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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT ADDENDUM AREA OF CONCERN 576 (AOC 576) ZONE E CNC CHARLESTON SC

6/19/2002

CH2M HILL

RFI REPORT ADDENDUM

Area of Concern 576, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

CH2M Jones

June 2002

Contract N62467-99-C-0960

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June 19, 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) – AOC 576, Zone E

Dear Mr. Scaturo:

Enclosed are four copies of the RFI Report Addendum (Revision 0) for AOC 576 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 Michael Karafa. Please contact him at 770/604-9182, extension 486, 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

RFI REPORT ADDENDUM

Area of Concern 576, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

PREPARED BY
CH2M-Jones

June 2002

Revision 0
Contract N62467-99-C-0960
158814.ZE.PR.27

Certification Page for RFI Report Addendum (Revision 0) – AOC 576, 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

Dean Williamson, P.E.

6/14/2002

Date

Contents

Section Page

Acronyms and Abbreviations vi
1.0 Introduction **1-1**
1.1 Background 1-1
1.2 Purpose of the RFI Report Addendum 1-2
1.3 Report Organization 1-2
Figure 1-1 Location of AOC 576 within Zone E, CNC 1-4
Figure 1-2 Aerial Photograph of AOC 576, Zone E 1-5
2.0 Summary of RFI Conclusions for AOC 576 ..... **2-1**
2.1 Soil Sampling and Analysis 2-1
2.1.1 Surface Soil 2-1
2.1.2 Subsurface Soil 2-1
2.2 Groundwater Sampling and Analysis 2-2
2.2.1 Shallow Groundwater 2-2
2.2.2 Deep Groundwater 2-3
2.3 Human Health Risk Assessment 2-4
2.3.1 Soils 2-4
2.3.2 Groundwater 2-4
2.4 RFI Conclusions and Recommendations 2-4
Figure 2-1 RFI Sampling Locations 2-5
3.0 Interim Measures and UST/AST Removals **3-1**
4.0 Summary of Additional Investigations **4-1**
5.0 COPC/COC Refinement **5-1**
5.1 Soil COPC/COC Refinement 5-1
5.1.1 BEQs 5-1
5.2 Shallow Groundwater COPC/COC Refinement 5-1
5.2.1 Beryllium 5-1
5.2.2 Bromodichloromethane 5-2
5.2.3 Pentachlorophenol 5-2
5.3 Deep Groundwater COPC/COC Refinement 5-2
5.3.1 Arsenic 5-2
5.3.2 Manganese 5-3

Contents, Continued

5.4 COC Summary 5-3
Table 5-1 Detected Concentrations of BEQs in Surface Soil 5-4
Table 5-2 Detected Concentrations of Beryllium, Bromodichloromethane, and Pentachlorophenol in Shallow Groundwater 5-5
Table 5-3 Detected Concentrations of Arsenic, Manganese and Iron in Deep Groundwater 5-7
6.0 Summary of Information Related to Site Closeout Issues 6-1
6.1 RFI Status 6-1
6.2 Presence of Inorganics in Groundwater 6-1
6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC 6-1
6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC 6-2
6.5 Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC 6-2
6.6 Potential Migration Pathways to Surface Water Bodies at the CNC 6-2
6.7 Potential Contamination in Oil/Water Separators 6-2
6.8 Land Use Controls 6-2
7.0 Recommendations 7-1
8.0 References 8-1

Appendices

A Excerpts from the *Zone E RFI Report, Revision 0* (EnSafe, 1997)

B CH2M-Jones' Responses to SCDHEC Comments on AOC 576 (from the *Zone E RFI Report, Revision 0*)

Acronyms and Abbreviations

AOC	Area of concern
AST	Aboveground storage tank
BCT	BRAC Cleanup Team
BEQ	Benzo(a)pyrene equivalent
BRAC	Base Realignment and Closure Act
BRC	Background reference concentration
CA	Corrective action
CMS	Corrective measures study
CNC	Charleston Naval Complex
COC	Chemical of concern
COPC	Chemical of potential concern
CSI	Confirmatory sampling investigation
DAF	Dilution attenuation factor
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
ft bls	Feet below land surface
FRE	Fixed-point risk evaluation
IM	Interim measure
HHRA	Human health risk assessment
HI	Hazard index
LUC	Land use control
MCL	Maximum contaminant level
µg/kg	Microgram per kilogram
µg/L	Microgram per liter
NAVBASE	Naval Base
NFA	No further action
NFI	No further investigation
OWS	Oil/water separator
PAH	Polyaromatic hydrocarbon

Acronyms and Abbreviations, Continued

PCP	Pentachlorophenol
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SCDHEC	South Carolina Department of Health and Environmental Control
SSL	Soil screening level
SVOC	semivolatile organic compound
SWMU	Solid waste management unit
TDS	Total dissolved solids
UST	Underground storage tank
VOC	Volatile organic compound

Section 1.0

1.0 Introduction

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

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

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to complete the RCRA Facility Investigation (RFI) for Area of Concern (AOC) 576 in Zone E of the CNC. The location of this site in Zone E is shown in Figure 1-1. Figure 1-2 shows an aerial photograph of the site.

1.1 Background

AOC 576 is the location of former Building 1012, an oil and paint storehouse/print office. Operations at Building 1012 were conducted from 1909 until 1930. No other information could be found regarding the operating practices of the storehouse or the print office during the RFI. Currently, this site is occupied by Building 80, which was built in 1943. Building 80 is currently being used by Detyen's Shipyards, Inc. for the manufacture and repair of ship hulls. The materials of concern identified based on historical operations for AOC 576 in the *Final Zone E RFI Work Plan, Revision 1* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995) include inks, paints, metals, solvents, and petroleum hydrocarbons. This area of Zone E is zoned M2, for industrial use. The CNC RCRA Permit identified AOC 576 as requiring a Confirmatory Sampling Investigation (CSI).

The RFI was initially conducted by EnSafe, and the *Zone E RFI Report, Revision 0* (EnSafe, 1997) was prepared and submitted during 1997. Regulatory review was conducted on this document and a draft response to the comments from SCDHEC was prepared by the Navy/EnSafe team. These comments and responses are included in Appendix B of this document.

1.2 Purpose of the RFI Report Addendum

This RFI Report Addendum has been prepared by CH2M-Jones to complete the RFI for AOC 576 in Zone E of the CNC. This document includes a summary of previous RFI investigations and conclusions, and discusses the results of the additional investigations, the refinement of chemicals of potential concern (COPCs) and chemicals of concern (COCs), existing site conditions, and surrounding 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 closeout 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 Sewer at the CNC
- Potential linkage to AOC 699, Investigated Storm Sewer at the CNC
- Potential linkage to 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 provided in this RFI Report Addendum to expedite evaluation of site closure.

1.3 Report Organization

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

1.0 Introduction – Presents the purpose of the report and background information relating to the RFI Report Addendum.

2.0 Summary of RFI Conclusions for AOC 576 – Summarizes the conclusions from the RFI and risk evaluations for AOC 576 as presented in the *Zone E RFI Report, Revision 0.*

3.0 Interim Measures and UST/AST Removals – Provides information regarding any interim measures (IMs) or tank removal activities performed at the site.

