report, analytical results for this sample are not included in Table 4-4. Lead was detected in the subsurface soil sample from boring 008SB27 at 2.4J mg/kg, within applicable criteria ranges. Other metals were detected, as well as benzo(a)pyrene equivalents (BEQs) and pesticides, but none exceeded the current screening criteria in this sample; therefore, no new COPCs were identified for AOC 642 subsurface soil.

4.2.3 Groundwater Results

The revised location of AOC 642 is partially inside the SWMU 8 boundary. Monitoring well G008GW005 was installed to assess SWMU 8 groundwater quality during the RFI, and lies within the revised boundary of AOC 642 (see Figure 4-1). Four groundwater sampling events were conducted for this well during the RFI, with samples analyzed for metals, pesticides/PCBs/dioxins, nitroaromatics/explosives, VOCs, and SVOCs. Results of these sampling events for COPCs identified at SWMU 8 are presented in Table 4-5.

The only SWMU 8 COPC parameters detected in well G008GW005 during all four events are metals. The only metal to exceed screening criteria was thallium, detected at 5.8J µg/L during the second sampling event only, exceeding the drinking water MCL of 2.0 µg/L. Parameters detected and believed to be associated with SWMU 8 waste disposal operations include hydrazine and diethylphthalate. Acetone was detected only once and is believed to be associated with laboratory contamination (detected in the fourth sampling event only, at 2J µg/L). Based on this information, the former pistol range activities conducted during WW II at AOC 642 do not appear to have adversely affected groundwater in this area.

4.3 COPC/COC Summary

No new COPCs were identified from results of the CH2M-Jones soil sampling at AOC 642 in 2001. No new COPCs were identified for AOC 642 based on re-screening of 1993 SWMU 8 soil data or Zone G RFI groundwater data from within the revised AOC 642 boundary.

The COPCs and COCs previously identified for AOC 642 in the *Zone G RFI Report, Revision 0* are discussed further in Section 5.0 of this RFI Report Addendum.

TABLE 4-1
Lead Detected in Surface Soil - Additional Investigations, 2001
RFI Report Addendum, AOC 642, Zone G, Charleston Naval Complex

Parameter	Location	Concentration (mg/kg)	Qualifier	Region III Residential Soil RBC (HI=0.1)	Soil to Groundwater SSL (DAF=10)	Zone G Surface Soil Background Concentration Range
Lead	G642SB013	19	=	400	400	3.5 - 275
	G642SB026	19	=			
	G642SB012	1.5	=			
	G642SB013	14	=			
	G642SB014	36	J			
	G642SB015	8.9	J			
	G642SB016	140	J			
	G642SB017	70	J			
	G642SB018	66	J			
	G642SB019	4.2	J			
	G642SB020	2.4	=			
	G642SB021	48	=			
	G642SB022	18	=			
	G642SB023	17	=			
	G642SB024	140	=			
	G642SB025	270	=			
	G642SB026	24	=			
	G642SB027	16	=			
	G642SB028	36	J			

= Indicates that the compound was detected, the reported concentration is equal to the sample concentration.

J Indicates that the compound was detected, the reported concentration is the estimated concentration.

mg/kg Milligrams per kilogram

TABLE 4-2
Lead Detected in Subsurface Soil - Additional Investigations, 2001
RFI Report Addendum, AOC 642, Zone G, Charleston Naval Complex

Parameter	Location	Concentration mg/kg	Qualifier	Region III Residential Soil RBC (HI=0.1)	Soil to Groundwater SSL (DAF=10)	Zone G Subsurface Soil Background Concentration Range
Lead	G642SB019	22	J	400	400	2.4 - 76
	G642SB012	120	=			
	G642SB013	57	J			
	G642SB014	2.7	J			
	G642SB015	26	J			
	G642SB016	15	J			
	G642SB017	32	J			
	G642SB018	21	J			
	G642SB019	25	J			
	G642SB020	24	=			
	G642SB021	40	=			
	G642SB022	17	=			
	G642SB023	4.2	=			
	G642SB024	1.7	=			
	G642SB025	2.5	=			
	G642SB026	7.6	=			
	G642SB027	31	J			
	G642SB028	4.7	J			

= Indicates that the compound was detected, the reported concentration is equal to the sample concentration.

J Indicates that the compound was detected, the reported concentration is the estimated concentration.

mg/kg Milligrams per kilogram

TABLE 4-3
Inorganic Totals and SPLP Results from Sample 642SB01102
RFI Report Addendum, AOC 642, Zone G, Charleston Naval Complex

		Inorganic Totals		Zone G Subsurface		SPLP	
Chemical Name	Date Collected	Result (mg/kg)	Qualifier	Soil Background Range	SSL (DAF=10)[a]	Result (µg/L)	Qualifier
Aluminum	07/29/1999	4,820	=	2,630 - 36,800	NA	307	=
Antimony	07/29/1999	0.38	J	ND	2.5	5.0	U
Arsenic[b]	07/29/1999	1.7	=	1.4 - 36	14.5	3.3	U
Barium	07/29/1999	14.0	=	7.7 - 63	800	288	=
Beryllium	07/29/1999	0.15	J	0.45 - 2.4	31.5	0.30	U
Cadmium	07/29/1999	0.26	J	0.08 - 0.52	4	1.40	J
Calcium	07/29/1999	579	J	6,390 - 127,000	NA	1,860	=
Chromium, Total	07/29/1999	8.5	=	7.4 - 65	19[VI]	0.50	U
Cobalt	07/29/1999	0.49	J	0.9 - 15	NA	1.7	U
Copper	07/29/1999	47.6	=	4.5 - 46	NA	10.3	J
Iron	07/29/1999	4,920	=	3,110 - 58,100	NA	159	=
Lead	07/29/1999	32.8	=	2.4 - 76	400[c]	6.5	J
Magnesium	07/29/1999	258	=	1,040 - 7,040	NA	216	J
Manganese	07/29/1999	16.1	=	20 - 409	NA	1.6	J
Mercury	07/29/1999	0.36	=	0.05 - 0.37	1	1.4	J
Nickel	07/29/1999	2.3	J	1.9 - 22	65	1.3	J
Potassium	07/29/1999	119	J	670 - 3,790	NA	353	U
Selenium	07/29/1999	0.39	U	0.54 - 1.0	2.5	2.9	U
Silver	07/29/1999	0.14	U	ND	17	2.0	U
Sodium	07/29/1999	362	=	1,070 - 3,890	NA	3,450	=
Thallium	07/29/1999	0.40	U	1.0	0.35	2.3	U
Tin (Sn)	07/29/1999	6.2	U	1.1 - 2.9	NA	29.5	U
Vanadium	07/29/1999	10.3	=	5.9 - 112	3,000	1.1	J
Zinc	07/29/1999	59.3	=	20 - 198	6,000	74.6	U
Total Organic Carbon	07/29/1999	4,420	=	NA	NA	NA	

SPLP Synthetic Precipitation Leachate Procedure

[a] Generic Soil Screening Level (SSL) adjusted to a Dilution Attenuation Factor (DAF) of 10 (Soil Screening Guidance: Technical Background Document, May 1996).

[b] Carcinogenic compound.

TABLE 4-3
Inorganic Totals and SPLP Results from Sample 642SB01102
RFI Report Addendum, AOC 642, Zone G, Charleston Naval Complex

		Inorganic Totals		Zone G		SPLP	
Chemical Name	**Date Collected**	**Result (mg/kg)**	**Qualifier**	**Subsurface Soil Background Range**	**SSL (DAF=10)[a]**	**Result (µg/L)**	**Qualifier**

[c] A screening level of 400 mg/kg has been established for lead (EPA Soil Screening Guidance: Technical Background Document, May 1996).

[VI] Based on Cr+6.

= indicates that the compound was detected, the reported concentration is equal to the sample concentration.

J indicates that the compound was detected, the reported concentration is the estimated concentration.

mg/kg Milligrams per kilogram

µg/L Micrograms per liter

NA indicates that the information is not applicable or not available.

U indicates that the compound was not detected, the reported concentration is the detection limit.

TABLE 4-4
COPC Concentrations for Surface Soil Samples within AOC 642 and SWMU 8 Boundaries
RFI Report Addendum, AOC 642, Zone G, Charleston Naval Complex

Parameter	Sample ID	Result (mg/kg)	Qualifier	RBC (HI=0.1)[a]	Zone G Background Range	SSL (DAF=10)[b]
Antimony	008SB16193	6.3	UJ	3.1	0.79 - 5.7	2.5
	008SB26193	6.3	UJ			
	008SB27193	5.6	UJ			
	008SB28193	5.4	UJ			
Arsenic[c]	008SB05193	1.6	J	0.43	3.1 - 25	14.5
	008SB16193	3.5	J			
	008SB26193	7.6	J			
	008SB27193	4	J			
	008SB28193	3.8	J			
Chromium	008SB05193	8	J	23[VI]	7.0 - 39	19
	008SB16193	10	U			
	008SB26193	24	=			
	008SB27193	11	=			
	008SB28193	5.6	=			
Thallium	008SB05193	1.4	UJ	0.55	0.55 - 0.91	0.35
	008SB16193	6.3	U			
	008SB26193	1.3	U			
	008SB27193	1.1	U			
	008SB28193	11	U			
Aroclor-1260	008SB05193	0.046	U	0.32	NA	1[d]
	008SB16193	0.084	U			
	008SB26193	0.041	U			
	008SB27193	0.036	U			
	008SB28193	0.035	U			
Benzo(a)anthracene[c]	008SB05193	0.46	U	0.87	NA	1
	008SB16193	0.42	U			
	008SB26193	0.42	U			
	008SB27193	0.37	U			
	008SB28193	0.36	U			
Benzo(a)pyrene[c]	008SB05193	0.036	J	0.087	NA	4
	008SB16193	0.065	J			
	008SB26193	0.42	U			
	008SB27193	0.37	U			
	008SB28193	0.36	U			
Benzo(b)fluoranthene[c]	008SB05193	0.086	J	0.87	NA	2.5
	008SB16193	0.13	J			
	008SB26193	0.42	U			
	008SB27193	0.37	U			

TABLE 4-4
COPC Concentrations for Surface Soil Samples within AOC 642 and SWMU 8 Boundaries
RFI Report Addendum, AOC 642, Zone G, Charleston Naval Complex

Parameter	Sample ID	Result (mg/kg)	Qualifier	RBC (HI=0.1)[a]	Zone G Background Range	SSL (DAF=10)[b]
Benzo(b)fluoranthene[c]	008SB28193	0.36	U	0.87	NA	2.5
Benzo(k)fluoranthene[c]	008SB05193	0.46	U	8.7	NA	24.5
	008SB16193	0.42	U			
	008SB26193	0.42	U			
	008SB27193	0.12	J			
	008SB28193	0.36	U			
Chrysene[c]	008SB05193	0.1	J	87	NA	80
	008SB16193	0.38	J			
	008SB26193	0.42	U			
	008SB27193	0.13	J			
	008SB28193	0.36	U			
Dibenz(a,h)anthracene[c]	008SB05193	0.46	U	0.087	NA	1
	008SB16193	0.42	U			
	008SB26193	0.42	U			
	008SB27193	0.37	U			
	008SB28193	0.36	U			
Indeno(1,2,3-cd)pyrene[c]	008SB05193	0.46	U	0.87	NA	7
	008SB16193	0.42	U			
	008SB26193	0.42	U			
	008SB27193	0.37	U			
	008SB28193	0.36	U			
BEQ	008SB05193	0.323	NA	0.087	1.304	NA
	008SB16193	0.33248	NA			
	008SB26193	0.48531	NA			
	008SB27193	0.42683	NA			
	008SB28193	0.41598	NA			

[a] Non-carcinogenic compounds are compared to a Risk Based Concentration (RBC) that is reduced by one order of magnitude.

[b] Generic Soil Screening Level (SSL) adjusted to a Dilution Attenuation Factor (DAF) of 10.

[c] Carcinogenic compound.

[d] A preliminary remediation goal of 1 mg/kg has been set for PCBs (Soil Screening Guidance: Technical Background Document, May 1996).

[VI] Based on Cr+6.

J indicates that the compound was detected, the reported concentration is the estimated concentration.

= indicates that the compound was detected, the reported concentration is equal to the sample concentration.

NA indicates that the information is not applicable or not available.

U indicates that the compound was not detected, the reported concentration is the detection limit.

UJ indicates that the compound was not detected, the reported concentration is an estimated detection limit.

TABLE 4-5
SWMU 8 COPC Concentrations in Monitoring Well G008GW005
RFI Report Addendum, AOC 642, Zone G, Charleston Naval Complex

Chemical Name	Sample ID	Date Collected	Results (µg/L)	Qualifier	Zone G Shallow Groundwater Background Range	MCL[a]	RBC (HI=0.1)[b]
Antimony	008GW00501	11/15/1996	2.1	U	3.0 - 6.0	6.0	1.5
	008GW00502	05/23/1997	2.8	U			
	008GW00503	09/14/1997	1.6	U			
	008GW00504	12/08/1997	3.1	U			
Barium	008GW00501	11/15/1996	23.5	=	14 - 937	2,000	260
	008GW00502	05/23/1997	18.9	J			
	008GW00503	09/14/1997	23.8	J			
	008GW00504	12/08/1997	15.6	J			
Thallium	008GW00501	11/15/1996	2.7	U	ND	2.0	0.26
	008GW00502	05/23/1997	**5.8**	J			
	008GW00503	09/14/1997	5.0	U			
	008GW00504	12/08/1997	5.0	U			
Vanadium	008GW00501	11/15/1996	2.5	J	3 - 30	NA	26
	008GW00502	05/23/1997	3.6	J			
	008GW00503	09/14/1997	5.2	J			
	008GW00504	12/08/1997	3.2	J			
Bis(2-ethylhexyl) phthalate[c]	008GW00501	11/15/1996	14.0	U	NA	NA	4.8
	008GW00502	05/23/1997	10.0	U			
	008GW00503	09/14/1997	10.0	U			
	008GW00504	12/08/1997	10.0	U			
Hydrazine[c]	008GW00502	05/23/1997	5.0	U	NA	NA	0.022
	008GW00503	09/14/1997	**10.2**	=			
	008GW00504	12/08/1997	**8.4**	=			

Bold values exceed both the range of background concentrations and the MCL (or RBC if a MCL is not available).

[a] MCLs are from the U.S. EPA National Primary Drinking Water Standards (March, 2001).

[b] Non-carcinogenic compounds are compared to a Risk Based Concentration (RBC) that is reduced by one order of magnitude. RBCs are from EPA Region III RBC Tables (10/6/2000)

[c] Carcinogenic compound.

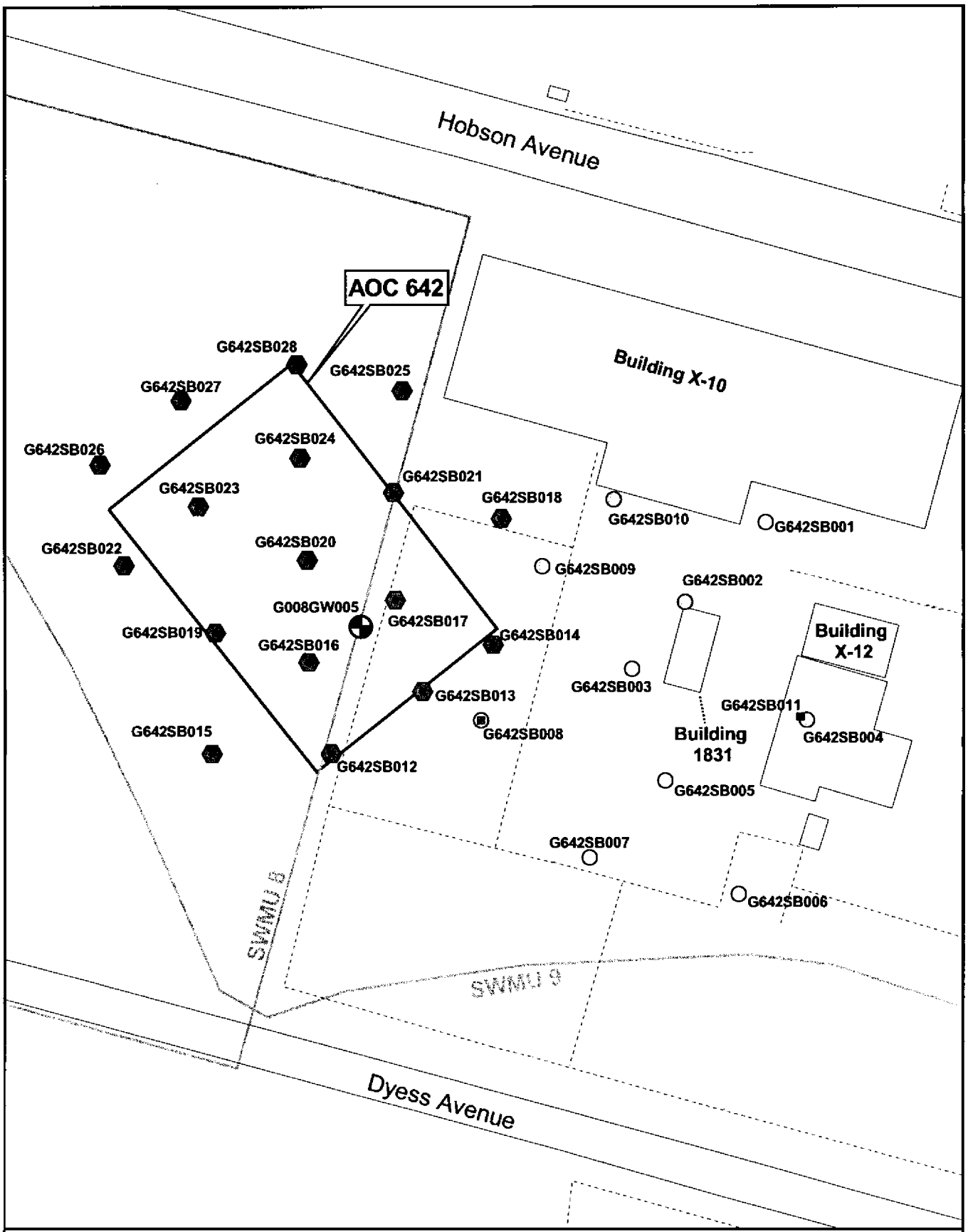
U indicates that the compound was not detected, the reported concentration is the detection limit

UJ indicates that the compound was not detected, the reported concentration is an estimated detection limit.

J indicates that the compound was detected, the reported concentration is the estimated concentration.

= indicates that the compound was detected, the reported concentration is equal to the sample concentration

NA indicates that the information is not applicable or not available.



- RFI Subsurface Soil Samples
- RFI Surface Soil Samples
- Groundwater Well
- CH2M Jones Soil Samples
- Fence
- Roads
- SWMU Boundary
- Buildings
- AOC Boundary

N

0 60 120 Feet

Figure 4-1
Additional Sample Locations
AOC 642, Zone G
Charleston Naval Complex

CH2MHILL

File Path: C:\18gis\Projects\Zone_G\aoc_642\aprs\aoc_642.apr, Date: 18 Dec 2001 10:00, User: ASWINFOR, Figure 4-1 - Figure 4-1 Additional Sample Locations

Section 5.0

5.0 COPC/COC Refinement

This section discusses compounds that were identified as COCs for the original AOC 642 location in the *Zone G RFI Report, Revision 0* (EnSafe, 1998a), or as COPCs from any additional investigations of the revised AOC 642 location, which are summarized in Section 4.0 of this RFI Report Addendum.

Based upon review of the additional information regarding the revised AOC 642 location and additional sampling performed by CH2M-Jones in 2001, no COCs are identified for surface soil, subsurface soil, or groundwater in this RFI Report Addendum for this area. No further investigation or action is proposed at AOC 642. COCs identified in the RFI Report for the former AOC 642 location and their relevance are discussed below.

