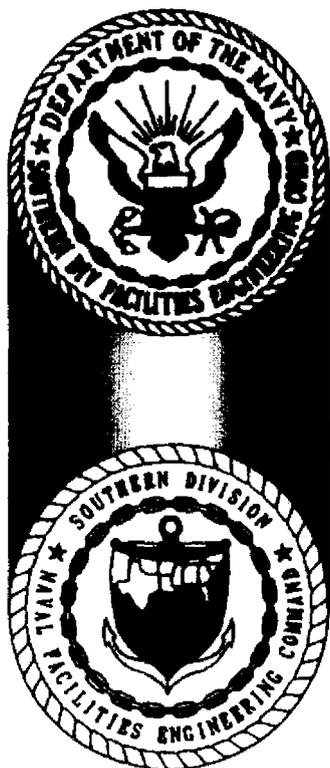


N61165.AR.003437  
CNC CHARLESTON  
5090.3a

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT  
ADDENDUM SOLID WASTE MANAGEMENT UNIT 97 (SWMU 97) ZONE E CNC  
CHARLESTON SC  
6/4/2002  
CH2M HILL

# RFI REPORT ADDENDUM

## Solid Waste Management Unit 97, Zone E



***Charleston Naval Complex  
North Charleston, South Carolina***

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

*CH2M-Jones*

*May 2002*

*Contract N62467-99-C-0960*



**CH2MHILL**

**CH2M HILL**

115 Perimeter Center Place N.E.

Suite 700

Atlanta, GA 30346-1278

Tel 770.604.9095

Fax 770.604.9183

June 4, 2002

Mr. David Scaturo  
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) – SWMU 97, Zone E

Dear Mr. Scaturo:

Enclosed are four copies of the RFI Report Addendum (Revision 0) for SWMU 97 in Zone E 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 Sam Naik. Please contact him at 770/604-9182, extension 255, should 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

## Solid Waste Management Unit 97, Zone E



***Charleston Naval Complex  
North Charleston, South Carolina***

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

PREPARED BY  
***CH2M-Jones***

*May 2002*

*Revision 0  
Contract N62467-99-C-0960  
158814.ZE.PR.01*

## Certification Page for RFI Report Addendum (Revision 0) – SWMU 97, Zone E

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.



---

Date

# 1 Contents

2	3 Section	Page
4	Acronyms and Abbreviations.....	v
5	<b>1.0 Introduction.....</b>	<b>1-1</b>
6	1.1 Purpose of the RFI Report Addendum.....	1-2
7	1.2 Report Organization.....	1-2
8	Figure 1-1 Location of SWMU 97 in Zone E.....	1-3
9	Figure 1-2 Site Map.....	1-4
10	<b>2.0 Summary of RFI Conclusions for SWMU 97.....</b>	<b>2-1</b>
11	2.1 Soil Sampling and Analysis.....	2-1
12	2.1.1 Surface Soil.....	2-1
13	2.1.2 Subsurface Soil.....	2-2
14	2.2 Groundwater Analysis.....	2-2
15	2.2.1 Shallow Groundwater.....	2-2
16	2.3 RFI Human Health Risk Assessment.....	2-3
17	2.3.1 Soils.....	2-3
18	2.3.2 Groundwater.....	2-3
19	2.4 RFI Conclusions and Recommendations.....	2-3
20	Figure 2-1 RFI Sample Locations.....	2-4
21	Figure 2-2 Arsenic Detections in Shallow Groundwater.....	2-5
22	<b>3.0 Summary of Interim Measures and UST/AST Removals at SWMU 97.....</b>	<b>3-1</b>
23	3.1 UST/AST Removals.....	3-1
24	3.2 Interim Measures.....	3-1
25	<b>4.0 Summary of Additional Investigations.....</b>	<b>4-1</b>
26	<b>5.0 COPC/COC Refinement.....</b>	<b>5-1</b>
27	5.1 Groundwater.....	5-1
28	5.1.1 Arsenic.....	5-1
29	5.2 COC Summary.....	5-1
30	<b>6.0 Summary of Information Related to Site Closeout Issues.....</b>	<b>6-1</b>
31	6.1 RFI Status.....	6-1
32	6.2 Presence of Inorganics in Groundwater.....	6-1
33	6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers	
34	at the CNC.....	6-1
35	6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC.....	6-2

# 1 **Contents, Continued**

---

2	6.5	Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC ...	6-2
3	6.6	Potential Migration Pathways to Surface Water Bodies at the CNC.....	6-2
4	6.7	Potential Contamination in Oil/Water Separators .....	6-2
5	6.8	Land Use Control .....	6-3
6	<b>7.0</b>	<b>Recommendations</b> .....	<b>7-1</b>
7	<b>8.0</b>	<b>References</b> .....	<b>8-1</b>
8			
9		<b>Appendices</b>	
10	<b>A</b>	Excerpts from the <i>Zone E RFI Report, Revision 0</i>	
11	<b>B</b>	Responses to SCDHEC Comments for SWMU 97 from the <i>Zone E RFI Report,</i>	
12		<i>Revision 0</i>	

# 1 Acronyms and Abbreviations

---

2	AOC	area of concern
3	AST	aboveground storage tank
4	BCT	BRAC Cleanup Team
5	BRAC	Base Realignment and Closure Act
6	BRC	background reference concentration
7	CA	corrective action
8	CMS	corrective measures study
9	CNC	Charleston Naval Complex
10	COC	chemical of concern
11	COPC	chemical of potential concern
12	CSI	confirmatory sampling investigation
13	DAF	dilution attenuation factor
14	EnSafe	EnSafe Inc.
15	EPA	U.S. Environmental Protection Agency
16	FRE	fixed-point risk evaluation
17	HHRA	human health risk assessment
18	HI	hazard index
19	IM	interim measure
20	LUC	land use control
21	$\mu\text{g/L}$	micrograms per liter
22	MCL	maximum contaminant level
23	NAVBASE	Naval Base
24	NFA	no further action