4.0 Summary of Additional Investigations – Summarizes information, if any, collected after completion of the *Zone E RFI Report, Revision 0.*

5.0 COPC/COC Refinement – Provides further evaluation of COPCs based on RFI and additional data to assess them as COCs.

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

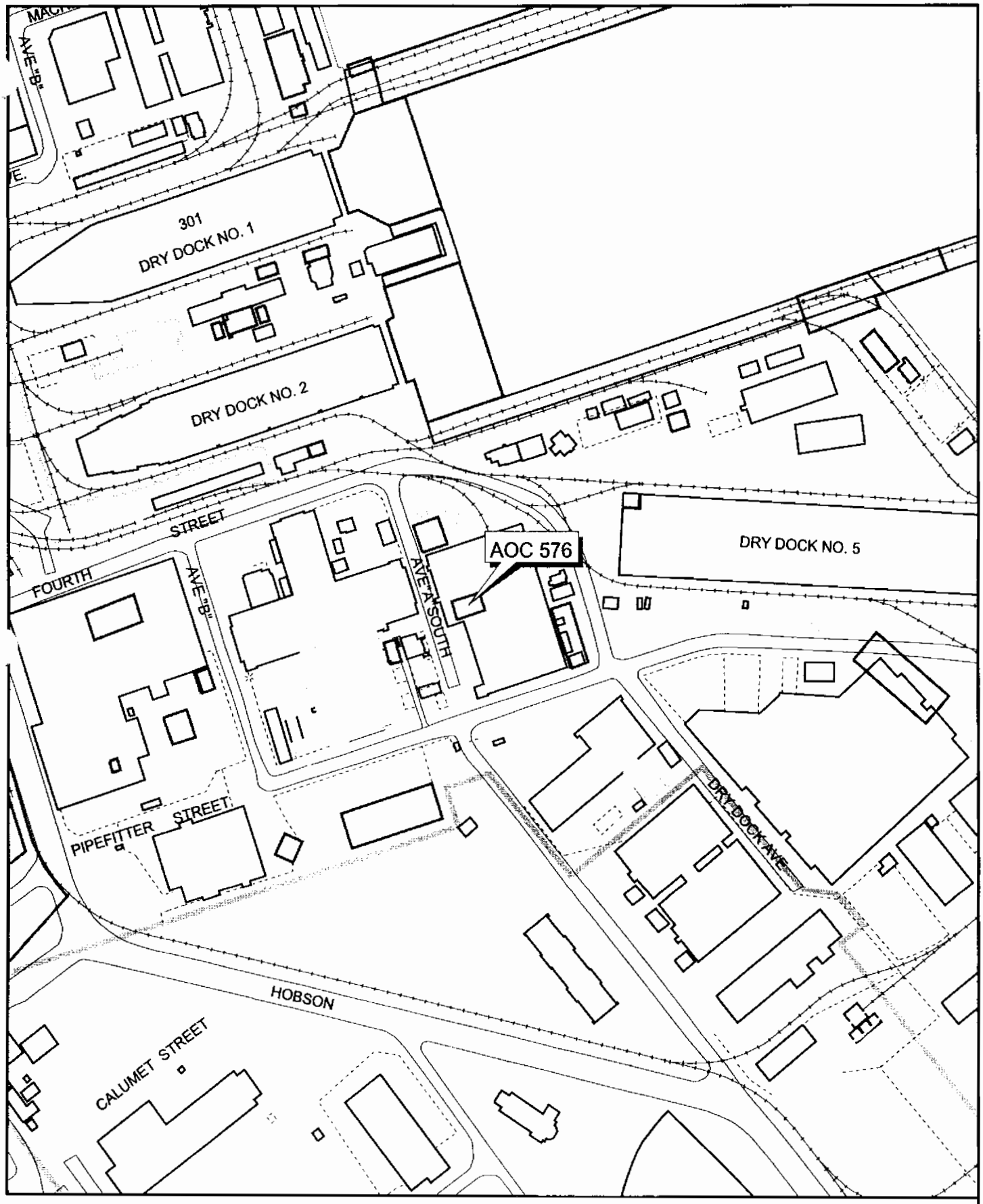
7.0 Recommendations – Provides recommendations for proceeding with site closure.

8.0 References – Lists the references used in this document.

Appendix A – Contains excerpts from the *Zone E RFI Report, Revision 0,* including a summary of detections of chemicals and a groundwater flow map for the site vicinity.

Appendix B – Contains responses to SCDHEC comments for AOC 576 from the *Zone E RFI Report, Revision 0.*

