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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT
ADDENDUM AREA OF CONCERN 550 (AOC 550) ZONE E CNC CHARLESTON SC
9/1/2003
CH2M HILL

RFI REPORT ADDENDUM

Area of Concern 550, Zone E



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

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

PREPARED BY
CH2M-Jones

September 2003

*Revision 2
Contract N62467-99-C-0960
158814.ZE.PR.01*

CH2MHILL TRANSMITTAL

To: David Scaturo
South Carolina Department of Health
and Environmental Control
Bureau of Land and Waste
Management
8901 Farrow Road
Columbia, SC 29203

From: Dean Williamson/CH2M-Jones

Date: Sept. 19, 2003

Re: CH2M-Jones' Responses to Comments by SCDHEC regarding the *RFI Report Addendum, AOC 550, Zone E, Revision 1* – Submitted on July 16, 2003

We Are Sending You:

X	Attached	Under separate cover via	
	Shop Drawings	Documents	Tracings
	Prints	Specifications	Catalogs
	Copy of letter	Other:	

Quantity	Description
4	Responses to Comments by SCDHEC regarding the <i>RFI Report Addendum, AOC 550, Zone E, Revision 1</i> – Submitted on July 16, 2003, and replacement pages

If material received is not as listed, please notify us at once.

Copy To:

Dann Spariosu/USEPA, w/att
Rob Harrell/Navy, w/att
Gary Foster/CH2M-Jones, w/att

Comments Prepared by Jerry Stamps

1) Response to Comment #3

A table comparing detections to the appropriate screening criteria should be included into this report. Such a table facilitates review of the document for both the regulatory agencies and the general public. However, comparisons to the residential RBCs are no longer necessary since the recommendation for NFA was removed. Therefore, please incorporate a table comparing the detected concentrations to the industrial RBCs.

CH2M-Jones Response:

The requested information was previously provided in the Zone E RFI Report, Revision 0 (EnSafe, 1997). In that report, Tables 10.24.2.1 and 10.24.2.2 compared soil detects to Industrial RBCs and other screening criteria and Table 10.24.4.1 compared groundwater detects to screening COPC criteria. Copies of these tables can be included as an appendix to the RFIRA.

Comments Prepared by Jo Cherie Overcash

1) The explanation under 2.2 Groundwater Sampling and Analysis is inaccurate with respect to the location of well 22/22D. Please revise.

CH2M-Jones Response:

We agree. This section will be clarified.

2) Figure 2-1 does not depict EGDEGW022/22D. Please revise accordingly.

CH2M-Jones Response:

We agree. Figure 2-1 will be revised.

3) The statement that "The groundwater at CNC is not potable, and is unlikely to be used for drinking water purposes in the future." found in Section 5.2.2.VOCs should be removed from text. Rather, it should be stated that a groundwater use restriction would apply.

CH2M-Jones Response:

We agree. The text will be modified.

**THE ATTACHED PAGES SHOULD BE INSERTED AS REPLACEMENTS IN THE
RFI REPORT ADDENDUM, AOC 550, ZONE E, REVISION 1 SUBMITTAL:**

- **REVISED PGS. 2-1 THROUGH 2-3**
 - **REVISED FIGURE 2-1**
 - **REVISED PGS. 5-3 THROUGH 5-4**
 - **TABLE 10.24.2.1 FOR INCLUSION IN APPENDIX A**
-



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July 16, 2003

Mr. David Scaturo
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Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: RFI Report Addendum (Revision 1) – AOC 550, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum (Revision 1) for AOC 550 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 do not hesitate to contact him at 770/604-9182, extension 255, should you have any questions or comments.

Sincerely,

CH2M HILL

A handwritten signature in black ink that reads "Dean Williamson".

Dean Williamson, P.E.

cc: Dann Spariosu/USEPA, w/att
Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att



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July 23, 2002

Mr. David Scaturo
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Re: RFI Report Addendum (Revision 0) – AOC 550, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum (Revision 0) for AOC 550 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 do not hesitate to contact him at 770/604-9182, extension 255, should you have any questions or comments.

Sincerely,

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Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

RFI REPORT ADDENDUM

Area of Concern 550, Zone E



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

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

PREPARED BY
CH2M-Jones

September 2003

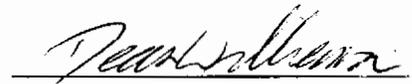
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158814.ZE.PR.01*

Certification Page for RFI Report Addendum (Revision 2) – AOC 550, Zone E

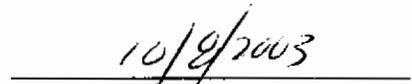
I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428



Dean Williamson, P.E.



Date

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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	IM	interim measure
19	HI	hazard index
20	LUC	land use control
21	MCL	maximum contaminant level
22	$\mu\text{g}/\text{kg}$	microgram per kilogram
23	$\mu\text{g}/\text{L}$	microgram per liter
24	NAVBASE	Naval Base
25	NFA	no further action
26	OWS	oil/water separator
27	PCB	polychlorinated biphenyl
28	RBC	risk-based concentration
29	RCRA	Resource Conservation and Recovery Act
30	RFI	RCRA Facility Investigation

1 **Acronyms and Abbreviations, Continued**

2	SCDHEC	South Carolina Department of Health and Environmental Control
3	SSL	soil screening level
4	SVOC	semivolatile organic compound
5	SWMU	solid waste management unit
6	TDS	total dissolved solids
7	UST	underground storage tank
8	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 Area of Concern (AOC) 550 in Zone E of
14 CNC. The location of this site in Zone E is shown in Figure 1-1. Figure 1-2 shows an aerial
15 photograph of the site.

16 1.1 Background

17 AOC 550 is the location of former Building 1111, a transportable boiler house used by the
18 U.S. Marine Corps from 1927 to 1941. The dimensions of this facility are unknown, but
19 former Building 1111 is shown at two locations on historic base maps. Personnel interviews
20 indicate that this facility was transportable. No other information was found during the
21 RFA regarding its design features or operating practices.

22 The materials of concern identified in the *Final Zone E RFI Work Plan, Revision 1* (EnSafe Inc.
23 [EnSafe]/Allen & Hoshall, 1995) at AOC 550 include petroleum hydrocarbons and heavy
24 metals. This area of Zone E is zoned M-2 (for industrial land use). The CNC RCRA Permit
25 identified AOC 550 as requiring a confirmatory sampling investigation (CSI).

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

1.2 Purpose of the RFI Report Addendum

The purpose of this RFI Report Addendum is to document the results of previous RFI investigations conducted by the Navy/EnSafe team at AOC 550. This RFI Report Addendum also discusses various closeout issues and the findings of previous investigations, existing site conditions, and the surrounding area land use.

Prior to changing the status of any site in the CNC RCRA CA permit, the BRAC Cleanup Team (BCT) agreed that the following issues should be considered:

- Status of the RFI
- Presence of metals (inorganics) in groundwater
- Potential linkage to Solid Waste Management Unit (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 (LUCs) at the site

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

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 the background information relating to the RFI Report Addendum.

2.0 Summary of RFI Conclusions for AOC 550 – Summarizes the conclusions from the RFI investigations and risk evaluations for AOC 550.

3.0 Interim Measures and UST/AST Removals – Summarizes any interim measures (IMs) or underground storage tank (UST)/aboveground storage tank (AST) removal activities conducted at the site.

- 1 **4.0 Summary of Additional Investigations** – Summarizes any information collected after
2 completion of the RFI report.
- 3 **5.0 COPC/COC Refinement** – Identifies and evaluates chemicals of potential concern
4 (COPCs) based on current screening criteria using all RFI and additional data.
- 5 **6.0 Summary of Information Related to Site Closeout Issues** – Discusses the various
6 issues that the BRAC Cleanup Team (BCT) agreed to evaluate prior to site closeout.
- 7 **7.0 Recommendations** – Provides recommendations for proceeding with site closure.
- 8 **8.0 References** – Lists the references used in this document.
- 9 **Appendix A** – Contains excerpts from the RFI report, including a summary of detections of
10 chemicals and a groundwater flow map for the site vicinity.
- 11 **Appendix B** – Contains responses to SCDHEC comments for AOC 550 from the RFI report.
- 12 **Appendix C** – Contains results from RFI groundwater sampling at grid well EGDEGW022.
- 13 **Appendix D** – Contains CH2M-Jones' responses to SCDHEC comments on the *RFI Report*
14 *Addendum, AOC 550, Zone E, Revision 0* (CH2M-Jones, 2002).
- 15 All tables and figures appear at the end of their respective sections.



-  Fence
-  Railroads
-  Roads
-  AOC Boundary
-  SWMU Boundary
-  Buildings

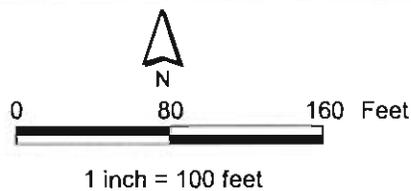


Figure 1-2
Aerial Photograph
AOC 550, Zone E
Charleston Naval Complex

Section 2.0

1 **2.0 Summary of RFI Conclusions for AOC 550**

2 This section summarizes the results and conclusions from the soil and groundwater
3 investigations conducted at AOC 550, which were reported in the *Zone E RFI Report,*
4 *Revision 0* (EnSafe, 1997). Figure 2-1 shows the soil and groundwater sampling locations.

5 The RFI report presented the results of these investigations and conclusions concerning
6 contamination and risk, as summarized in the following sections. Appendix A contains the
7 tables of detected compounds in soil and groundwater, as well as a groundwater flow map
8 for the vicinity. A 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 AOC 550 involved the collection and analysis of surface and subsurface
11 soil samples from locations under concrete and asphalt pavement. Soil samples were
12 collected in two sampling events. During the first sampling event, only five of eight
13 proposed surface and subsurface soil samples were collected, due to the thickness of the fill
14 material. Samples from the first sampling event were analyzed for volatile organic
15 compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. During the
16 second soil sampling event, two surface and two co-located subsurface soil samples were
17 collected and analyzed for SVOCs and metals. One surface soil duplicate sample was
18 collected at AOC 550 and was also analyzed for pesticides/polychlorinated biphenyls
19 (PCBs), cyanide, and organotins. Figure 2-1 shows the RFI sampling locations.

20 **2.1.1 Surface Soil Results**

21 During the RFI, surface soil detections of organic compounds were evaluated against the
22 U.S. Environmental Protection Agency (EPA) Region III industrial risk-based
23 concentrations (RBCs). Surface soil detections of inorganic compounds were evaluated
24 against the EPA Region III industrial RBCs and the Zone E background reference
25 concentrations (BRCs).

26 Copies of Tables 10.24.2.1 and 10.24.2.2, from the *Zone E RFI Report, Revision 0*, which
27 compares soil detects to industrial RBCs and other screening criteria, are provided in
28 Appendix A.

29 Detected concentrations of organic and inorganic analytes exceeding their respective criteria
30 are as follows:

1 **VOCs:** There were no VOC detections in surface soil above laboratory detection limits.

2 **SVOCs:** No SVOC detections in surface soil exceeded the screening criteria.

3 **Inorganics:** No inorganic detections in surface soil exceeded the screening criteria.

4 **Pesticides/PCBs:** There were no detections of pesticides/PCBs in surface soil above
5 laboratory detection limits.

6 **Dioxins:** No dioxin detections in surface soil exceeded the screening criteria.

7 Figure 2-1 shows the soil sampling locations.

8 **2.1.2 Subsurface Soil Results**

9 During the RFI, subsurface soil detections of organic compounds were compared with
10 generic soil screening levels (SSLs) (using a dilution attenuation factor [DAF]=10).

11 Subsurface soil detections of inorganic compounds were compared with generic SSLs (using
12 a DAF=10) and the Zone E BRCs.

13 Detected concentrations of organic and inorganic compounds from subsurface soil samples
14 are as follows:

15 **VOCs:** No VOC detections in subsurface soil exceeded the screening criteria.