# 1 **Acronyms and Abbreviations, Continued**

---

2	NFI	no further investigation
3	OWS	oil/water separator
4	PCB	polychlorinated biphenyl
5	PCE	tetrachloroethene
6	RBC	risk-based concentration
7	RCRA	Resource Conservation and Recovery Act
8	RFI	RCRA Facility Investigation
9	SCDHEC	South Carolina Department of Health and Environmental Control
10	SSL	soil screening level
11	SVOC	semivolatile organic compound
12	SWMU	solid waste management unit
13	TDS	total dissolved solids
14	UST	underground storage tank
15	VOC	volatile organic compound



# 1 1.0 Introduction

---

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

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

11 In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation  
12 and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to  
13 complete the RCRA Facility Investigation (RFI) for Solid Waste Management Unit (SWMU)  
14 97 in Zone E of CNC. The location of this site in Zone E is shown in Figure 1-1. Figure 1-2  
15 shows an aerial photograph of the site.

16 SWMU 97 is a former less-than-90-day accumulation area located on the east corner of  
17 Building 236. Wastes were stored in 55-gallon drums on pallets inside the 20 ft x 20 ft metal  
18 structure on an asphalt foundation. The dates of operation are not known. The storage area  
19 location is currently empty. Building 236 currently houses the corporate offices of Detyens  
20 Shipyards, Inc. and a machine shop.

21  
22 The materials of concern identified in the *Final Zone E RFI Work Plan, Revision 1* (EnSafe Inc.  
23 [EnSafe]/ Allen & Hoshall, 1995) at SWMU 97 include freon, metals, solvents, and  
24 petroleum hydrocarbons. This area of Zone E is zoned M2 (for industrial land use). The  
25 CNC RCRA Permit identified SWMU 97 as requiring a confirmatory sampling investigation  
26 (CSI).

27

28 The RFI was initially conducted by the Navy/EnSafe team. The RFI activities were  
29 documented in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). A regulatory review was  
30 conducted on this document and a draft response to the comments from SCDHEC were  
31 prepared by the Navy/EnSafe team.

## 1 **1.1 Purpose of the RFI Report Addendum**

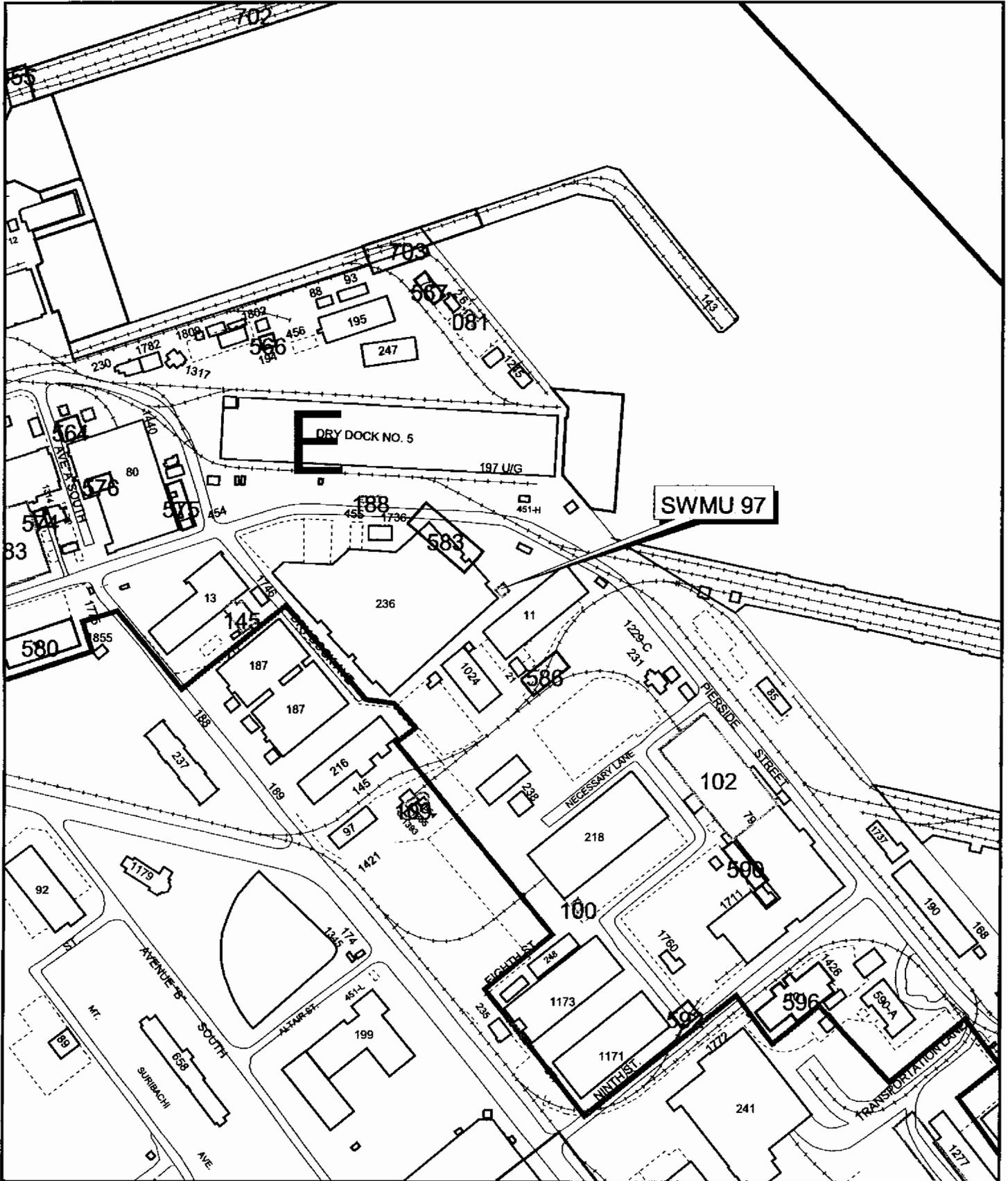
2 The purpose of this RFI Report Addendum is to document the results of previous RFI  
3 investigations conducted by the Navy/EnSafe team at SWMU 97. This RFI Report  
4 Addendum also discusses various closeout issues and the findings of previous  
5 investigations, existing site conditions, and the surrounding area land use.