5.1 COCs in Surface Soil at Former AOC 642 Location

The COCs identified in surface soil for the former AOC 642 location in the *Zone G RFI Report, Revision 0* included:

- Arsenic
- Beryllium
- Nickel
- Thallium

The original AOC 642 RFI surface soil COCs are not representative of the new AOC 642 location, and are not expected to have been associated with small arms firing operations. Of these parameters, only thallium was identified as a COC in surface soil at the new location, based on the 1993 data. Thallium did not exceed criteria in any of the 1993 pre-RFI surface soil samples collected from within the new AOC boundary. Thallium is not expected to be associated with pistol range operations, and is not retained as a COC for AOC 642. For the corrected AOC 642 location, re-screening of available data did not produce any COCs in surface soil.

5.2 COCs in Subsurface Soil at Former AOC 642 Location

No COPCs, and consequently no COCs, were identified for subsurface soil, sediment, or groundwater at the former AOC 642 location. The results of the additional sampling conducted in 2001 by CH2M-Jones, and by EnSafe in 1993 in this area did not result in

identification of any COCs in subsurface soil at the corrected AOC 642 location. Although lead typically is an indicator parameter for a former pistol range, it was not identified as a concern at this AOC at either the original or the corrected locations.

5.3 COCs in Groundwater

The *Zone G RFI Report, Revision 0* did not identify any COCs in groundwater for the former AOC 642 location. Based upon review of the data from the four sampling events for monitoring well G008GW005 within the revised AOC 642 location, no additional COCs for AOC 642 were identified. Low levels of diethylphthalate and hydrazine detected sporadically in SWMU 8 monitoring well G008 GW005 are believed to be associated with SWMU 8 landfilling and liquid waste disposal activities, and not with the small arms firing range at AOC 642.

These parameters will be addressed as part of the closeout of SWMU 8, but diffuse groundwater contamination from another unit should not adversely affect closeout of AOC 642.

5.4 Summary

Extensive sampling of surface and subsurface soils at the corrected AOC 642 location by CH2M-Jones during 2001 revealed no evidence of excessive lead contamination in soils from the former World War II small arms range operation. No adverse human health or environmental impacts from past small arms range operations are noted. No COCs related to this site were identified for either unrestricted or industrial use. Several chemicals detected in groundwater from SWMU 8 monitoring well G008GW005 appear to be related to operations at SWMU 8. Groundwater beneath AOC 642 which has been impacted by SWMU 8 waste disposal activities will be addressed as part of the corrective measures for SWMU 8.

Section 6.0

6.0 Summary of Information Related to Site Closeout Issues

6.1 RFI Status

The Zone G RFI field work and *Zone G RFI Report, Revision 0* (EnSafe, 1998a) were completed using the best information available at the time regarding the site location and characteristics. No Further Investigation (NFI) of AOC 642 was proposed in the *Zone G RFI Work Plan Addendum* (EnSafe, 2000). CH2M-Jones proposed and completed additional delineation sampling at the revised AOC location to address potential lead contamination in surface and subsurface soils, but none was detected. Supporting data do not identify any site-related COCs. No further sampling or investigation is proposed or necessary at AOC 642.

In accordance with the RFI completion process, if a determination of NFI is made, then a site may proceed to either NFA status or to a CMS. Because there were no COCs related to this site, CH2M-Jones recommends this site for NFA.

6.2 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to the occasional or intermittent detection of several metals (primarily arsenic, thallium, and antimony) in groundwater at concentrations above the applicable MCL, preceded or followed by detections of these same metals below the MCL or below the practicable quantitation limit.

Analytical results from monitoring well G008GW005 indicate that these inorganics are not site-related COCs in groundwater at AOC 642.

6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC

The sanitary sewer investigation was designed to include segments of the sewer where releases of contamination were known or considered likely to have occurred. No investigations related to SWMU 37 were conducted at AOC 642. No known or suspected

linkage between SWMU 37 and AOC 642 exists. Therefore, further evaluation of this issue is not warranted.

6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC

Investigated segments of the storm sewer were identified in the *Zone L RFI Report, Revision 0* (EnSafe, 1998b). No investigated segments of the storm sewer were identified in Zone G. The nearest investigated segment of the storm sewer is over 2,000 ft to the northwest of AOC 642, in Zones E and F.

There are no data or information to suggest that AOC 642 has impacted the storm sewer system that is over 2,000 ft away. Therefore, further investigation of a linkage between the storm sewer system and AOC 642 is not warranted.

6.5 Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC

Investigated railroad lines were identified in the *Zone L RFI Report, Revision 0*. The nearest investigated railroad line to AOC 642 is over 2,000 ft to the northwest, in Zone E. There is no known linkage between AOC 642 and the investigated railroad lines of AOC 504. Therefore, further evaluation of this issue is not warranted.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

Two potential migration pathways from the site to surface water are overland flow via stormwater runoff, and subsurface flow via groundwater. There were no COCs identified in surface soil at AOC 642; therefore, further evaluation of a potential pathway for contaminant migration via stormwater runoff is not warranted.

Soil data did not indicate that site groundwater was impacted by site activities, therefore COPCs were not identified in groundwater at AOC 642. As a result, there is no contaminated groundwater plume related to AOC 642 to migrate to a surface water body. Therefore, further evaluation of potential migration of contaminated groundwater from AOC 642 to a surface water body is not warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

The issue of potential contamination of OWSs refers to the possible presence of an OWS that has not yet been investigated at a SWMU or AOC as part of the RCRA or UST process.

No OWSs are present at AOC 642. Therefore, additional evaluation of this issue at AOC 642 is not warranted.

6.7 Land Use Control Management Plan

Evaluation of data collected during, and after the RFI field work, did not identify any COCs in site soil at the corrected AOC 642 location. Long-term land use restrictions are not needed for AOC 642.

Section 7.0

7.0 Recommendations

AOC 642 is a former pistol range used during the 1940s. The CNC RFA (EnSafe, 1995) reported the site to be located adjacent to and directly south of Building X-10, and west of Buildings X-12 and 1431. In the CNC RCRA permit, AOC 642 was listed as a CSI site.

The AOC location and shape were revised by the BCT subsequent to submittal of the *Zone G RFI Report, Revision 0* (EnSafe, 1998a) and the area investigated south of Building X-10 during the RFI is now known not to be associated with the former pistol firing range. The actual AOC 642 location was discovered to overlap the eastern end of SWMU 8, near the area where the Area 1 Interim Measures were conducted to remediate waste oil pits.

The new AOC 642 area was investigated in 2001 to determine if surface or subsurface soil contamination with lead from spent bullets, but no exceedances of criteria for lead in any of the 17 surface or subsurface soil samples were identified.

Additional supporting soil and groundwater data from the adjacent SWMU 8 RFI investigation and 1993 SWMU 8 soil investigation were incorporated into the AOC 642 evaluation, because some of those sampling locations now lie within the revised AOC 642 boundary.

A review of all data has not identified COCs related to the former pistol range operations in site soil or groundwater. The only COCs identified in site groundwater are believed to be associated with SWMU 8 operations, where they are identified as COCs and will be addressed in the closure of that unit.

Therefore, CH2M-Jones recommends that the status of AOC 642 in Zone G be changed to NFA. Once the BCT concurs that NFA is appropriate for this site, a Statement of Basis will be prepared that will be made available for public comment with SCDHEC policy. This will allow for public participation in the final remedy selection process.

Section 8.0

8.0 References

CH2M-Jones. Technical Memorandum – *Background PAHs Study Report – Technical Information for Development of Background BEQ Values*. Revision 0. February 2001a.

CH2M-Jones. *Sampling Plan – AOC 643, Zone G, U.S. Navy Southern Division, Naval Facilities Engineering Command*. July 2001b.

CH2M-Jones. *Charleston Naval Complex Project Team Notebook and Instructions*. Revision 1. October 2001c.

EEG. *Completion Report – Interim Measure for SWMU 8, Naval Base Charleston, Charleston SC*. October 12, 1999.

EnSafe/Allen & Hoshall. *Final RCRA Facility Assessment Naval Base Charleston Volume II*. June 6, 1995.

EnSafe Inc. *Zone G RCRA Facility Investigation Report*. Revision 0. February 20, 1998a.

EnSafe Inc. *Zone L RCRA Facility Investigation Report*. Revision 0. December 18, 1998b.

EnSafe Inc. *Zone G RCRA Facility Investigation Report Work Plan Addendum*. January 17, 2000.

U.S. Environmental Protection Agency. *Soil Screening Guidance: Technical Background Document*. May 1996.

U.S. Environmental Protection Agency. EPA Region III RBC Table. October 2000.

Appendix A

Comments by Stacey French (specific)

Specific Comment 13:

Section 10.5 AOC 642, Former Pistol Range, Page 10.5.1

This section provides a description of AOC 642 and indicates that the site is currently an asphalt paved parking area. Providing construction drawings of the parking lot, or any investigations to provide the amount of cover over the AOC would be helpful. This would document presence or absence of cover over the bullets.

This section also states that it is unknown if any spent bullets were removed from the site. Has an investigation into the vertical extent of the bullets been conducted? This question is important in determining if the entire area affected by the Former Pistol Range has been covered (capped) by the asphalt parking area. Please include the response to this comment in the text of the document.

Navy/EnSafe Response 13:

Field notes of the soil sampling will be reviewed to determine the thickness of the asphalt and/or any other material overlying the soil. Cover thickness will be included in the final RFI report. No spent bullets were encountered during soil sampling at AOC 642. In addition, lead concentrations are all less then the Zone G background concentrations.

CH2M-Jones Response 13:

The asphalt parking lot in question is located south of Building X-10, where AOC 642 was believed to have been located during the Zone G RFI. This location has been since updated and new investigations did not identify spent bullets or excessive lead contamination in soils. Therefore, concerns about capping of wastes left in place are not pertinent to the current AOC 642 location.

Specific Comment 14:

Figure 10.5-1 Sampling Locations AOC 642

The extent of the asphalt paved parking lot should be indicated on the figure in order to clarify the extent of the site. Additionally, the fence referenced in Section 10.5 should be shown on the figure. Please revise the figure. This comment also applies to the other figures of AOC 642 in this section of the RFI.

Navy/EnSafe Response 14:

Figure 10.5-1 and the others in this section will be revised as requested.

CH2M-Jones Response 14:

See CH2M-Jones response to Comment 13; because the AOC boundary has moved, concerns about the extent of the Building X-10 parking lot are no longer pertinent. The extent of asphalt cover in this area is shown in the aerial photo of Figure 1-2 in the CH2M-Jones RFI Report Addendum.

Specific Comment 15:

Section 10.5.3 Soil Sampling and Analyses, Page 10.5.3, lines 9 &10.

This sentence indicates that nine of the ten borings were limited to the upper interval only due to the shallow groundwater interval. The depth that groundwater was encountered should be included in the section. The shallow groundwater table suggests that a groundwater investigation should be conducted. Knowing the origin and amount of cover placed during construction of the asphalt parking area and the buildings on top of the AOC is important in determine the affect the AOC 642 had on the soils and groundwater.

Navy/EnSafe Response 15:

Field notes taken during soil sampling at this site indicate that saturated soils were encountered between 1.5 and 3,.5 feet below ground surface. This data will be included in the RFI report. The figures in this section will be revised to included the extent of asphalt cover. A description of the material underlying the asphalt will be included in section 10.5.1. However, it would not be possible to determine its provenance.

CH2M-Jones Response 15:

Because the AOC boundary had been revised subsequent to the date of the RFI soil sampling in question, CH2M-Jones conducted additional surface and subsurface soil sampling at the new AOC 642 location in 2001. Seventeen surface soil and 17 subsurface soil samples were collected and analyzed for lead. Results did not exceed screening criteria for any sample. Monitoring well G008GW005 from SWMU 8 now lies inside the current AOC 642 boundary, and lead has not been detected in this well over any of four sampling events conducted. For these reasons, CH2M-Jones believes that AOC 642 small arms operations did not adversely impact groundwater quality in this area.

Comment 42:

Table 11.1 Site Conclusions and Zone G Preliminary Recommendations

AOC 642 The Department does not agree with the recommendation presented for this site. See comment number 15. Based on the nature of the site, the fact that it is unknown if any spent lead bullets were removed, and the shallow groundwater table, a subsurface soil and groundwater investigation is warranted. This should be discussed in Section 11.5.

Navy/EnSafe Response 42:

Because of the shallow water table, subsurface soil samples were not collected. The field log books noted no spent bullets at this site. The COPCs are arsenic, beryllium, manganese, nickel, beryllium, and thallium. Lead is conspicuously absent. Only two of the COPCs were detected at concentrations which exceeded SSLs. To address this issue, the Navy proposes to perform an SPLP analysis to determine empirically whether these elements are likely to migrate from soil to groundwater. Should this analysis reveal migration likely, monitoring wells may be required. The recommendations will be reviewed based on the additional information.

CH2M-Jones Response 42:

See CH2M-Jones response to comment 15 above. Subsurface soil samples have been collected and do not exceed screening criteria for lead, and groundwater data from existing monitoring well G008GW005 do not indicate that small arms operations have not adversely impacted groundwater quality at this location.

Appendix B

Table 10.5.1
Zone G
AOC 642 Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Collected	Analyses	Remarks
642SB001	642SB00101 642CB00101*	Upper	9/18/96	Note 1 Note 2	Lower interval not sampled due to water table *Duplicate sample
642SB002	642SB00201	Upper	9/18/96	Note 1	Lower interval not sampled due to water table
642SB003	642SB00301	Upper	9/18/96	Note 1	Lower interval not sampled due to water table
642SB004	642SB00401	Upper	9/18/96	Note 1	Lower interval not sampled due to water table
642SB005	642SB00501	Upper	9/18/96	Note 1	Lower interval not sampled due to water table
642SB006	642SB00601	Upper	9/18/96	Note 1	Lower interval not sampled due to water table
642SB007	642SB00701	Upper	9/18/96	Note 1	Lower interval not sampled due to water table
642SB008	642SB00801 642SB00802	Upper Lower	9/18/96	Note 1	
642SB009	642SB00901	Upper	9/18/96	Note 1	Lower interval not sampled due to water table
642SB010	642SB01001	Upper	9/18/96	Note 1	Lower interval not sampled due to water table

Notes:

1 = SW-846 (metals) at DQO Level III

2 = Appendix IX suite: Appendix IX (pesticides/PCBs, herbicides, SVOCs, VOCs); SW-846 (metals, dioxins, OP-pesticides) cyanide; hex-chrome at DQO Level IV

* = Duplicate sample

Table 10.5.2
Zone G
AOC 642
Organic Compound Analytical Results for Soil

Parameters	Sample Interval	Frequency of Detection	Range of Detections (µg/kg)	Mean of Detections (µg/kg)	Reference Conc.* (µg/kg)	Number of Samples Exceeding Reference
Dioxins (1 Duplicate Sample) (µg/kg)						
Dioxin(2,3,7,8-TCDD TEQ)[1]	Upper	1/1	0.1749	0.1749	1000	0
	Lower	0/0	NA	NA	1900	0

Notes:

1 = Calculated from methods described in USEPA Interim *Supplemental Guidance to RAGS: Human Health Risk Assessment*, Bulletin 2 (USEPA, 1995c)

* = Residential RBCs (THQ=0.1) were used as a reference concentration for upper interval samples. Generic soil-to-groundwater SSLs (DAF=20) from the *Soil Screening Guidance: Technical Background Document* (USEPA, 1996b) were used as a reference concentration for lower interval samples

NA = Not applicable

µg/kg = Micrograms per kilogram

Table 10.5.3
Zone G
AOC 642
Inorganic Analytical Results for Soil

Parameters	Sample Interval	Frequency of Detection	Range of Detections (mg/kg)	Mean of Detections (mg/kg)	Reference Conc.* (mg/kg)	Number of Samples Exceeding Reference
Inorganic (Upper Interval - 10 Samples plus 1 Duplicate Sample/Lower Interval - 1 Sample) (mg/kg)						
Aluminum (Al)	Upper	10/10	1110 - 6530	2420	7800	0
	Lower	1/1	3290	3290	1000000	0
Arsenic (As)	Upper	10/10	4.5 - 82	20.9	0.43	10
	Lower	1/1	1.70	1.70	29	0
Barium (Ba)	Upper	10/10	5.80 - 92.7	43.3	550	0
	Lower	1/1	4.9	4.9	1600	0
Beryllium (Be)	Upper	10/10	0.24 - 1.20	0.506	0.150	10
	Lower	1/1	0.10	0.1000	63	0
Cadmium (Cd)	Upper	9/10	0.21 - 2.7	1.08	3.9	0
	Lower	0/1	ND	ND	8	0
Calcium (Ca)	Upper	10/10	4980 - 312000	76700	NL	NA
	Lower	1/1	2080	2,080	NL	NA
Chromium (Cr)	Upper	10/10	5.3 - 23.5	11.2	39	0
	Lower	1/1	4.8	4.8	1000000	0
Cobalt (Co)	Upper	10/10	1.10 - 17.4	5.74	470	0
	Lower	1/1	0.38	0.38	2000	0
Copper (Cu)	Upper	9/10	5.9 - 58.3	29.6	27000	0
	Lower	1/1	2.1	2.1	920	0

Table 10.5.3
Zone G
AOC 642
Inorganic Analytical Results for Soil

Parameters	Sample Interval	Frequency of Detection	Range of Detections (mg/kg)	Mean of Detections (mg/kg)	Reference Conc.* (mg/kg)	Number of Samples Exceeding Reference
Iron (Fe)	Upper	10/10	3080 - 13400	8280	2300	10
	Lower	1/1	2570	2570	NL	NA
Lead (Pb)	Upper	10/10	2.80 - 70.3	35.3	400	0
	Lower	1/1	3.9	3.9	400	0
Magnesium (Mg)	Upper	10/10	638 - 33900	5100	NL	NA
	Lower	1/1	296	2960	NL	NA
Manganese (Mn)	Upper	10/10	42.1 - 350	125	180	2
	Lower	1/1	18.7	18.7	1100	0
Mercury (Hg)	Upper	5/10	0.04 - 0.06	0.0480	2.30	0
	Lower	0/1	ND	ND	2.10	0
Nickel (Ni)	Upper	9/10	1.90 - 253	44.8	160	1
	Lower	1/1	1.90	1.90	130	0
Potassium (K)	Upper	5/10	266 - 596	421	NL	NA
	Lower	0/1	ND	ND	NL	NA
Selenium (Se)	Upper	6/10	0.46 - 0.80	0.695	39.0	0
	Lower	0/1	ND	ND	5	0
Sodium (Na)	Upper	2/10	357 - 1550	954	NL	NA
	Lower	0/1	ND	ND	NL	NA
Thallium (Tl)	Upper	5/10	0.40 - 1.00	0.664	0.63	2
	Lower	0/1	ND	ND	0.95	0

Table 10.5.3
Zone G
AOC 642
Inorganic Analytical Results for Soil

Parameters	Sample Interval	Frequency of Detection	Range of Detections (mg/kg)	Mean of Detections (mg/kg)	Reference Conc.* (mg/kg)	Number of Samples Exceeding Reference
Vanadium (V)	Upper	10/10	5.4 - 45.5	20.4	55	0
	Lower	1/1	4.00	4.00	6000	0
Zinc (Zn)	Upper	10/10	10.3 - 822	186	2300	0
	Lower	1/1	7.5	7.5	12000	0

Notes:

* = Residential RBCs (THQ=0.1) were used as a reference concentration for upper interval samples. Generic soil-to-groundwater SSLs (DAF=20) from the *Soil Screening Guidance: Technical Background Document* (USEPA, 1996c) were used as a reference concentration for lower interval samples