16 **SVOCs:** Among detected organic analytes in subsurface soil, only benzo(a)anthracene
17 exceeded its SSL of 700 microgram per kilogram ($\mu\text{g}/\text{kg}$) at a concentration of 730 $\mu\text{g}/\text{kg}$ at
18 sampling location E550SB001.

19 **Inorganics:** No inorganic detections in subsurface soil exceeded screening criteria.

20 **2.2 Groundwater Sampling and Analysis**

21 During the RFI, one shallow monitoring well, E550GW001, was installed. Shallow gridwell
22 EGDEGW022 was designated to help characterize the groundwater at AOC 550. This well
23 was abandoned subsequent to the initial RFI sampling and has been replaced by a new well
24 E550GW002. Groundwater samples from E550GW001 were analyzed for VOCs, SVOCs,
25 metals, chlorides, sulfates, and total dissolved solids (TDS). Groundwater samples from
26 EGDEGW022 were analyzed for the same parameters, plus pesticides/PCBs and cyanide.
27 No duplicate groundwater samples were collected at this site. A deep well, EGDEGW02D,
28 also exists near the site, but was not included in the RFI groundwater evaluation for this
29 site. The location of E550GW001, EGDEGW022, and EGDEGW022D are shown in Figure
30 2-1.

1 Detections in groundwater samples during the RFI were compared with the EPA Region III
2 tap water RBCs, maximum contaminant levels (MCLs), and the Zone E BRCs for shallow
3 zones of the aquifer.

4 **2.2.1 Shallow Groundwater Results**

5 The following detections were found in the shallow groundwater samples at this site:

6 **VOCs:** Among VOCs detected above laboratory detection limits, naphthalene exceeded the
7 EPA Region III tap water RBC of 0.65 µg/L in samples from the grid well GDEGW22D. No
8 MCL has been established for this compound.

9 **SVOCs:** Among SVOCs detected above laboratory detection limits, acenaphthene,
10 dibenzofuran, and 2-methylnaphthalene in samples from the grid well EGDEGW22D
11 exceeded their EPA Region III tapwater RBCs of 37 µg/L, 2.4 µg/L and 12 µg/L,
12 respectively. No MCL has been established for these compounds.

13 **Inorganics:** The RFI reported the following inorganic detection above screening criteria:

- 14 • Iron was detected at a concentration of 14,900 micrograms per liter (µg/L) in the one
15 sample from E550GW001, above the tap water RBC of 1,100 µg/L. No primary MCL
16 exists for iron, and no shallow groundwater BRC was developed for iron in Zone E
17 during the RFI.

18 **2.3 RFI Human Health Risk Assessment (HHRA)**

19 The RFI report used a fixed-point risk evaluation (FRE) approach at this site, which
20 considered future site resident and site worker scenarios for the human health risk
21 assessment (HHRA). The detailed risk assessment for the AOC 550 site is presented in
22 Section 10.24.6 of the RFI report.

23 **2.3.1 Soils**

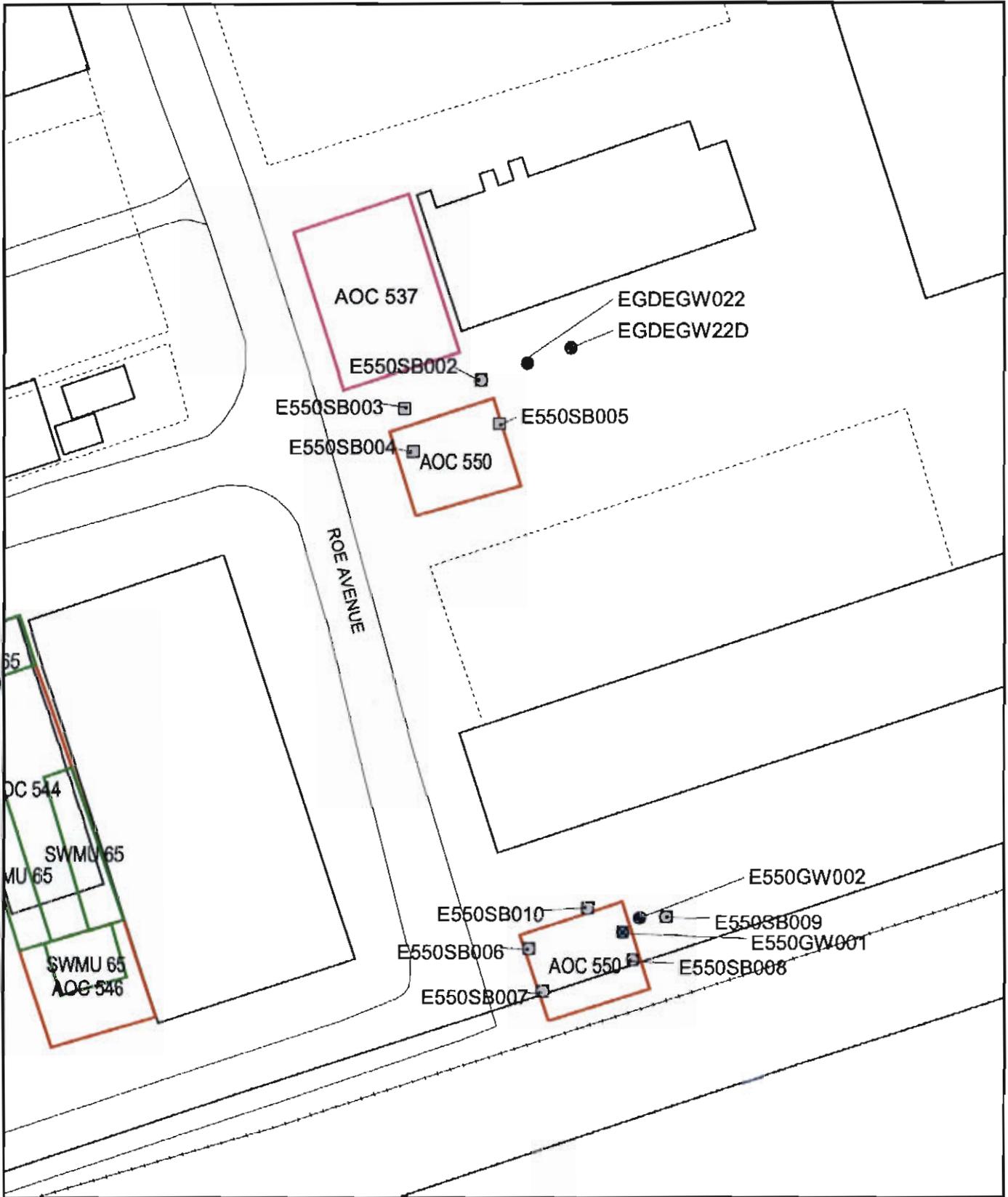
24 The HHRA did not identify any COCs in surface or subsurface soil.

25 **2.3.2 Groundwater**

26 Arsenic was retained as a COC in shallow groundwater.

27 **2.4 RFI Conclusions and Recommendations**

28 The RFI report recommended that a Corrective Measures Study (CMS) be conducted for the
29 shallow groundwater COC arsenic at AOC 550.



- Groundwater Well-Abandoned
- Groundwater Well-Active
- Surface Soil Sample Location
- Subsurface Soil Sample Location
- ≡ Railroads
- ≡ Roads

- AOC Boundary
- SWMU Boundary



0 40 80 Feet

1 inch = 55 feet

Figure 2-1
RFI Sampling Locations
AOC 550, Zone E
Charleston Naval Complex

CH2MHILL

1 **3.0 Interim Measures and UST/AST Removals**

2 **3.1 UST/AST Removals**

3 There are no known USTs or ASTs associated with AOC 550.

4 **3.2 Interim Measures**

5 No IMs have been conducted at AOC 550 to date.

1 **4.0 Summary of Additional Investigations**

- 2 No additional investigations have been conducted at AOC 550 since the RFI field
3 investigations conducted by EnSafe during the period of 1996 through 1997.

5.0 COPC/COC Refinement

This section discusses COCs identified in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). In addition, surface and subsurface soil results for VOCs are rescreened against a generic SSL using a DAF=1.

The RFI report identified arsenic in shallow groundwater as a COC. No COCs were identified by the RFI report for soil. The nature of occurrence and the relevance of this COCs at this site and the rescreening of soil VOC data are further discussed below.

During the RFI, several SVOCs were detected in groundwater samples collected from deep grid well EGDEGW22D, which is located near AOC 550. These data were not discussed in the RFI report. A discussion of these data are provided herein.

5.1 Soil

5.1.1 VOC Screening using SSL at DAF=1

Soil VOC detections were compared to SSLs at DAF =1. Table 5-1 shows the VOCs detected in soil samples. No VOCs exceeded this screening criterion. No VOCs were detected in surface soil samples.

5.2 Groundwater

5.2.1 Arsenic

The RFI identified arsenic in shallow groundwater as a COC based on arsenic detections above the MCL of 50 µg/L. Two arsenic detections in the shallow well E550GW001, at concentrations of 55.9 µg/L and 93.2 µg/L, exceeded the MCL, but were less than the maximum Zone E background arsenic concentration in shallow groundwater of 316 µg/L, as shown in Table 5-2 and Figure 5-1.

Elevated arsenic detections in groundwater at many sites at CNC have been attributed as most likely due to natural occurrence when elevated iron has also been detected in groundwater at the same site, which suggests that iron-reducing conditions are present at the site and influencing the arsenic concentrations. The iron concentrations in shallow groundwater at the site strongly indicate that iron-reducing conditions are present. The mechanism of this natural occurrence is described in *Technical Memorandum, An Overview of*

1 *Arsenic Geochemistry, Terminal Electron Accepting Processes in GW Systems, and Implications for*
2 *the CNC Hydrogeologic Environment (CH2M Jones, 2001).* Additional information on the
3 process of dissimilatory iron reduction was provided in a memorandum entitled "A
4 *Discussion of the Occurrence of Arsenic in Background Groundwater at the CNC.*" The site data,
5 particularly the iron data for groundwater presented in Table 5-2, suggest that the elevated
6 arsenic in shallow groundwater at AOC 550 is due to natural geochemical processes at this
7 site. Based on these observations and because arsenic is within the range of background
8 concentrations in Zone E, arsenic in shallow groundwater is not considered a COC.

9 **5.2.2 SVOCs**

10 During the RFI, several SVOCs (acenaphthene, 2-methylnaphthalene, dibenzofuran, and
11 naphthalene) were detected above their respective EPA Region III tapwater RBCs (with an
12 HI=0.1). All of the exceedances of the tapwater RBC occurred in groundwater samples from
13 the grid well EGDEGW22D. No MCLs have been established for these parameters. Table 5-3
14 shows the detections of these compounds in the groundwater at AOC 550. Detections of
15 these chemicals in well EGDEGW22D are summarized below:

- 16 • Acenaphthene was detected in the second and third sampling event, at concentrations
17 of 43 and 9 µg/L, respectively. The first detection exceeded the EPA Region III tapwater
18 RBC (HI=0.1) of 37 µg/L. These detections were preceded and followed by detections
19 below the tapwater RBC.
- 20 • Dibenzofuran was detected in samples from the grid well EGDEGW22D during all four
21 RFI sampling events, with detections ranging from 8 to 21 µg/L, above its EPA Region
22 III tapwater RBC (HI=0.1) of 2.4 µg/L.
- 23 • 2-methylnaphthalene was detected in samples from the grid well EGDEGW22D during
24 all four RFI sampling events, with detections ranging from 54 to 81 µg /L, above its EPA
25 Region III tapwater RBC (HI= 0.1) of 12 µg/L.
- 26 • Naphthalene was detected in samples from the grid well EGDEGW22D during all four
27 RFI sampling events, with detections ranging from 3 to 8 µg /L, above its EPA Region
28 III tapwater RBC (HI= 0.1) of 0.65 µg/L.