## 6 **1.2 Report Organization**

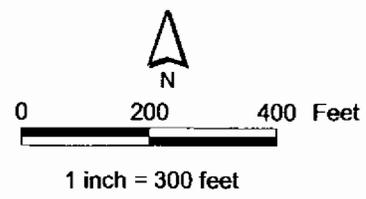
7 This RFI Report Addendum consists of the following sections, including this introductory  
8 section:

- 9 **1.0 Introduction** – Presents the purpose of the report and background information relating  
10 to the site.
- 11 **2.0 Summary of RFI Conclusions for SWMU 97** – Summarizes the conclusions from the  
12 RFI and risk evaluations for SWMU 97 as presented in *the Zone E RFI Report, Revision 0*.
- 13 **3.0 Interim Measures and UST/AST Removals** – Provides information regarding any  
14 interim measures (IMs) or underground storage tank (UST)/aboveground storage tank  
15 (AST) removal activities performed at the site.
- 16 **4.0 Summary of Additional Investigations** – Summarizes any information collected after  
17 completion of the *Zone E RFI Report, Revision 0* (EnSafe, 1997).
- 18 **5.0 COPC/COC Refinement** – Provides further evaluation of chemicals of potential concern  
19 (COPCs) based on RFI and additional data to assess them as chemicals of concern  
20 (COCs).
- 21 **6.0 Summary of Information Related to Site Closeout Issues** – Discusses the various site  
22 closeout issues that the BRAC Cleanup Team (BCT) agreed to evaluate prior to site  
23 closeout.
- 24 **7.0 Recommendations** – Provides recommendations for proceeding with site closure.
- 25 **8.0 References** – Lists the references used in this document.
- 26 **Appendix A** – Contains excerpts from the *Zone E RFI Report, Revision 0*, including a  
27 summary of detections of chemicals and a groundwater flow map for the site vicinity.
- 28 **Appendix B** – Contains responses to SCDHEC comments for SWMU 97 from the *Zone E RFI*  
29 *Report, Revision 0*.

NOTE: Original figure created in color



- Railroads
- Roads
- AOC Boundary
- SWMU Boundary
- Shoreline
- Buildings
- Zone Boundary



**Figure 1-1**  
Location of SWMU 97 in Zone E  
Charleston Naval Complex



**Figure 1-2**  
Site Map  
SWMU 97, Zone E  
Charleston Naval Complex

**Section 2.0**

---

## 1 **2.0 Summary of RFI Conclusions for SWMU 97**

---

2 This section summarizes the results and conclusions from the soil and groundwater  
3 investigations conducted at SWMU 97 which were reported in the *Zone E RFI Report,*  
4 *Revision 0* (EnSafe, 1997). Figure 2-1 shows soil and groundwater sampling locations.

5 As part of the Zone E RFI, soil and groundwater investigations were conducted at SWMU  
6 97 during 1995 to 1997. The RFI report presented the results of these investigations and  
7 conclusions concerning contamination and risk, as summarized in the following sections. A  
8 further evaluation of COCs at this site is provided in Section 5.0.

### 9 **2.1 Soil Sampling and Analysis**

10 RFI soil sampling at SWMU 97 involved the collection and analysis of three surface soil and  
11 three subsurface soil samples from locations under concrete and asphalt pavement. Figure  
12 2-1 shows the RFI sampling locations. All samples were analyzed for volatile organic  
13 compounds (VOCs), semivolatile organic compounds (SVOCs), metals,  
14 pesticides/polychlorinated biphenyls (PCBs), cyanide, and organotins. These boring  
15 locations were identified as E097SB001 through E097SB003. One surface soil sample was  
16 selected as a duplicate and was also analyzed for herbicides, organophosphorus pesticides,  
17 hexavalent chromium, and dioxins.

#### 18 **2.1.1 Surface Soil**

19 During the RFI, surface soil detections of organic compounds were evaluated against the  
20 U.S. Environmental Protection Agency (EPA) Region III industrial risk-based  
21 concentrations (RBCs) (with a hazard index [HI]=0.1 for noncarcinogens). Surface soil  
22 detections of inorganic compounds were evaluated against the EPA Region III industrial  
23 RBCs (HI=0.1 for noncarcinogens) and the Zone E background reference concentrations  
24 (BRCs).

25 Detected concentrations of organic and inorganic analytes exceeding their respective criteria  
26 are as follows:

- 27 • **VOCs:** No VOC detections exceeded the screening criteria.
- 28 • **SVOCs:** No SVOC detections exceeded the screening criteria.
- 29 • **Dioxins:** The RFI reported that there were no detections in surface soil above the  
30 screening criteria for dioxin compounds.

- 1 • **Inorganics:** No inorganic detections exceeded the screening criteria.
- 2 • **Pesticides/PCBs:** There were no detections of pesticides above screening criteria limits
- 3 and no detections of PCBs above laboratory detection limits in surface soil samples from
- 4 SWMU 97.