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



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

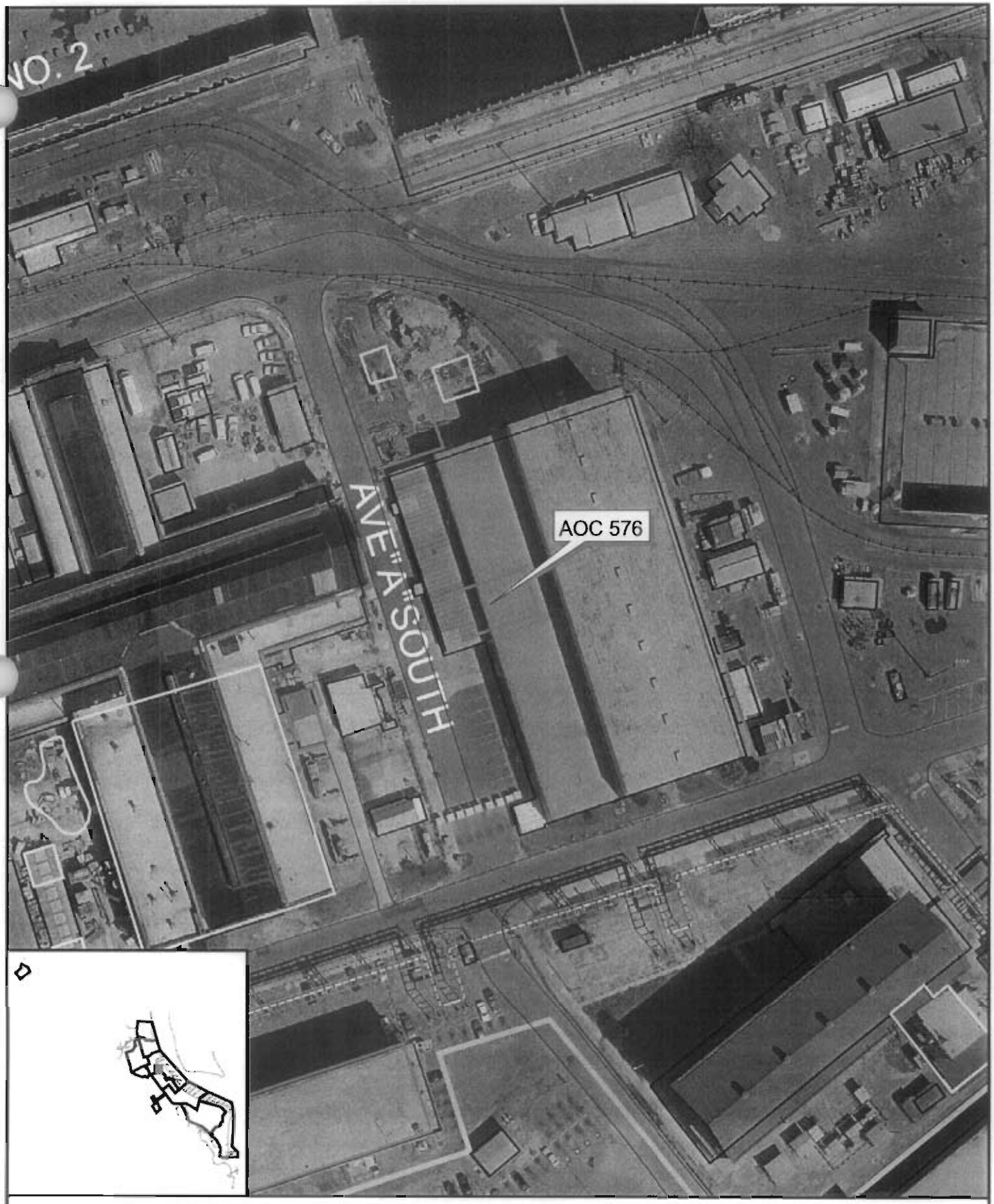
N

0 200 400 Feet

1 inch = 333.043 feet

Figure 1-1
Location of AOC 576 in Zone E
Charleston Naval Complex

NOTE: Aerial Photo Date is 1997



Fence
Railroads
Roads
Shoreline
AOC Boundary
SWMU Boundary
Buildings
Zone Boundary

N

0 70 140 Feet

1 inch = 93 feet

Figure 1-2
Aerial Photograph of AOC 576
Charleston Naval Complex

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Section 2.0

2.0 Summary of RFI Conclusions for AOC 576

This section summarizes the results and conclusions from the soil and groundwater investigations conducted at AOC 576, which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Figure 2-1 shows the soil and groundwater sampling locations.

As part of the Zone E RFI, soil and groundwater investigations were conducted at AOC 576 during 1995 and 1996. The RFI report presented the results of these investigations and conclusions concerning contamination and risk, as summarized in the following sections. A further evaluation of COCs at this site is provided in Section 5.0. Tables showing the site's detected constituents in soil and groundwater, which were presented in the RFI report, are provided in Appendix A of this RFI Report Addendum.

2.1 Soil Sampling and Analysis

Soil was sampled during one sampling event at AOC 576. During the sampling event, five surface and five co-located subsurface samples were collected. There are no unpaved areas at the site. These boring locations were identified as E576SB001 through E576SB005 (see Figure 2-1). All samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. One upper-interval sample was selected as a field duplicate and analyzed for metals, a more comprehensive list of VOCs and SVOCs, organophosphorus pesticides, hexavalent chromium, herbicides, and dioxins.

2.1.1 Surface Soil

During the initial RFI, surface soil detections of organic compounds were screened against the U.S. Environmental Protection Agency (EPA) Region III industrial risk-based concentrations (RBCs). Surface soil detections of inorganic compounds were evaluated against the EPA Region III industrial RBCs and the Zone E background reference concentrations (BRCs). Detected concentrations of organic and inorganic analytes exceeding their respective screening criteria were as follows:

- **VOCs:** No VOCs exceeded the screening criteria.
- **SVOCs:** No SVOCs exceeded the screening criteria.
- **Inorganics:** No inorganics exceeded the screening criteria.

2.1.2 Subsurface Soil

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

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

- **VOCs:** No VOCs exceeded the screening criteria.
- **SVOCs:** No SVOCs exceeded the screening criteria.
- **Inorganics:** No inorganics exceeded the screening criteria.

2.2 Groundwater Sampling and Analysis

During the RFI for AOC 576, two shallow groundwater monitoring wells identified as E576GW001 and E576GW002 and one deep groundwater monitoring well identified as E576GW02D were installed (see Figure 2-1). Each well was sampled during four sampling events between 1996 and 1997. Groundwater samples were submitted for analysis for VOCs, SVOCs, metals, chlorides, sulfates, and total dissolved solids (TDS) during the four sampling events. The detections in groundwater samples were compared with the EPA Region III tap water RBCs, maximum contaminant levels (MCLs), and the Zone E BRCs for shallow and deep aquifers.

2.2.1 Shallow Groundwater

Detections in the shallow groundwater samples were as follows:

- **VOCs:** There were no detections of VOC concentrations above screening criteria, except for one detection of bromodichloromethane at 9 micrograms per liter (µg/L) in well E576GW002. This detection exceeded the tap water RBC of 0.170 µg/L. This reported value is below the MCL (for total trihalomethanes) of 80 µg/L. Subsequent sampling did not indicate the presence of this VOC in groundwater.

- **SVOCs:** Only one chemical, pentachlorophenol, exceeded its screening criteria in one of the two shallow wells from AOC 576 in a single sample. Pentachlorophenol was detected in E576GW002 at 6 µg/L, which exceeded its tap water RBC of 0.560 µg/L and its MCL of 1 µg/L. There were no other detections of SVOC concentrations above screening criteria.

- **Inorganics:** The *Zone E RFI Report, Revision 0* reported that among detected inorganic analytes, aluminum, beryllium, and iron exceeded their respective screening criteria:
  - Aluminum was detected in E576GW001 at a concentration of 5,970 µg/L, above both its tap water RBC of 3,700 µg/L, and the Zone E shallow groundwater BRC of 2,810 µg/L. No primary MCL has been established for aluminum.
  - Beryllium was detected in E576GW001 at a concentration of 3 µg/L, which exceeded its tap water RBC of 0.0160 µg/L and the Zone E shallow groundwater BRC of 0.430 µg/L, but did not exceed its MCL of 4 µg/L.
  - Iron was detected in E576GW001 at a concentration of 51,700 µg/L, which exceeded its tap water RBC of 1,100 µg/L. There is no primary MCL for iron. No shallow groundwater BRC has been established for iron in Zone E.

2.2.2 Deep Groundwater

The following detections were found in the deep groundwater at the site:

- **VOCs:** There were no VOC detections above screening criteria.
- **SVOCs:** There were no SVOC detections above laboratory detection limits.
- **Inorganics:** Among detected inorganic analytes, arsenic, iron, and manganese exceeded their respective screening criteria:
  - Arsenic was detected in E576GW02D at a concentration of 31.5 µg/L, exceeding both its tap water RBC of 0.045 µg/L and the Zone E deep groundwater BRC of 16.4 µg/L. Arsenic did not exceed its MCL of 50 µg/L.
  - Iron was detected in E576GW02D at a concentration of 2,730 µg/L, which exceeded its tap water RBC of 1,100 µg/L. No primary MCL exists for iron and no deep groundwater BRC has been established for iron in Zone E.
  - Manganese was detected in E576GW02D at a concentration of 1,070 µg/L, which exceeded its tap water RBC of 84 µg/L and Zone E deep groundwater BRC of 869 µg/L. No primary MCL exists for manganese.