29 **Acenaphthene**

30 There were no detections of acenaphthene above laboratory detection limits in the shallow
31 grid well EGDEGW022 located adjacent to the deep grid well EGDEGW22D. There were no
32 detections of acenaphthene in the soil sample EGDESB022 collected from the well boring for

1 EGDEGW022, or in the surface or subsurface soil sample from nearby soil boring
2 E550SB002. It does not appear that a source of acenaphthene exists in the soil or
3 groundwater in the shallow zone. The groundwater at CNC is not potable, and a
4 groundwater restriction against potable use would apply.

5 A comparison of the maximum detected acenaphthene concentration (43 ug/L) with the
6 tapwater RBC at a HI=1.0 (370 µg/L) indicates that no detections exceeded the RBC
7 (HI=1.0). The target organs for acenaphthene are the liver and kidneys. None of the other
8 SVOCs detected in groundwater have these same target organs. Based on these
9 observations, no further investigation of acenaphthene is proposed, and acenaphthene is
10 not considered a groundwater COC at this site.

11 **Dibenzofuran**

12 There were no detections of dibenzofuran above laboratory detection limits in the shallow
13 grid well EGDEGW022 located adjacent to the deep grid well EGDEGW22D. There were no
14 detections of dibenzofuran in the soil sample EGDESB022 collected from the well boring for
15 EGDEGW022, or in the surface or subsurface soil sample from nearby soil boring
16 E550SB002. A source of dibenzofuran does not appear to be present in the soil or
17 groundwater in the shallow zone. The groundwater at CNC is not potable and a
18 groundwater restriction against potable use would apply.

19 A comparison of the maximum detected dibenzofuran concentration (21 µg/L) with the
20 tapwater RBC based on a HI=1.0 (24 ug/L) shows that none of the detected concentrations
21 exceeded the RBC. The target organ for dibenzofuran is unspecified. Based on lack of
22 exceedances of the RBC (HI=1.0), no further investigation of dibenzofuran is proposed, and
23 dibenzofuran is not considered a groundwater COC at this site.

24 **2-Methylnaphthalene and Naphthalene**

25 There were no detections of 2-methylnaphthalene or naphthalene above laboratory
26 detection limits in the shallow grid well EGDEGW022 located adjacent to the deep grid well
27 EGDEGW22D. There were no detections of 2-methylnaphthalene or naphthalene in the soil
28 sample EGDESB022 collected from the well boring for EGDEGW022, or in the surface or
29 subsurface soil sample from nearby soil boring E550SB002. While both of these chemicals
30 are petroleum constituents, it does not appear that a source of 2-methylnaphthalene or
31 naphthalene exist in the soil or groundwater in the shallow zone. The groundwater at the
32 CNC is not potable, and a groundwater restriction against potable use would apply.

1 The target toxicity effect of naphthalene is a reduction in body weight. The maximum
2 detected concentration of naphthalene (8 µg/L) exceeds the tapwater RBC at HI=1.0 of 6.5
3 µg/L. The hazard index, based on this maximum value, is 1.23.

4 There are no EPA toxicity factors for 2-methylnaphthalene. A target RBC was developed
5 using the naphthalene toxicity criteria by the EPA's National Center for Environmental
6 Assessment (NCEA). Thus, the target toxicity effects for 2-methylnaphthalene are the same
7 as for naphthalene. The estimated RBC for 2-methylnaphthalene is 120 µg/L. When
8 compared to the maximum detected 2-methylnaphthalene concentration of 81 µg/L, the
9 calculated HI is 0.69. The cumulative HI for naphthalene and 2-methylnaphthalene for the
10 effects on body weight loss is calculated as 1.9 (0.65 plus 1.23). This value is slightly above
11 an HI=1.0, but is within the range of HI from 1 to 3 that is generally considered to not pose
12 an unacceptable risk. The HIs for naphthalene and 2-methylnaphthalene based on the
13 average detected concentrations are 0.77 and 0.58, respectively, which result in a cumulative
14 HI of 1.35. This HI is within the acceptable risk range of HI of 1 to 3.

15 Based on these observations, no further investigation of 2-methylnaphthalene or
16 naphthalene is proposed, and these chemicals are not considered groundwater COCs at this
17 site.

18 **5.3 COC Summary**

19 No soil or groundwater COCs for industrial land use are identified at AOC 550.

TABLE 5-1
 Detected Concentrations of Carbon Disulfide and Methyl Ethyl Ketone in Soil
RFI Report Addendum, AOC 550, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC	SSL (DAF=1)	Zone E Background Range of Conc.
(Subsurface Soil)							
Carbon Disulfide					780	2	NA
	E550SB001	550SB00102	0.004	J			
	E550SB002	550SB00202	0.006	U			
	E550SB006	550SB00602	0.001	J			
	E550SB007	550SB00702	0.005	U			
	E550SB008	550SB00802	0.006	U			
Methyl Ethyl Ketone					4,700	0.4 ^a	NA
	E550SB001	550SB00102	0.013	U			
	E550SB002	550SB00202	0.011	U			
	E550SB006	550SB00602	0.010	J			
	E550SB007	550SB00702	0.011	U			
	E550SB008	550SB00802	0.012	U			

^a EPA Region III SSL, DAF = 1

- J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.
- U Indicates that the concentration was not detected.

TABLE 5-2
 Arsenic, Iron, and Manganese in Groundwater
RFI Report Addendum, AOC 550, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Arsenic		Iron		Manganese	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
MCL		50		NA		NA	
EPA Region III Tap Water RBC (HI=0.1)		0.045		1,100		73	
Zone E Shallow Mean Background Reference Concentration^a		36		9,023		442	
Zone E Shallow Background Range Concentration^a		2.6 - 316		144 - 76,600		2 - 2,650	
E550GW001	04/11/1996	18.5	=	14,900	J	625	J
E550GW001	08/12/1996	19.9	=	12,000	=	203	=
E550GW001	12/04/1996	93.2	=	29,400	=	731	=
E550GW001	02/24/1997	55.9	=	25,800	=	677	=
EGDEGW022	04/12/1996	6.7	J	8,080	=	290	=
EGDEGW022	08/02/1996	3.7	J	7,620	=	263	J
EGDEGW022	11/21/1996	3.1	J	2,520	J	157	=
EGDEGW022	02/06/1997	2.5	U	9,690	=	345	=

TABLE 5-2
 Arsenic, Iron, and Manganese in Groundwater
 RFI Report Addendum, AOC 550, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Arsenic		Iron		Manganese	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
	MCL	50		NA		NA	
	EPA Region III Tap Water RBC (HI=0.1)	0.045		1,100		73	
	Zone E Shallow Mean Background Reference Concentration^a	36		9,023		442	
	Zone E Shallow Background Range Concentration^a	2.6 - 316		144 - 76,600		2 - 2,650	

^a The Zone E Mean Background Reference Concentrations and Range of Concentrations were obtained from Appendix J of the *Project Team Notebook and Instructions - Charleston Naval Complex, Environmental Restoration Project, Revision 1A* (CH2M-Jones, December 2001).

Concentrations in bold and outlined text exceed the appropriate screening criteria.

= Indicates that the analyte is detected at the concentration shown.

HI Hazard index

J Indicates an estimated value. A "J" qualifier may signify that the concentration is below the PQL, or that the "J" has been applied as a result of the data validation.

µg/L micrograms per liter

NA Screening criteria not available for the referenced compound.

U Indicates analyte not detected above laboratory detection limit.

TABLE 5-3
 Detections of Organic Groundwater COPCs
 RFI Report Addendum, AOC 550, Zone E, Charleston Naval Complex

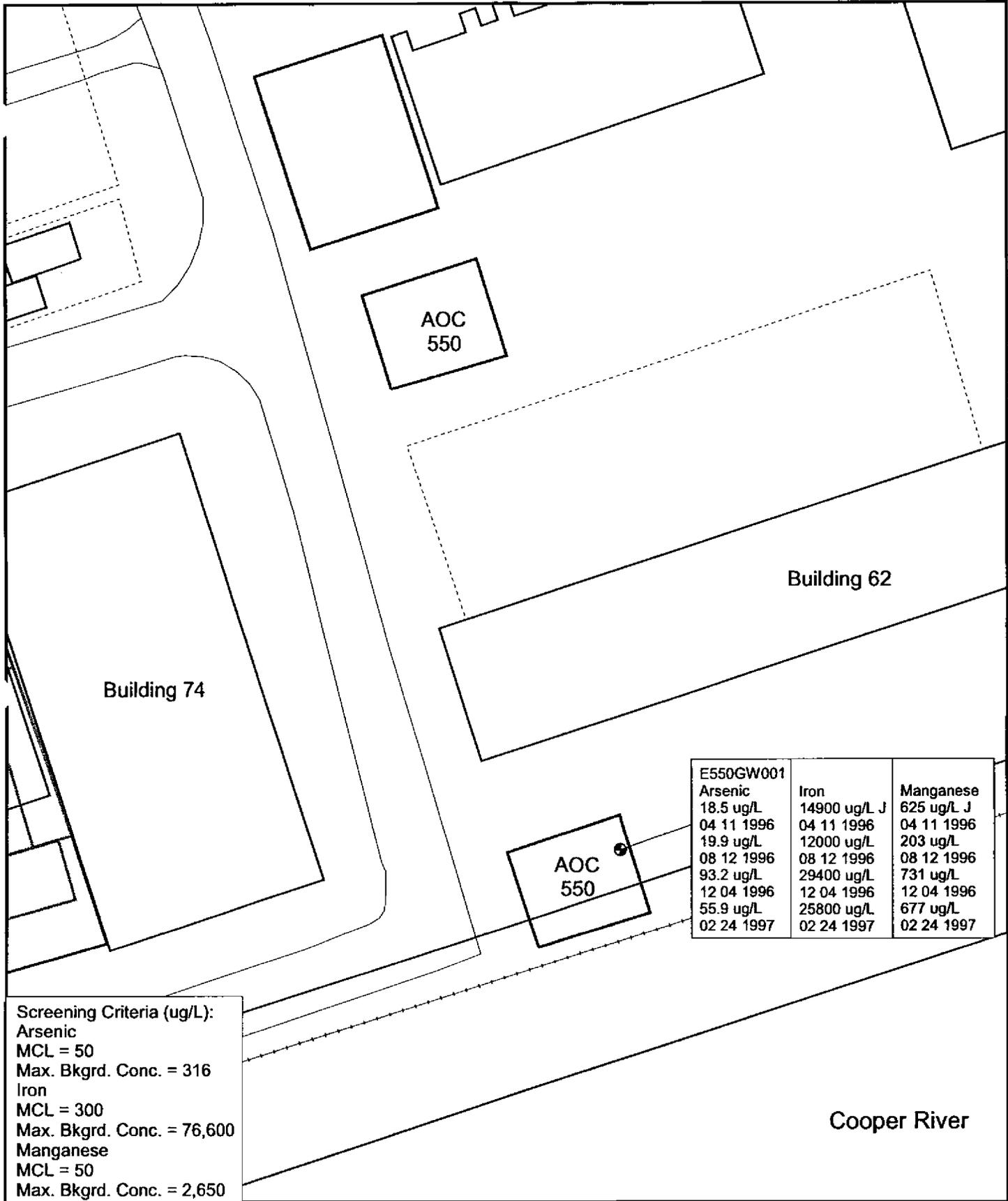
Parameter	Station ID	Sample ID	Concentration ($\mu\text{g/L}$)	Qualifier	Date Sampled	MCL ($\mu\text{g/L}$)	EPA Region III Tapwater RBC (HI=0.1) ($\mu\text{g/L}$)
2-Methylnaphthalene	EGDEGW22D	GDEGW22D01	54.0	=	04/12/1996	NA	12
	EGDEGW22D	GDEGW22D02	81.0	=	08/02/1996		
	EGDEGW22D	GDEGW22D03	71.0	=	11/21/1996		
	EGDEGW22D	GDEGW22D04	73.0	=	02/06/1997		
Acenaphthene	EGDEGW22D	GDEGW22D01	16.0	=	04/12/1996	NA	37
	EGDEGW22D	GDEGW22D02	43.0	=	08/02/1996		
	EGDEGW22D	GDEGW22D03	39.0	=	11/21/1996		
	EGDEGW22D	GDEGW22D04	30.0	=	02/06/1997		
Dibenzofuran	EGDEGW22D	GDEGW22D01	8.0	J	04/12/1996	NA	2.4
	EGDEGW22D	GDEGW22D02	21.0	=	08/02/1996		
	EGDEGW22D	GDEGW22D03	21.0	=	11/21/1996		
	EGDEGW22D	GDEGW22D04	15.0	=	02/06/1997		
Naphthalene	EGDEGW22D	GDEGW22D01	3.0	J	04/12/1996	NA	0.65
	EGDEGW22D	GDEGW22D02	8.0	J	08/02/1996		
	EGDEGW22D	GDEGW22D03	5.0	J	11/21/1996		
	EGDEGW22D	GDEGW22D04	4.0	J	02/06/1997		

Concentrations in bold text and outlined within the table represent exceedances of the appropriate screening criteria.