5 Figure 2-1 shows the soil sampling locations.

## 6 **2.1.2 Subsurface Soil**

7 During the RFI, subsurface soil detections of organic compounds were compared with

8 generic soil screening levels (SSLs) (using a dilution attenuation factor [DAF]=10).

9 Subsurface soil detections of inorganic compounds were compared with generic SSLs (using

10 a DAF=10) and the Zone E BRCs.

11 Detected concentrations of organic and inorganic compounds from subsurface soil samples

12 are as follows:

- 13 • **VOCs:** No VOC detections exceeded the screening criteria in subsurface soils.
- 14 • **SVOCs:** No SVOC detections exceeded the screening criteria in subsurface soils.
- 15 • **Inorganics:** No inorganic detections exceeded the screening criteria in subsurface soils.
- 16 • **Pesticides/PCBs:** There were no pesticides/PCBs detections above laboratory detection
- 17 limits in subsurface soil samples from SWMU 97.

## 18 **2.2 Groundwater Analysis**

19 During the RFI for SWMU 97, one shallow monitoring well, E097GW001, was installed at

20 the east corner of Building 236, as shown in Figure 2-1. Groundwater samples were

21 analyzed for VOCs, SVOCs, metals, pesticides/PCBs, cyanide, organotins, chlorides,

22 sulfates, and total dissolved solids (TDS). No duplicate groundwater samples were

23 collected.

24 During the RFI, this shallow well was sampled four times during the period(1996–1997).

25 The detections in groundwater samples were compared with the EPA Region III tap water

26 RBCs, maximum contaminant levels (MCLs) and the Zone E BRCs for shallow aquifers.

### 27 **2.2.1 Shallow Groundwater**

28 Analyte concentrations in shallow groundwater samples were detected as follows at this

29 site:

- 30 **VOCs:** There were no VOC detections above laboratory detection limits in shallow
- 31 groundwater samples from SWMU 97.

1 **SVOCs:** There were no SVOC detections above laboratory detection limits in shallow  
2 groundwater samples from SWMU 97.

3 **Inorganics:** The *Zone E RFI Report, Revision 0* reported detections in the first sampling event  
4 only. Among detected inorganic analytes, two metals exceeded their respective screening  
5 criteria:

- 6 • Antimony was detected at a concentration of 5.10 micrograms per liter ( $\mu\text{g}/\text{L}$ ) in the one  
7 sample from E097GW00101, above the tap water RBC of 1.5  $\mu\text{g}/\text{L}$ . No shallow  
8 groundwater BRC was developed for antimony in Zone E during the RFI. The detection  
9 did not exceed the antimony MCL of 6.0  $\mu\text{g}/\text{L}$ .
- 10 • Arsenic was detected at a concentration of 31.5  $\mu\text{g}/\text{L}$  in the one sample from  
11 E097GW001, above both the tap water RBC of 0.045  $\mu\text{g}/\text{L}$  and the Zone E shallow  
12 groundwater BRC of 18.7  $\mu\text{g}/\text{L}$  for arsenic. The detection did not exceed the arsenic  
13 MCL of 50.0  $\mu\text{g}/\text{L}$ .

14 Figure 2-2 shows the groundwater sampling location and results for arsenic.

## 15 **2.3 RFI Human Health Risk Assessment**

16 The *Zone E RFI Report, Revision 0* used a fixed-point risk evaluation (FRE) approach at this  
17 site, which considered site resident and site worker scenarios. The detailed risk assessment  
18 for the SWMU 97 site is presented in Sections 10.12.6.2 and 10.12.6.3 of the *Zone E RFI*  
19 *Report, Revision 0*.