ND = Not detected

NL = Not listed

NA = Not applicable

mg/kg = Milligrams per kilogram

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Dioxins (ng/kg)							
Dioxin (2,3,7,8-TCDD TEQs)[1]	642SB001	0.1749	1000	NA	NT	1900	NA
Inorganics (mg/kg)							
Aluminum (Al)	642SB001	6530	7800.0	18700	NT	1000000	23600
	642SB002	2130			NT		
	642SB003	1590			NT		
	642SB004	2420			NT		
	642SB005	1110			NT		
	642SB006	2050			NT		
	642SB007	1150			NT		
	642SB008	2530			3290		
	642SB009	2100			NT		
	642SB010	2610			NT		
Arsenic (As)	642SB001	6.5	0.43	17.2[a]	NT	29	15.5[a]
	642SB002	4.5			NT		
	642SB003	19.4			NT		
	642SB004	31.7			NT		
	642SB005	8.9			NT		
	642SB006	82			NT		
	642SB007	30.7			NT		
	642SB008	5			1.7		
	642SB009	6.4			NT		
	642SB010	13.5			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Barium (Ba)	642SB001	18.0	550.0	109	NT	1600	64.5
	642SB002	8.8			NT		
	642SB003	52.3			NT		
	642SB004	44.2			NT		
	642SB005	66.9			NT		
	642SB006	92.7			NT		
	642SB007	37.2			NT		
	642SB008	5.8			4.9		
	642SB009	67.3			NT		
	642SB010	39.8			NT		
Beryllium (Be)	642SB001	0.27	0.15	1.20	NT	63	1.63
	642SB002	0.24			NT		
	642SB003	0.75			NT		
	642SB004	0.46			NT		
	642SB005	0.40			NT		
	642SB006	1.20			NT		
	642SB007	0.58			NT		
	642SB008	0.32			0.10		
	642SB009	0.41			NT		
	642SB010	0.43			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Cadmium (Cd)	642SB001	0.24	3.9	1.07	NT	6	0.48
	642SB002	0.29			NT		
	642SB003	1.7			NT		
	642SB004	1.1			NT		
	642SB005	1.0			NT		
	642SB006	0.21			NT		
	642SB007	2.7			NT		
	642SB009	2.1			NT		
	642SB010	0.36			NT		
Calcium (Ca)	642SB001	18100	NL	NL	NT	NL	NL
	642SB002	59700			NT		
	642SB003	61600			NT		
	642SB004	39300			NT		
	642SB005	155000			NT		
	642SB006	4980			NT		
	642SB007	77500			NT		
	642SB008	5110			2080		
	642SB009	312000			NT		
	642SB010	33500			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Chromium (Cr)	642SB001	11.4	39 VI	42.8	NT	1000000	43.4[a]
	642SB002	5.3	7800 III		NT		
	642SB003	14			NT		
	642SB004	11			NT		
	642SB005	8.1			NT		
	642SB006	10.3			NT		
	642SB007	10.1			NT		
	642SB008	6.5			4.8		
	642SB009	23.5			NT		
	642SB010	11.8			NT		
Cobalt (Co)	642SB001	3.4	470.0	6.60	NT	2000	8.14
	642SB002	1.1			NT		
	642SB003	4.9			NT		
	642SB004	4			NT		
	642SB005	3			NT		
	642SB006	12.1			NT		
	642SB007	17.4			NT		
	642SB008	1.2			0.38		
	642SB009	7.7			NT		
	642SB010	2.6			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Copper (Cu)	642SB001	6.4	27000	260	NT	920	32.6
	642SB002	5.9			NT		
	642SB003	46.2			NT		
	642SB004	27.4			NT		
	642SB005	23.3			NT		
	642SB006	38.7			NT		
	642SB007	58.3			NT		
	642SB008	ND			2.1		
	642SB009	39.9			NT		
	642SB010	19.9			NT		
Iron (Fe)	642SB001	7600	2300	NL	NT	NL	NL
	642SB002	3080			NT		
	642SB003	13400			NT		
	642SB004	12400			NT		
	642SB005	4900			NT		
	642SB006	11800			NT		
	642SB007	12800			NT		
	642SB008	5360			2570		
	642SB009	5500			NT		
	642SB010	5970			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Lead(Pb)	642SB001	12.4	400.0	181	NT	400	66.3
	642SB002	6.5			NT		
	642SB003	47.2			NT		
	642SB004	70.3			NT		
	642SB005	43.1			NT		
	642SB006	17.6			NT		
	642SB007	48.4			NT		
	642SB008	2.8			3.9		
	642SB009	69.2			NT		
	642SB010	35			NT		
Magnesium (Mg)	642SB001	1054	NL	NL	NT	NL	NL
	642SB002	996			NT		
	642SB003	1270			NT		
	642SB004	638			NT		
	642SB005	2480			NT		
	642SB006	4090			NT		
	642SB007	33900			NT		
	642SB008	1070			296		
	642SB009	3920			NT		
	642SB010	1620			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Manganese (Mn)	642SB001	42.1	180.0	325	NT	1100	291
	642SB002	80.2			NT		
	642SB003	135			NT		
	642SB004	80			NT		
	642SB005	162			NT		
	642SB006	72.7			NT		
	642SB007	205			NT		
	642SB008	68.5			18.7		
	642SB009	350			NT		
	642SB010	56.5			NT		
Mercury (Hg)	642SB001	0.04	2.3	1.03	NT	2.1	0.31
	642SB003	0.04			NT		
	642SB005	0.06			NT		
	642SB009	0.06			NT		
	642SB010	0.04			NT		
Nickel (Ni)	642SB001	6.6	160.0	20.6	NT	130	18.3
	642SB002	4.7			NT		
	642SB003	27.6			NT		
	642SB004	17.2			NT		
	642SB006	53.2			NT		
	642SB007	253			NT		
	642SB008	1.9			1.9		
	642SB009	28.6			NT		
	642SB010	10.8			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Potassium (K)	642SB001	426	NL	NL	NT	NL	NL
	642SB003	279			NT		
	642SB008	539			ND		
	642SB009	596			NT		
	642SB010	266			NT		
Selenium (Se)	642SB001	0.46	39.0	1.22	NT	5	1.26
	642SB003	0.70			NT		
	642SB004	0.79			NT		
	642SB006	0.80			NT		
	642SB007	0.78			NT		
	642SB010	0.64			NT		
Sodium (Na)	642SB001	357	NL	NL	NT	NL	NL
	642SB008	1550			ND		
Thallium (Tl)	642SB001	0.40	0.63	0.85	NT	0.95	0.95
	642SB003	0.47			NT		
	642SB004	1.0			NT		
	642SB006	0.87			NT		
	642SB007	0.58			NT		

Table 10.5.4
Zone G
AOC 642
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Vanadium (V)	642SB001	19.8	55.0	60.9	NT	6000	72.5
	642SB002	5.4			NT		
	642SB003	26			NT		
	642SB004	38.2			NT		
	642SB005	15.2			NT		
	642SB006	14			NT		
	642SB007	18.6			NT		
	642SB008	8.1			4.0		
	642SB009	45.5			NT		
	642SB010	12.8			NT		
Zinc (Zn)	642SB001	22.5	2300.0	519	NT	12000	145
	642SB002	20.2			NT		
	642SB003	196			NT		
	642SB004	190			NT		
	642SB005	81			NT		
	642SB006	822			NT		
	642SB007	241			NT		
	642SB008	10.3			7.5		
	642SB009	218			NT		
	642SB010	58.1			NT		

Notes:

a	=	Background value for non-clay samples.
*	=	Residential RBCs (THQ=0.1) were used as a reference concentration for upper interval samples. Generic soil-to-groundwater SSLs (DAF=20) from the *Soil Screening Guidance: Technical Background Document* (USEPA, 1996b) were used as a reference concentration for lower interval samples.
1	=	Calculated from methods described in USEPA Interim *Supplemental Guidance to RAGS: Human Health Risk Assessment*, Bulletin 2 (USEPA, 1995c).
ND	=	Not detected.
NT	=	Not taken.
NL	=	Not listed.
NA	=	Not applicable.

Bolded concentrations exceed both the reference concentration (RBC or SSL) and the zone background.
All background values for Zone G are based on twice the means of the grid sample concentrations.

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Volatile Organic Compounds (µg/kg)							
Acetone	S08B01	130	780000	NA	NT	16000	NA
	S08B03	ND			160		
	S08B11	ND			170		
	S08B17	53			ND		
	S08B19	ND			29		
	S08B20	ND			170		
	S08B21	ND			76		
	S08B22	ND			200		
	S08B23	ND			1100		
	S08B24	ND			220		
	S08B25	56			140		
	S08B26	220			220		
	S08B30	ND			100		
	S08B31	120			160		
Carbon disulfide	S08B11	ND	780000	NA	7.9	32000	NA
	S08B31	2.1			ND		
2-Butanone	S08B25	7.8	4700000	NA	ND	7900	NA
	S08B30	ND			10		
	S08B31	12			ND		
	008SB001	2			NT		
	008SB003	6			NT		
	636SB002	30			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Chlorobenzene	S08B01	18	160000	NA	ND	1000	NA
	S08B02	ND			50		
	S08B03	ND			7.3		
	S08B05	53			NT		
	S08B07	11			NT		
	S08B09	8.5			NT		
	S08B11	185			35		
	S08B12	14			NT		
	S08B13	66			NT		
	S08B14	16			NT		
	S08B15	56			NT		
	S08B16	30			NT		
	S08B17	19			NT		
	S08B18	12			NT		
	S08B19	17			ND		
	S08B20	19			41		
	S08B22	9.2			28		
	S08B24	33			ND		
	S08B25	7.6			ND		
	S08B26	26			ND		
	S08B27	6.6			ND		
	S08B28	9.1			ND		
	S08B30	ND			46		
	S08B31	20			33		
Ethylbenzene	S08B11	840	780000	NA	ND	13000	NA
	S08B30	ND			6.6		
1,1,2,2-Tetrachloroethene	636SB009	ND	3200	NA	10	3	NA

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
1,1,2-Trichloroethane	S08B22	ND	11	NA	92	20	NA
1,1,1-Trichloroethane	S08B11	1600	160000	NA	ND	2000	NA
	S08B17	1.4			NT		
	S08B24	8.7			ND		
	S08B25	2.9			ND		
	S08B30	ND			3.8		
	S08B31	3.9			ND		
Toluene	S08B01	8.2	1600000	NA	NT	12000	NA
	S08B05	9.3			NT		
	S08B11	580			ND		
	S08B22	ND			5.8		
	S08B24	8.6			ND		
	S08B25	1.5			ND		
	S08B30	ND			6		
Vinyl acetate	S08B22	ND	7800000	NA	17	170000	NA
Xylene (total)	S08B11	3400	16000000	NA	ND	148000	NA
	S08B25	1.7			ND		
	S08B30	ND			14		
	S08B31	2.2			ND		
Semivolatile Organic Compounds (µg/kg)							
2,4-Dinitrotoluene	S08B12	130	16000	NA	ND	0.8	NA

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
BEQs[1]	S08B01	**450.0**	88.0	NA	NA	NA	NA
	S08B02	2.7			NA		
	S08B03	5.51			NA		
	S08B04	50.40			NA		
	S08B05	44.70			NA		
	S08B09	**133.20**			NA		
	S08B11	**85437.50**			NA		
	S08B12	**826.20**			NA		
	S08B14	**120.86**			NA		
	S08B15	**182.42**			NA		
	S08B16	78.38			NA		
	S08B17	**2309.90**			NA		
	S08B18	**9515.60**			NA		
	S08B19	68.86			NA		
	S08B25	0.68			NA		
	S08B26	**172.32**			NA		
	S08B27	1.33			NA		
	S08B28	ND			NA		
	S08B30	66.15			NA		
	S08B31	**20588.50**			NA		
	008SB003	**942.40**			NA		
	636SB001	**296.78**			NA		
	636SB002	**327.81**			NA		
	636SB003	**509.06**			NA		
	636SB004	ND			NA		
	636SB005	8.15			NA		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
BEQs[1] (continued)	636SB006	71.84	88.0	NA	NA	NA	NA
	636SB007	127.62			NA		
	636SB008	273.79			NA		
	636SB009	46.84			NA		
	636SB010	0.045			NA		
	636SB011	180.70			NA		
	636SB014	ND			NA		
Benzoic acid	636SB003	ND	31000000	NA	64	400000	NA
	636SB004	ND			63		
	636SB009	40			ND		
Naphthalene	S08B02	110	310000	NA	ND	84000	NA
	S08B03	ND			72		
	S08B04	38			NT		
	S08B12	ND			12000		
	S08B14	200			NT		
	S08B17	130			NT		
	S08B18	430			NT		
	S08B20	90			ND		
	S08B21	ND			670		
	S08B24	130			220		
	S08B28	ND			250		
	008SB001	320			ND		
	636SB004	77			130		
	636SB005	300			ND		
	636SB008	43			NT		
4-Chloroaniline	S08B14	780	31000	NA	NT	700	NA
Acenaphthylene	S08B12	100	230000	NA	ND	293000	NA