= Indicates that the analyte was detected at the concentration shown.

TABLE 5-3
 Detections of Organic Groundwater COPCs
RFI Report Addendum, AOC 550, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Concentration ($\mu\text{g/L}$)	Qualifier	Date Sampled	MCL ($\mu\text{g/L}$)	EPA Region III Tapwater RBC (HI=0.1) ($\mu\text{g/L}$)
J	Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.						
MCL	Maximum Contaminant Level						
NA	Not Available						



- Groundwater Well
- Fence
- Railroads
- Roads
- AOC Boundary
- SWMU Boundary
- Buildings

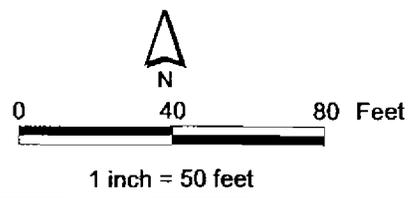


Figure 5-1
 Arsenic Groundwater Detections
 AOC 550, Zone E
 Charleston Naval Complex

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/AOCs within Zone E of the CNC, including AOC 550. With the submission of this RFI Report Addendum, the RFI is considered to be complete.

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 antimony in shallow wells above the laboratory detection limits. Detections of arsenic above the MCL in shallow well E550GW001 at the site are not attributed to site-specific sources but to natural occurrence as discussed in Section 5.2 above. The arsenic detections did not exceed the maximum Zone E background arsenic concentration in shallow groundwater of 316 µg/L. Intermittent detections of thallium in shallow groundwater at the site do not point to a site-specific source, but can be attributed to natural occurrence. The thallium detections did not exceed the maximum Zone E background thallium concentration in shallow groundwater of 6 µg/L, as shown in Table 6-1. Thallium was not identified as a COC in the RFI report. Further evaluation of this issue is not warranted.

1 **6.3 Potential Linkage to SWMU 37, Investigated Sanitary**
2 **Sewers at the CNC**

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

5 **6.4 Potential Linkage to AOC 699, Investigated Storm Sewers**
6 **at the CNC**

7 No direct connection from AOC 550 to the storm sewers is known to exist. Based on these
8 findings, further evaluation of this issue is not warranted.

9 **6.5 Potential Linkage to AOC 504, Investigated Railroad Lines**
10 **at the CNC**

11 The nearest existing railroad line to AOC 550 is approximately 7 feet south of the site.
12 There is no known linkage between AOC 550 and the investigated railroad lines of AOC
13 504. Further evaluation of this issue is not warranted.

14 **6.6 Potential Migration Pathways to Surface Water Bodies at**
15 **the CNC**

16 The nearest surface water body to AOC 550 is the Cooper River, which lies approximately
17 50 feet southeast of the site. The only potential migration pathway from the site to surface
18 water is via overland flow via stormwater runoff. The site is covered with buildings and
19 pavement, which eliminates contact of surface soil with stormwater. Similarly, runoff
20 directed to the storm sewer system, which discharges to the Cooper River, does not contact
21 the surface soil. Therefore, further evaluation of a potential pathway for contaminant
22 migration via stormwater runoff is not warranted.

23 **6.7 Potential Contamination in Oil/Water Separators (OWSs)**

24 There are no OWSs associated with AOC 550. In addition, there is no reference to an OWS
25 at the site in the *Oil Water Separator Data* report (Department of the Navy, September 2000).
26 Therefore, further evaluation of this issue is not warranted.

1 **6.8 Land Use Controls (LUCs)**

2 The CNC BCT has agreed that all of Zone E will have at least some LUCs and restrictions.
3 At a minimum, these LUCs are likely to include restrictions against residential land use.
4 Screening conducted using current screening criteria adopted by the BCT did not identify
5 any COCs in soil or groundwater at AOC 550 for the industrial land use scenario or for the
6 soil-to-groundwater pathway. The BCT has agreed that LUCs will be applied across all of
7 Zone E. These LUCs are expected to include, at a minimum, restricting future land use to
8 non-residential purposes. Because this site is located in Zone E, these LUCs will apply at
9 this site.

TABLE 6-1
 Thallium in Groundwater
 RFI Report Addendum, AOC 550, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Thallium	
		Concentration (µg/L)	Qualifier
MCL		2	
EPA Region III Tap Water RBC (HI=0.1)		0.26	
Zone E Shallow Mean Background Reference Concentration^a		4	
Zone E Shallow Background Range Concentration^a		3 - 6	
E550GW001	04/11/1996	5	U
E550GW001	08/12/1996	2.7	U
E550GW001	12/04/1996	4	J
E550GW001	02/24/1997	5	U
EGDEGW022	04/12/1996	5	U
EGDEGW022	08/02/1996	3.2	J
EGDEGW022	11/21/1996	3	UJ
EGDEGW022	02/06/1997	2.7	UJ

^aThe Zone E Mean Background Reference Concentrations and Range of Concentrations were obtained from Appendix J of the *Project Team Notebook and Instructions - Charleston Naval Complex, Environmental Restoration Project, Revision 1A* (CH2M-Jones, December 2001).

Concentrations in bold and outlined text exceed the appropriate screening criteria.

HI Hazard index

J Indicates an estimated value. A "J" qualifier may signify that the concentration is below the PQL, or that the "J" has been applied as a result of the data validation.

µg/L micrograms per liter

U Indicates analyte not detected above laboratory detection limit.

1 **7.0 Recommendations**

2 AOC 550 is the location of former Building 1111, a transportable boiler house used by the
3 U.S. Marine Corps from 1927 to 1941. The dimensions of this facility are unknown, but
4 former Building 1111 is shown at two locations on historic base maps. Personnel interviews
5 indicate that this facility was transportable. No other information was found during the
6 RFA regarding the building's design features or operating practices.

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 AOC 550 site. However, further
9 evaluation of COPCs, as presented in this RFI Report Addendum, shows that arsenic in
10 shallow groundwater is not a COC. Additionally, there are no soil COCs for the industrial
11 land use scenario or for the soil-to-groundwater pathway at this site. Therefore, no
12 corrective action is necessary for continued use of the site for industrial land use purposes.
13 Land use controls are recommended to ensure that the site remains used for industrial land
14 use only (no residential land use).

15 The BCT has agreed that LUCs will be applied across all of Zone E of the CNC, including
16 this site. These LUCs will include a restriction against residential use. Once the BCT concurs
17 that LUCs are appropriate for the site, a Statement of Basis will be prepared that will be
18 made available for public comment in accordance with SCHDEC policy. This will allow for
19 public participation in the final remedy selection.

1 **8.0 References**

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

**Table 10.24.2.1
AOC 550
Organic Compounds Detected in Soil**

Compound	Sampling Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Number of Samples Exceeding RBC
VOCs ($\mu\text{g}/\text{kg}$)						
2-Butanone (MEK)	Lower	1/5	10.0	10.0	NA	NA
Carbon disulfide	Lower	2/5	1.000 - 4.00	2.50	NA	NA
SVOCs ($\mu\text{g}/\text{kg}$)						
Acenaphthene	Lower	2/7	440 - 860	650	NA	NA
Acenaphthylene	Lower	1/7	60.0	60.0	NA	NA
SVOCs ($\mu\text{g}/\text{kg}$)						
Anthracene	Lower	2/7	250 - 350	300	NA	NA
Benzo(g,h,i)perylene	Lower	4/7	50.0 - 420	197	NA	NA
Dibenzofuran	Lower	2/7	180 - 330	255	NA	NA
1,3-Dichlorobenzene	Lower	2/7	140 - 250	195	NA	NA
1,4-Dichlorobenzene	Lower	1/7	110	110	NA	NA
Fluoranthene	Upper	1/7	140	140	8,200,000	0
	Lower	5/7	100 - 1,800	756	NA	NA
Fluorene	Lower	2/7	270 - 600	435	NA	NA
2-Methylnaphthalene	Lower	2/7	71.0 - 230	151	NA	NA
Naphthalene	Lower	2/7	64.0 - 160	112	NA	NA
Phenanthrene	Lower	3/7	41.0 - 1,200	747	NA	NA
Pyrene	Upper	1/7	160	160	6,100,000	0
	Lower	5/7	96.0 - 1,800	653	NA	NA
SVOCs (B(a)P Equivalent) ($\mu\text{g}/\text{kg}$)						
B(a)P Equiv.	Upper	1/7	26.8	26.8	780	0
	Lower	5/7	71.2 - 1,090	395	NA	NA
Benzo(a)anthracene	Upper	1/7	86.0	86.0	7,800	0
	Lower	3/7	46.0 - 730	409	NA	NA
Benzo(b)fluoranthene	Upper	1/7	180	180	7,800	0
	Lower	4/7	100 - 620	335	NA	NA

**Table 10.24.2.1
AOC 550
Organic Compounds Detected in Soil**

Compound	Sampling Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Number of Samples Exceeding RBC
Benzo(k)fluoranthene	Lower	4/7	66.0 - 630	264	NA	NA
Benzo(a)pyrene	Lower	5/7	62.0 - 720	268	NA	NA
SVOCs (B(a)P Equivalents) ($\mu\text{g}/\text{kg}$)						
Chrysene	Upper	1/7	150	150	780,000	0
	Lower	4/7	66.0 - 760	373	NA	NA
Dibenz(a,h)anthracene	Lower	2/7	110 - 190	150	NA	NA
Indeno(1,2,3-cd)pyrene	Lower	3/7	39.0 - 400	206	NA	NA
Dioxins (ng/kg)						
Dioxin Equiv.	Upper	1/1	0.0426	0.0426	43	0
1234678-HpCDD	Upper	1/1	1.35	1.35	NA	NA
OCDD	Upper	1/1	25.6	25.6	NA	NA
OCDF	Upper	1/1	3.47	3.47	NA	NA

Notes:

$\mu\text{g}/\text{kg}$ = Micrograms per kilogram
 ng/kg = Nanograms per kilogram
 RBC = Risk-based concentration
 NA = No industrial RBC established

**Table 10.24.2.2
AOC 550
Inorganic Detections for Soil (mg/kg)**

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Reference Conc.	Number of Samples Exceeding RBC and RC
Aluminum (Al)	Upper	7/7	2,530 - 6,290	4,270	100,000	26,600	0
	Lower	7/7	2,790 - 7,340	5,310	NA	41,100	NA
Antimony (Sb)	Lower	2/7	0.540 - 0.830	0.685	NA	1.60	NA
Arsenic (As)	Upper	7/7	0.710 - 2.10	1.05	3.80	23.9	0
	Lower	7/7	0.970 - 6.10	3.45	NA	19.9	NA
Barium (Ba)	Upper	7/7	10.3 - 15.6	13.1	14,000	130	0
	Lower	7/7	10.2 - 60.7	27.5	NA	94.1	NA
Beryllium (Be)	Upper	5/7	0.120 - 0.260	0.164	1.30	1.70	0