### 20 **2.3.1 Soils**

21 The FRE did not identify any COPCs in surface or subsurface soil at SWMU 97.

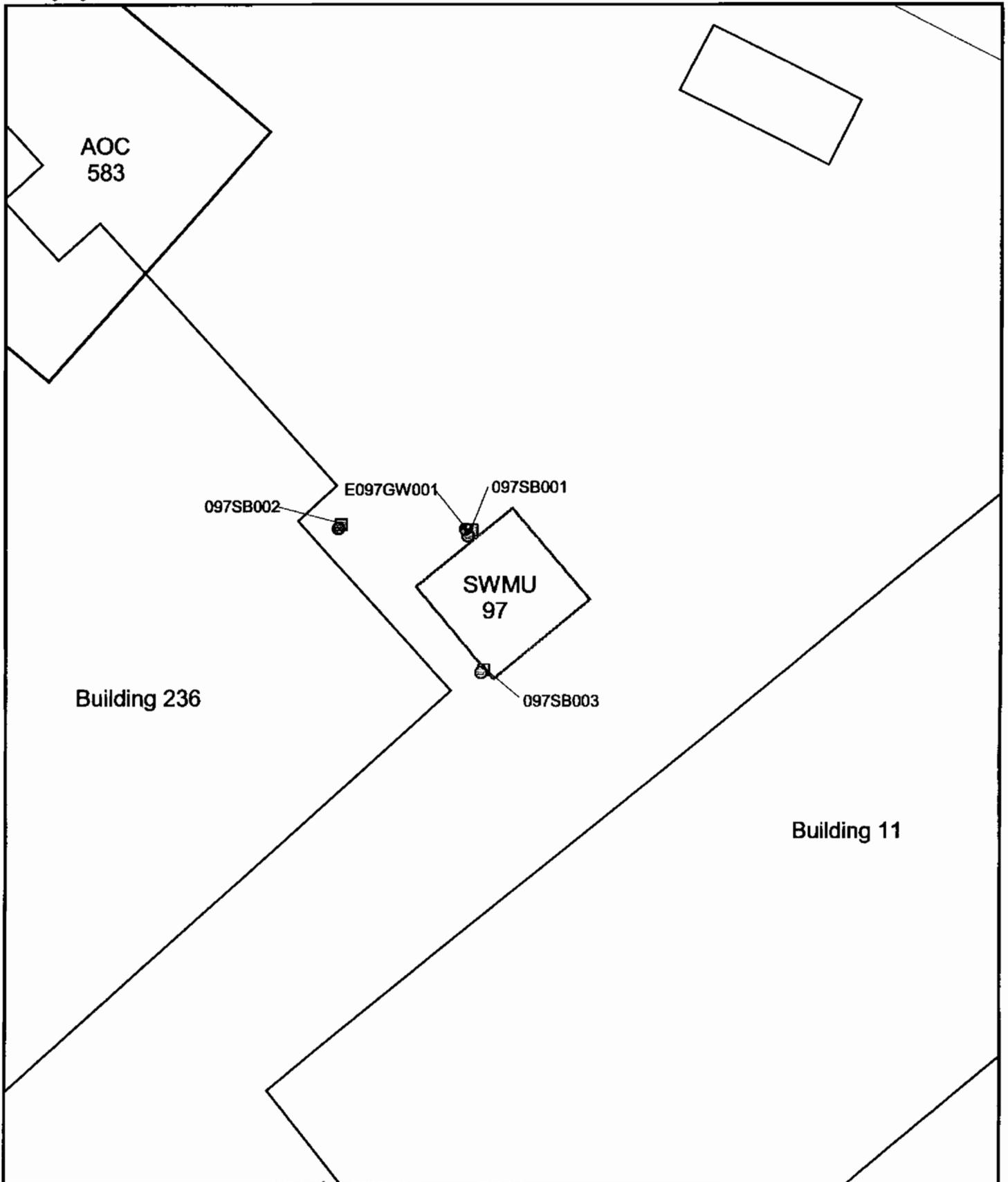
### 22 **2.3.2 Groundwater**

23 Arsenic was retained as a COC for shallow groundwater for both the unrestricted and  
24 commercial/industrial future land use scenarios.

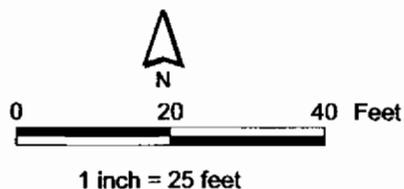
## 25 **2.4 RFI Conclusions and Recommendations**

26 The *Zone E RFI Report, Revision 0* recommended that a Corrective Measures Study (CMS) be  
27 conducted for the shallow groundwater COC (arsenic) at SWMU 97.

NOTE: Original figure created in color



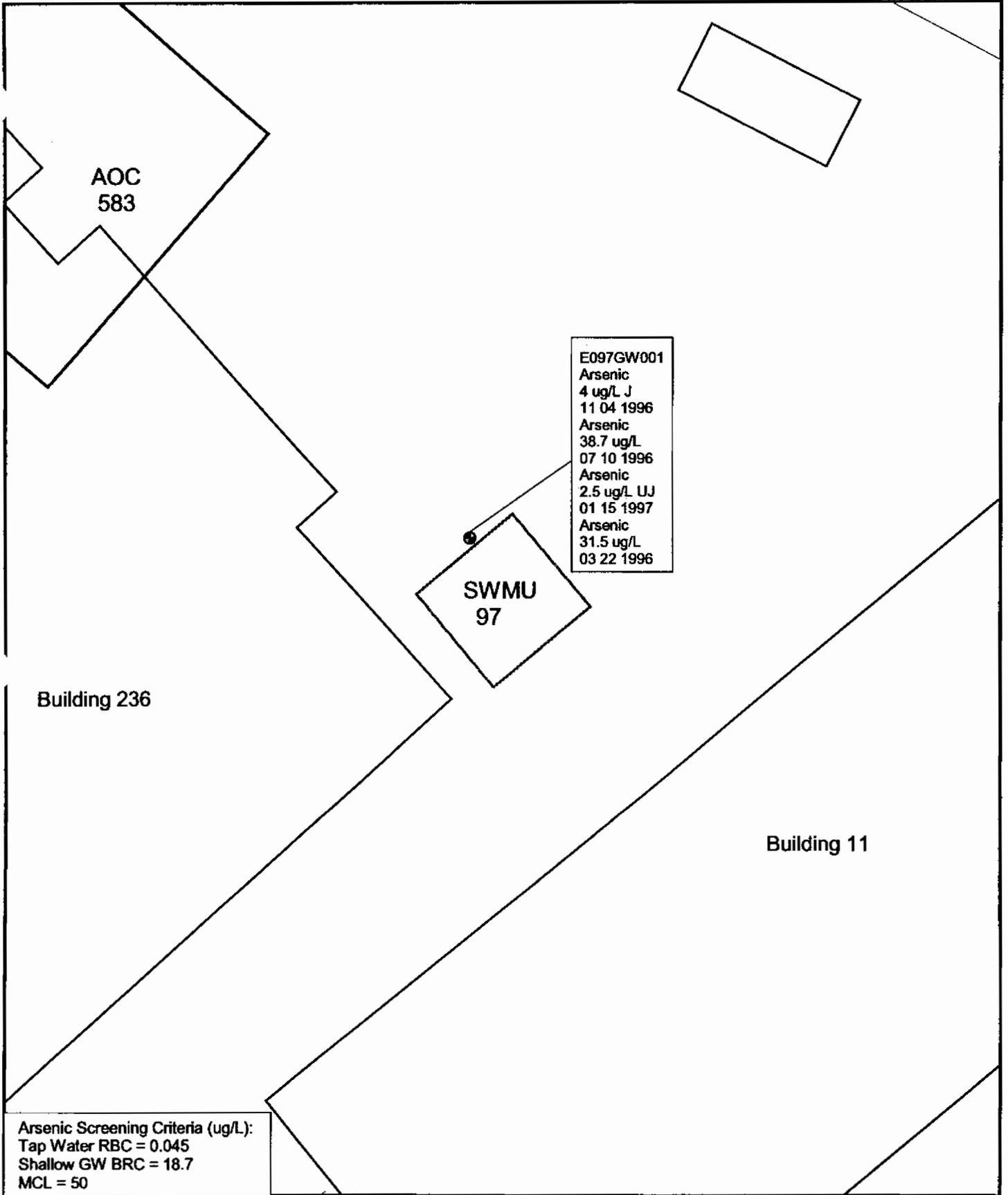
- Groundwater Well Location
- ⊗ Surface Soil Sampling Location
- ⊠ Subsurface Soil Sampling Location
- ~ Roads
- ▭ AOC Boundary
- ▭ SWMU Boundary
- ▭ Buildings