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
2-Methylnapthalene	S08B02	160	310000	NA	ND	126000	NA
	S08B03	ND			46		
	S08B04	60			ND		
	S08B12	ND			63000		
	S08B13	37			NT		
	S08B14	330			NT		
	S08B17	180			NT		
	S08B18	500			NT		
	S08B20	110			ND		
	S08B21	ND			1000		
	S08B22	ND			380		
	S08B24	180			320		
	S08B26	ND			180		
	S08B30	ND			125		
	008SB001	370			NT		
	636SB002	42			ND		
	636SB005	510			ND		
	636SB010	52			NT		
Acenaphthene	S08B11	5800	470000	NA	ND	570000	NA
	S08B12	130			ND		
	S08B15	140			NT		
	S08B17	530			NT		
	S08B18	2200			NT		
	S08B28	ND			830		
	S08B30	ND			93		
	S08B31	4700			ND		
	008SB003	51			NT		
	636SB008	81			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Dibenzofuran	S08B03	ND	31000	NA	52	50000	NA
	S08B11	2065			ND		
	S08B14	68			NT		
	S08B15	280			NT		
	S08B17	190.5			NT		
	S08B18	950			NT		
	S08B24	42			ND		
	S08B31	1400			ND		
	008SB001	62			NT		
	636SB005	120			ND		
	636SB008	76			NT		
Fluorene	S08B03	ND	310000	NA	52	560000	NA
	S08B11	5380			NT		
	S08B12	240			ND		
	S08B15	150			NT		
	S08B17	445			NT		
	S08B18	1900			NT		
	S08B28	ND			780		
	S08B31	3700			ND		
	008SB003	52			NT		
	636SB008	170			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Phenanthrene	S08B02	94	230000	NA	ND	1380000	NA
	S08B03	30			810		
	S08B04	67			NT		
	S08B06	46			NT		
	S08B09	110			NT		
	S08B11	65000			110		
	S08B12	3500			42000		
	S08B13	78			NT		
	S08B14	220			NT		
	S08B15	3000			NT		
	S08B17	2600			NT		
	S08B18	10000			NT		
	S08B19	44			NT		
	S08B20	55			ND		
	S08B21	ND			1700		
	S08B22	ND			790		
	S08B24	95			300		
	S08B25	87.5			39		
	S08B28	ND			4500		
	S08B30	140			590		
	S08B31	21500			ND		
	008SB001	130			NT		
	008SB003	1200			NT		
	636SB001	200			NT		
	636SB002	99			ND		
	636SB003	140			52		
	636SB004	ND			75		
	636SB005	270			48		
	636SB007	47			NT		
	636SB008	1700			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Anthracene	S08B03	ND	2300000	NA	180	12000000	NA
	S08B11	16600			32		
	S08B12	210			7100		
	S08B14	36			NT		
	S08B15	90			NT		
	S08B17	1200			NT		
	S08B18	3500			NT		
	S08B21	ND			600		
	S08B22	ND			480		
	S08B24	ND			73		
	S08B28	ND			1200		
	S08B30	ND			110		
	S08B31	7200			ND		
	008SB003	220			NT		
	636SB001	79			NT		
	636SB002	51			ND		
	636SB003	50			ND		
	636SB008	100			NT		
	636SB011	48			NT		
Carbazole	S08B03	ND	32000	NA	93	600	NA
	S08B11	3595			NT		
	S08B15	190			NT		
	S08B17	260			NT		
	S08B18	1200			NT		
	S08B28	ND			320		
	S08B31	1900			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Fluoranthene	S08B03	59.5	310000	NA	1100	4300000	NA
	S08B04	44			NT		
	S08B05	130			NT		
	S08B06	39			NT		
	S08B07	46			NT		
	S08B09	310			NT		
	S08B10	46			NT		
	S08B11	110500			400		
	S08B12	5300			7500		
	S08B13	60			NT		
	S08B14	290			NT		
	S08B15	2200			NT		
	S08B16	210			NT		
	S08B17	2750			NT		
	S08B18	12000			NT		
	S08B19	69			24		
	S08B20	ND			78		
	S08B21	ND			350		
	S08B22	ND			1100		
	S08B23	ND			68		
	S08B24	ND			670		
	S08B25	195			ND		
	S08B26	35			ND		
	S08B27	150			ND		
	S08B28	64			3700		
	S08B29	41			NT		
	S08B30	170			83		
	S08B31	29500			42		
	008SB003	1900			NT		
	636SB001	270			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Fluoranthene (continued)	636SB002	275	310000	NA	ND	4300000	NA
	636SB003	480			130		
	636SB004	ND			150		
	636SB005	53			130		
	636SB006	57			NT		
	636SB007	130			NT		
	636SB008	2700			NT		
	636SB009	41			ND		
	636SB010	42			NT		
	636SB011	370			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Pyrene	S08B01	490	230000	NA	NT	4200000	NA
	S08B03	49			1100		
	S08B04	88			NT		
	S08B05	140			NT		
	S08B07	48			NT		
	S08B09	310			NT		
	S08B10	49			NT		
	S08B11	107500			400		
	S08B12	5600			30000		
	S08B13	180			NT		
	S08B14	620			NT		
	S08B15	3700			NT		
	S08B16	360			NT		
	S08B17	3000			NT		
	S08B18	13000			NT		
	S08B19	150			64		
	S08B21	ND			2300		
	S08B22	ND			2900		
	S08B23	ND			53		
	S08B24	ND			2300		
	S08B25	210			54		
	S08B26	49			1300		
	S08B27	280			67		
	S08B28	64			5800		
	S08B29	47			NT		
	S08B30	150			290		
	S08B31	27000			53		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Pyrene (continued)	008SB001	42	230000	NA	NT	4200000	NA
	008SB003	2500			NT		
	636SB001	220			NT		
	636SB002	280			ND		
	636SB003	550			120		
	636SB004	ND			130		
	636SB005	52			110		
	636SB006	120			NT		
	636SB007	180			NT		
	636SB008	2600			NT		
	636SB009	49			120		
	636SB010	47			NT		
	636SB011	250			NT		
Butylbenzylphthalate	S08B05	62	1600000	NA	NT	930000	NA
	S08B14	52			NT		
	636SB006	130			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Benzo(a)anthracene	S08B03	ND	880	NA	590	2000	NA
	S08B09	140			NT		
	S08B11	**430200**			180		
	S08B12	660			ND		
	S08B15	200			NT		
	S08B17	**1950**			NT		
	S08B18	**7700**			NT		
	S08B21	ND			200		
	S08B24	ND			460		
	S08B28	ND			**2400**		
	S08B31	**16000**			ND		
	008SB003	**940**			NT		
	636SB001	130			NT		
	636SB002	182			ND		
	636SB003	270			62		
	636SB004	ND			67		
	636SB005	39			56		
	636SB006	47			NT		
	636SB007	83			NT		
	636SB008	240			NT		
	636SB011	170			NT		
	636SB014	ND			49		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Chrysene	S08B03	55.5	88000	NA	660	160000	NA
	S08B05	100			NT		
	S08B09	200			NT		
	S08B11	45000			ND		
	S08B12	2600			9300		
	S08B14	260			NT		
	S08B15	620			NT		
	S08B16	380			NT		
	S08B17	2150			NT		
	S08B18	7600			NT		
	S08B19	64			ND		
	S08B23	ND			46		
	S08B24	ND			670		
	S08B25	68			ND		
	S08B26	ND			320		
	S08B27	130			ND		
	S08B28	ND			2300		
	S08B30	ND			120		
	S08B31	19000			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Chrysene (continued)	008SB003	1100	88000	NA	NT	160000	NA
	636SB001	180			NT		
	636SB002	210			ND		
	636SB003	360			76		
	636SB004	ND			130		
	636SB005	52			88		
	636SB006	62			NT		
	636SB007	120			NT		
	636SB008	790			NT		
	636SB009	38			ND		
	636SB010	45			NT		
	636SB011	200			NT		
	636SB014	ND			65		
bis(2-Ethylhexyl)phthalate	S08B04	50	46000	NA	NT	3600000	NA
	S08B05	320			NT		
	S08B07	80			NT		
	S08B10	110			NT		
	S08B14	370			NT		
	S08B16	140			NT		
	S08B19	78			ND		
	636SB002	420			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Benzo(b)fluoranthene	S08B02	27	880	NA	ND	5000	NA
	S08B03	54.5			1300		
	S08B04	44			NT		
	S08B05	86			NT		
	S08B09	190			NT		
	S08B11	**41750**			210		
	S08B12	**2700**			ND		
	S08B15	400			NT		
	S08B16	130			NT		
	S08B17	**2000**			NT		
	S08B18	**9200**			NT		
	S08B19	98			84		
	S08B22	ND			760		
	S08B23	ND			67		
	S08B24	ND			630		
	S08B26	ND			120		
	S08B28	ND			2400		
	S08B31	**18000**			ND		
	008SB003	800			NT		
	636SB001	270			NT		
	636SB002	215			ND		
	636SB003	490			85		
	636SB004	ND			130		
	636SB005	42			120		
	636SB006	54			NT		
	636SB007	120			NT		
	636SB008	420			NT		
	636SB009	46			ND		
	636SB011	140			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Benzo(k)fluoranthene	S08B03	ND	8800	NA	370	49000	NA
	S08B11	20750			100		
	S08B12	760			5100		
	S08B14	70			NT		
	S08B15	180			NT		
	S08B17	775			NT		
	S08B18	2800			NT		
	S08B27	120			ND		
	S08B28	ND			730		
	S08B31	7400			ND		
	008SB003	830			NT		
	636SB001	160			NT		
	636SB002	180			ND		
	636SB003	270			70		
	636SB004	ND			110		
	636SB005	ND			71		
	636SB006	48			NT		
	636SB007	100			NT		
	636SB008	300			NT		
	636SB009	40			ND		
	636SB011	100			NT		
	636SB014	ND			56		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Benzo(a)pyrene	S08B01	450	88	NA	NT	8000	NA
	S08B03	ND			790		
	S08B04	46			NT		
	S08B05	36			NT		
	S08B09	100			NT		
	S08B11	31600			140		
	S08B12	480			3800		
	S08B14	110			NT		
	S08B15	120			NT		
	S08B16	65			NT		
	S08B17	1560			NT		
	S08B18	6700			NT		
	S08B19	59			ND		
	S08B21	ND			490		
	S08B22	ND			850		
	S08B23	ND			35		
	S08B26	ND			160		
	S08B28	ND			1600		
	S08B30	ND			57.5		
	S08B31	14000			ND		
	008SB003	730			NT		
	636SB001	200			NT		
	636SB002	187			ND		
	636SB003	360			78		
	636SB004	ND			72		
	636SB005	ND			69		
	636SB006	56			NT		
	636SB007	98			NT		
	636SB008	190			NT		
	636SB009	38			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Benzo(a)pyrene (continued)	636SB011	140	88	NA	NT	8000	NA
	636SB014	ND			50		
Indeno(1,2,3-cd)pyrene	S08B03	ND	880	NA	540	14000	NA
	S08B11	18400			ND		
	S08B14	99			NT		
	S08B17	850			NT		
	S08B18	2600			NT		
	S08B24	ND			250		
	S08B28	ND			760		
	S08B31	6950			ND		
	008SB003	290			NT		
	636SB001	130			NT		
	636SB002	190			ND		
	636SB003	170			ND		
	636SB004	ND			58		
	636SB005	ND			45		
	636SB006	52			NT		
	636SB007	82			NT		
	636SB008	140			NT		
	636SB009	38			ND		
	636SB011	85			NT		
Dibenz(a,h)anthracene	S08B03	ND	88	NA	150	2000	NA
	S08B11	4555			ND		
	S08B17	260			NT		
	S08B18	830			NT		
	S08B31	2400			ND		
	636SB001	42			NT		
	636SB002	80			ND		
	636SB003	53			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Benzo(g,h,i)perylene	S08B03	ND	230000	NA	570	4.66E08	NA
	S08B11	15850			ND		
	S08B14	120			NT		
	S08B15	94			NT		
	S08B17	740			NT		
	S08B18	2100			NT		
	S08B24	ND			160		
	S08B28	ND			750		
	S08B31	5750			ND		
	008SB003	320			NT		
	636SB001	120			NT		
	636SB002	175			ND		
	636SB003	160			ND		
	636SB004	ND			60		
	636SB005	ND			44		
	636SB006	89			NT		
	636SB007	87			NT		
	636SB008	150			NT		
	636SB009	38			ND		
	636SB011	90			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Pesticides/PCBs (µg/kg)							
Dieldrin	S08B01	8.5	40	NA	NT	4	NA
	S08B03	ND			610		
	S08B11	46			ND		
	S08B22	ND			66		
	S08B28	ND			7.9		
	008SB002	5.2			NT		
Aldrin	S08B11	41	380000	NA	ND	500	NA
	S08B12	ND			7.6		
Heptachlor	S08B09	3.9	140	NA	NT	23000	NA
Heptachlor epoxide	S08B01	5.1	70	NA	NT	700	NA
	S08B03	ND			250		
	S08B06	2.2			NT		
	S08B09	11			NT		
	S08B19	1.8			ND		
	S08B31	2.6			ND		
Endrin	S08B21	ND	2300	NA	47	1000	NA
	636SB005	ND			8.7		
Endrin aldehyde	S08B12	ND	2300	NA	71	1000	NA
	S08B14	4			NT		
	S08B22	ND			55		
	S08B24	ND			25		
Endrin ketone	S08B01	4.5	2300	NA	NT	1000	NA
	S08B28	ND			6		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Endosulfan II	S08B22	ND	47000	NA	19	18000	NA
4,4'-DDE	S08B01	13	1900.0	NA	NT	54000	NA
	S08B03	ND			43		
	S08B06	15			NT		
	S08B14	12			NT		
	S08B16	28			NT		
	S08B17	17			NT		
	S08B18	5.2			NT		
	S08B19	35			110		
	S08B22	ND			38		
	S08B24	ND			47		
	S08B27	ND			4.4		
	S08B28	ND			27		
	S08B31	77			ND		
	636SB001	11			NT		
	636SB002	117.5			ND		
	636SB003	5.7			ND		
	636SB004	ND			120		
	636SB005	14			ND		
	636SB006	45			NT		
	636SB007	5.2			NT		
	636SB008	22			NT		
	636SB009	17			ND		
	636SB011	6.5			NT		
	636SB013	3.1			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
4,4'-DDD	S08B01	45	2700	NA	NT	16000	NA
	S08B04	8.4			NT		
	S08B14	38			NT		
	S08B16	24			NT		
	S08B17	7.8			NT		
	S08B22	ND			71		
	S08B24	ND			130		
	S08B26	ND			23		
	S08B28	ND			58		
	S08B31	28.5			ND		
	636SB001	7.3			NT		
	636SB002	179			ND		
	636SB004	ND			180		
	636SB006	12			NT		
	636SB007	9.6			NT		
	636SB008	20			NT		
	636SB009	24			NT		
	636SB011	5			NT		
	636SB014	3.1			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
4,4'-DDT	S08B06	6.6	1900	NA	NT	32000	NA
	S08B19	29			200		
	S08B31	25			ND		
	008SB003	6.3			NT		
	636SB002	16			ND		
	636SB003	3.8			ND		
	636SB004	ND			34		
	636SB006	8.7			NT		
	636SB007	15			NT		
	636SB008	38			NT		
	636SB011	8.7			NT		
alpha-Chlordane	S08B03	ND	1800	NA	240	10000	NA
	S08B09	11			NT		
	S08B12	2.8			21		
	S08B16	7.3			NT		
	S08B17	7.3			NT		
	S08B24	ND			4.2		
	S08B31	11			ND		
	636SB002	3.2			ND		
	636SB005	3.8			ND		
	636SB006	3.4			NT		
	636SB007	2.2			NT		
	636SB008	3.1			NT		
	636SB009	6.3			ND		
	636SB011	4.2			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
gamma-Chlordane	S08B01	3.7	1800	NA	NT	10000	NA
	S08B03	3			ND		
	S08B06	4.4			NT		
	S08B07	2.8			NT		
	S08B08	4.5			NT		
	S08B09	51			NT		
	S08B12	4.4			ND		
	S08B16	22			NT		
	S08B17	33			NT		
	S08B19	5.1			8.4		
	S08B22	ND			34		
	S08B24	ND			19		
	S08B26	ND			8		
	S08B27	ND			2.8		
	S08B28	ND			14		
	S08B31	95.5			ND		
	008SB003	9.2			NT		
	636SB001	5.4			NT		
	636SB002	11.8			ND		
	636SB003	2.1			ND		
	636SB004	3.6			24		
	636SB005	20			ND		
	636SB006	4.6			NT		
	636SB007	11			NT		
	636SB008	19			NT		
	636SB009	51			ND		
	636SB011	5.3			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Aroclor-1260	S08B08	77	320	NA	NT	1000	NA
	S08B12	ND			570		
	636SB004	ND			410		
	636SB005	320			ND		
	636SB007	350			NT		
	636SB008	920			NT		
	636SB009	69			ND		
	636SB010	12			NT		
	636SB011	36			NT		
	636SB012	8.5			NT		
	636SB013	28			ND		
Explosives/Propellants (μg/kg)							
Hydrazine	008SB001	274	210	NA	NT	0.088	NA
	008SB002	88.4			NT		
	008SB003	76.4			NT		
	636SB002	19.1			67		
	636SB003	19.3			ND		
	636SB004	ND			13.9		
	636SB005	ND			19.1		
	636SB006	12.8			NT		
	636SB008	14.4			NT		
Dioxins (ng/kg)							
Dioxin (2,3,7,8-TCDD TEQs)[1]	636SB002	3.8765	1000	NA	NT	1900	NA