Table 10.24.2.2
AOC 550
Inorganic Detections for Soil (mg/kg)

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Reference Conc.	Number of Samples Exceeding RBC and RC
Cadmium (Cd)	Lower	5/7	0.160 - 0.630	0.310	NA	2.71	NA
	Upper	2/7	0.120 - 0.150	0.135	100	1.50	0
Calcium (Ca)	Lower	3/7	0.480 - 0.680	0.557	NA	0.960	NA
	Upper	7/7	4,140 - 37,600	14,000	NA	NA	NA
Chromium (Cr)	Lower	7/7	905 - 76,100	25,600	NA	NA	NA
	Upper	7/7	3.20 - 6.80	5.20	1,000	94.6	0
Cobalt (Co)	Lower	7/7	4.60 - 22.8	12.8	NA	75.2	NA
	Upper	7/7	0.580 - 37.9	6.79	12,000	19.0	0
Copper (Cu)	Lower	7/7	0.630 - 8.40	2.78	NA	14.9	NA
	Upper	7/7	1.10 - 10.2	3.20	8,200	66.0	0
Iron (Fe)	Lower	7/7	1.40 - 124	34.4	NA	152	NA
	Upper	7/7	1,220 - 3,560	1,900	61,000	NA	0
Lead (Pb)	Lower	7/7	1,240 - 10,800	5,810	NA	NA	NA
	Upper	7/7	1.80 - 36.0	8.16	1,300	265	0
Magnesium (Mg)	Lower	7/7	2.10 - 306	100	NA	173	NA
	Upper	7/7	264 - 548	401	NA	NA	NA
Manganese (Mn)	Lower	7/7	226 - 3,020	1,340	NA	NA	NA
	Upper	7/7	11.4 - 32.5	22.0	4,700	302	0
Mercury (Hg)	Lower	7/7	9.70 - 156	50.5	NA	881	NA
	Upper	1/7	0.0900	0.0900	61	2.60	0
Nickel (Ni)	Lower	6/7	0.0800 - 0.380	0.210	NA	1.59	NA
	Upper	7/7	1.60 - 6.10	2.69	4,100	77.1	0
Potassium (K)	Lower	7/7	1.10 - 13.1	5.73	NA	57.0	NA
	Upper	7/7	289 - 654	442	NA	NA	NA
Selenium (Se)	Lower	7/7	359 - 1,800	720	NA	NA	NA
	Upper	1/7	0.580	0.580	1,000	1.70	0
Sodium (Na)	Lower	4/7	0.610 - 0.970	0.773	NA	2.40	NA
	Upper	3/7	148 - 323	218	NA	NA	NA
Tin (Sn)	Lower	5/7	154 - 615	360	NA	NA	NA
	Upper	2/7	1.000 - 1.30	1.15	100,000	59.4	0
	Lower	3/7	1.40 - 21.3	10.1	NA	9.23	NA

Table 10.24.2.2
AOC 550
Inorganic Detections for Soil (mg/kg)

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Reference Conc.	Number of Samples Exceeding RBC and RC
Vanadium (V)	Upper	7/7	3.70 - 6.10	5.07	1,400	94.3	0
	Lower	7/7	4.80 - 17.8	11.5	NA	155	NA
Zinc (Zn)	Upper	7/7	4.70 - 40.7	14.1	61,000	827	0
	Lower	7/7	7.10 - 248	98.0	NA	886	NA

Notes:

- mg/kg = Milligrams per kilogram
- RBC = Risk-based concentration
- RC = Reference concentration
- NA = No industrial RBC or RC established

Chemicals Detected in Zone E Soil Samples
AOC 550

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<i>Volatile Organic Compounds (ug/kg)</i>						
2-Butanone (MEK)	550SB006	ND	10.00	4700000.00	NA	NA
Carbon disulfide	550SB001	ND	4.00	780000.00	NA	NA
	550SB006	ND	1.00			
<i>Semi-volatile Compounds (ug/kg)</i>						
1,3-Dichlorobenzene	550SB001	ND	140.00	700000.00	NA	NA
	550SB010	ND	250.00			
1,4-Dichlorobenzene	550SB010	ND	110.00	27000.00	NA	NA
2-Methylnaphthalene	550SB001	ND	230.00	NA	NA	NA
	550SB010	ND	71.00			
Acenaphthene	550SB001	ND	440.00	470000.00	NA	NA
	550SB010	ND	860.00			
Acenaphthylene	550SB010	ND	60.00	310000.00	NA	NA
Anthracene	550SB001	ND	250.00	23000000.00	NA	NA
	550SB010	ND	350.00			
Benzo(a)anthracene	550SB001	ND	730.00	880.00	NA	NA
	550SB002	86.00	ND			
	550SB009	ND	46.00			
	550SB010	ND	450.00			
Benzo(a)pyrene	550SB001	ND	720.00	88.00	NA	NA
	550SB002	ND	80.00			
	550SB006	ND	120.00			
	550SB009	ND	62.00			
	550SB010	ND	360.00			
Benzo(b)fluoranthene	550SB001	ND	620.00	880.00	NA	NA
	550SB002	180.00	140.00			
	550SB006	ND	100.00			
	550SB010	ND	480.00			
Benzo(g,h,i)perylene	550SB001	ND	420.00	310000.00	NA	NA
	550SB006	ND	88.00			
	550SB009	ND	50.00			
	550SB010	ND	230.00			
Benzo(k)fluoranthene	550SB001	ND	630.00	8800.00	NA	NA
	550SB006	ND	110.00			
	550SB009	ND	66.00			
	550SB010	ND	250.00			
Chrysene	550SB001	ND	760.00	88000.00	NA	NA
	550SB002	150.00	ND			
	550SB006	ND	96.00			
	550SB009	ND	66.00			
	550SB010	ND	570.00			
Dibenz(a,h)anthracene	550SB001	ND	190.00	88000.00	NA	NA
	550SB010	ND	110.00			
Dibenzofuran	550SB001	ND	180.00	31000.00	NA	NA
	550SB010	ND	330.00			
Fluoranthene	550SB001	ND	1800.00	3100000.00	NA	NA

Chemicals Detected in Zone E Soil Samples
AOC 550

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	550SB002	140.00	100.00			
	550SB006	ND	170.00			
	550SB009	ND	110.00			
	550SB010	ND	1600.00			
Fluorene	550SB001	ND	270.00	310000.00	NA	NA
	550SB010	ND	600.00			
Indeno(1,2,3-cd)pyrene	550SB001	ND	400.00	880.00	NA	NA
	550SB009	ND	39.00			
	550SB010	ND	180.00			
Naphthalene	550SB001	ND	160.00	310000.00	NA	NA
	550SB010	ND	64.00			
Phenanthrene	550SB001	ND	1000.00	310000.00	NA	NA
	550SB009	ND	41.00			
	550SB010	ND	1200.00			
Pyrene	550SB001	ND	1800.00	230000.00	NA	NA
	550SB002	160.00	96.00			
	550SB006	ND	160.00			
	550SB009	ND	110.00			
	550SB010	ND	1100.00			
Dioxin/Dibenzofuran (ng/kg)						
1234678-HpCDD	550CB001	1.35	ND	NA	NA	NA
OCDD	550CB001	25.60	ND	NA	NA	NA
OCDF	550CB001	3.47	ND	NA	NA	NA
Total Hepta-Dioxins	550CB001	1.66	ND	NA	NA	NA
Inorganic Compounds (mg/kg)						
Aluminum (Al)	550SB001	3460.00	7340.00	7800.00	26000	41100
	550SB002	2550.00	2790.00			
	550SB006	2530.00	6580.00			
	550SB007	4220.00	3780.00			
	550SB008	6290.00	4390.00			
	550SB009	5660.00	7070.00			
	550SB010	4830.00	5220.00			
Antimony (Sb)	550SB001	ND	0.83	3.10	1.77	1.6
	550SB006	ND	0.54			
Arsenic (As)	550SB001	0.72	6.10	3.10	1.77	1.6
	550SB002	2.10	1.40			
	550SB006	1.20	4.00			
	550SB007	1.10	1.20			
	550SB008	0.72	0.97			
	550SB009	0.71	5.70			
	550SB010	0.76	4.80			
Barium (Ba)	550SB001	10.75	60.70	550.00	130	94.1
	550SB002	14.20	11.00			
	550SB006	10.30	21.70			
	550SB007	12.00	11.90			

Chemicals Detected in Zone E Soil Samples
AOC 550

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Beryllium (Be)	550SB008	15.60	10.20			
	550SB009	14.60	24.80			
	550SB010	13.90	52.50			
	550SB001	0.13	0.63	0.15	1.7	2.71
	550SB002	0.26	0.25			
	550SB006	0.12	0.33			
	550SB007	0.15	0.18			
Cadmium (Cd)	550SB008	0.14	0.16			
	550SB001	ND	0.48	3.90	1.5	0.96
	550SB002	0.15	ND			
	550SB006	ND	0.68			
	550SB009	0.12	ND			
Calcium (Ca)	550SB010	ND	0.51			
	550SB001	3370.00	23200.00	NA	NA	NA
	550SB002	37600.00	23500.00			
	550SB006	12500.00	30900.00			
	550SB007	7500.00	2490.00			
	550SB008	11300.00	905.00			
	550SB009	20800.00	22000.00			
Chromium (Cr)	550SB010	4240.00	76100.00			
	550SB001	3.75	19.70	39.00	94.6	75.2
	550SB002	6.70	5.90			
	550SB006	3.20	16.80			
	550SB007	4.90	5.20			
	550SB008	5.60	4.60			
	550SB009	6.80	14.80			
Cobalt (Co)	550SB010	5.10	22.80			
	550SB001	0.57	2.80	470.00	19	14.9
	550SB002	37.90	3.70			
	550SB006	0.72	1.40			
	550SB007	5.10	8.40			
	550SB008	1.00	0.63			
	550SB009	1.30	1.10			
Copper (Cu)	550SB010	0.96	1.40			
	550SB001	1.10	124.00	310.00	66	152
	550SB002	10.20	6.00			
	550SB006	1.40	28.90			
	550SB007	2.40	2.40			
	550SB008	1.90	1.40			
	550SB009	3.20	8.50			
Iron (Fe)	550SB010	2.20	69.80			
	550SB001	1280.00	10800.00	2300.00	NA	NA
	550SB002	3560.00	2790.00			
	550SB006	1220.00	7380.00			
	550SB007	1550.00	1570.00			
	550SB008	1940.00	1240.00			
	550SB009	1970.00	10200.00			