2.3 Human Health Risk Assessment (HHRA)

The *Zone E RFI Report, Revision 0* used a fixed-point risk evaluation (FRE) approach at this site. The FRE considered site resident and site worker scenarios during the FRE. The detailed risk assessment for AOC 576 is presented in Section 10.38.6 of the RFI Report.

2.3.1 Soils

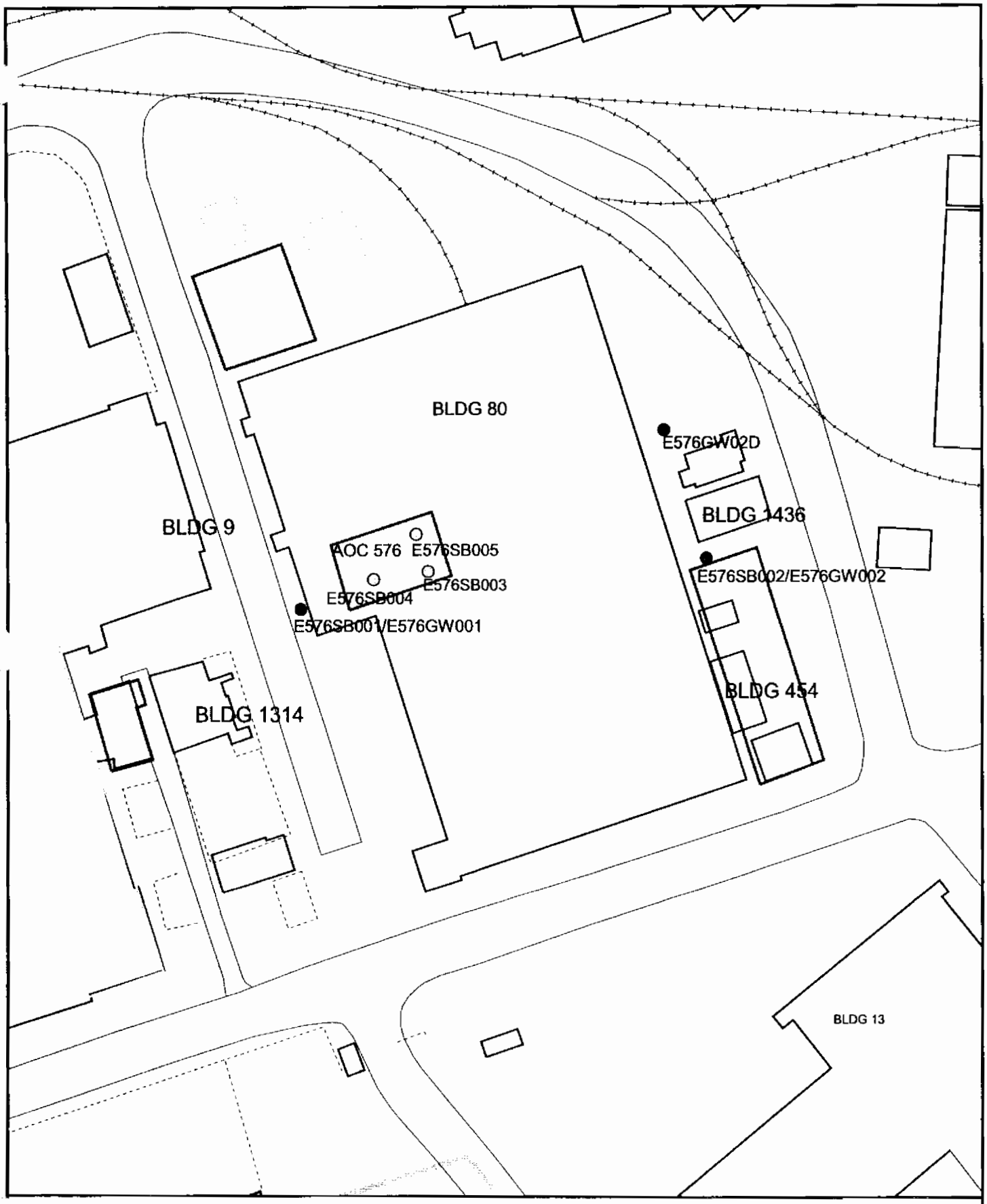
For the unrestricted future land use scenario, benzo(a)pyrene equivalents (BEQs) were retained as COCs for surface soils. BEQs were calculculated in five samples ranging from 82.9 μg/L to 501 μg/L, which did not exceed the BEQ industrial RBC of 780 micrograms per kilogram (μg/kg). However, BEQs were detected above its residential risk-based remediation goal of 0.060 μg/kg, and were identified as a COC in the FRE. The FRE did not identify COCs in subsurface soils at AOC 576.

2.3.2 Groundwater

Beryllium, pentachlorophenol, and bromodichloromethane were retained as COCs in shallow groundwater, and arsenic and manganese were retained as COCs in deep groundwater.

2.4 RFI Conclusions and Recommendations

The *Zone E RFI Report, Revision 0* recommended that a Corrective Measures Study (CMS) be conducted for surface soil COCs (BEQs), shallow groundwater COCs (beryllium, pentachlorophenol, and bromodichloromethane), and deep groundwater COCs (arsenic and manganese) at AOC 576.



Groundwater Well
Surface Boring
Fence
Railroads
Shoreline
AOC Boundary
SWMU Boundary
Buildings
Zone Boundary

N

0 50 100 Feet

1 inch = 46 feet

Figure 2-1
RFI Sampling Locations
AOC 576, Zone E
Charleston Naval Complex

Section 3.0

3.0 Interim Measures and UST/AST Removals

There are no records of any underground storage tanks (USTs) or aboveground storage tanks (ASTs) being present at this site. No IMs have been conducted at AOC 576.

Section 4.0

4.0 Summary of Additional Investigations

No additional investigations have been conducted at AOC 576.

Section 5.0

5.0 COPC/COC Refinement

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified BEQs as surface soil COCs; beryllium, pentachlorophenol, and bromodichloromethane as shallow groundwater COCs; and arsenic and manganese as deep groundwater COCs for AOC 576 under the future industrial land use scenario. However, based on an evaluation of these detections against current screening criteria adopted by the BCT, these chemicals are not considered COCs. The nature of occurrence and the relevance of these chemicals at AOC 576 are further discussed below.

5.1 Soil COPC/COC Refinement

5.1.1 BEQs

The RFI report identified BEQs as a COC for surface soil at AOC 576. BEQs did not exceed the industrial RBC of 780 µg/kg in any samples, but were identified as a COC in the RFI report. However, BEQs in surface soil did not exceed the CNC site-wide reference concentration for surface soil of 1,304 µg/kg, which was adopted by the BCT (refer to the *Background PAHs Study Report: Technical Information for Development of Background BEQ Values* [CH2M-Jones, 2001a]). The BEQ data are summarized in Table 5-1.