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Inorganics (mg/kg)							
Aluminium (Al)	S08B01	1700	7800.0	18700	NA	1000000	23600
	S08B02	4500			5600		
	S08B03	3650			8700		
	S08B04	2700			NT		
	S08B05	4000			NT		
	S08B06	2500			NT		
	S08B07	3900			NT		
	S08B08	4400			NT		
	S08B09	5100			NT		
	S08B10	2600			NT		
	S08B11	6705			9400		
	S08B12	2200			4700		
	S08B13	8100			NT		
	S08B14	1300			NT		
	S08B15	2400			NT		
	S08B16	1900			NT		
	S08B17	3625			NT		
	S08B18	2200			NT		
	S08B19	3100			3700		
	S08B20	2000			9900		
	S08B21	3900			7700		
	S08B22	2800			3400		
	S08B23	4200			17000		
	S08B24	1300			3600		
	S08B25	1130			3200		
	S08B26	12000			3900		
	S08B27	860			820		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Aluminum (Al) (continued)	S08B28	600	7800.0	18700	5900	1000000	23600
	S08B29	640			NT		
	S08B30	710			3175		
	S08B31	4605			14000		
	008SB001	3970			NT		
	008SB002	5230			NT		
	008SB003	5440			NT		
	636SB001	5900			NT		
	636SB002	6435			8110		
	636SB003	12100			12300		
	636SB004	2690			10100		
	636SB005	2200			11700		
	636SB006	3950			NT		
	636SB007	7450			NT		
	636SB008	10100			NT		
	636SB009	5360			36500		
	636SB010	6770			NT		
	636SB011	3890			NT		
	636SB012	1840			NT		
	636SB013	9510			12800		
	636SB014	8330			16600		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Antimony (Sb)	S08B03	ND	3.1	2.89	32	5	NL
	S08B11	7.4			ND		
	S08B14	7.6			NT		
	S08B22	ND			23		
	S08B24	ND			21		
	S08B31	ND			7.6		
	636SB009	6.4			ND		
	636SB010	0.66			NT		
	636SB011	1.5			NT		
	636SB013	ND			0.65		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC[a] (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL[a] (DAF=20)	Subsurface Background
Arsenic (As)	S08B01	10	0.43	17.2[a]	NT	29	15.5[a]
	S08B02	20			8		
	S08B03	2.95			21		
	S08B04	5.6			NT		
	S08B05	1.6			NT		
	S08B06	5			NT		
	S08B07	1.9			NT		
	S08B08	6.9			NT		
	S08B09	5.9			NT		
	S08B10	3.1			NT		
	S08B11	9.3			9.6		
	S08B12	2.2			2.2		
	S08B13	8.6			NT		
	S08B14	6.2			NT		
	S08B15	2.2			NT		
	S08B16	3.5			NT		
	S08B17	7.05			NT		
	S08B18	3.8			NT		
	S08B19	5.9			5.7		
	S08B20	8.4			12		
	S08B21	3.6			ND		
	S08B22	2.6			6.6		
	S08B23	ND			12		
	S08B24	150			7.9		
	S08B25	7.9			ND		
	S08B26	7.6			2.8		
	S08B27	4			3		
	S08B28	3.8			6.5		
	S08B29	2.1			NT		
	S08B30	3			1.45		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Arsenic (As) (continued)	S08B31	8.85	0.43	17.2[a]	7.6	29	15.5[a]
	008SB001	12.7			NT		
	008SB002	1.5			NT		
	008SB003	6.7			NT		
	636SB001	7.1			NT		
	636SB002	7.05			5.1		
	636SB003	11.4			13.5		
	636SB004	2.7			9.2		
	636SB005	22.8			12.3		
	636SB006	2.3			NT		
	636SB007	5.1			NT		
	636SB008	6.7			NT		
	636SB009	5.5			18.4		
	636SB010	22.4			NT		
	636SB011	4.7			NT		
	636SB012	2.1			NT		
	636SB013	17.2			13.2		
	636SB014	1.2			8.4		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Barium (Ba)	S08B01	29	550.0	109	NT	1600	64.5
	S08B02	63			27		
	S08B03	11.15			500		
	S08B04	15			NT		
	S08B05	7.6			NT		
	S08B06	52			NT		
	S08B07	9.1			NT		
	S08B08	28			NT		
	S08B09	28			NT		
	S08B10	14			NT		
	S08B11	58.1			93		
	S08B12	14			69		
	S08B13	28			NT		
	S08B14	36			NT		
	S08B15	13			NT		
	S08B16	13			NT		
	S08B17	50.6			NT		
	S08B18	34			NT		
	S08B19	45			13		
	S08B20	42			40		
	S08B21	12			35		
	S08B22	15			100		
	S08B23	3.7			39		
	S08B24	120			77		
	S08B25	7.0			4.8		
	S08B26	20			12		
	S08B27	4.8			5.6		
	S08B28	4.3			62		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Barium (Ba) (continued)	S08B29	5	550.0	109	NT	1600	64.5
	S08B30	5			7.1		
	S08B31	67.1			40		
	008SB001	16.2			NT		
	008SB002	7.9			NT		
	008SB003	24.5			NT		
	636SB001	35.7			NT		
	636SB002	48.1			25.7		
	636SB003	26.3			35.8		
	636SB004	10.4			37.6		
	636SB005	52.4			29.4		
	636SB006	10.9			NT		
	636SB007	99.1			NT		
	636SB008	48.0			NT		
	636SB009	39.0			43.6		
	636SB010	43.7			NT		
	636SB011	28.8			NT		
	636SB012	11.9			NT		
	636SB013	34.3			40.7		
	636SB014	7.1			72.2		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Beryllium (Be)	S08B11	ND	0.15	1.20	1.0	63	1.63
	S08B22	ND			0.6		
	S08B23	ND			1.2		
	S08B24	0.69			ND		
	008SB001	0.23			ND		
	008SB002	0.13			ND		
	008SB003	0.35			ND		
	636SB001	0.38			ND		
	636SB002	0.41			0.28		
	636SB003	0.66			0.71		
	636SB004	0.25			0.57		
	636SB005	0.51			0.82		
	636SB006	0.18			NT		
	636SB007	0.35			NT		
	636SB008	0.48			NT		
	636SB009	1.0			1.6		
	636SB010	0.53			NT		
	636SB011	0.22			NT		
	636SB012	0.18			NT		
	636SB013	0.85			0.91		
	636SB014	0.14			0.77		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Cadmium (Cd)	S08B03	ND	3.9	1.07	5.9	8	0.48
	S08B08	0.7			NT		
	S08B11	1.85			ND		
	S08B12	0.63			2.0		
	S08B14	1.1			NT		
	S08B17	0.77			NT		
	S08B19	0.59			ND		
	S08B20	ND			1.6		
	S08B21	ND			1.0		
	S08B22	ND			1.2		
	S08B23	ND			2.0		
	S08B24	ND			1.2		
	S08B29	0.6			NT		
	008SB003	0.21			NT		
	636SB001	0.56			NT		
	636SB002	0.33			ND		
	636SB003	0.20			0.29		
	636SB004	0.26			0.39		
	636SB005	0.12			0.67		
	636SB006	0.22			NT		
	636SB007	0.41			NT		
	636SB008	0.41			NT		
	636SB009	0.49			0.46		
	636SB010	0.24			NT		
	636SB011	0.32			NT		
	636SB012	0.37			NT		
	636SB013	0.11			0.1		
	636SB014	ND			0.19		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Calcium (Ca)	S08B01	11000	NL	NL	NT	NL	NL
	S08B02	11000			170000		
	S08B03	23500			11000		
	S08B04	190000			NT		
	S08B05	10000			NT		
	S08B06	88000			NT		
	S08B07	7500			NT		
	S08B08	19000			NT		
	S08B09	18000			NT		
	S08B10	43000			NT		
	S08B11	9950			5000		
	S08B12	210000			74000		
	S08B13	58000			NT		
	S08B14	38000			NT		
	S08B15	140000			NT		
	S08B16	65000			NT		
	S08B17	43850			NT		
	S08B18	160000			NT		
	S08B19	57000			39000		
	S08B20	79000			45000		
	S08B21	8800			43000		
	S08B22	56000			47000		
	S08B23	5800			16000		
	S08B24	50000			20000		
	S08B25	257500			8700		
	S08B26	41000			24000		
	S08B27	330000			18000		
	S08B28	320000			81000		
	S08B29	330000			NT		
	S08B30	330000			35450		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Calcium (Ca) (continued)	S08B3101	98500	NL	NL	55000	NL	NL
	008SB001	4760			NT		
	008SB002	6270			NT		
	008SB003	9470			NT		
	636SB001	39400			NT		
	636SB002	23900			1660		
	636SB003	35900			32000		
	636SB004	156000			25300		
	636SB005	7920			51300		
	636SB006	34300			NT		
	636SB007	10000			NT		
	636SB008	26500			NT		
	636SB009	15700			14700		
	636SB010	54400			NT		
	636SB011	50700			NT		
	636SB012	236000			NT		
	636SB013	18400			18400		
	636SB014	4090			9890		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC[a] (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL[a] (DAF=20)	Subsurface Background
Chromium (Cr)	S08B01	21	39 VI	42.8	NT	1000000	43.4[a]
	S08B02	6.5	7800 III		34		
	S08B03	6.1			103		
	S08B04	6.6			NT		
	S08B05	8			NT		
	S08B06	7.8			NT		
	S08B07	6.5			NT		
	S08B08	20			NT		
	S08B09	17			NT		
	S08B10	8.2			NT		
	S08B11	40.9			23		
	S08B12	18			22		
	S08B13	27			NT		
	S08B14	37			NT		
	S08B15	11			NT		
	S08B17	52			NT		
	S08B18	48			NT		
	S08B19	25			14		
	S08B20	4.2			33		
	S08B21	4.5			35		
	S08B22	3.7			26		
	S08B23	4.5			49		
	S08B24	5.4			32		
	S08B25	6.25			5.1		
	S08B26	24			9.9		
	S08B27	11			5.1		
	S08B28	5.6			60		
	S08B29	4.1			NT		
	S08B30	5			5.75		
	S08B31	103			29		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Chromium (Cr) (continued)	008SB001	4.9	39 VI	42.8	NT	1000000	43.4[a]
	008SB002	5.8	7800 III		NT		
	008SB003	12.3			NT		
	636SB001	19.2			NT		
	636SB002	13.25			12.4		
	636SB003	24.2			24.1		
	636SB004	5.8			23.1		
	636SB005	4.6			36.4		
	636SB006	6.5			NT		
	636SB007	13.8			NT		
	636SB008	26.0			NT		
	636SB009	64.2			54.4		
	636SB010	15.9			NT		
	636SB011	8.6			NT		
	636SB012	5.0			NT		
	636SB013	19.2			27.0		
	636SB014	7.3			25.4		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Cobalt (Co)	S08B01	7.3	470.0	6.60	NT	2000	8.14
	S08B02	1.4			1.5		
	S08B03	1.2			12		
	S08B04	2.1			NT		
	S08B06	1.4			NT		
	S08B08	1.9			NT		
	S08B09	1.5			NT		
	S08B11	4.95			4.7		
	S08B12	3.4			3.5		
	S08B13	3.2			NT		
	S08B14	3.2			NT		
	S08B15	2.2			NT		
	S08B17	2.9			NT		
	S08B20	1.9			3.9		
	S08B21	ND			2.8		
	S08B22	ND			7		
	S08B23	1.2			7.9		
	S08B24	3			3.5		
	S08B25	2.35			ND		
	S08B26	3.6			ND		
	S08B27	2.4			ND		
	S08B28	2.3			3.6		
	S08B29	2.7			NT		
	S08B30	2.1			1.5		
	S08B31	7.35			4.3		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Cobalt (Co) (continued)	008SB002	0.55	470.0	6.60	NT	2000	8.14
	008SB003	2.20			NT		
	636SB001	1.8			NT		
	636SB002	9.95			1.9		
	636SB003	3.1			3.2		
	636SB004	14.0			2.7		
	636SB005	3.0			2.9		
	636SB006	0.95			NT		
	636SB007	1.5			NT		
	636SB008	5.7			NT		
	636SB009	11.9			9.4		
	636SB010	2.6			NT		
	636SB011	1.6			NT		
	636SB012	2.1			NT		
	636SB013	9.6			4.2		
	636SB014	0.96			4.2		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Copper (Cu)	S08B01	400	27000	260	NT	920	32.6
	S08B02	11			40		
	S08B03	20.5			**2700**		
	S08B04	17			NT		
	S08B05	7.9			NT		
	S08B06	12			NT		
	S08B07	4.7			NT		
	S08B08	120			NT		
	S08B09	96			NT		
	S08B10	33			NT		
	S08B11	159			84		
	S08B12	39			**14000**		
	S08B13	250			NT		
	S08B14	150			NT		
	S08B15	37			NT		
	S08B17	74.7			NT		
	S08B20	9.1			27		
	S08B21	ND			46		
	S08B22	ND			400		
	S08B23	ND			64		
	S08B24	17			350		
	S08B25	9.3			ND		
	S08B26	13			9.7		
	S08B27	3.1			ND		
	S08B28	3.5			71		
	S08B29	4.4			ND		
	S08B30	6.6			3.2		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Copper (Cu) (continued)	S08B31	81.55	27000	260	13	920	32.6
	008SB001	5.0			NT		
	008SB002	6.5			NT		
	008SB003	60.4			NT		
	636SB001	1330			NT		
	636SB002	19.5			2.4		
	636SB003	18.0			30.6		
	636SB004	15.3			109.0		
	636SB005	12.8			134.0		
	636SB006	45.7			NT		
	636SB007	515.0			NT		
	636SB008	68.5			NT		
	636SB009	235			33.7		
	636SB010	13.6			NT		
	636SB011	60.4			NT		
	636SB012	10.6			NT		
	636SB013	160			15.6		
	636SB014	0.76			26.6		
Cyanide (CN)	008SB003	0.3	160	0.38	NT	40	0.22
	636SB002	0.22			NT		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Iron (Fe)	S08B01	8600	2300	NL	NT	NL	NL
	S08B02	2200			53000		
	S08B03	2900			78000		
	S08B04	3600			NT		
	S08B05	1700			NT		
	S08B06	3800			NT		
	S08B07	3400			NT		
	S08B08	7700			NT		
	S08B09	7900			NT		
	S08B10	2900			NT		
	S08B11	26900			16000		
	S08B12	4100			15000		
	S08B13	8800			NT		
	S08B14	5500			NT		
	S08B15	3500			NT		
	S08B16	4100			NT		
	S08B17	6065			NT		
	S08B18	4200			NT		
	S08B19	5700			6100		
	S08B20	3300			76000		
	S08B21	2100			9400		
	S08B22	1600			11000		
	S08B23	1900			37000		
	S08B24	3400			7500		
	S08B25	3325			2300		
	S08B26	14000			3000		
	S08B27	3800			3500		
	S08B28	2900			6900		
	S08B29	2100			NT		
	S08B30	2500			3365		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Iron (Fe) (continued)	S08B31	6730	2300.0	NL	15000	NL	NL
	008SB001	1650			NT		
	008SB002	2070			NT		
	008SB003	6760			NT		
	636SB001	7560			NT		
	636SB002	7400			11300		
	636SB003	14600			14700		
	636SB004	3460			10800		
	636SB005	4470			14100		
	636SB006	2770			NT		
	636SB007	8600			NT		
	636SB008	10500			NT		
	636SB009	12200			37500		
	636SB010	6730			NT		
	636SB011	4900			NT		
	636SB012	2450			NT		
	636SB013	10200			16800		
	636SB014	1790			14400		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Lead (Pb)	S08B01	310	400.0	181	NT	400	66.3
	S08B02	11			9.8		
	S08B03	8.15			1400		
	S08B04	19			NT		
	S08B05	19			NT		
	S08B06	41			NT		
	S08B07	6.8			NT		
	S08B08	76			NT		
	S08B09	53			NT		
	S08B10	21			NT		
	S08B11	187			40		
	S08B12	29			630		
	S08B13	34			NT		
	S08B14	230			NT		
	S08B15	41			NT		
	S08B16	340			NT		
	S08B17	160			NT		
	S08B18	23			NT		
	S08B19	180			120		
	S08B20	6.3			47		
	S08B21	6.1			37		
	S08B22	2.3			390		
	S08B23	29			38		
	S08B24	11			310		
	S08B25	11.4			3		
	S08B26	56			19		
	S08B27	15			2.4		
	S08B28	9.4			140		
	S08B29	4.4			NT		
	S08B30	8.5			7.0		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Lead (Pb) (continued)	S08B31	95.1	400.0	181	20	400	66.3
	008SB001	10.6			NT		
	008SB002	6.6			NT		
	008SB003	48.3			NT		
	636SB001	102			NT		
	636SB002	453.5			13.7		
	636SB003	42.2			40.1		
	636SB004	14.1			93.2		
	636SB005	6.9			19.0		
	636SB006	16.3			NT		
	636SB007	97.1			NT		
	636SB008	87.5			NT		
	636SB009	394			60.1		
	636SB010	51.8			NT		
	636SB011	43.9			NT		
	636SB012	5.9			NT		
	636SB013	66.2			42.1		
	636SB014	4.9			78.0		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Magnesium (Mg)	S08B01	420	NL	NL	NT	NL	NL
	S08B02	270			4400		
	S08B03	405			3800		
	S08B04	2000			NT		
	S08B05	260			NT		
	S08B06	1200			NT		
	S08B07	440			NT		
	S08B08	1400			NT		
	S08B09	1200			ND		
	S08B10	550			NT		
	S08B11	1570			2800		
	S08B12	2300			1000		
	S08B13	2200			NT		
	S08B14	610			NT		
	S08B15	2600			NT		
	S08B16	800			NT		
	S08B17	1890			NT		
	S08B18	3200			NT		
	S08B19	1100			2200		
	S08B20	990			2400		
	S08B21	260			1900		
	S08B22	670			1300		
	S08B23	140			4700		
	S08B24	620			1000		
	S08B25	2450			320		
	S08B26	2300			1000		
	S08B27	3200			420		
	S08B28	3100			3100		
	S08B29	3300			ND		
	S08B30	3100			669.5		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Magnesium (Mg) (continued)	S08B31	4100	NL	NL	4500	NL	NL
	008SB001	218			NT		
	008SB002	300			NT		
	008SB003	774			NT		
	636SB001	1700			NT		
	636SB002	1073.5			522		
	636SB003	2350			3090		
	636SB004	1610			2010		
	636SB005	250			3940		
	636SB006	830			NT		
	636SB007	1070			NT		
	636SB008	1990			NT		
	636SB009	1330			7770		
	636SB010	1530			NT		
	636SB011	702			NT		
	636SB012	2550			NT		
	636SB013	1370			2980		
	636SB014	262			2860		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Manganese (Mn)	S08B01	41	180.0	325	NT	1100	291
	S08B02	13			81		
	S08B03	25.5			520		
	S08B04	90			NT		
	S08B05	22			NT		
	S08B06	79			NT		
	S08B07	24			NT		
	S08B08	78			NT		
	S08B09	50			NT		
	S08B10	29			NT		
	S08B11	282			130		
	S08B12	150			90		
	S08B13	130			NT		
	S08B14	54			NT		
	S08B15	150			NT		
	S08B16	52			NT		
	S08B17	53.3			NT		
	S08B18	110			NT		
	S08B19	82			140		
	S08B20	69			210		
	S08B21	13			120		
	S08B22	36			100		
	S08B23	5.7			1600		
	S08B24	33			72		
	S08B25	133			18		
	S08B26	270			42		
	S08B27	180			69		
	S08B28	160			80		
	S08B29	270			NT		
	S08B30	170			30.4		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Manganese (Mn) (continued)	S08B31	113	180.0	325	140	1100	291
	008SB001	16.0			NT		
	008SB002	19.5			NT		
	008SB003	113			NT		
	636SB001	86.8			NT		
	636SB002	60.95			23.0		
	636SB003	253			186		
	636SB004	86.4			107		
	636SB005	21.8			425		
	636SB006	40.8			NT		
	636SB007	71.4			NT		
	636SB008	82.5			NT		
	636SB009	106			706		
	636SB010	80.7			NT		
	636SB011	75.9			NT		
	636SB012	154			NT		
	636SB013	37.3			229		
	636SB014	7.2			244		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Mercury (Hg)	S08B01	0.63	2.3	1.03	NT	2.1	0.31
	S08B02	0.03			0.067		
	S08B03	0.075			6.9		
	S08B04	0.023			NT		
	S08B05	0.044			NT		
	S08B06	0.065			NT		
	S08B07	0.042			NT		
	S08B08	0.62			NT		
	S08B09	0.2			NT		
	S08B10	0.086			NT		
	S08B11	0.63			0.12		
	S08B12	0.021			5.1		
	S08B13	0.13			NT		
	S08B14	0.19			NT		
	S08B15	0.11			NT		
	S08B16	0.033			NT		
	S08B17	0.14			NT		
	S08B18	0.027			NT		
	S08B19	0.037			0.056		
	S08B20	0.014			0.15		
	S08B21	0.027			0.073		
	S08B22	0.018			0.25		
	S08B23	0.017			0.15		
	S08B24	0.012			2.1		
	S08B25	0.03			ND		
	S08B26	0.074			0.058		
	S08B28	ND			0.13		
	S08B30	0.012			0.435		
	S08B31	0.15			0.058		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Mercury (Hg) (continued)	636SB001	0.07	2.3	1.03	NT	2.1	0.31
	636SB002	0.085			ND		
	636SB003	0.12			1.1		
	636SB004	0.13			0.35		
	636SB005	ND			0.19		
	636SB006	0.04			NT		
	636SB007	0.34			NT		
	636SB008	0.41			NT		
	636SB009	0.21			0.31		
	636SB010	0.26			NT		
	636SB011	0.32			NT		
	636SB012	0.25			NT		
	636SB013	0.06			0.21		
	636SB014	0.04			1.1		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Nickel (Ni)	S08B01	13	160.0	20.6	NT	130	18.3
	S08B02	ND			16		
	S08B03	ND			79		
	S08B04	6.9			NT		
	S08B06	5.8			NT		
	S08B08	8.1			NT		
	S08B09	9.3			ND		
	S08B11	20.15			8.9		
	S08B12	13			22		
	S08B13	25			NT		
	S08B14	13			NT		
	S08B15	8.5			NT		
	S08B16	5.6			NT		
	S08B17	13.95			NT		
	S08B18	9.9			NT		
	S08B19	13			5.8		
	S08B20	5.3			11		
	S08B21	ND			14		
	S08B22	ND			32		
	S08B23	ND			16		
	S08B24	6.5			21		
	S08B25	7.3			ND		
	S08B26	8.8			ND		
	S08B27	8.4			ND		
	S08B28	7.7			14		
	S08B29	8			NT		
	S08B30	7.4			5.1		
	S08B31	25.1			10		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Nickel (Ni) (continued)	008SB001	2.7	160.0	20.6	NT	130	18.3
	008SB002	2.2			NT		
	008SB003	8.2			NT		
	636SB001	7.8			NT		
	636SB002	5.9			1.6		
	636SB003	9.2			9.0		
	636SB004	5.5			9.0		
	636SB005	8.1			11.9		
	636SB006	27.0			NT		
	636SB007	5.1			NT		
	636SB008	8.4			NT		
	636SB009	34.4			17.1		
	636SB010	8.8			NT		
	636SB011	5.1			NT		
	636SB012	6.3			NT		
	636SB013	20.1			8.3		
	636SB014	1.9			8.7		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Potassium (K)	S08B01	130	NL	NL	NT	NL	NL
	S08B02	110			730		
	S08B03	130			1200		
	S08B04	270			NT		
	S08B06	210			NT		
	S08B07	140			NT		
	S08B08	540			NT		
	S08B09	410			NT		
	S08B10	140			NT		
	S08B11	545			1400		
	S08B12	290			780		
	S08B13	630			NT		
	S08B14	150			NT		
	S08B15	320			NT		
	S08B16	160			NT		
	S08B17	603.5			NT		
	S08B18	660			NT		
	S08B19	230			330		
	S08B20	210			840		
	S08B21	120			1000		
	S08B22	140			410		
	S08B23	ND			2300		
	S08B24	190			390		
	S08B25	309			ND		
	S08B26	990			330		
	S08B27	440			170		
	S08B28	310			1200		
	S08B29	320			ND		
	S08B30	280			159		
	S08B31	1365			1700		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Potassium (K) (continued)	008SB003	318	NL	NL	NT	NL	NL
	636SB001	510			NT		
	636SB002	274			ND		
	636SB003	990			1420		
	636SB004	313			923		
	636SB005	ND			1260		
	636SB006	247			NT		
	636SB007	463			NT		
	636SB008	599			NT		
	636SB009	634			3970		
	636SB010	652			NT		
	636SB011	264			NT		
	636SB012	522			NT		
	636SB013	709			1560		
	636SB014	ND			1690		
Selenium (Se)	008SB001	0.48	39.0	1.22	NT	5	1.26
	008SB003	0.51			NT		
	636SB001	0.38			NT		
	636SB002	0.56			0.66		
	636SB003	0.73			0.59		
	636SB004	ND			0.81		
	636SB005	0.50			0.79		
	636SB008	0.74			ND		
	636SB009	ND			2.2		
	636SB010	0.35			NT		
	636SB013	0.85			0.90		
	636SB014	0.89			0.84		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Silver	S08B01	1.2	39	NL	NT	34	NL
	S08B03	ND			3.4		
	636SB009	ND			0.81		
Sodium (Na)	S08B01	110	NL	NL	NT	NL	NL
	S08B02	ND			1100		
	S08B03	435			3200		
	S08B04	290			NT		
	S08B06	170			NT		
	S08B07	370			NT		
	S08B08	650			NT		
	S08B09	310			NT		
	S08B10	690			NT		
	S08B11	301.5			3300		
	S08B12	240			450		
	S08B13	950			NT		
	S08B14	210			NT		
	S08B15	220			NT		
	S08B16	370			NT		
	S08B17	176.5			NT		
	S08B18	410			NT		
	S08B19	150			190		
	S08B20	150			2700		
	S08B21	220			1400		
	S08B22	150			920		
	S08B23	ND			3900		
	S08B24	140			710		
	S08B25	422			170		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Sodium (Na) (continued)	S08B26	1000	NL	NL	1200	NL	NL
	S08B27	240			870		
	S08B28	240			1100		
	S08B29	220			NT		
	S08B30	310			399		
	S08B31	662.5			4200		
	008SB002	240			NT		
	008SB003	275			NT		
	636SB001	635			NT		
	636SB003	748			3700		
	636SB004	ND			2260		
	636SB005	ND			2770		
	636SB007	1180			NT		
	636SB008	802			NT		
	636SB009	1580			11600		
	636SB010	553			NT		
	636SB011	793			NT		
	636SB012	342			NT		
	636SB013	646			3470		
	636SB014	723			2160		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Thallium (Tl)	008SB003	0.65	0.63	0.85	NT	0.95	0.95
	636SB001	0.82			NT		
	636SB002	0.42			ND		
	636SB003	**0.92**			0.61		
	636SB005	ND			0.88		
	636SB009	0.73			**1.0**		
	636SB010	0.59			NT		
	636SB013	ND			0.90		
	636SB014	ND			0.54		
Tin (Sn)	636SB009	34.2	4700	9.67	ND	11000	2.96
	636SB010	1.1			NT		
	636SB011	4.2			NT		
	636SB012	1.1			NT		
	636SB014	0.75			ND		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Vanadium (V)	S08B01	6.5	55.0	60.9	NT	6000	72.5
	S08B02	8.4			22		
	S08B03	6.7			96		
	S08B04	6.1			NT		
	S08B05	13			NT		
	S08B06	6.9			NT		
	S08B07	6.3			NT		
	S08B08	18			NT		
	S08B09	13			NT		
	S08B10	6.2			NT		
	S08B11	28.3			25		
	S08B12	14			15		
	S08B13	28			NT		
	S08B14	8			NT		
	S08B15	20			NT		
	S08B16	15			NT		
	S08B17	24.25			NT		
	S08B18	9			NT		
	S08B19	13			13		
	S08B20	6.8			30		
	S08B21	4.3			27		
	S08B22	3.3			58		
	S08B23	4.2			16		
	S08B24	8.7			26		
	S08B25	5.25			4		
	S08B26	28			9.3		
	S08B27	8.1			4.9		
	S08B28	4.4			20		
	S08B29	5.8			NT		
	S08B30	4			5.15		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Vanadium (V) (continued)	S08B31	17.75	55.0	60.9	33	6000	72.5
	008SB001	4.2			NT		
	008SB002	5.0			NT		
	008SB003	13.3			NT		
	636SB001	20.7			NT		
	636SB002	15.6			19.6		
	636SB003	30.4			31.7		
	636SB004	5.5			25.7		
	636SB005	12.7			30.8		
	636SB006	7.6			NT		
	636SB007	16.8			NT		
	636SB008	21.2			NT		
	636SB009	15.8			82.0		
	636SB010	18.5			NT		
	636SB011	9.5			NT		
	636SB012	9.5			NT		
	636SB013	23.6			30.6		
	636SB014	6.9			33.7		

Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Zinc (Zn)	S08B01	500	2300.0	519	NT	12000	145
	S08B02	8.7			110		
	S08B03	27.5			2300		
	S08B04	19			NT		
	S08B05	39			NT		
	S08B06	53			NT		
	S08B07	13			NT		
	S08B08	190			NT		
	S08B09	120			NT		
	S08B10	44			NT		
	S08B11	609.5			130		
	S08B12	110			3300		
	S08B13	170			NT		
	S08B14	640			NT		
	S08B15	54			NT		
	S08B16	87			NT		
	S08B17	157			NT		
	S08B18	93			NT		
	S08B19	130			50		
	S08B20	16			62		
	S08B21	2.8			69		
	S08B22	4.9			810		
	S08B23	5.7			110		
	S08B24	9.7			550		
	S08B25	23.9			4.9		
	S08B26	40			26		
	S08B27	23			6.7		
	S08B28	16			160		
	S08B29	14			NT		
	S08B30	18			10.4		

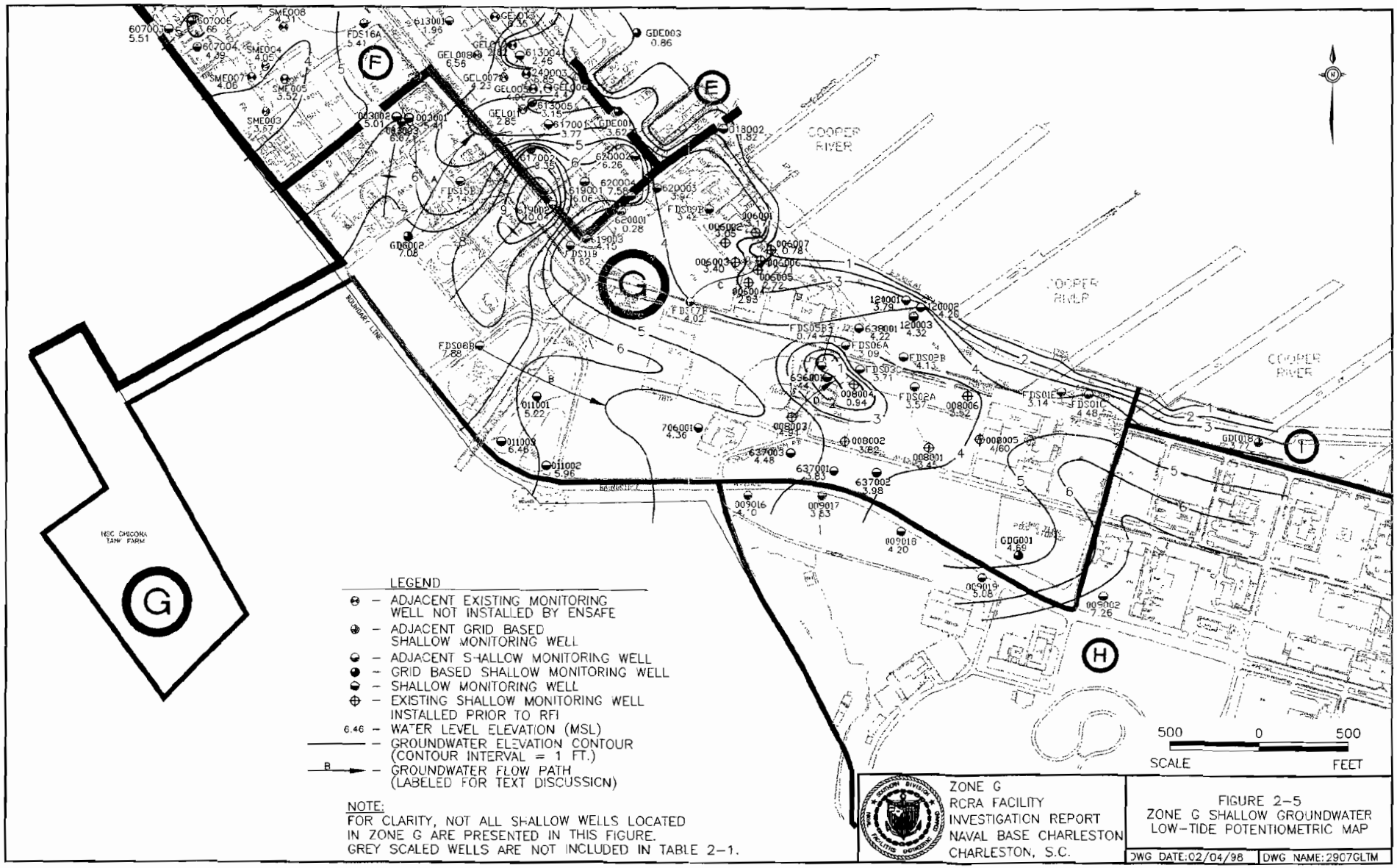
Table 10.6.5
Zone G
SWMU 8 and AOC 636
Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
Zinc (Zn) (continued)	S08B31	223	2300.0	519	54	12000	145
	008SB001	6.5			NT		
	008SB002	13.4			NT		
	008SB003	124			NT		
	636SB001	179			NT		
	636SB002	271.5			15.7		
	636SB003	50.6			88.1		
	636SB004	33.7			231		
	636SB005	15.7			87.5		
	636SB006	38.3			NT		
	636SB007	196			NT		
	636SB008	140			NT		
	636SB009	1270			150		
	636SB010	35.9			NT		
	636SB011	195			NT		
	636SB012	30.5			NT		
	636SB013	109			75.7		
	636SB014	3.1			98.6		

Notes:

a	=	Background value for non-clay samples
*	=	Residential RBCs (THQ=0.1) were used as a reference concentration for upper interval samples. Generic soil to groundwater SSLs (DAF=20) from the *Soil Screening Guidance: Technical Background Document* (USEPA, 1996b) were used as a reference concentration for lower interval samples
1	=	Calculated from methods described in USEPA Interim *Supplemental Guidance to RAGS: Human Health Risk Assessment*, Bulletin 2 (USEPA, 1995c)
ND	=	Not detected
NT	=	Not taken
NL	=	Not listed
NA	=	Not applicable
µg/kg	=	Micrograms per kilogram
mg/kg	=	Milligrams per kilogram

Bolded concentrations exceed both the reference concentration (RBC or SSL) and the zone background
All background values for Zone G are based on twice the means of the grid sample concentrations


COOPER RIVER
COOPER RIVER
COOPER RIVER
NSC CHECORA TANK FARM
BOUNDARY LINE
F
E
G
H
LEGEND
– ADJACENT EXISTING MONITORING WELL NOT INSTALLED BY ENSAFE
– ADJACENT GRID BASED SHALLOW MONITORING WELL
– ADJACENT SHALLOW MONITORING WELL
– GRID BASED SHALLOW MONITORING WELL
– SHALLOW MONITORING WELL
– EXISTING SHALLOW MONITORING WELL INSTALLED PRIOR TO RFI
6.46 – WATER LEVEL ELEVATION (MSL)
– GROUNDWATER ELEVATION CONTOUR (CONTOUR INTERVAL = 1 FT.)
B – GROUNDWATER FLOW PATH (LABELED FOR TEXT DISCUSSION)
NOTE:
FOR CLARITY, NOT ALL SHALLOW WELLS LOCATED IN ZONE G ARE PRESENTED IN THIS FIGURE.
GREY SCALED WELLS ARE NOT INCLUDED IN TABLE 2–1.
500 0 500
SCALE FEET
ZONE G
RCRA FACILITY
INVESTIGATION REPORT
NAVAL BASE CHARLESTON
CHARLESTON, S.C.
FIGURE 2–5
ZONE G SHALLOW GROUNDWATER
LOW–TIDE POTENTIOMETRIC MAP
DWG DATE:02/04/98
DWG NAME:2907GLTM

Appendix C

G

COMPLETION REPORT
Interim Measure for
SWMU 8
Naval Base Charleston
Charleston, SC

Engineering Branch Head: _____ **Date:** 11-19-99

Prepared By: _____ **Date:** 11/17/99

Site work for this Interim Measure was completed by SUPSHIP, Environmental Detachment Charleston. This report is being submitted by South Carolina Research Authority (SCRA) Environmental Enterprise Group (EEG) established as a result of the US Navy's privatization of SUPSHIP Environmental Detachment Charleston on 13 September 1999.

DOCUMENT GENERATED BY:
SOUTH CAROLINA RESEARCH AUTHORITY
Environmental Enterprise Group
1899 NORTH HOBSON AVENUE
NORTH CHARLESTON, SC 29405

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ACRONYMS, ABBREVIATIONS and SYMBOL

ACM	Asbestos Containing Material
AOC	Area of Concern
BLS	Below Land Surface
CMS	Corrective Measures Study
DERP	Defense Environmental Restoration Program
DET	Environmental Detachment Charleston
DON	Department of the Navy
FO	Fuel Oil
IM	Interim Measure
IR	Installation Restoration
NBCECPT	Naval Base Charleston Environmental Cleanup Project Team
PPM	Parts Per Million
PVC	Polyvinyl Chloride
RBC	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
ROC	Run of Crush
SARA	Superfund Amendments and Reauthorization Act
SCDHEC	South Carolina Department of Health and Environmental Control
SOUTHDIV	Southern Division Naval Facilities Engineering Command
SUPSHIP	Supervisor of Shipbuilding, Conversion and Repair, USN
SWMU	Solid Waste Management Unit
TPH	Total Petroleum Hydrocarbons
USN	United States Navy

1. INTRODUCTION

1.1 INSTALLATION RESTORATION PROGRAM The purpose of the Department of the Navy (DON) Installation Restoration (IR) Program is to identify, assess, characterize and clean up or control contamination from past hazardous waste disposal operations and hazardous material spills at Navy and Marine Corps activities. The Defense Environmental Restoration Program (DERP) is codified in the Superfund Amendments and Reauthorization Act (SARA) Section 211 (10 USC 2701). The IR Program is a component of DERP.

1.1.1 NAVAL BASE CHARLESTON IR PROGRAM At Naval Base Charleston, a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was prepared which divided the Naval Base into zones and identified Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) within each zone. The RFA evaluated each SWMU and AOC and determined which sites required further investigation. Based on the RFA, a RCRA Facility Investigation (RFI) work plan has been or is being prepared for each zone containing SWMUs and AOCs requiring further investigation. On completion of the RFI for each Zone, a RFI report will be prepared for that zone. The RFI reports will identify SWMUs and AOCs containing wastes requiring remediation. Eventually, Corrective Measures Studies (CMSs) will be prepared to determine the best means of remediating each site.

1.2 INTERIM MEASURES Interim Measures (IM) performed as part of the IR Program are intended to eliminate sources of environmental contamination or limit the spread of environmental contaminants prior to the completion of the RFI CMSs.

1.3 SWMU 8 Past investigations documented in the Zone G RCRA Facility Investigation Report for NAVBASE Charleston have identified waste oil, metals and oil sludge as contaminants of concern at this site. SWMU 8 consisted of three unlined pits that were used for the disposal of waste oil sludge produced during industrial activities at the shipyard from 1944 to 1977. Area 1 was pumped down in 1974 and covered with clean fill material. Area 2 was filled with debris and

covered in 1955 trapping oil in the subsurface. SWMU 8 also encompasses (geographically) AOC 636 – Torpedo Magazine, Building 161 (Figure 1, Appendix A). AOC 636 is the former torpedo magazine where subsurface disposal of unused torpedoes and munitions allegedly occurred prior to 1944.

1.4 SWMU 8 INTERIM MEASURE During the interval between the RFI and the completion of the CMS, it was decided by Southern Division Naval Facilities Engineering Command (SOUTHDIV) that an IM would be performed by Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP), United States Navy (USN), Portsmouth Va., Environmental Detachment Charleston (SPORTENVDETCHASN). The objective of this IM was to perform soil borings to locate and delineate the oil contaminated soil boundaries, and to excavate and remove the source of contamination (visible sludge), heavily contaminated soil, and free product. Additionally, AOC 636 (former torpedo magazine) was to be investigated for buried explosives or propellants. This IM is consistent with the ultimate cleanup of SWMU 8 and is not intended to circumvent the public participation process inherent within environmental cleanup under RCRA authority.

1.4.1 SWMU 8 INTERIM MEASURE EXECUTION SUMMARY The execution of this IM consisted of separating SWMU 8 into two work areas by performing soil screenings. The first area (Area 1) contained two smaller pits and the second area (Area 2) contained free product waste oil (Figure 1, Appendix A). Excavation and proper disposal/recycling of materials and site restoration was performed in each area. A recovery system was installed in Area 2. Summaries of each area are detailed in section 1.4.1.1. Additionally Area 2 was investigated for unexploded ordnance.

1.4.1.1 AREA 1 SUMMARY

Project execution began on 1 November 1996 with investigating Area 1 to identify the size of the area surveyed. Soil borings began on 8 November 1996 to define the soil contamination boundaries. The contaminated area was determined to be approximately 51,000 square feet. Following the removal of Run of Crush (ROC) and gravel; 12" sludge piping was discovered at

approximately two feet below ground surface. The piping was found to run in an east to west direction and intersected with four additional feed lines, which possibly were the transfer lines of the abandoned oil pits. The pipe's surface wrapping was sampled and found to contain asbestos. Asbestos was removed from some sections of the pipe, with other sections of pipe removed with the asbestos attached. Approximately four hundred thirty seven (437) linear feet of pipe was disposed as asbestos containing waste material. Excavation of the area was to a depth of 4 to 5 feet below ground surface where an approximate 6 inch oil sludge layer was encountered. All visible oil/sludge impacted soil was removed resulting in approximately five hundred (500) tons of soil being disposed of to a permitted Subtitle "D" landfill. Additionally, scrap metal, timbers, glass and other miscellaneous debris was removed. Groundwater was encountered at approximately 4 to 5 feet. Back filling of Area 1 began on 23 July 1997. The site was filled, compacted and graded, and completed on 2 September 1997.

1.4.1.2 AREA 2 & AOC 636 SUMMARY

AOC 636 was investigated utilizing historical data and the former torpedo facility was found to be a torpedo storage area not a disposal site. RFI soil borings and one shallow monitoring well sample data further substantiated that no target chemicals (typical heavy metals associated with military explosives) associated with torpedoes or munitions were detected. It was determined unexploded ordnance was not a threat and no further action was required as agreed upon at the February 97 Naval Base Charleston Environmental Cleanup Project Team meeting (NBCECPT). Execution of Area 2 was started on 2 February 1997. Excavation of Area 2 began on 3 March 1997. Area 2 was further delineated by soil borings and digging test trenches to define the impacted soils. The total size of excavation increased the dimensions of the area to approximately eight hundred forty five (845) feet long by sixty five (65) feet wide to a depth of ten (10) to twelve (12) feet deep (Figure 2, Appendix A). Groundwater was encountered at approximately 4 to 5 feet Approximately twenty six thousand (26,000) tons of petroleum contaminated soil was removed and disposed of in a Subtitle "D" landfill. Oil skimmer operations began 21 October 97. Additionally, scrap metal, timbers, glass, brick and other miscellaneous debris was removed. Approximately fifty thousand (50,000) gallons of oil was recovered and recycled. Approximately two hundred forty two

(242) linear feet of 12" asbestos lagged oil sludge piping was removed and disposed of as asbestos containing waste material. Piping was removed outside of excavation and plugged (see Figure 2, Appendix A).

The Area 2 excavation was filled with #57 granite from the bottom up to 5 foot below land surface (ground water level). A layer of geofabric was then installed. The remaining 5 feet was filled with clean soil and a 4 inch layer of run of crush (ROC). A total of eighteen (18) 12" diameter PVC recovery pipes (Figure 3, Appendix A) were installed approximately 50 foot apart to a depth of 10-12 feet to facilitate recovery of any free product or alternative remedial remedies (Figure 2, Appendix A).

1.4.2 SWMU 8 INTERIM MEASURE CONCLUSION

This IM effectively removed all visible sludge/contaminated soil from Areas 1 and 2. AOC 636 was investigated and determined that no further action was required.

2. INTERIM MEASURE EXECUTION

2.1 ACTIONS REQUIRED BY INTERIM MEASURE WORK PLAN

Required actions are listed below:

- Perform soil screening in Area 1 to define the boundaries of the sludge pits and spread of petroleum products
- Perform a geophysics study to screen Area 2 for unexploded ordnance (AOC 636)
- Perform soil screening in Area 2 to define the boundaries of the contaminated soil
- Removal and disposal of the asphalt and gravel covering Area 1 and Area 2
- Perform waste characterization samples of oil sludge impacted soils in Area 1 and Area 2, and characterize for proper disposal
- Excavation and disposal of sludge impacted soils in Area 1 and Area 2
- Restoration of Area 1 by backfilling and grading to surrounding area
- Restoration of Area 2 by backfilling, installation of recovery system, and grading to surrounding area

2 OBSERVATIONS NOTED

2.2.1 SOIL CONDITIONS The land surface to approximately 6" below ground surface was made up of gravel (ROC). From 6" below ground surface to the bottom of the excavation consisted of oil/sludge impacted soils and other debris (metal, glass, brick, etc. that had been previously disposed of as backfill). The bottom of the excavation (10-12 feet) was a gray clay region that exhibited no oil/sludge characteristics.

2.2.2 GROUNDWATER Groundwater was encountered at approximately 4 to 5 feet.

2.3 PLAN MODIFICATIONS AND JUSTIFICATION

The actual size of the excavations increased due to visible oil product in soil screenings (soil borings and test trenches).

The unexpected discovery of asbestos lagged piping that required special removal and disposal.

Recycling of approximately 25,000 pounds of steel recovered as debris during excavation.

Excavation continuing through the intersection of Dyess Avenue and Brumby Street.

3. INTERIM MEASURE OUTCOME

3.1 SITE CONDITIONS FOLLOWING COMPLETION OF WORK. Following completion of all site work on 03 September 1999, the DET had removed 26,533 tons of waste oil contaminated soil. Additionally, the DET recovered and recycled approximately 50,000 gallons of oil. Area 1 was backfilled, compacted, covered with ROC and graded to existing conditions. Area 2 was backfilled, recovery system installed, compacted, covered with ROC and graded to existing conditions. Site Photographs are included in Appendix B.

4. SAMPLING

4.1 WASTE CHARACTERIZATION SAMPLING

Waste characterization samples SPORT0257, SPORT275, SPORT0316, SPORT321, SPORT0341, SPORT0391, SPORT0395, SPORT0399, SPORT0433, SPORT0438, SPORT0726, and SPORT0727 were obtained for proper characterization of soils for disposal. Waste characterization samples SPORT0609 and SPORT0617 were obtained for proper recovered oil recycling. Waste characterization samples SPORT0880 and SPORT0881 were obtained for proper dewatering of excavation. See Appendix C for sampling documentation.