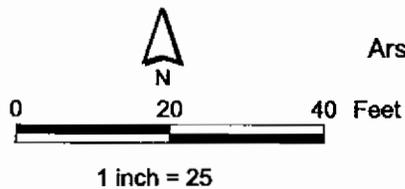
**Figure 2-1**  
RFI Sample Locations  
SWMU 97, Zone E  
Charleston Naval Complex

**CH2MHILL**

NOTE: Original figure created in color



- Groundwater Well Location
- ∨ Railroads
- ∨ Roads - Lines
- AOC Boundary
- SWMU Boundary
- Buildings



**Figure 2-2**  
Arsenic Detections in Shallow Groundwater  
SWMU 97, Zone E  
Charleston Naval Complex



1 **3.0 Summary of Interim Measures and UST/AST**  
2 **Removals at SWMU 97**

---

3 **3.1 UST/AST Removals**

4 There is no indication of a UST or AST being present at this site.

5 **3.2 Interim Measures (IMs)**

6 There were no IMs conducted at the site.

**Section 4.0**

---

## 1 **4.0 Summary of Additional Investigations**

---

- 2 No additional investigations have been conducted at SWMU 97 since the RFI field
- 3 investigations conducted by EnSafe during the period of 1995-1997.

**Section 5.0**

---

## 1 **5.0 COPC/COC Refinement**

---

2 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified arsenic as a shallow groundwater  
3 COC for SWMU 97 for the future industrial land use scenario. The nature of occurrence and  
4 the relevance of this analyte at this site are further discussed below.

### 5 **5.1 Groundwater**

#### 6 **5.1.1 Arsenic**

7 The RFI report considered arsenic as a COC at SWMU 97 based on the detections of arsenic  
8 above the EPA Region III tap water RBC and the shallow groundwater BRC of at 18.7 µg/L.  
9 The detections of arsenic in the shallow well RFI samples at this site ranged from 4 µg/L to  
10 38.7 µg/L, all of which are below the MCL for arsenic of 50 µg/L. Therefore, arsenic is not a  
11 groundwater COC at this site.

### 12 **5.2 COC Summary**

13 No COCs that require further action are identified at SWMU 97.



## 6.0 Summary of Information Related to Site Closeout Issues

---

### 6.1 RFI Status

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs/ Areas of Concern (AOCs) within Zone E of the CNC, including SWMU 97.

In accordance with the RFI completion process, if a determination of No Further Investigation (NFI) is made upon completion of the RFI, then a site may proceed to either no further action (NFA) status or to a CMS. The RFI report identified arsenic as a COC for shallow groundwater at SWMU 97. Based on the discussion presented in Section 5.0 above, arsenic in shallow groundwater is not considered a COC at SWMU 97; therefore, CH2M-Jones recommends this site for NFA status.

The remaining subsections address the issues that the BCT agreed to evaluate prior to site closeout.

### 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.

There were no detections of thallium in the shallow well above the laboratory detection limits. There were no detections of antimony or arsenic in shallow groundwater at the site above the MCL. Further evaluation of this issue is not warranted.

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

There are no data suggesting that there was an impact to the sanitary sewers from this site. Therefore, further evaluation of this issue is not warranted.

1 **6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at**  
2 **the CNC**

3 No COCs requiring further evaluation are present at this site and there are no data  
4 suggesting an impact to the investigated storm sewers at this site from site-related activities.  
5 Based on these findings, further evaluation of this issue is not warranted.

6 **6.5 Potential Linkage to AOC 504, Investigated Railroad Lines**  
7 **at the CNC**

8 The nearest existing railroad line to SWMU 97 is approximately 130 feet northeast of the  
9 site. There is no known linkage between SWMU 97 and the investigated railroad lines of  
10 AOC 504. Therefore, further evaluation of this issue is not warranted.

11 **6.6 Potential Migration Pathways to Surface Water Bodies at**  
12 **the CNC**

13 The nearest surface water body to SWMU 97 is the Cooper River, which lies approximately  
14 250 feet northeast of the site. The only potential migration pathway from the site to surface  
15 water is via overland flow via stormwater runoff. The entire site is covered with buildings  
16 and pavement, which eliminates contact of surface soil with stormwater. Similarly, runoff  
17 directed to the storm sewer system, which discharges to the Cooper River, does not contact  
18 the surface soil. Since no COCs requiring further evaluation are present at this site, no  
19 further evaluation of a potential pathway for contaminant migration via stormwater runoff  
20 is warranted.

21 The potential for groundwater contamination associated with SWMU 97 to enter the Cooper  
22 River will be addressed when groundwater is addressed on an installation-wide level in a  
23 later document.