It should be noted that there were no exceedances of screening criteria for polycyclic aromatic hydrocarbons (PAHs) in subsurface soils, and BEQs were not identified as subsurface COCs at this site during the RFI. Additionally, BEQ compounds were not detected above screening criteria in the groundwater, indicating that the BEQs detected in surface soils do not pose a threat to groundwater via leaching. Therefore, BEQs are not considered a COC in soils at AOC 576.

5.2 Shallow Groundwater COPC/COC Refinement

5.2.1 Beryllium

The *Zone E RFI Report, Revision 0* considered beryllium as a COC in shallow groundwater based on a detection above the EPA Region III tap water RBC in E576GW001 at 3 micrograms per liter (µg/L). However, none of the beryllium detections exceeded the MCL of 4 µg/L during the RFI. Therefore, beryllium is not a COC in shallow groundwater for this site. The beryllium data are summarized in Table 5-2.

5.2.2 Bromodichloromethane

The RFI report considered bromodichloromethane as a shallow groundwater COC based on a detection of 9 µg/L in well E576GW002 during the first sampling event, above the EPA Region III tap water RBC of 0.17 µg/L. Based on the re-screening of the RFI data using current CNC screening values, bromodichloromethane was detected at a range of 2 µg/L to 12 µg/L during the four RFI sampling events, and none of the detections exceed the MCL of 80 µg/L (for total trihalomethanes). Based on these observations, bromodichloromethane is not considered a COC at this site. The bromodichloromethane data are summarized in Table 5-2.

5.2.3 Pentachlorophenol (PCP)

The RFI report considered PCP as a shallow groundwater COC at AOC 576 based on its detection in monitoring well E576GW002 during the first sampling event. However, three subsequent RFI sampling events did not show pentachlorophenol above laboratory detection limits, and it was not detected in any of the other monitoring wells above the laboratory detection limits. None of the other media from the site indicated the presence of PCP. This single detection of PCP does not indicate a site-related release and is no longer detected in groundwater. Therefore PCP is not considered a COC in groundwater at AOC 576. The PCP data are summarized in Table 5-2.

5.3 Deep Groundwater COPC/COC Refinement

5.3.1 Arsenic

Arsenic was detected in groundwater samples collected from the deep well (E576GW02D) during all four RFI sampling events. The detected values of arsenic in groundwater ranged from 22.8 µg/L to 58 µg/L. Two arsenic detections at 51.7 µg/L (from the second event) and 58 µg/L (from the third event) exceed the MCL of 50 µg/L. However, all four concentrations fall within the Zone E background range of 3 µg/L to 132 µg/L. The arsenic data are summarized in Table 5-3.

Additionally, elevated iron and manganese concentrations were detected in the deep well at AOC 576 (see Table 5-3). These data suggest that iron-reducing conditions are present at the site and are influencing the arsenic concentrations. Arsenic concentrations in groundwater at the CNC have previously been shown to be correlated with iron concentrations at the CNC, as described in the document *Technical Memorandum, An Overview of Arsenic Geochemistry, Terminal Electron Accepting Processes in GW Systems, and Implications for the CNC Hydrogeologic Environment* (CH2M-Jones, 2001b). These data suggest that the elevated

arsenic is due to natural geochemical processes at this site. For these reasons, arsenic is not considered a COC for deep groundwater at AOC 576.

5.3.2 Manganese

Manganese was detected in four groundwater samples from the deep well E576GW02D collected as part of the four RFI sampling events. The detected values of manganese in groundwater ranged from 1,050 µg/L (from the fourth event) to 1,210 µg/L (from the third event). All four manganese values exceed the EPA Region III tap water RBC of 730 µg/L. However, these concentrations fall within the Zone E background range of 1.3 µg/L to 1,660 µg/L. Manganese detections at the site are considered to be naturally occurring, and therefore manganese is not considered to be a COC in deep groundwater at AOC 576. The manganese data are summarized in Table 5-3.

5.4 COC Summary

No COCs were identified in soil or groundwater for the unrestricted or the industrial land use scenarios at AOC 576.

TABLE 5-1
Detected Concentrations of BEQs in Surface Soil
RFI Report Addendum, AOC 576, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Date Collected	Concentration (mg/kg)	Qualifier	EPA Region III Industrial RBC	EPA Region III Residential RBC	Zone E Surface Soil Background Range	SSL[a] (DAF=10)
BEQs	576SB00101	E576SB001	09/06/1995	0.308	=	0.78[b]	3.1	0.5 - 7.4	2.5
	576SB00102	E576SB001	09/06/1995	0.45	U				
	576SB00201	E576SB002	09/06/1995	0.331	=				
	576SB00202	E576SB002	09/06/1995	0.462	U				
	576SB00301	E576SB003	09/06/1995	0.726	=				
	576SB00302	E576SB003	09/06/1995	0.451	U				
	576SB00401	E576SB004	09/06/1995	0.243	=				
	576SB00402	E576SB004	09/06/1995	0.451	U				
	576SB00501	E576SB005	09/06/1995	0.214	=				
	576SB00502	E576SB005	09/06/1995	0.451	U				

All values are presented in milligrams per kilogram (mg/kg).

[a] EPA Region III generic soil screening level (SSL), using a dilution attenuation factor (DAF)=10, EPA Region III RBC Tables, October 2000.

[b] RBC for benzo(a)pyrene.

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

U Indicates that the concentration was not detected.

TABLE 5-2
Detected Concentrations of Beryllium, Bromodichloromethane, and Pentachlorophenol in Shallow Groundwater
RFI Report Addendum, AOC 576, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Date Collected	Concentration (µg/L)	Qualifier	EPA Region III Tap Water RBC	MCL	Zone E Background Range
Beryllium	576GW00101	E576GW001	04/01/1996	3	J	7.3	4	0.3 - 0.9
	576GW00102	E576GW001	07/16/1996	2.5	J			
	576GW00103	E576GW001	11/12/1996	3.2	J			
	576GW00104	E576GW001	01/23/1997	2.3	J			
	576GW00201	E576GW002	04/01/1996	1	U			
	576GW00202	E576GW002	07/16/1996	0.8	J			
	576GW00203	E576GW002	11/12/1996	1.3	U			
	576GW00204	E576GW002	01/22/1997	0.79	J			
Bromodichloromethane	576GW00101	E576GW001	04/01/1996	5	U	0.17	80	NA
	576GW00101a	E576GW001	03/06/1998	5	U			
	576GW00102	E576GW001	07/16/1996	5	U			
	576GW00102a	E576GW001	10/11/1998	5	U			
	576GW00103	E576GW001	11/12/1996	5	U			
	576GW00104	E576GW001	01/23/1997	5	U			
	576GW00201	E576GW002	04/01/1996	9	=			
	576GW00201a	E576GW002	03/06/1998	4	J			
	576GW00202	E576GW002	07/16/1996	5	=			
	576GW00202a	E576GW002	10/12/1998	12	=			
	576GW00203	E576GW002	11/12/1996	3	J			

TABLE 5-2
Detected Concentrations of Beryllium, Bromodichloromethane, and Pentachlorophenol in Shallow Groundwater
RFI Report Addendum, AOC 576, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Date Collected	Concentration (µg/L)	Qualifier	EPA Region III Tap Water RBC	MCL	Zone E Background Range
Bromodichloromethane	576GW00204	E576GW002	01/22/1997	2	J	0.17	80	NA
Pentachlorophenol	576GW00104	E576GW001	01/23/1997	50	U	0.56	NA	NA
	576GW00201	E576GW002	04/01/1996	6	J			
	576GW00202	E576GW002	07/16/1996	50	U			
	576GW00203	E576GW002	11/12/1996	50	U			
	576GW00204	E576GW002	01/22/1997	50	U			

All values are presented in micrograms per liter (µg/L).