5. WASTE GENERATION

5.1 ASBESTOS WASTE

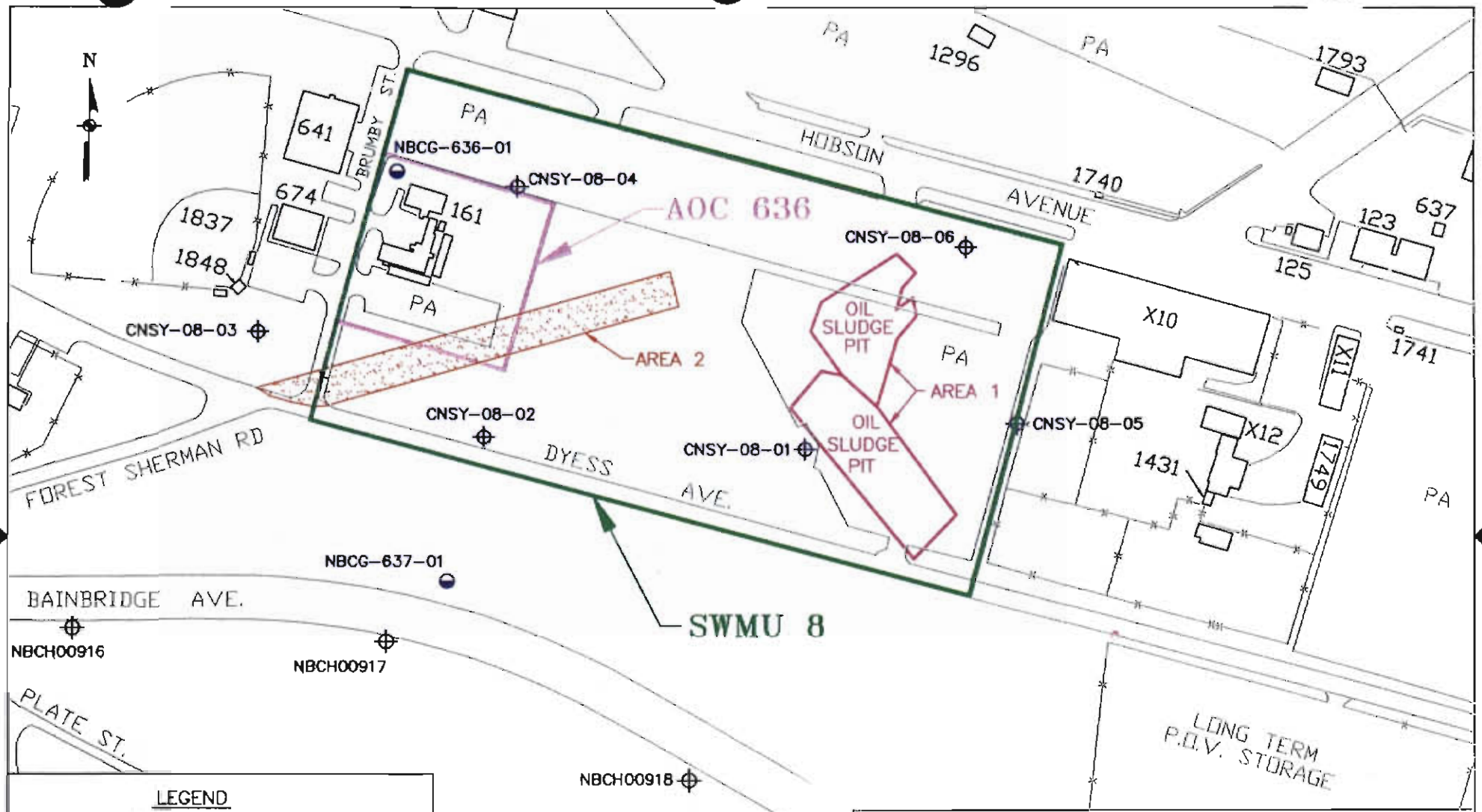
A total of 679 linear feet of asbestos lagged 12" piping was disposed of to a permitted treatment, storage and disposal facility. See Appendix D for waste manifest.

5.2 RECOVERED OIL FOR RECYCLING

Approximately 50,000 gallons of recovered oil was transported to a recycling facility. See Appendix E for manifest.

5.3 NON-HAZARDOUS WASTE

A total of 26,533 tons of non-hazardous contaminated soil was disposed to a permitted Subtitle D facility. See Appendix F for waste manifest.



LEGEND

- LOCATION OF OIL BODY
- SOIL BORING/SHALLOW MONITORING WELL
- EXISTING WELL

100 0 200 400

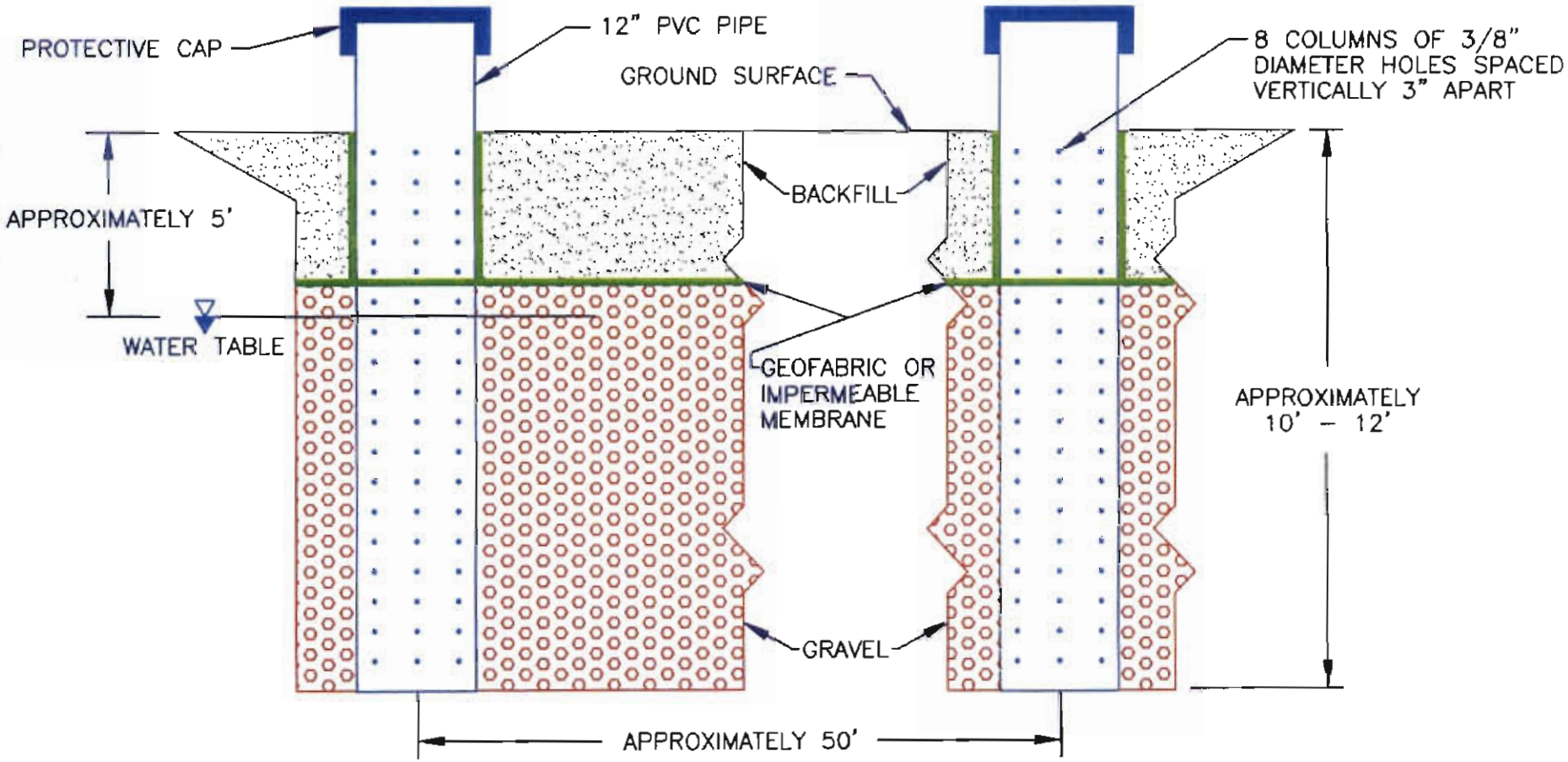
GRAPHIC SCALE (FEET)

SCRA EEG Environmental Enterprise Group

ENVIRONMENTAL ENTERPRISE GROUP
1899 NORTH HOBSON AVENUE – BUILDING 30
NORTH CHARLESTON, SOUTH CAROLINA 29405-2106

FIGURE 1
SWMU 8 SITE MAP

DATE:	PREPARED BY:	REV
05 OCTOBER 1999	J.I. BROWNLEE	–
SCALE:	SHEET: A-1	



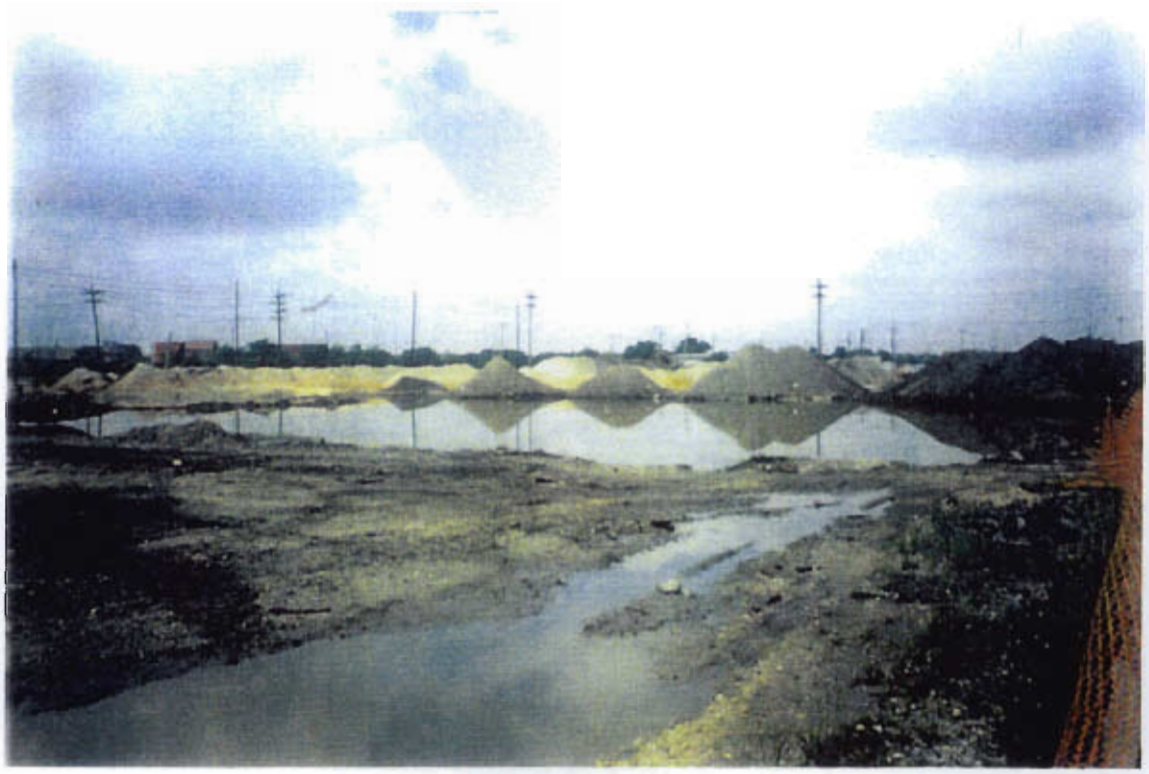
ENVIRONMENTAL ENTERPRISE GROUP
1899 NORTH HOBSON AVENUE – BUILDING 30
NORTH CHARLESTON, SOUTH CAROLINA 29405-2106

SCRA EEG Environmental Enterprise Group

FIGURE 3
SWMU 8 PRODUCT RECOVERY SYSTEM

DATE:	PREPARED BY:	REV
06 OCTOBER 1999	J.I. BROWNLEE	–

SCALE: NONE SHEET: A-3

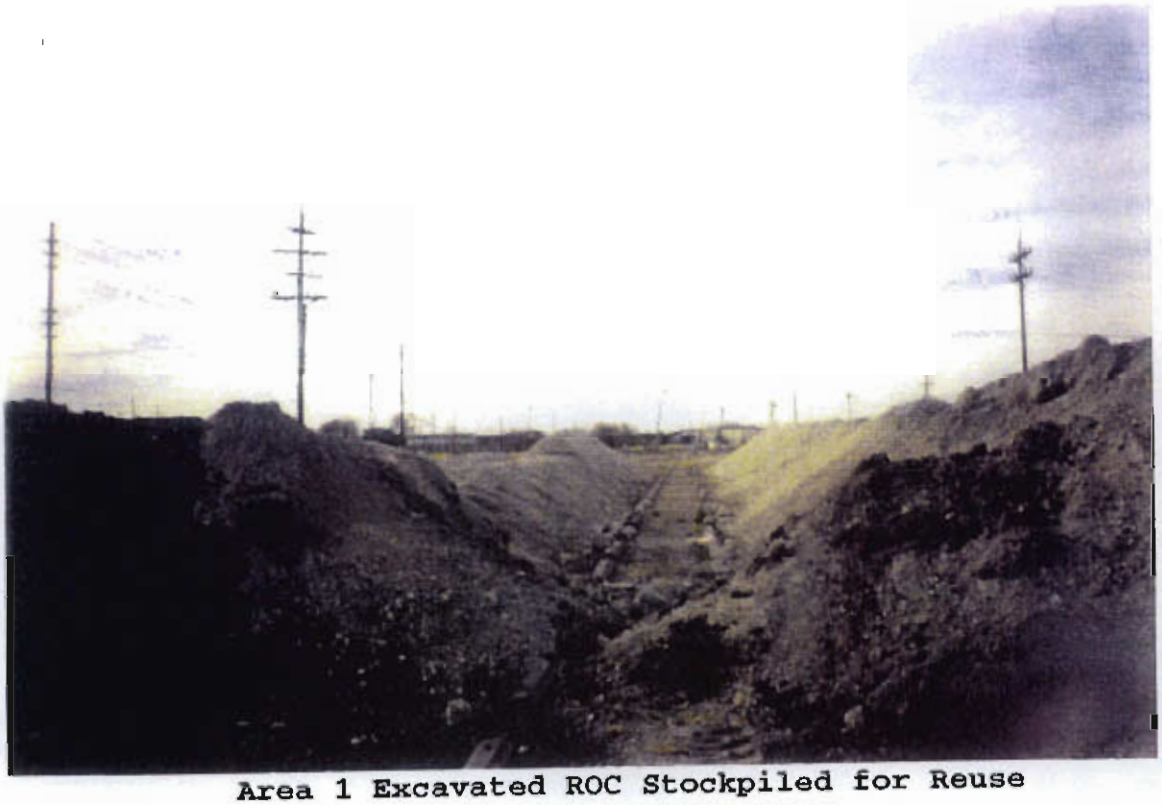


Area 1 Excavation

Area 1 Excavation

Area 1 Soil Recovery Operations

Area 1 Covered Piles of Excavated Soil



Area 1 Excavated ROC Stockpiled for Reuse

Area 1 Sludge Oil Piping

Area 2 Excavating Soil onto Lined Berm

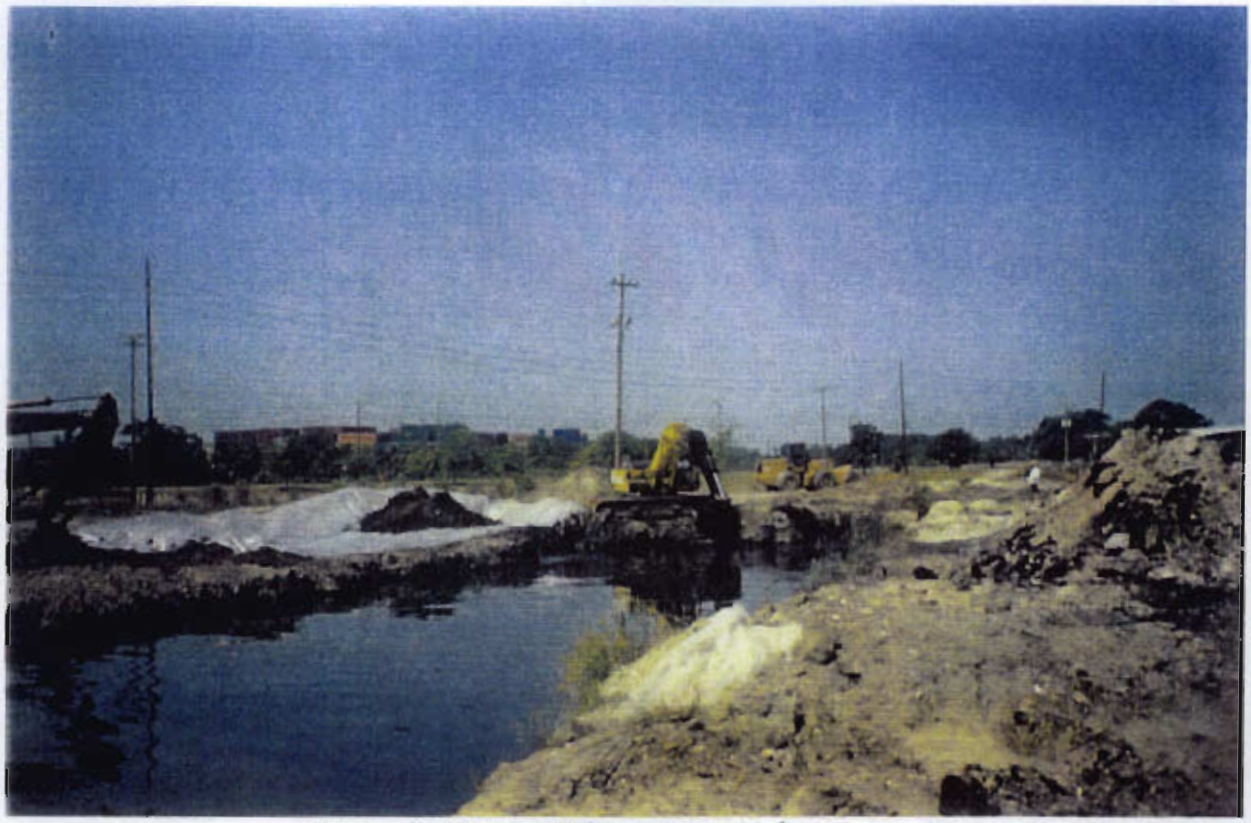
Area 2 Excavated Debris

Area 2 Excavated Debris

Area 2 Excavated Debris

Area 2 Excavated Debris

Area 2 Excavated Debris



Area 2 Excavating onto Lined Berm

Loading Trucks with Oil Contaminated Soil/Debris

Oil Skimmer in Operation

Filling Excavation with Gravel

Installation of Recovery System

Installation of Geotextile Fabric

Backfilling Over Geotextile Fabric

Site after Grading and Protective Posts Installed

Appendix D

HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#:	39715
Date:	October 15, 1999
Client Name:	Ensafe
Project/Site Name:	Charleston Zone G
Date Sampled:	July 28 & 29, 1999
Number of Samples:	22 Non-Aqueous Sample(s) with 0 MS/MSD(s) 1 Aqueous Sample(s) with 0 MS/MSD(s)
Laboratory:	Southwest Laboratory of Oklahoma, Inc.
Validation Guidance:	National Functional Guidelines for Organic and Inorganic Data, February, 1994
QA/QC Level:	DQO Level III
Method(s) Utilized:	SW846 Third Edition
Analytical Fractions:	Volatiles, Semivolatiles, Pesticides, PCBs, SPLP Pesticides, SPLP PCBs, Metals, SPLP Metals and Total Organic Carbons

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

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

Craig G. Sawyer
for Paul B. Humburg, President

10-18-99.
Date

4127 Plaza 94 South • St. Charles, MO 63304
(636) 936-1332 • Fax (636) 936-1335

SDG# 39715

Samples and Fractions Reviewed

Sample Identifications — Analytical Fractions

ENSAFE ID	MATRIX	VOA		SVOA		PEST		PCB		SP-PEST		SP-PCB		MET		SP-MET		TOC	
FDSTB03101	WATER	X																	
FDSSH02801	SOIL		X		X		X								X				
FDSSH02802	SOIL		X		X		X								X				
FDSSH02901	SOIL		X		X		X								X				
FDSSH02902	SOIL		X		X		X								X				
FDSSH03001	SOIL		X		X		X								X				
FDSCH03001	SOIL		X		X		X								X				
FDSSH03002	SOIL		X		X		X								X				
FDSSH03101	SOIL		X		X		X								X				
FDSCH03101	SOIL		X		X		X								X				
FDSSH03102	SOIL		X		X		X								X				
003SB01101	SOIL						X												
003SB01102	SOIL						X												
003SB01201	SOIL						X												
003CB01201	SOIL						X												
003SB01202	SOIL						X												
003SB01402	SOIL						X				X								X
633SB01101	SOIL						X												
633CB01101	SOIL						X												
633SB01102	SOIL						X												
633SB01202	SOIL								X				X						X
643SB01302	SOIL						X				X				X		X		X
642SB01102	SOIL														X		X		X
Total Billable Samples (Water/Soil)		1	10	0	10	0	20	0	1	0	2	0	1	0	12	0	2	0	4