24 **6.7 Potential Contamination in Oil/Water Separators**

25 There are no oil/water separators (OWSs) associated with SWMU 97. In addition, there is  
26 no reference to an OWS at the site in the *Oil Water Separator Data* report, Department of the  
27 Navy, September 2000. Therefore, further evaluation of this issue is not warranted.

28

## 1 **6.8 Land Use Control**

2 Evaluation of data using current screening criteria adopted by the BCT did not identify any  
3 COCs in soil or groundwater at SWMU 97 for an unrestricted land use scenario. Therefore,  
4 land use controls (LUCs) are not necessary at this site.

5 The Navy expects to establish LUCs via deed restrictions for all of Zone E at the CNC.  
6 Because this site is located in Zone E, LUCs will apply at this site. It is expected that the  
7 Zone E LUCs will include, at a minimum, a restriction that the land be used for non-  
8 residential use.



## 1 **7.0 Recommendations**

---

2 SWMU 97 is a former less-than-90-day accumulation area located on the east corner of  
3 Building 236. Wastes were stored in 55-gallon drums on pallets inside the 20 ft x 20 ft metal  
4 structure on an asphalt foundation. The dates of operation are not known. The storage area  
5 location is currently empty. Building 236 currently houses the corporate offices of Detyens  
6 Shipyards, Inc. and a machine shop.

7 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified arsenic in shallow groundwater  
8 as a COC and concluded that a CMS is appropriate for the SWMU 97 site. However, further  
9 evaluation of COPCs, as presented in this RFI Report Addendum, concludes that arsenic in  
10 shallow groundwater is not a COC, and additionally, that there are no soil COCs at this site.  
11 Therefore, no corrective action is necessary and this site is recommended for NFA.

12 Once the BCT concurs that NFA is appropriate for the site, a Statement of Basis will be  
13 prepared that will be made available for public comment in accordance with SCDHEC  
14 policy. This will allow for public participation in the final remedy selection.

**Section 8.0**

---

## 1 **8.0 References**

---

- 2 EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston*. 1997.
- 3 EnSafe Inc./ Allen & Hoshall. *Final RCRA Facility Assessment, NAVBASE Charleston*. July  
4 1995.
- 5 EnSafe Inc./ Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, NAVBASE Charleston*.  
6 June 1995.
- 7 South Carolina Department of Health and Environmental Control, Final RCRA Part B  
8 Permit No. SC0 170 022 560.

**Appendix A**

---

Table 10.12.A  
 Chemicals Present in Site Samples  
 SWMU 97 - Surface Soil  
 NAVBASE - Charleston  
 Charleston, SC

Parameter	Frequency of Detection		Range of Detection		Average Detected Concentration	Range of SQL		Screening Concentration			Units	Number Exceeding		
								Residential RBC	Industrial RBC	Reference		Res.	Ind.	Ref.
<b>Carcinogenic PAHs</b>														
B(a)P Equiv.	2	3	54.83	86.20	70.5145	831.96	831.96	88	780	NA	UG/KG			
Benzo(a)anthracene	2	3	44	78	61	360	360	880	7800	NA	UG/KG			
Benzo(a)pyrene	2	3	46	66	56	360	360	88	780	NA	UG/KG			
Benzo(b)fluoranthene	2	3	40	70	55	360	360	880	7800	NA	UG/KG			
Benzo(k)fluoranthene	2	3	38	61	49.5	360	360	8800	78000	NA	UG/KG			
Chrysene	2	3	47	92	69.5	360	360	88000	780000	NA	UG/KG			
Indeno(1,2,3-cd)pyrene	1	3	47	47	47	360	380	880	7800	NA	UG/KG			
<b>TCDD Equivalents</b>														
Dioxin Equiv.	1	1	0.30	0.30	0.30	NA	NA	1000	1000	NA	NG/KG			
<b>Inorganics</b>														
Aluminum (Al)	3	3	2010	3540	2813.33	NA	NA	7800	100000	26600	MG/KG			
Arsenic (As)	3	3	0.87	4.9	3.49	NA	NA	0.43	3.8	23.9	MG/KG	3	2	
Barium (Ba)	3	3	3.2	18	12.97	NA	NA	550	14000	130	MG/KG			
Beryllium (Be)	2	3	0.33	0.34	0.34	0.11	0.11	0.15	1.3	1.7	MG/KG	2		
Cadmium (Cd)	1	3	0.26	0.26	0.26	0.11	0.12	3.9	100	1.5	MG/KG			
Calcium (Ca)	N	3	19100	113000	53166.67	NA	NA	NA	NA	NA	MG/KG			
Chromium (Cr)	3	3	3.8	54.9	24.47	NA	NA	39	1000	94.6	MG/KG	1		
Cobalt (Co)	3	3	0.9	2.1	1.63	NA	NA	470	12000	19	MG/KG			
Copper (Cu)	3	3	1.9	8.2	5.23	NA	NA	310	8200	66	MG/KG			
Iron (Fe)	N	3	1050	6380	3476.67	NA	NA	NA	NA	NA	MG/KG			
Lead (Pb)	3	3	1.5	41.2	26.53	NA	NA	400	400	265	MG/KG			
Magnesium (Mg)	N	3	396	2430	1495.33	NA	NA	NA	NA	NA	MG/KG			
Manganese (Mn)	3	3	24.8	179	94.43	NA	NA	180	4700	302	MG/KG			
Nickel (Ni)	3	3	1.9	5.5	4.00	NA	NA	160	4100	77.1	MG/KG			
Potassium (K)	N	3	511	934	712.33	NA	NA	NA	NA	NA	MG/KG			
Sodium (Na)	N	2	438	684	561.00	199	199	NA	NA	NA	MG/KG			
Vanadium (V)	3	3	2.2	9.6	5.53	NA	NA	55	1400	94.3	MG/KG			
Zinc (Zn)	3	3	4.5	31.9	21.67	NA	NA	2300	61000	827	MG/KG			
<b>Pesticides</b>														
4,4'-DDE	1	3	15.1	15.1	15.10	2.75	2.84	1900	17000	NA	UG/KG			
alpha-Chlordane	2	3	2.68	97	49.84	1.43	1.43	470	2200	NA	UG/KG			
Dieldrin	1	3	5.5	5.5	5.50	2.75	2.84	40	360	NA	UG/KG			
Endrin	1	3	4.91	4.91	4.91	2.75	2.84	2300	61000	NA	UG/KG			
gamma-Chlordane	2	3	6.41	260	133.21	1.43	1.43	470	2200	NA	UG/KG			
Heptachlor	1	3	7.7	7.7	7.70	1.43	1.48	140	1300	NA	UG/KG			
Heptachlor epoxide	1	3	7.37	7.37	7.37	1.43	1.48	70	630	NA	UG/KG			
<b>Semivolatile Organics</b>														
4-Chloro-3-methylphenol	1	3	67	67	67	360	380	NA	NA	NA	UG/KG			
Acenaphthene	1	3	54	54	54	360	380	470000	12000000	NA	UG/KG			
Benzo(g,h,i)perylene	1	3	55	55	55	360	380	310000	8200000	NA	UG/KG			
Benzoic acid	2	3	130	200	165	1800	1800	31000000	100000000	NA	UG/KG			
Fluoranthene	2	3	66	110	88	360	360	310000	8200000	NA	UG/KG			
Pentachlorophenol	1	3	43	43	43	1800	1800	5300	48000	NA	UG/KG			
Phenanthrene	1	3	76	76	76	360	380	310000	8200000	NA	UG/KG			
Pyrene	2	3	79	190	134.5	360	360	230000	6100000	NA	UG/KG			
<b>Volatile Organics</b>														
Acetone	1	3	40	40	40	11	11	780000	20000000	NA	UG/KG			
Methylene chloride	1	3	2	2	2	5	6	85000	760000	NA	UG/KG			