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

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.

NA Not available/not applicable

U Indicates that the concentration was not detected.

TABLE 5-3
Detected Concentrations of Arsenic, Manganese, and Iron in Deep Groundwater
RFI Report Addendum, AOC 576, Zone E, Charleston Naval Complex

Sample ID	Station ID	Date Collected	Arsenic Concentration (µg/L)	Qualifier	Manganese Concentration (µg/L)	Qualifier	Iron Concentration (µg/L)	Qualifier
576GW02D01	E576GW02D	04/05/1996	35.1	=	1,070	=	2,730	=
576GW02D02	E576GW02D	07/16/1996	51.7	=	1,190	=	4,230	=
576GW02D03	E576GW02D	11/12/1996	58	=	1,210	=	1,310	=
576GW02D04	E576GW02D	01/23/1997	22.8	=	1,050	J	3,970	=

All values are presented in micrograms per liter (µg/L).

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

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.

Section 6.0

6.0 Summary of Information Related to Site Closeout Issues

6.1 RFI Status

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 *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified COCs for surface soils, shallow groundwater, and deep groundwater at AOC 576. However, based on the discussion presented in Section 5.0 of this report, no COCs in soil or groundwater were identified at AOC 576.

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 or deep wells above the laboratory detection limits. There were two detections of arsenic above the MCL in samples from the deep groundwater monitoring well E576GW02, but the detections do not point to a site-specific source, and can be attributed to natural occurrence as discussed in Section 5.3. There were intermittent thallium detections in shallow groundwater at the site, but they did not exceed the MCL, and these detections do not point to a site-specific source, but can be attributed to natural occurrence. 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.

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

No direct connection from these sites to the storm sewers are known to exist. No COCs requiring further evaluation are present at the site. Based on these findings, further evaluation of this issue is not warranted.

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

The nearest railroad line to AOC 576 is approximately 120 feet north of the site. There are no data that suggest a linkage between AOC 576 and the investigated railroad lines of AOC 504. Further evaluation of this linkage is not warranted.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

The nearest surface water body to AOC 576 is the Cooper River, which lies approximately 300 feet north of the site. The only potential migration pathway from the site to surface water is via overland flow via stormwater runoff. The entire site is covered with buildings and pavement, which eliminates contact of surface soil with stormwater. Similarly, runoff directed to the storm sewer system, which discharges to the Cooper River, does not contact the surface soil. Therefore, no further evaluation of a potential pathway for contaminant migration via stormwater runoff is warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

There are no OWSs associated with AOC 576. In addition, there is no reference to an OWS at the site in the *Oil Water Separator Data* report, Department of the Navy, September 2000. Therefore, further evaluation of this issue is not warranted.

6.8 Land Use Controls (LUCs)

The BCT has agreed that all of Zone E will have at least some LUCs and restrictions. At a minimum, these LUCs are likely to include restrictions against residential land use. Site-specific LUCs are also expected to be required at specific sites within Zone E depending on the site-specific investigations. No COCs were identified for the industrial use scenario at AOC 576. LUCs will be applied to limit the reuse of this site to industrial use.

Section 7.0

7.0 Recommendations

AOC 576 is a former oil and paint storehouse/print office, known as Building 1012. Operations were conducted from 1909 until 1930. No other information could be found regarding the operating practices of the storehouse or the print office. Building 80 is currently located at the site and is currently being used by Detyen's Shipyards, Inc. for the manufacture and repair of ship hulls. The CNC RCRA Permit identified AOC 576 as requiring a CSI.

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified BEQs as COCs in surface soils; beryllium, pentachlorophenol, and bromodichloromethane as COCs in shallow groundwater; and arsenic and manganese as COCs in deep groundwater at the AOC 576 site. Based on a comparison of the data against current screening criteria adopted by the BCT, as well as site conditions which are discussed previously in this report, no COCs are identified for AOC 576 under the unrestricted or industrial land use scenarios. Therefore, the site is suitable for continued industrial reuse without active corrective measures. LUCs will be applied to limit the reuse of this site to industrial use, since it is in Zone E.

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

Section 8.0

8.0 References

CH2M-Jones. *Background PAHs Study Report: Technical Information for the Development of Background BEQ Values*. February 2001a.

CH2M-Jones. *Technical Memorandum, An Overview of Arsenic Geochemistry, Terminal Electron Accepting Processes in GW Systems, and Implications for the CNC Hydrogeologic Environment*. August 2001b.

EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston*. 1997.

EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, NAVBASE Charleston*. July 1995.

EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, NAVBASE Charleston*. June 1995.

South Carolina Department of Health and Environmental Control, Final RCRA Part B Permit No. - SC0 170 022 560.

U.S. Environmental Protection Agency. *Region III RBC Tables*. October 5, 2000.

Appendix A

Appendix A1
Chemicals Present in Site Samples
AOC 576 - Surface Soil
NAVBASE - Charleston
Charleston, South Carolina