Chemicals Detected in Zone E Soil Samples
AOC 550

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *	
Lead (Pb)	550SB010	1700.00	6690.00				
	550SB001	1.80	300.00	400.00	265	173	
	550SB002	36.00	25.80				
	550SB006	2.20	41.80				
	550SB007	3.50	4.00				
	550SB008	3.20	2.10				
	550SB009	6.40	21.30				
	550SB010	4.00	306.00				
	Magnesium (Mg)	550SB001	257.00	2740.00	NA	NA	NA
		550SB002	502.00	462.00			
550SB006		342.00	1520.00				
550SB007		344.00	299.00				
550SB008		465.00	226.00				
550SB009		548.00	1100.00				
550SB010		344.00	3020.00				
Manganese (Mn)		550SB001	10.95	156.00	180.00	302	881
		550SB002	32.50	24.20			
		550SB006	21.00	39.80			
	550SB007	17.50	12.50				
	550SB008	25.80	9.70				
	550SB009	32.40	57.40				
	550SB010	13.70	54.10				
	Mercury (Hg)	550SB001	ND	0.38	2.30	2.6	1.59
		550SB002	0.09	0.08			
		550SB006	ND	0.20			
550SB008		ND	0.12				
550SB009		ND	0.12				
550SB010		ND	0.36				
Nickel (Ni)	550SB001	1.35	10.40	160.00	77.1	57	
	550SB002	6.10	2.00				
	550SB006	1.80	6.80				
	550SB007	2.10	2.50				
	550SB008	2.30	1.10				
	550SB009	3.20	4.20				
	550SB010	1.70	13.10				
	Potassium (K)	550SB001	437.00	1113.50	NA	NA	NA
		550SB002	410.00	534.00			
		550SB006	439.00	813.00			
550SB007		507.00	466.00				
550SB008		654.00	447.00				
550SB009		357.00	359.00				
550SB010		289.00	619.00				
Selenium (Se)		550SB001	ND	0.83	39.00	1.7	2.4
		550SB006	ND	0.68			
		550SB008	0.58	ND			
	550SB009	ND	0.61				
	550SB010	ND	0.97				

Chemicals Detected in Zone E Soil Samples
AOC 550

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *	
Sodium (Na)	550SB001	ND	430.00	NA	NA	NA	
	550SB002	323.00	272.00				
	550SB006	ND	154.00				
	550SB009	182.00	328.00				
	550SB010	148.00	615.00				
Tin (Sn)	550SB009	1.30	1.40	4700.00	59.4	9.23	
	550SB010	1.00	7.70				
Vanadium (V)	550SB001	4.15	16.00	55.00	94.3	155	
	550SB002	5.30	5.70				
	550SB006	3.70	16.30				
	550SB007	5.20	5.20				
	550SB008	5.60	4.80				
	550SB009	6.10	17.80				
	550SB010	5.30	15.00				
	Zinc (Zn)	550SB001	4.55	238.00	2300.00	827	886
		550SB002	40.70	30.50			
		550SB006	7.20	89.60			
550SB007		10.40	17.10				
550SB008		7.20	7.10				
550SB009		19.40	55.80				
550SB010		8.80	248.00				

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.

* Surface soil samples will be used for human health risk assessment for the Zone E report.

Chemicals Detected in Zone E Groundwater Samples
AOC 550

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MCL
<i>Other Compounds (mg/l)</i>								
Chloride	550GW001	764.00	1700.00	465.00	423.00	NA	NA	NA
Sulfate	550GW001	14.00	2.60	0.70	0.88	NA	NA	NA
Total Dissolved Solids (TDS)	550GW001	1750.00	3740.00	1340.00	1250.00	NA	NA	NA
<i>Inorganic Compounds (ug/l)</i>								
Aluminum (Al)	550GW001	110.00	ND	ND	35.20	3700	2810	NA
Arsenic (As)	550GW001	18.50	19.90	93.20	55.90	0.05	18.7	50
Barium (Ba)	550GW001	60.00	88.00	63.00	52.30	260	211	2000
Calcium (Ca)	550GW001	127000.00	149000.00	127000.00	112000.00	NA	NA	NA
Copper (Cu)	550GW001	ND	ND	ND	1.50	150	2.7	1300
Iron (Fe)	550GW001	14900.00	12000.00	29400.00	25800.00	1100	NA	NA
Magnesium (Mg)	550GW001	36400.00	78700.00	29600.00	22600.00	NA	NA	NA
Manganese (Mn)	550GW001	625.00	203.00	731.00	677.00	84	2560	NA
Mercury (Hg)	550GW001	0.20	ND	ND	ND	1100	NA	0.002
Nickel (Ni)	550GW001	1.60	ND	ND	ND	73	15.2	100
Potassium (K)	550GW001	19800.00	48600.00	18900.00	13200.00	NA	NA	NA
Sodium (Na)	550GW001	512000.00	1260000.00	326000.00	239000.00	NA	NA	NA
Thallium (Tl)	550GW001	ND	ND	4.00	ND	0.29	5.4	2
Vanadium (V)	550GW001	1.70	ND	0.70	ND	28	11.4	NA
Zinc (Zn)	550GW001	ND	ND	6.70	ND	11000	27.3	NA

Notes:

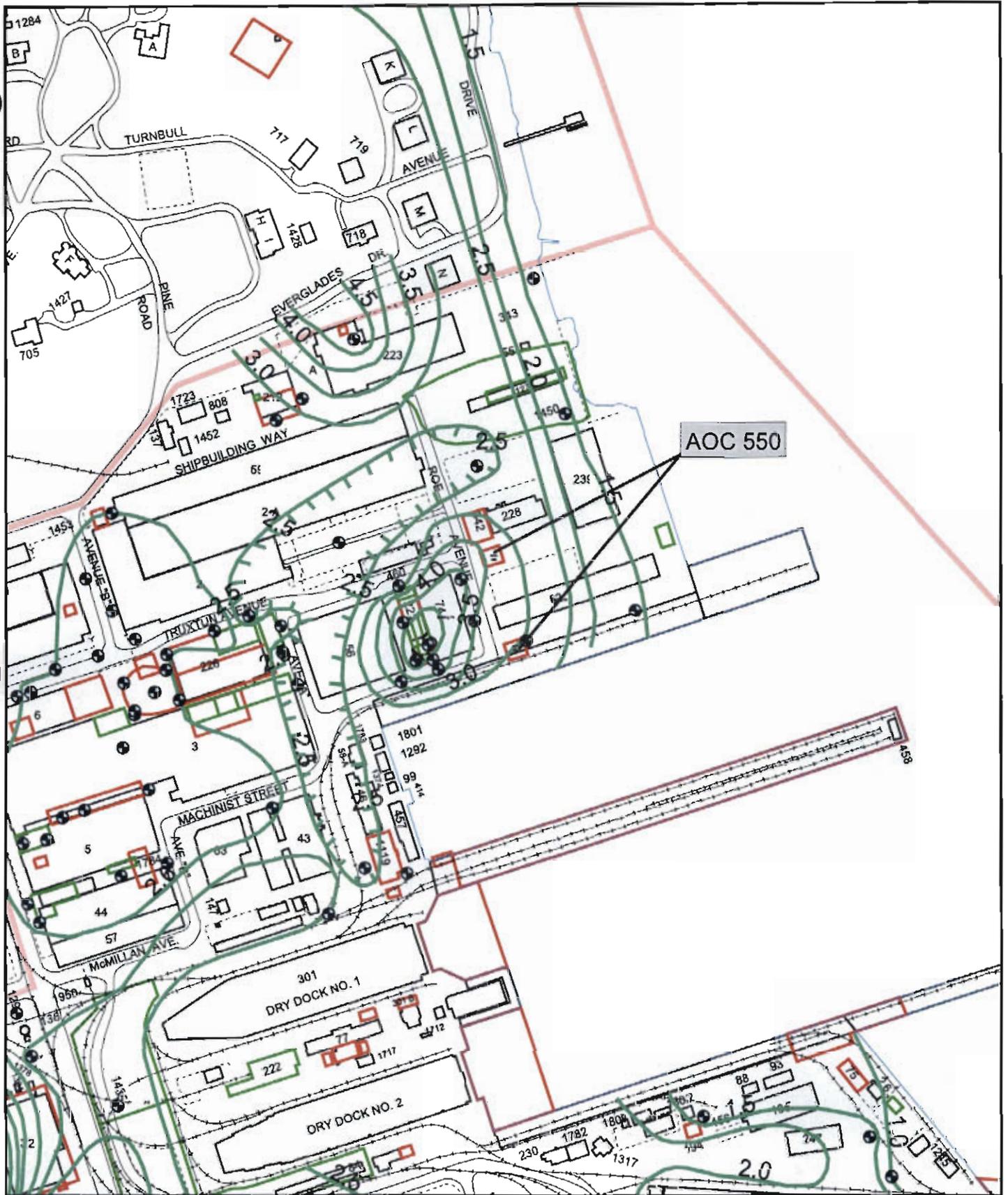
ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.



AOC 550

- Shallow Groundwater Well
- Groundwater Elevation
- - - Fence
- ≡ Railroads
- ≡ Roads
- ▭ AOC Boundary
- ▭ SWMU Boundary
- ▭ Buildings
- ▭ Zone Boundary



0 200 400 feet



1 inch = 300 feet

Figure A-1
 Shallow Groundwater Contour Map, May 2002
 AOC 550, Zone E
 Charleston Naval Complex

CH2MHILL

Comment Prepared by Eric F. Cathcart

SWMU 550

SCDHEC Comment 46:

Section 10.24.3 notes that one well was omitted from installation "due to the close proximity of the grid-based deep and shallow well pair". The Department agrees with these revisions; however, the report does not include data from the grid-based shallow well (NBCEGDE022).

Navy/EnSafe Response:

Analytical results from this shallow well were taken into consideration when evaluating the nature and extent of constituents at AOC 550. The analytical results from well NBCEGDE022, along with its location, will be provided in this section of the Final Zone E RFI Report.

CH2M-Jones Response 46:

RFI results from well NBCEGDE022 are included in Appendix C of this RFIRA. NBCEGDE022 is displayed on Fig. 2-1 as EGDEGW022 in the RFIRA.

Comment Prepared by Dynamac/Gannett Fleming

AOC 550

SCDHEC Comment 1:

Section 10.24.4, Page 10.24-14, Line 18: The text states that the relatively high arsenic concentrations in groundwater samples at nearby SWMU 65 were not a threat to surface water in the Cooper River. The relationship between AOC 550 and SWMU 65 is not explained, or are "relatively high" concentrations defined. The significance of the arsenic groundwater data for SWMU 65 to surface water at AOC 550 must be explained. It must be explained why the relatively high arsenic concentrations in SWMU 65 groundwater samples are not considered a threat to surface water in the Cooper River. Lastly, "relatively high" concentrations should be defined in quantitative terms.

Navy/EnSafe Response:

The text will be revised to read "relatively high arsenic concentrations were also detected in groundwater samples at nearby SWMU 65, but were determined not to significantly impact surface water in the Cooper River. Please refer to Section 10.6.9.6, Table 10.6.9.2; maximum groundwater concentration does not exceed the Adjusted Eco/HH Groundwater RBC for arsenic."

CH2M-Jones Response 1:

There is no known relationship between groundwater at SWMU 65 and AOC 550. Arsenic in groundwater at AOC 550 is discussed in this RFIRA. Arsenic in groundwater at SWMU 65 will be addressed as part of the RFIRA for that site.