\* - Identified as a residential COPC  
 \*\* - Identified as an industrial COPC  
 N - Essential nutrient  
 MG/KG - milligrams per kilogram  
 UG/KG - micrograms per kilogram  
 NG/KG - nanograms per kilogram  
 SQL - Sample quantitation limit  
 RBC - Risk-based concentration  
 NA - Not applicable

Table 10.12.B  
 Chemicals Present in Site Samples  
 SWMU 97 - Shallow Groundwater  
 NAVBASE - Charleston  
 Charleston, SC

Parameter	Frequency of Detection		Range of Detection		Average Detected Concentration	Range of SQL		Screening Concentration Residential		Units	Number Exceeding Res. Ref.	
								RBC	Reference			
Inorganics												
Aluminum (Al)	1	1	109	109	109	NA	NA	3700	2810	UG/L		
Antimony (Sb) *	1	1	5.1	5.1	5.1	NA	NA	1.5	NA	UG/L	1	1
Arsenic (As) *	1	1	31.5	31.5	31.5	NA	NA	0.045	18.7	UG/L	1	1
Chromium (Cr)	1	1	1.5	1.5	1.5	NA	NA	18	12.3	UG/L		
Vanadium (V)	1	1	12.6	12.6	12.6	NA	NA	26	11.4	UG/L		1

\* - Identified as a COPC

UG/L - micrograms per liter

SQL - Sample quantitation limit

NA - Not applicable





Response To SCDHEC Comments on SWMU 97 of the  
Zone E RCRA Facility Investigation Report, Revision 0 (EnSafe, 1997)  
Charleston Naval Complex  
North Charleston, SC

---

**CHARLES B. WATSON COMMENTS**

**SCDHEC Comment 6:**

Arsenic, beryllium, and chromium were above residential RBC for surface soil and should be evaluated.

**Navy/EnSafe Response:**

Arsenic, beryllium, and chromium were addressed in the site-specific risk assessment which identified the fact that each of these elements were well below their respective background reference concentrations.

**CH2M-Jones Response:**

*No further response.*

**ERIC F. CATHCART COMMENTS**

**SCDHEC Comment 24:**

Antimony and arsenic were above residential RBC for shallow groundwater. Their nature and extent should be evaluated. The RFI is therefore incomplete.

**Navy/EnSafe Response:**

Antimony, although considered a COPC, was reported only in the original first-quarter sample and was not reported at a concentration above a detectable limit during the second, third, or fourth quarters of sampling. Arsenic was detected in concentrations greater than its corresponding background reference concentration only in the first two quarterly sampling events. However, the last two sampling events yielded concentrations less than the reference concentration and/or detection limit. A comparison of the maximum reported concentrations of antimony and arsenic at nearby wells indicates that antimony was not detected in any groundwater samples, and arsenic did not exceed its reference concentration. All arsenic detections were less than the maximum reported concentration of 31.5 mg/L at SWMU 97. Neither antimony nor arsenic exceeded their respective MCLs, therefore it appears that the risk and hazard posed by antimony and arsenic have been overestimated. Discussions are ongoing pertaining to the widespread presence of inorganics in groundwater and how to interpret the significance of that data. A technical memo was submitted to the Project Team to review several months ago and it was briefly discussed at a meeting with SCDHEC in June. At that meeting SCDHEC indicated their review of the memo was not complete and that further discussion should be deferred until that review was complete.

**CH2M-Jones Response:**

*The antimony and arsenic concentrations detected in groundwater at the site are below their respective MCLs and are also well within the range of antimony and arsenic detected in groundwater in Zone E grid wells (2.1 to 6 µg/L and 3 to 316 µg/L, respectively). No further evaluation of arsenic and antimony in groundwater at the site is warranted.*