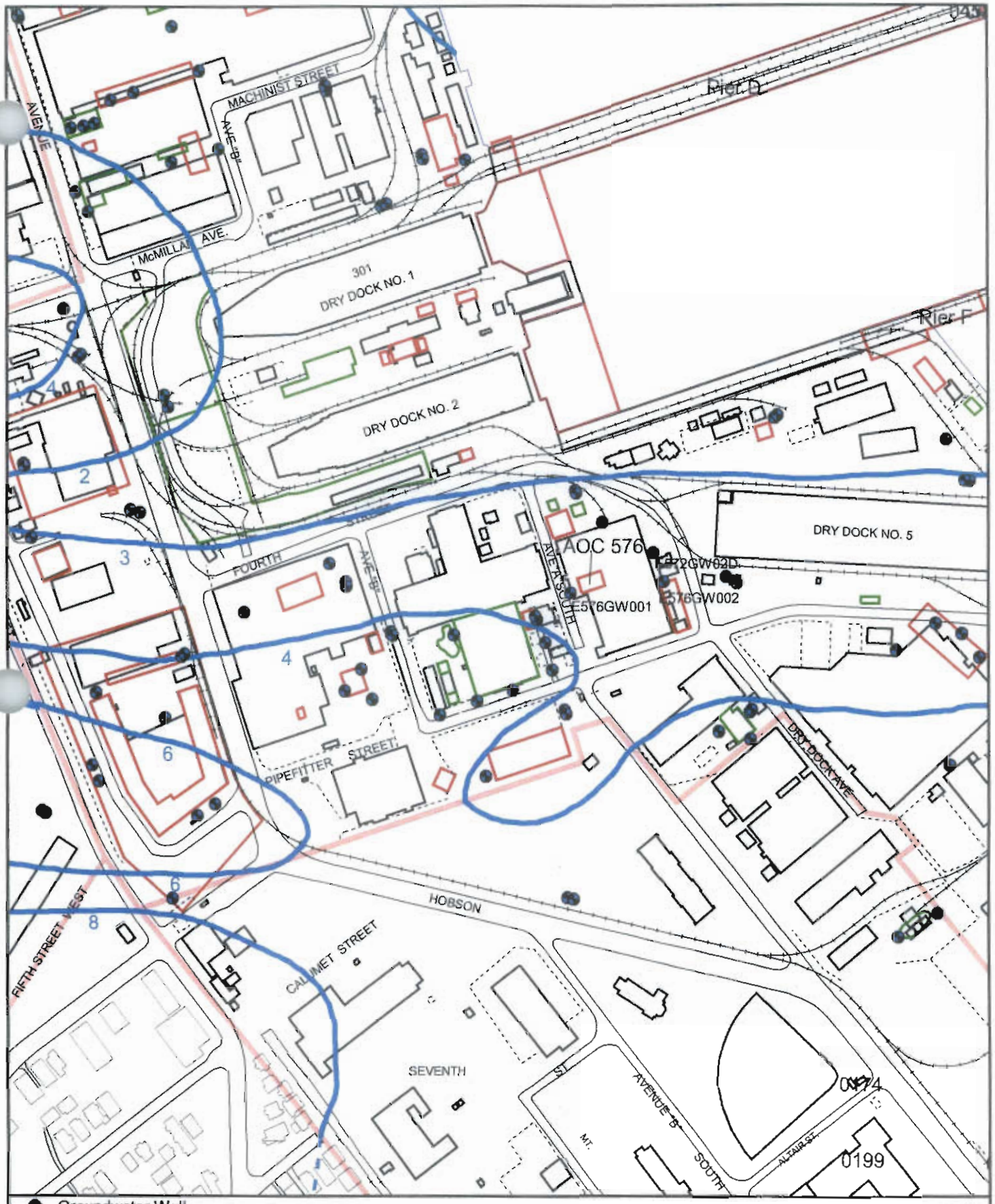
Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentrations Residential RBC	Industrial RBC	Reference	Units	Number Exceeding Res.	Ind.	Ref.
Carcinogenic PAHs															
B(a)P Equiv.	*	5	5	82.862	725.81	267	NA	NA	88	780	NA	UG/KG	3		
Benzo(a)anthracene		4	5	42	610	228	370	370	880	7800	NA	UG/KG			
Benzo(a)pyrene	*	5	5	69	460	179	NA	NA	88	780	NA	UG/KG	3		
Benzo(b)fluoranthene		2	5	92	380	236	370	410	880	7800	NA	UG/KG			
Benzo(k)fluoranthene		4	5	120	410	228	370	370	8800	78000	NA	UG/KG			
Chrysene		4	5	62	710	281	370	370	88000	780000	NA	UG/KG			
Dibenz(a,h)anthracene	*	3	5	43	140	80	370	410	88	780	NA	UG/KG	1		
Indeno(1,2,3-cd)pyrene		4	5	80	220	118	370	370	880	7800	NA	UG/KG			
TCDD Equivalents															
Dioxin Equiv.		1	1	0.3757	0.3757	0.38	NA	NA	1000	1000	NA	NG/KG			
Inorganics															
Aluminum (Al)		5	5	3730	6110	5034	NA	NA	7800	100000	26600	MG/KG			
Antimony (Sb)		2	5	0.68	0.77	0.73	0.44	0.5	3.1	82	1.77	MG/KG			
Arsenic (As)		5	5	2.1	5.7	4.14	NA	NA	0.43	3.8	23.9	MG/KG			
Barium (Ba)		5	5	19	31.2	25.42	NA	NA	550	14000	130	MG/KG			
Beryllium (Be)		5	5	0.39	0.48	0.42	NA	NA	0.15	1.3	1.7	MG/KG			
Cadmium (Cd)		2	5	0.14	0.16	0.15	0.11	0.12	3.9	100	1.5	MG/KG			
Calcium (Ca)	N	5	5	3860	36300	15752	NA	NA	NA	NA	NA	MG/KG			
Chromium (Cr)		5	5	5.8	11.6	8.22	NA	NA	39	1000	94.6	MG/KG			
Cobalt (Co)		5	5	0.67	37.9	14.49	NA	NA	470	12000	19	MG/KG			
Copper (Cu)		5	5	1.4	24.1	11.42	NA	NA	310	8200	66	MG/KG			
Iron (Fe)	N	5	5	3560	5940	4920	NA	NA	NA	NA	NA	MG/KG			
Lead (Pb)		5	5	4.1	335	108	NA	NA	400	1300	265	MG/KG			1
Magnesium (Mg)	N	5	5	224	913	693	NA	NA	NA	NA	NA	MG/KG			
Manganese (Mn)		5	5	20.4	136	62	NA	NA	180	4700	302	MG/KG			
Mercury (Hg)		4	5	0.04	0.43	0.20	0.12	0.12	2.3	61	2.6	MG/KG			
Nickel (Ni)		3	5	4.5	5.3	5.00	3	6.8	160	4100	77.1	MG/KG			
Potassium (K)	N	5	5	332	1010	576	NA	NA	NA	NA	NA	MG/KG			
Selenium (Se)		1	5	0.58	0.58	0.58	0.55	0.62	39	1000	1.7	MG/KG			
Sodium (Na)	N	5	5	143	300	209	NA	NA	NA	NA	NA	MG/KG			
Tin (Sn)		3	5	2.6	4.8	3.47	2.2	2.5	4700	100000	59.4	MG/KG			
Vanadium (V)		5	5	5.8	11	8.62	NA	NA	55	1400	94.3	MG/KG			
Zinc (Zn)		5	5	6	247	76	NA	NA	2300	61000	827	MG/KG			
Pesticides															
Endrin aldehyde		1	1	9.7	9.7	9.70	NA	NA	2300	61000	NA	UG/KG			
Semivolatile Organics															
2-Methylnaphthalene		1	5	73	73	73	370	410	310000	8200000	NA	UG/KG			
Acenaphthene		1	5	170	170	170	370	410	470000	12000000	NA	UG/KG			
Anthracene		1	5	250	250	250	370	410	2300000	61000000	NA	UG/KG			
Benzo(g,h,i)perylene		4	5	110	270	153	370	370	310000	8200000	NA	UG/KG			
bis(2-Ethylhexyl)phthalate		1	5	440	440	440	370	390	46000	410000	NA	UG/KG			
Butylbenzylphthalate		2	5	440	520	480	370	410	1600000	41000000	NA	UG/KG			
Dibenzofuran		1	5	110	110	110	370	410	31000	820000	NA	UG/KG			
Di-n-butylphthalate		1	5	44	44	44	370	410	780000	20000000	NA	UG/KG			
Fluoranthene		4	5	67	1200	454	370	370	310000	8200000	NA	UG/KG			
Fluorene		1	5	190	190	190	370	410	310000	8200000	NA	UG/KG			
Naphthalene		1	5	170	170	170	370	410	310000	8200000	NA	UG/KG			
Phenanthrene		3	5	150	1200	503	370	410	310000	8200000	NA	UG/KG			
Pyrene		4	5	71	1300	480	370	370	230000	6100000	NA	UG/KG			
Volatile Organics															
Acetone		3	5	27	70	45	12	12	780000	20000000	NA	UG/KG			
Methylene chloride		3	5	24	25	24	6	6	85000	760000	NA	UG/KG			