Appendix C
AOC 550, Chemicals Detected in EGDEGW022 RFI Groundwater Samples

Chemical Name	SAMPLE	RESULT	UNIT	Qualifier	Date collected
<i>Inorganic Compounds</i>					
Aluminum	GDEGW02202	50.5	ug/L	J	08/02/1996
Aluminum	GDEGW02203	30.7	ug/L	J	11/21/1996
Aluminum	GDEGW02204	25.0	ug/L	J	02/06/1997
Arsenic	GDEGW02201	6.7	ug/L	J	04/12/1996
Arsenic	GDEGW02202	3.7	ug/L	J	08/02/1996
Arsenic	GDEGW02203	3.1	ug/L	J	11/21/1996
Barium	GDEGW02202	85.8	ug/L	=	08/02/1996
Barium	GDEGW02203	65.6	ug/L	J	11/21/1996
Barium	GDEGW02204	130.0	ug/L	J	02/06/1997
Beryllium	GDEGW02204	0.3	ug/L	J	02/06/1997
Calcium	GDEGW02201	95600.0	ug/L	=	04/12/1996
Calcium	GDEGW02202	87800.0	ug/L	=	08/02/1996
Calcium	GDEGW02203	62300.0	ug/L	=	11/21/1996
Calcium	GDEGW02204	76600.0	ug/L	=	02/06/1997
Chromium, Total	GDEGW02203	0.9	ug/L	J	11/21/1996
Copper	GDEGW02203	2.0	ug/L	J	11/21/1996
Copper	GDEGW02204	1.7	ug/L	J	02/06/1997
Iron	GDEGW02201	8080.0	ug/L	=	04/12/1996
Iron	GDEGW02202	7620.0	ug/L	=	08/02/1996
Iron	GDEGW02203	2520.0	ug/L	J	11/21/1996
Iron	GDEGW02204	9690.0	ug/L	=	02/06/1997
Lead	GDEGW02204	2.1	ug/L	J	02/06/1997
Magnesium	GDEGW02201	38300.0	ug/L	=	04/12/1996
Magnesium	GDEGW02202	33600.0	ug/L	=	08/02/1996
Magnesium	GDEGW02203	16100.0	ug/L	=	11/21/1996
Magnesium	GDEGW02204	32000.0	ug/L	=	02/06/1997
Manganese	GDEGW02201	290.0	ug/L	=	04/12/1996
Manganese	GDEGW02202	263.0	ug/L	J	08/02/1996
Manganese	GDEGW02203	157.0	ug/L	=	11/21/1996
Manganese	GDEGW02204	345.0	ug/L	=	02/06/1997
Nickel	GDEGW02201	2.0	ug/L	J	04/12/1996
Nickel	GDEGW02203	1.6	ug/L	J	11/21/1996
Nickel	GDEGW02204	1.0	ug/L	J	02/06/1997
Potassium	GDEGW02201	23200.0	ug/L	=	04/12/1996
Potassium	GDEGW02202	18900.0	ug/L	=	08/02/1996
Potassium	GDEGW02203	10500.0	ug/L	=	11/21/1996
Potassium	GDEGW02204	18600.0	ug/L	=	02/06/1997
Sodium	GDEGW02201	318000.0	ug/L	=	04/12/1996
Sodium	GDEGW02202	241000.0	ug/L	=	08/02/1996
Sodium	GDEGW02203	117000.0	ug/L	=	11/21/1996
Sodium	GDEGW02204	281000.0	ug/L	=	02/06/1997
Thallium	GDEGW02202	3.2	ug/L	J	08/02/1996
Vanadium	GDEGW02201	3.1	ug/L	J	04/12/1996
Vanadium	GDEGW02203	1.2	ug/L	J	11/21/1996
Vanadium	GDEGW02204	0.8	ug/L	J	02/06/1997
Zinc	GDEGW02204	17.3	ug/L	J	02/06/1997
<i>Other Compounds</i>					

Appendix C
AOC 550, Chemicals Detected in EGDEGW022 RFI Groundwater Samples

Chemical Name	SAMPLE	RESULT	UNIT	Qualifier	Date collected
Heptachlor	GDEGW02204	0.042	ug/L	=	02/06/1997
Benzoic acid	GDEGW02202	1	ug/L	J	08/02/1996
Chloroform	GDEGW02203	5	ug/L	J	11/21/1996
Methylene Chloride	GDEGW02202a	1	ug/L	J	10/10/1998
Chloride	GDEGW02201	476000	ug/L	=	04/12/1996
Chloride	GDEGW02202	420000	ug/L	=	08/02/1996
Chloride	GDEGW02203	198000	ug/L	=	11/21/1996
Chloride	GDEGW02204	753000	ug/L	=	02/06/1997
Nitrate-Nitrite-N	GDEGW02202a	210	ug/L	=	10/10/1998
Nitrogen	GDEGW02202a	4800	ug/L	=	10/10/1998
Phosphorus	GDEGW02202a	510	ug/L	=	10/10/1998
Sulfate (as SO4)	GDEGW02202	42600	ug/L	=	08/02/1996
Sulfate (as SO4)	GDEGW02202a	48000	ug/L	=	10/10/1998
Sulfate (as SO4)	GDEGW02203	18000	ug/L	=	11/21/1996
Sulfate (as SO4)	GDEGW02204	5200	ug/L	=	02/06/1997
TDS	GDEGW02201	1370000	ug/L	=	04/12/1996
TDS	GDEGW02202	1160000	ug/L	=	08/02/1996
TDS	GDEGW02203	528000	ug/L	=	11/21/1996
TDS	GDEGW02204	1600000	ug/L	=	02/06/1997
Total Organic Carbon	GDEGW02202a	8500	ug/L	=	10/10/1998

= indicates that the analyte is detected at the concentration shown

J indicates an estimated value. A "J" value may signify that the concentration is below the PQL, or that the "J" has been applied as a result of the data validation.

CH2MHILL TRANSMITTAL

To: Jerry Stamps
South Carolina Department of Health
and Environmental Control
Bureau of Land and Waste
Management
2600 Bull Street
Columbia, SC 29201

From: Dean Williamson/CH2M-Jones

Date: November 14, 2002

Re: CH2M-Jones' Responses to Comments by SCDHEC regarding the *RFI Report Addendum, Area of Concern 550, Zone E, Charleston Naval Complex (Revision 0)*

Quantity	Description
4	CH2M-Jones' Responses to Comments by SCDHEC regarding the <i>RFI Report Addendum, Area of Concern 550, Zone E, Charleston Naval Complex (Revision 0)</i> – Originally Submitted on July 23, 2002

If material received is not as listed, please notify us at once

Remarks:

Copy To:

Jo Cherie Overcash/SCDHEC, w/att
BCT Distribution List

Engineering Comments Prepared by Jerry Stamps

1. Section 2.0.

The investigation at AOC 550 has resulted in the widespread detection of PAHs, particularly in the subsurface soil. The Navy must calculate a BEQ for the PAHs and screen the result against the appropriate screening value defined in the CNC Project Team Notebook and Instructions (December 2001). Furthermore, the Navy must calculate a TEQ value for the detected dioxins and compare the result to the corresponding EPA Region III Residential RBC. If the calculated TEQ value exceeds the residential RBC, the Navy must demonstrate that the detectable quantities of dioxins do not pose an unacceptable risk to human health.

CH2M-Jones Response:

General Response:

Please note that CH2M-Jones did not intend to request an NFA status for this site. The single sentence in the Revision 0 RFI Report Addendum requesting NFA status (line 12 on page 7-1) was inadvertently included and will be removed from the Revision 1 submittal for this site. AOC 550 is appropriate for current and continued industrial land use as there are no industrial land use COCs. Land use controls restricting land use to non-residential use are expected to be an adequate remedy for this site and appropriate given its location within the highly industrialized portion of the CNC. Such a designation is appropriate for this site and consistent with previous BCT agreements regarding remedial decision-making at the CNC.

The request for NFA in line 12 on page 7-1 of the Revision 0 RFI Report Addendum may have precipitated some of the reviewer's comments. Our responses below may be best understood with the understanding that the request for NFA will be removed from the Revision 1 RFI Report Addendum for this site:

CH2M-Jones Specific Response to SCDHEC Comment 1:

BEQs were previously evaluated in the Zone E RFI Report, Revision 0 and found to not be COCs. No PAHs in surface soil were detected above their respective industrial RBC. The BEQ value for the single upper interval soil in which BEQs were detected was reported as 26.8 µg/kg in the RFI report, which is well below the residential and industrial RBC as well as below the current CNC sitewide reference concentration.

Since BEQs were previously evaluated in the Zone E RFI Report, Revision 0, and were not identified as a COC, there is no need for rescreening these data in the RFI Report Addendum; this approach is consistent with Section 4.5 of the CNC Project Team Notebook, which identifies COPCs/COCs that require rescreening by the Navy/CH2M-Jones team.

PAHs in subsurface soil were also evaluated as potential COPCs and COCs in the Zone E RFI Report, Revision 0, and were not determined to be COCs. Only one PAH (benzo[a]anthracene) was detected in one subsurface soil sample above its SSL (at a concentration of 730 µg/kg versus an SSL of 700 µg/kg). This chemical and other PAHs were concluded to not be COCs at this site. Per current BCT agreements as presented in the CNC

Project Team Notebook, rescreening of PAHs and BEQs in the RFI Report Addendum is not necessary if these chemicals are not identified as COCs in the Revision 0 RFI Report.

It should be noted that no comments regarding the need to reevaluate PAHs at this site were made by SCDHEC or EPA reviewers during their review of the Revision 0 Zone E RFI Report. This suggests that based on the intended continued industrial use of the site, previous reviewers did not consider BEQs to be an issue at the site.

TEQs were also evaluated during the RFI and found not to be a COC. For this reason, TEQs were not reevaluated in the RFI Report Addendum. TEQs were detected in one soil sample at 0.0426 ng/kg, well below the residential RBC of 4.4 ng/kg. There does not appear to be any reason to revise the RFI Report Addendum to discuss TEQs, since TEQs were discussed and evaluated during the Revision 0 Zone E RFI Report.

2. Figure 2-1.

AOC 550 appears to have been identified at two separate locations; however, the investigation was focused on the southern location. Only one sample was collected within the vicinity of the northern location for AOC 550. The Navy must provide the rationale as to why the investigation focused on the southern location, and justify why further investigation is not necessary for the northern location.

CH2M-Jones Response:

The Zone E RFI work plan proposed a similar level of investigation at each of the former locations of the temporary boiler house. During the original RFI field effort, the field team was unable to collect soil samples at some upper and lower intervals at both the northern and southern locations due to the depth of fill encountered during sampling. The sampling conditions encountered and the inability to obtain soil samples at a number of locations during the original RFI field effort were reported in the Revision 0 Zone E RFI Report.

Figure 2-1 of the RFI report addendum did not show all subsurface soil sampling locations at this AOC at the northern location. The actual subsurface soil sampling locations at this northern part of the AOC can be seen in the current GIS. A revised Figure 2-1 showing these locations will be provided.

Additional sampling is not considered necessary in the northern area since the area was targeted for soil sampling in the work plan and adequate samples were collected and analyzed. As occurred at other AOCs and SWMUs at the CNC, conditions were encountered during sampling that precluded collection of some of the intended samples. However, fill material encountered at this site during attempts to collect surface soil samples was previously determined by the BCT to not warrant sampling and analysis. No additional sampling is considered necessary.

3. Section 5.0, Table 5-1.

As included in other RFI Report Addenda, the Navy should include a table identifying all detectable quantities of organic constituents with a column for the EPA Region III Residential RBC for the sake of comparison. Table 5-1 identifies the detectable quantities

of Carbon Disulfide and Methyl Ethyl Ketone; however, the PAHs, 1,3-dichlorobenzene, and 1,4-dichlorobenzene were omitted from this table.

CH2M-Jones Response:

The tables showing detected organic chemicals as compared to residential RBCs that is often provided in the RFI report addenda are typically copies of tables that were previously provided in the Revision 0 RFI report. For this site, the Zone E RFI Report, Revision 0 did not develop a table comparing detected chemicals to residential RBCs.

CH2M-Jones does not intend to request an NFA determination for this site. Since the site meets acceptable risk criteria for continued and future industrial land use, our intent is to request land use controls and No Further Investigation status. Section 7.0 will be modified to indicate that the recommended pathway forward for the site is to apply land use controls to restrict the site to industrial land use, rather than recommending NFA status (See also our response to Comment 2 by Ms. J. Overcash regarding this issue). Thus, no comparison to residential RBCs is necessary at this time. However, such a table comparing detected chemicals to residential RBCs can be created if the Department believes it is essential to the report.

Table 5.1 was developed specifically to address previous BCT agreements to compare soil VOC detections to an SSL based on a DAF=1. The inclusion of residential RBCs in this table is unnecessary. Because PAHs, 1,3-dichlorobenzene, and 1,4-dichlorobenzene are semivolatiles, they were not included in this table.

4. Section 7.0.

This section states that "...there are no soil COCs for the industrial land use scenario...". This section further recommends a No Further Action (NFA) determination for AOC 550. In order to obtain a NFA, the Navy must demonstrate that the contamination is below the EPA Region III Residential RBC and/or background reference concentration, as applicable. It appears as though the surface soil data was compared only to the Industrial RBC. As such, the Department cannot grant a NFA determination for AOC 550 at this time.