VOA= Volatiles
SVOA= Semivolatiles
PEST= Pesticides
PCB= PCBs
SP-PEST= SPLP Pesticides
SP-PCB= SPLP PCBs
MET= Metals
SP-MET= SPLP Metals
TOC= Total Organic Carbons

ALCP3
01/99

CLW 10/12/99

CHARLESTON - ZONE G
CHARLESTON ZONE G SOIL (ONLY)
SDG# 39715

P-METAL

SAMPLE ID ------->		642-S-B011-02		643-S-B013-02		BLK-0-9715-07		BLK-0-9715-08			
ORIGINAL ID ----->		642SB01102		643SB01302		PBW		PBWT			
LAB SAMPLE ID --->		39726.01		39726.02		PBW		PBWT			
ID FROM REPORT -->		642SB01102		643SB01302		PBW		PBWT			
SAMPLE DATE ----->		07/29/99		07/29/99		07/29/99		07/29/99			
DATE EXTRACTED -->		08/03/99		08/03/99		08/03/99		08/03/99			
DATE ANALYZED --->		08/04/99		08/04/99		08/04/99		08/04/99			
MATRIX ---------->		Soil		Soil		Water		Water			
UNITS ---------->		UG/L	A	UG/L	A	UG/L	D	UG/L	D		
CAS #	Parameter	39715		39715		39715		39715			
7439-97-6	Mercury (Hg)	1.4	~~B~~ J	1.2	~~B~~ J	1.	U	1.	U		
7429-90-5	Aluminum (Al)	307.		216.		32.1	U	42.5	B		
7440-36-0	Antimony (Sb)	5.	U	5.	U	5.	U	5.	U		
7440-38-2	Arsenic (As)	3.3	U	3.3	U	3.3	U	3.3	U		
7440-39-3	Barium (Ba)	288.		8.	~~B~~ J	0.4	U	1.	B		
7440-41-7	Beryllium (Be)	0.3	U	0.3	U	0.3	U	0.3	U		
7440-43-9	Cadmium (Cd)	1.4	~~B~~ J	0.3	U	0.3	U	17.5	B		
7440-70-2	Calcium (Ca)	1860.		2800.		394.	B	172.	U		
7440-47-3	Chromium (Cr)	0.5	U	0.68	~~B~~ J	0.5	U	0.95	B		
7440-48-4	Cobalt (Co)	1.7	U	1.7	U	1.7	U	1.7	U		
7440-50-8	Copper (Cu)	10.3	~~B~~ J	5.1	~~B~~ J	1.	B	1.4	B		
7439-89-6	Iron (Fe)	159.		462.		24.2	U	332.			
7439-92-1	Lead (Pb)	6.5	~~B~~ J	4.5	~~B~~ J	2.1	U	3.2			
7439-95-4	Magnesium (Mg)	216.	~~B~~ J	325.		37.	U	37.	U		
7439-96-5	Manganese (Mn)	1.6	~~B~~ J	4.3	~~B~~ J	1.2	U	1.3	B		
7440-02-0	Nickel (Ni)	1.3	~~B~~ J	1.	~~B~~ J	0.8	U	0.93	B		
7782-49-2	Selenium (Se)	2.9	U	2.9	U	2.9	U	2.9	U		
7440-22-4	Silver (Ag)	2.	U	2.	U	2.	U	2.	U		
7440-28-0	Thallium (Tl)	2.3	U	2.3	U	2.6	B	2.3	U		
7440-62-2	Vanadium (V)	1.1	~~B~~ J	2.2	~~B~~ J	0.9	U	0.9	U		
7440-66-6	Zinc (Zn)	74.6	U	19.5	~~B~~ U	34.3		11.2	B		
7440-31-5	Tin (Sn)	29.5	U	29.5	U	29.5	U	29.5	U		
7440-09-7	Potassium (K)	353.	U	353.	U	353.	U	353.	U		
7440-23-5	Sodium (Na)	3450.		8330.		67.	U	310.	B		

PBW 10/12/99

*** Lab Results - Unvalidated Data - DO NOT Cite or Quote ***

Appendix E

	StationID	G642SB012		G642SB012		G642SB013		G642SB013	
	SampleID	642SB01201 (0-1ft)		642SB01202 (3-5ft)		642CB01301 (0-1ft)		642SB01301 (0-1ft)	
	DateCollected	10/4/01 1:40 PM		10/4/01 1:45 PM		10/4/01 1:50 PM		10/4/01 1:50 PM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC35		CNC35		CNC35		CNC35	
Parameter	**Units**								
Lead	mg/kg	1.5	=	120	=	19	=	14	=

	StationID	G642SB013		G642SB014		G642SB014		G642SB015	
	SampleID	642SB01302 (3-5ft)		642SB01401 (0-1ft)		642SB01402 (3-5ft)		642SB01501 (0-1ft)	
	DateCollected	10/4/01 1:55 PM		10/4/01 12:15 PM		10/4/01 12:20 PM		10/4/01 10:15 AM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC36		CNC36		CNC36		CNC36	
Parameter	Units								
Lead	mg/kg	57	J	36	J	2.7	J	8.9	J

	StationID	G642SB015		G642SB016		G642SB016		G642SB017	
	SampleID	642SB01502 (3-5ft)		642SB01601 (0-1ft)		642SB01602 (3-5ft)		642SB01701 (0-1ft)	
	DateCollected	10/4/01 10:20 AM		10/4/01 10:30 AM		10/4/01 10:35 AM		10/4/01 12:00 PM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC36		CNC36		CNC36		CNC36	
Parameter	**Units**								
Lead	mg/kg	26	J	140	J	15	J	70	J

	StationID	G642SB017		G642SB018		G642SB018		G642SB019	
	SampleID	642SB01702 (3-5ft)		642SB01801 (0-1ft)		642SB01802 (3-5ft)		642CB01902 (3-5ft)	
	DateCollected	10/4/01 12:05 PM		10/4/01 1:30 PM		10/4/01 1:35 PM		10/4/01 2:50 PM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC36		CNC36		CNC36		CNC36	
Parameter	Units								
Lead	mg/kg	32	J	66	J	21	J	22	J

	StationID	G642SB019		G642SB019		G642SB020		G642SB020	
	SampleID	642SB01901 (0-1ft)		642SB01902 (3-5ft)		642SB02001 (0-1ft)		642SB02002 (3-5ft)	
	DateCollected	10/4/01 2:45 PM		10/4/01 2:50 PM		10/4/01 10:00 AM		10/4/01 10:25 AM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC36		CNC36		CNC35		CNC35	
Parameter	**Units**								
Lead	mg/kg	4.2	J	25	J	2.4	=	24	=

	StationID	G642SB021		G642SB021		G642SB022		G642SB022	
	SampleID	642SB02101 (0-1ft)		642SB02102 (3-5ft)		642SB02201 (0-1ft)		642SB02202 (3-5ft)	
	DateCollected	10/4/01 1:20 PM		10/4/01 1:25 PM		10/4/01 2:35 PM		10/4/01 2:40 PM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC35		CNC35		CNC35		CNC35	
Parameter	**Units**								
Lead	mg/kg	48	=	40	=	18	=	17	=

	StationID	G642SB023		G642SB023		G642SB024		G642SB024	
	SampleID	642SB02301 (0-1ft)		642SB02302 (3-5ft)		642SB02401 (0-1ft)		642SB02402 (3-5ft)	
	DateCollected	10/4/01 2:00 PM		10/4/01 2:05 PM		10/4/01 9:40 AM		10/4/01 9:45 AM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC35		CNC35		CNC35		CNC35	
Parameter	**Units**								
Lead	mg/kg	17	=	4.2	=	140	=	1.7	=

	StationID	G642SB025		G642SB025		G642SB026		G642SB026	
	SampleID	642SB02501 (0-1ft)		642SB02502 (3-5ft)		642CB02601 (0-1ft)		642SB02601 (0-1ft)	
	DateCollected	10/4/01 11:45 AM		10/4/01 11:50 AM		10/4/01 2:10 PM		10/4/01 2:10 PM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC35		CNC35		CNC35		CNC35	
Parameter	**Units**								
Lead	mg/kg	270	=	2.5	=	19	=	24	=

	StationID	G642SB026		G642SB027		G642SB027		G642SB028	
	SampleID	642SB02602 (3-5ft)		642SB02701 (0-1ft)		642SB02702 (3-5ft)		642SB02801 (0-1ft)	
	DateCollected	10/4/01 2:15 PM		10/4/01 2:25 PM		10/4/01 2:30 PM		10/4/01 11:30 AM	
	DateAnalyzed	10/10/2001		10/10/2001		10/10/2001		10/10/2001	
	SDGNumber	CNC35		CNC35		CNC36		CNC36	
Parameter	**Units**								
Lead	mg/kg	7.6	=	16	=	31	J	36	J

	StationID	G642SB028	
	SampleID	642SB02802 (3-5ft)	
	DateCollected	10/4/01 11:35 AM	
	DateAnalyzed	10/10/2001	
	SDGNumber	CNC36	
Parameter	**Units**		
Lead	mg/kg	4.7	J

Data Validation Summary - Charleston Naval Complex – Zone G, AOC 642

TO: William Elliott/CH2M HILL/GNA

FROM: Amy Juchem/CH2M HILL/GNA
Herb Kelly/CH2M HILL/GNA

DATE: January 30, 2002

The purpose of this memorandum is to present the results of the data validation process for the samples collected at Zone G, AOC 642. The samples were collected on October 4, 2001.

The specific samples and analytical fractions reviewed are summarized below in Table 1.

The Quality Control areas that were review and the resulting findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) *National Functional Guidelines for Inorganic Data Review (EPA 1994) and National Functional Guidelines for Organic Data Review (EPA 1999)*. Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

Samples were submitted to Severn Trent Services, STL Savannah Laboratories, Inc., in Savannah, Georgia for Lead following SW-846-6010 Methodology.

Sample results that were not within the acceptance limits were appended with a qualifying flag, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. These also include the secondary, or the two-digit "sub-qualifier" flags. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data. The secondary qualifiers are presented and defined below.

Attachment 1 lists the changes in data qualifiers, due to the validation process.

The following primary flags were used to qualify the data:

[=] Detected. The analyte was analyzed for and detected at the concentration shown.

[J] Estimated. The analyte was present but the reported value may not be accurate or precise.

[U] Undetected. The analyte was analyzed for but not detected above the method detection limit.

[UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.

[R] Rejected. The data is not useable.

Secondary Data Validation Qualifiers

Code	Definition
2S	Second Source
BL	Blank
BD	Blank Spike/Blank Spike Duplicate or (LCS/LCSD) Precision
BS	Blank Spike/LCS
CC	Continuing Calibration Verification
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals - B's → J's)
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
LR	Concentration exceeded Linear Range
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TN	Tune

Table 1 - Chemical Analytical Methods – Field and Quality Control Samples

TABLE 1
Chemical Analytical Methods – Field and Quality Control Samples
Charleston Naval Complex, Zone G, AOC 642, Charleston, SC

Site	Station ID	Sample ID	Lab Sample ID	Date Collected	Matrix	Sample Type	Upper Depth	Lower Depth	S116536
CNC35	G642SB020	642SB02001	S116536*1	10/4/01 1000	SO	N	0	1	X
CNC35	G642SB024	642SB02402	S116536*10	10/4/01 945	SO	N	3	5	X
CNC35	G642SB025	642SB02501	S116536*11	10/4/01 1145	SO	N	0	1	X
CNC35	G642SB025	642SB02502	S116536*12	10/4/01 1150	SO	N	3	5	X
CNC35	G642SB026	642SB02601	S116536*13	10/4/01 1410	SO	N	0	1	X
CNC35	G642SB026	642CB02601	S116536*14	10/4/01 1410	SO	FD	0	1	X
CNC35	G642SB026	642SB02602	S116536*15	10/4/01 1415	SO	N	3	5	X
CNC35	G642SB027	642SB02701	S116536*16	10/4/01 1425	SO	N	0	1	X
CNC35	G642SB012	642SB01201	S116536*17	10/4/01 1340	SO	N	0	1	X
CNC35	G642SB012	642SB01202	S116536*18	10/4/01 1345	SO	N	3	5	X
CNC35	G642SB013	642SB01301	S116536*19	10/4/01 1350	SO	N	0	1	X
CNC35	G642SB020	642SB02002	S116536*2	10/4/01 1025	SO	N	3	5	X
CNC35	G642SB013	642CB01301	S116536*20	10/4/01 1350	SO	FD	0	1	X
CNC35	G642SB023	642SB02302MS	S116536*28	10/4/01 1405	SO	MS	3	5	X
CNC35	G642SB021	642SB02101	S116536*3	10/4/01 1320	SO	N	0	1	X
CNC35	G642SB023	642SB02302SD	S116536*30	10/4/01 1405	SO	SD	3	5	X
CNC35	G642SB021	642SB02102	S116536*4	10/4/01 1325	SO	N	3	5	X
CNC35	G642SB022	642SB02201	S116536*5	10/4/01 1435	SO	N	0	1	X
CNC35	G642SB022	642SB02202	S116536*6	10/4/01 1440	SO	N	3	5	X
CNC35	G642SB023	642SB02301	S116536*7	10/4/01 1400	SO	N	0	1	X
CNC35	G642SB023	642SB02302	S116536*8	10/4/01 1405	SO	N	3	5	X
CNC35	G642SB024	642SB02401	S116536*9	10/4/01 940	SO	N	0	1	X
CNC36	G642SB013	642SB01302	S116536A*1	10/4/01 1355	SO	N	3	5	X
CNC36	G642SB018	642SB01801	S116536A*10	10/4/01 1330	SO	N	0	1	X
CNC36	G642SB018	642SB01802	S116536A*11	10/4/01 1335	SO	N	3	5	X
CNC36	G642SB019	642SB01901	S116536A*12	10/4/01 1445	SO	N	0	1	X
CNC36	G642SB019	642SB01902	S116536A*13	10/4/01 1450	SO	N	3	5	X

TABLE 1
Chemical Analytical Methods – Field and Quality Control Samples
Charleston Naval Complex, Zone G, AOC 642, Charleston, SC

SDG	Station ID	Sample ID	Lab Sample ID	Date Collected	Matrix	Sample Type	Upper Depth	Lower Depth	SW6010 Metals
CNC36	G642SB019	642CB01902	S116536A*14	10/4/01 1450	SO	FD	3	5	X
CNC36	G642SB027	642SB02702	S116536A*15	10/4/01 1430	SO	N	3	5	X
CNC36	G642SB028	642SB02801	S116536A*16	10/4/01 1130	SO	N	0	1	X
CNC36	G642SB028	642SB02802	S116536A*17	10/4/01 1135	SO	N	3	5	X
CNC36	G642SB014	642SB01401	S116536A*2	10/4/01 1215	SO	N	0	1	X
CNC36	G642SB014	642SB01402	S116536A*3	10/4/01 1220	SO	N	3	5	X
CNC36	G642SB017	642SB01701MS	S116536A*33	10/4/01 1200	SO	MS	0	1	X
CNC36	G642SB017	642SB01701SD	S116536A*35	10/4/01 1200	SO	SD	0	1	X
CNC36	G642SB015	642SB01501	S116536A*4	10/4/01 1015	SO	N	0	1	X
CNC36	G642SB015	642SB01502	S116536A*5	10/4/01 1020	SO	N	3	5	X
CNC36	G642SB016	642SB01601	S116536A*6	10/4/01 1030	SO	N	0	1	X
CNC36	G642SB016	642SB01602	S116536A*7	10/4/01 1035	SO	N	3	5	X
CNC36	G642SB017	642SB01701	S116536A*8	10/4/01 1200	SO	N	0	1	X
CNC36	G642SB017	642SB01702	S116536A*9	10/4/01 1205	SO	N	3	5	X
CNC36	FIELDQC	642EB012L1	S116536A*18	10/4/01 1500	WQ	EB			X

MATRIX CODE

SO – Soil
WQ – Water QC Samples

SAMPLE TYPE CODE

EB - Equipment Blank
FD - Field Duplicate
MS - Matrix Spike
SD - Matrix Spike Duplicate
N - Native Sample

Inorganic Parameters

Quality Control Review

The following list represents the QA/QC measures that are typically reviewed during the data quality evaluation procedure for inorganic parameters.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Sample preparation, initial calibration blanks/continuing calibration blanks, and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", in which target parameters have been added prior to digestion/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Pre/Post Digestion Spike (MS/MSD)** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **ICP Interference Check Sample** – This sample verifies the lab's interelement and background correction factors.
- **Initial Calibration Verification** – This parameter ensures that the instrument is capable of producing acceptable quantitative data for the target analyte list to be measured.
- **Continuing Calibration Verification** – This one-point, mid-range parameter establishes that the initial calibration is still valid by checking the performance of the instrument on a continual basis.
- **ICP Serial Dilution** – The serial dilution of samples quantitated by ICP determines whether or not significant physical or chemical interferences exist due to the sample matrix.

Metals Analyses

The QA/QC parameters for the Metals analyses for all of the samples were within acceptable control limits, except as noted below.

Matrix Spike/Matrix Spike Duplicate

The percent recoveries for the matrix spike and matrix spike duplicate for lead in SDG CNC36 were 125 percent and 135 percent respectively. The samples in this SDG were qualified "J" as estimated, due to the percent recoveries for the matrix spike and matrix spike duplicate exceeding the upper acceptance limit of 120 percent.

Conclusion

A review of the analytical data submitted regarding the investigation of AOC 642 in Zone G at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

The analytical data had minor QC concerns as indicated above, however, it did not affect data usability for those specific results. The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Attachment 1 - Changed Qualifiers and Results
Zone G, AOC 642 - Data Validation

SDG	Sample ID	Lab Sample ID	Matrix	Parameter Class	Analytical Method	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
CNC36	642SB01302	S116536A*1	SO	METAL	SW6010	LEAD	57	=	57	J	mg/Kg	MS
CNC36	642SB01401	S116536A*2	SO	METAL	SW6010	LEAD	36	=	36	J	mg/Kg	MS
CNC36	642SB01402	S116536A*3	SO	METAL	SW6010	LEAD	2.7	=	2.7	J	mg/Kg	MS
CNC36	642SB01501	S116536A*4	SO	METAL	SW6010	LEAD	8.9	=	8.9	J	mg/Kg	MS
CNC36	642SB01502	S116536A*5	SO	METAL	SW6010	LEAD	26	=	26	J	mg/Kg	MS
CNC36	642SB01601	S116536A*6	SO	METAL	SW6010	LEAD	140	=	140	J	mg/Kg	MS
CNC36	642SB01602	S116536A*7	SO	METAL	SW6010	LEAD	15	=	15	J	mg/Kg	MS
CNC36	642SB01701	S116536A*8	SO	METAL	SW6010	LEAD	70	=	70	J	mg/Kg	MS
CNC36	642SB01702	S116536A*9	SO	METAL	SW6010	LEAD	32	=	32	J	mg/Kg	MS
CNC36	642SB01801	S116536A*10	SO	METAL	SW6010	LEAD	66	=	66	J	mg/Kg	MS
CNC36	642SB01802	S116536A*11	SO	METAL	SW6010	LEAD	21	=	21	J	mg/Kg	MS
CNC36	642SB01901	S116536A*12	SO	METAL	SW6010	LEAD	4.2	=	4.2	J	mg/Kg	MS
CNC36	642SB01902	S116536A*13	SO	METAL	SW6010	LEAD	25	=	25	J	mg/Kg	MS
CNC36	642CB01902	S116536A*14	SO	METAL	SW6010	LEAD	22	=	22	J	mg/Kg	MS
CNC36	642SB02702	S116536A*15	SO	METAL	SW6010	LEAD	31	=	31	J	mg/Kg	MS
CNC36	642SB02801	S116536A*16	SO	METAL	SW6010	LEAD	36	=	36	J	mg/Kg	MS
CNC36	642SB02802	S116536A*17	SO	METAL	SW6010	LEAD	4.7	=	4.7	J	mg/Kg	MS