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

Appendix A2
Chemicals Present in Site Samples
AOC 576 - Groundwater
NAVBASE - Charleston
Charleston, South Carolina

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentrations Residential RBC	Reference	Units	Number Exceeding RBC	Ref.
Deep Wells													
Inorganics													
Arsenic (As)	*	1	1	35.1	35.1	35.1	NA	NA	0.045	16.4	UG/L	1	1
Barium (Ba)		1	1	51.1	51.1	51.1	NA	NA	260	218	UG/L		
Calcium (Ca)	N	1	1	186000	186000	186000	NA	NA	NA	NA	UG/L		
Cobalt (Co)		1	1	18.1	18.1	18.1	NA	NA	220	12.9	UG/L		1
Iron (Fe)	N	1	1	2730	2730	2730	NA	NA	NA	NA	UG/L		
Magnesium (Mg)	N	1	1	15900	15900	15900	NA	NA	NA	NA	UG/L		
Manganese (Mn)	*	1	1	1070	1070	1070	NA	NA	84	869	UG/L	1	1
Nickel (Ni)		1	1	10.7	10.7	10.7	NA	NA	73	42.2	UG/L		
Potassium (K)	N	1	1	5040	5040	5040	NA	NA	NA	NA	UG/L		
Sodium (Na)	N	1	1	279000	279000	279000	NA	NA	NA	NA	UG/L		
Zinc (Zn)		1	1	5.6	5.6	5.6	NA	NA	1100	11.8	UG/L		
Volatile Organics													
1,2-Dichloroethene (total)		1	1	2	2	2	NA	NA	5.5	NA	UG/L		
Shallow Wells													
Inoganics													
Aluminum (Al)	*	2	2	1080	5970	3525	NA	NA	3700	2810	UG/L	1	1
Beryllium (Be)	*	1	2	3	3	3	1	1	0.016	0.43	UG/L	1	1
Calcium (Ca)	N	1	2	280000	280000	280000	12800	12800	NA	NA	UG/L		
Chromium (Cr)		1	2	10.9	10.9	10.9	1	1	18	12.3	UG/L		
Cobalt (Co)		2	2	3.6	183	93.3	NA	NA	220	2.5	UG/L		2
Iron (Fe)	N	2	2	570	51700	26135	NA	NA	NA	NA	UG/L		
Lead (Pb)		1	2	9.6	9.6	9.6	3	3	15	4.8	UG/L		1
Magnesium (Mg)	N	2	2	4280	69400	36840	NA	NA	NA	NA	UG/L		
Manganese (Mn)		2	2	68.2	2340	1204.1	NA	NA	84	2560	UG/L	1	
Nickel (Ni)		2	2	1.1	67	34.05	NA	NA	73	15.2	UG/L		1
Sodium (Na)	N	1	2	889000	889000	889000	22400	22400	NA	NA	UG/L		
Vanadium (V)		1	2	10.9	10.9	10.9	1	1	26	11.4	UG/L		
Zinc (Zn)		1	2	101	101	101	9	9	1100	27.3	UG/L		1
Semivolatile Organics													
Pentachlorophenol	*	1	2	6	6	6	50	50	0.56	NA	UG/L	1	
Volatile Organics													
Bromodichloromethane	*	1	2	9	9	9	5	5	0.17	NA	UG/L	1	

* - Identified as a COPC
N - Essential nutrient
UG/L - microgram per kilogram
SQL - Sample quantitation limit
RBC - Risk-based concentration
NA - Not applicable



Groundwater Well
Shallow Groundwater Contours ft bls (Inferred)
Shallow Groundwater Contours ft bls (Known)
Fence
Railroads
Roads
AOC Boundary
SWMU Boundary
Buildings
Zone Boundary

N

0 100 200 Feet

1 inch = 93 feet

Figure A-1
Shallow Groundwater Contour Map
AOC 576, Zone E
Charleston Naval Complex

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Appendix B

Specific Comments Prepared by Eric Cathcart

AOC 576

SCDHEC Comment 61:

Organic compounds detected in first quarter groundwater samples from the deep well include 1,2-Dichloroethene (total). This compound may be a degradation product of trichloroethylene or tetrachloroethane. This RFI has not defined the horizontal or vertical extent of this contaminant. It has also failed to reveal the source.

Navy/EnSafe Response:
1,2-Dichloroethene was detected in monitoring well NBCE57602D. However, concentrations were below its RBC and MCL and the detection was not confirmed by nearby grid well NBCEGDE13D. Based on review of data from surrounding deep monitoring wells, the Navy feels it has delineated the extent of DCE contamination in this area. TCE and PCE have been identified in elevated concentrations in deep groundwater at several sites and grid wells throughout the northern portion of Zone E, therefore, DCE could very well be from the degradation of TCE and/or PCE. Due to the high number of potential point sources close to one another, contribution of contaminants may not be site-attributable. Analytical results from this area will be evaluated and the Navy will discuss additional well locations with the Project Team.

CH2M-Jones Response:
No additional response.

SCDHEC Comment 62:

Organic compounds detected in first quarter groundwater samples from the shallow wells include pentachlorophenol above the MCL. Pentachlorophenol is a compound that is commonly used in the manufacturing of insecticides, algicides, herbicides, fungicides, and bactericides; wood preservatives. Soil data does not include pentachlorophenol or bromodichloromethane. The Department recommends the collection of additional soil samples to include these parameters.

Navy/EnSafe Response:
Soil samples collected from soil borings installed at the locations of shallow monitoring wells were analyzed for SVOCs, and thus would have indicated pentachlorophenol and bromodichloromethane had they been detected. There were no detections of either of these compounds in soil.

CH2M-Jones Response:
Pentachlorophenol was not detected above laboratory detection limits in site wells during three subsequent groundwater sampling events, indicating that this pentachlorophenol does not appear to be a site-related COC. This single detection of pentachlorophenol does not indicate a site-related release. Therefore, pentachlorophenol is not considered a COC in groundwater at AOC 576. No further investigation of pentachlorophenol is warranted at this site.