CH2M-Jones Response:

Section 7.0 will be revised to recommend that the site be used only for continued and future industrial land use on the basis that no industrial land use COCs have been identified and that land use controls should be an adequate remedy for this site. A CMS work plan and CMS report will be provided to document the remedial action decision making for this site.

Hydrogeology Comments Prepared by Jo Cherie Overcash

Site Visit:

1. According to the facility's geographic information system (GIS) database, there are four monitoring wells in the vicinity of AOC 550; grid wells GDEGW22 and GDEGW22D are depicted at the northern AOC 550 while E550GW001 and E550GW002 are depicted at the southern AOC 550. However, neither grid well GDEGW22D nor E550GW002 exists in the field. Moreover, there is no data in the database from these wells. The Navy should clarify this discrepancy.

CH2M-Jones Response:

Based on a recent well inspection (within the last few weeks) by the CH2M-Jones field team, wells EGDEGW022, EGDEGW22D, and E550GW002 do exist at the site. Well E550GW002 may have been installed to replace E550GW001, which we believe was previously abandoned (but for which we have no documentation). Well E550GW001 was located approximately 9 feet from E550GW002. A small square concrete path can be seen at the approximate former location of this well, suggesting that it was abandoned. Data for wells EGDEGW022, EGDEGW22D, and E550GW001 are in the current GIS version. Apparently no data are available for E550GW002 because this well has not been sampled since it was installed.

The Revision 0 RFI Report Addendum for AOC 550 can be revised to clarify the current status of these wells. One of our field team leaders can also assist the reviewer in locating these wells in the field.

Concerns:

2. The RCRA Facility Investigation, of which confirmatory sampling is the first step, was conducted under the assumption that this area of the Base would remain industrial. However, the Navy has requested a "no further action" (NFA) decision for this unit, which would be based on unrestricted land use. The surface and subsurface soil data generated during the RFI must be screened against residential values (EPA Region III Risk-Based Concentration Table, October 2000) in order to determine whether there are constituents of concern for unrestricted land use.

CH2M-Jones Response:

CH2M-Jones will not be requesting NFA status for this site. Please refer to our response to comments from Mr. Jerry Stamps for a broader discussion of this issue. CH2M-Jones's recommendation in Section 7.0 of the RFI report addendum for this site will be changed from NFA to continued and future industrial use only. No industrial COCs have been identified for this site. Thus, a screening of all site data relative to residential RBCs is not necessary at this time, but such a review or screening may be conducted in the future by an owner who may choose to develop the property for other than industrial land use.

3. In Section 2.2.1, Shallow Groundwater Results, the Navy states that no volatile organic compounds (VOCs) nor semi-volatile organic compounds (SVOCs) were detected at AOC 550 in concentrations above the laboratory detection limit. These statements are inaccurate in that the GIS database clearly lists detections of certain VOCs and SVOCs. For example, acenaphthene, dibenzofuran, fluorine, 2-methylnaphthalene, naphthalene, phenanthrene and 2,4-dimethylphenol are listed as "=" or "J" qualifiers. The Navy should acknowledge the presence of these VOCs and SVOCs in shallow groundwater. Please note that the tap water value for dibenzofuran is 2.4 micrograms per liter ($\mu\text{g}/\text{L}$) at a hazard index of 0.1 for a non-carcinogen. The reported values for this parameter are: 21= $\mu\text{g}/\text{L}$, 8J $\mu\text{g}/\text{L}$, 15= $\mu\text{g}/\text{L}$, 21= $\mu\text{g}/\text{L}$. The Navy must revise the text and address the presence of dibenzofuran in shallow groundwater.

CH2M-Jones Response:

The presence of these chemicals in groundwater, primarily in well GDEGW22D, will be acknowledged and discussed in the revised report.

4. The RFI identified arsenic as a constituent of concern in shallow groundwater at AOC 550 because arsenic exceeded the maximum contaminant level (MCL) of 50 micrograms per liter ($\mu\text{g}/\text{L}$) in two of four sampling events at shallow well E550GW001. Arsenic was reported at concentrations of 18.5 $\mu\text{g}/\text{L}$, 19.9 $\mu\text{g}/\text{L}$, 55.9 $\mu\text{g}/\text{L}$ and 93.2 $\mu\text{g}/\text{L}$. The Navy further states that the arsenic concentrations at AOC 550 are less than the maximum concentration of 316 micrograms per liter ($\mu\text{g}/\text{L}$) reported for Zone E shallow background as listed on Table 3 entitled Statistical Summary of the Analytical Results for Shallow Groundwater Background Samples by Zone for CNC Main Base of the CNC Team Notebook. However, the mean concentration reported on Table 3 for arsenic in Zone E is 36 $\mu\text{g}/\text{L}$. **Please note that the Department has not approved these background ranges.** Furthermore, one should remember that the mean concentration of arsenic in Zone E is considerably less than the concentration detected at AOC 550.

The Navy references the hypothesis outlined in *An Overview of Arsenic Geochemistry, TEA Processes in Groundwater Systems, and Implications for the CNC Hydrogeologic Environment* (CH2M Jones, 2001) to explain the natural geochemical processes occurring at AOC 550. While geochemical processes may be occurring at AOC 550, the Navy should substantiate their conclusion that the elevated concentration of arsenic in groundwater at AOC 550 is attributable to geochemical processes. The Navy should clarify terms like "elevated iron" and "iron-reducing conditions". The Navy should more fully discuss the relationship among iron, manganese and arsenic as presented on Table 5-2 entitled Arsenic, Iron, and Manganese in Groundwater and as presented on Figure 5-1 entitled Arsenic Groundwater Detections. **Moreover it should be noted that the Division of Hydrogeology has not approved the referenced technical memorandum.**

While the highest concentration of arsenic in grid well EGDEGW022 (which should be included in the background data set) located at the northern AOC 550 has been estimated at 6.7 $\mu\text{g}/\text{L}$, the text does not discuss the relationship among arsenic, iron and manganese at this location either, nor does the text explain how it is that the

concentration of arsenic at the northern AOC 550 is so much less than the concentrations found at the southern AOC 550.

The Navy should substantiate their conclusion that the elevated concentration of arsenic in groundwater at AOC 550 is attributable to geochemical processes. The Navy should provide additional data to support this conclusion. For example, the Navy should include groundwater pH values and an explanation of how pH may affect the mobility of certain metals, namely arsenic; the Navy could speciate arsenic to aid in determining whether the elevated values can be attributed to natural geochemical processes. It is important to note that the total dissolved solid (TDS) values recorded in the GIS database for these wells do not preclude this groundwater from being considered a potential source of drinking water.

CH2M-Jones Response:

Per a recent teleconference with the reviewer, it was agreed that CH2M-Jones would provide a summary of the information discussed in the previously submitted memorandum regarding natural geochemical processes involving iron reduction as the most plausible reason for the arsenic observed at elevated concentrations in both background and site wells at the CNC. This material will be provided in a format that can be included as an appendix to the RFI report addenda or similar reports, for which arsenic does not appear to be present in the groundwater due to releases from the SWMU or AOC.

Arsenic in groundwater at concentrations above the MCL of 50 µg/L is a sitewide background issue at the CNC and should be addressed within a context that recognizes the occurrence of arsenic in background wells at concentrations above the MCL. Given arsenic's occurrence in CNC background wells, we believe that developing a sitewide decision-making approach that recognizes the sitewide presence of arsenic in background wells would be appropriate. Decisions regarding arsenic in groundwater need to be made at several sites soon and should be made within a decision-making framework that addresses arsenic as a background issue and in a manner such that site-specific decisions are made efficiently and on a consistent basis.

An analogy to the arsenic in groundwater issue can be made to the issue of PAHs/BEQs in soil at the CNC. Because of the frequent occurrence of BEQs above residential and industrial RBCs in soil samples in both background (grid) soil and site soil samples, the BCT spent considerable effort to create a sitewide decision-making framework that acknowledged the presence of BEQs in background samples and allowed site-by-site decisions regarding BEQs in soil to be made quickly, effectively, and uniformly, while maintaining compatibility with applicable risk management issues. BEQs in soils at specific sites are still evaluated on a site-by-site basis, but the sitewide decision-making agreements that recognize BEQs as a background contaminant have greatly expedited the site-by-site decision process.

We suggest that a similar sitewide decision-making approach for arsenic in groundwater would be helpful to the project. Such a decision-making approach could be included in a brief team memorandum that could be added to the CNC Project Team Notebook and Instructions. The memorandum could provide an opinion, based on the overall weight of evidence, as to why arsenic occurs in background wells at elevated concentrations and outline key issues to assess at a specific site in order to assess whether data indicate that arsenic should be

considered a COC or not. Issues that could be assessed at each site include whether any elevated arsenic in soil has been identified, whether arsenic values consistently exceed the MCL, and whether the iron concentrations are indicative of iron-reducing conditions at the site.

5. In Section 6.3 the RFI Report Addendum states that there “are no data suggesting that there was an impact to the sanitary sewers from this site.” However, according to the facility’s geographic information system (GIS) database, elevated concentrations of metals were reported at a number of direct push technology (DPT) locations along the sanitary sewer in the vicinity of AOC 550. For example, DPT 037GP074E1 is located at the southeast corner of the northern AOC 550. At this location, the GIS reports arsenic at 216.0 µg/L, chromium at 226.0 µg/L, lead at 379.0 µg/L, thallium at 12.8 µg/L and zinc at 5,600 µg/L. Moreover, according to the GIS, lead was detected in DPT locations 037GP067E1, 037GP073E1, and 037GP075E1 in concentrations above the action level of 15 µg/L.

While the groundwater data collected from shallow permanent monitoring wells EGDEGW022 and E550GW001 do not indicate an adverse impact of these metals, neither of these wells is appropriately located to monitor groundwater quality at the southeast corner of the northern AOC 550. According to groundwater flow, the existing monitoring wells are sidegradient to this area of AOC 550. Based on available data, the Division of Hydrogeology concludes that groundwater quality has not been adequately delineated in this area of the Base. A permanent monitoring well in this vicinity is necessary in order to verify groundwater quality downgradient of the southern portion of the northern AOC 550 (see attached GIS figure). The Navy must propose to install a minimum of one additional permanent monitoring well to monitor groundwater quality at AOC 550.

CH2M-Jones Response:

As discussed recently in a response to a similar comment on AOC 528, the unfiltered groundwater samples collected as part of the Zone L investigation using Geoprobes are significantly compromised and the metals results are rendered invalid by the presence of significant levels of turbidity. Consequently, the metals concentrations reported for these samples are not representative of actual groundwater quality.

Turbidity levels encountered in the DPT groundwater samples mentioned above were as follows:

DPT Sample	Turbidity (NTU)
037GP074E1	616
037GP067E1	777
037GP073E1	458
037GP075E1	101

These turbidity levels greatly exceed the recommended levels of no greater than 10 NTU (EPA, 2002) and cannot be considered representative of actual groundwater quality.

Consequently, these samples and associated metals concentrations are not appropriate for comparison to MCLs or other regulatory criteria.

In conclusion, the Navy should:

- Propose to install an additional monitoring well at the southern sector of the northern AOC 550.
- Analyze the groundwater samples from the newly installed well(s) for the full suite of RFI parameters.
- Include this additional groundwater data in a revised RFI Addendum.
- Revised the RFI Addendum Report to also address the concerns outlined above.

CH2M-Jones Response:

We disagree with the need for an additional well at this location. The only groundwater data of adequate quality for decision-making (from the permanent monitoring wells) do not indicate that significant contamination is present.

We will revise the RFI Report Addendum as appropriate to address the detected organic chemicals in groundwater and status of the monitoring wells as discussed above.