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CNC CHARLESTON  
5090.3a

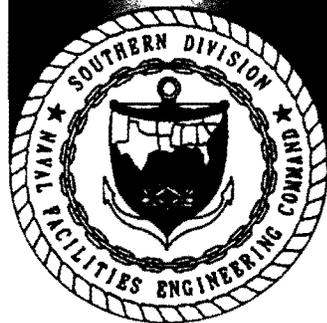
INTERIM MEASURE COMPLETION REPORT SOIL REMOVAL AREA OF CONCERN 516  
(AOC 516) BUILDING 233 ZONE C WITH TRANSMITTAL CNC CHARLESTON SC  
4/23/2001  
NAVFAC SOUTHERN

# INTERIM MEASURE WORK PLAN

## AOC 516, Building 233, Zone C



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



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

PREPARED BY  
***CH2M-Jones***

*November 2000*

*Revision 0  
Contract N62467-99-C-0960*



DEPARTMENT OF THE NAVY

SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
P.O. BOX 190010  
2155 EAGLE DRIVE  
NORTH CHARLESTON, S.C. 29419-9010

5090/11  
Code 18713  
23 Apr 01

Mr. John Litton, P.E.  
Director, Division of Hazardous and Infectious Waste Management  
Bureau of Land and Waste Management  
South Carolina Department of Health and Environmental Control  
2600 Bull Street  
Columbia, SC 29201

Subj: SUBMITTAL OF AREA OF CONCERN 516 INTERIM COMPLETION REPORT

Dear Mr. Litton,

The purpose of this letter is to submit an Interim Measure Completion Report (Revision 0) for Area of Concern (AOC) 516, Building 233, Zone C located at the Charleston Naval Complex. The work plan is submitted to fulfill the requirements of condition IV.E.2 of the RCRA Part B permit issued to the Navy by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency (EPA).

The document is distributed under separate cover letter by CH2M Hill. Appropriate certification is provided under that correspondence. We request that the Department and the EPA review this document and provide comments or approval whichever is appropriate.

If you should have any questions, please contact, Matthew Humphrey or myself at (843) 743-9985 and (843) 820-5551 respectively.

Sincerely,

  
ROBERT A. HARRELL, JR., P.E.  
Environmental Engineer  
BRAC Division

Copy to:  
SCDHEC (4)  
USEPA (Dann Spariosu)  
CSO Naval Base Charleston (Matt Humphrey)  
CH2M-Hill (Dean Williamson)

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18713  
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18E2HPH



**CH2MHILL**

**CH2M HILL**

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April 20, 2001

John Litton, P.E.  
Director  
Division of Hazardous and Infectious Wastes  
South Carolina Department of Health and  
Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

Dear Mr. Litton:

Enclosed please find four copies of the Interim Measure Completion Report for Area of Concern 516, Building 233, Zone C, at 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.

Please contact me if you have any questions or comments.

Sincerely,

Dean Williamson, P.E.

xc: Tony Hunt/Navy, w/att  
Rob Harrell/Navy, w/att  
Mihir Mehta/SCDHEC  
Gary Foster/CH2M HILL, w/att

**Certification Page for IM Completion Report – AOC 516,  
Building 233, Zone C**

**Soil Removal**

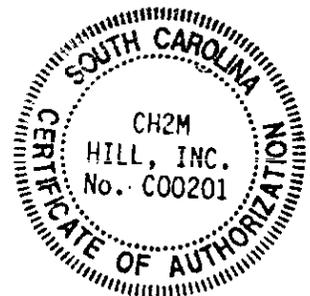
I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina  
Temporary Permit No. T2000342



Dean Williamson, P.E.

4/19/2001  
Date



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# 1 Acronyms and Abbreviations

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2	AOC	area of concern
3	BCT	BRAC Cleanup Team
4	BEQ	benzo(a)pyrene equivalent
5	BRAC	Base Realignment and Closure Act
6	CA	corrective action
7	CNC	Charleston Naval Complex
8	COC	chemical of concern
9	COPC	chemical of potential concern
10	EEG	Environmental Enterprise Group Inc.
11	EnSafe	Ensafe Inc.
12	EPA	U.S. Environmental Protection Agency
13	ft bls	feet below land surface
14	IM	interim measure
15	µg/kg	micrograms per kilogram
16	mg/kg	milligrams per kilogram
17	NAVBASE	Naval Base
18	NFA	no further action
19	OWS	oil-water separator
20	PAH	polycyclic aromatic hydrocarbon
21	RBC	risk-based concentration
22	RCRA	Resource Conservation and Recovery Act
23	RFA	RCRA Facility Assessment
24	RFI	RCRA Facility Investigation
25	SCDHEC	South Carolina Department of Health and Environmental Control
26	SWMU	solid waste management unit
27	TCLP	toxicity characteristic leachate procedure
28	WMI	Waste Management Inc.

SECTION 1  
**Introduction**

# 1.0 Introduction

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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) 516 in Zone C of  
14 the Naval Complex. Review of site data resulted in the site being recommended for an  
15 Interim Measure (IM) to delineate and remove arsenic- and lead-impacted soil with  
16 concentrations above the appropriate cleanup levels (CH2M-Jones, 2000).

## 1.1 Background

18 As part of RCRA CA activities, an RFI report was finalized for Zone C (EnSafe Inc [EnSafe],  
19 1997). Zone C is located on the western edge of the northern portion of the CNC. It is  
20 bounded by McMillian Avenue to the south, Hobson Avenue to the east, Avenue "D" to the  
21 northeast, and the CNC property boundary to the west and north.

22 AOC 516, Building 233, is located west of Buildings NSC-64, 66, and 67, in the block formed  
23 by Turnbull Avenue West, Second Street West, Avenue D, and Avenue F. The site was used  
24 for spray-washing vehicles and equipment from 1972 until the 1980s. Following this time  
25 period the area was used for recharging lead-acid batteries. The RCRA Facility Assessment  
26 (RFA) completed by EnSafe (1995) identified lead and other metals, battery acids, solvents,  
27 and petroleum hydrocarbons as chemicals of potential concern (COPCs) resulting from  
28 operations. An RFI work plan was developed for AOC 516, which included these COPCs as  
29 target analytes. The RFI for AOC 516 was conducted concurrently and in combination with  
30 the RFI for SWMU 47.

1 Arsenic in surface soil at a single sampling location, C047SB007, was detected above its  
2 Zone C reference concentration (14.1 milligrams per kilogram [mg/kg]). Although this soil  
3 was sampled as part of the Solid Waste Management Unit (SWMU) 47 RFI, it is in close  
4 proximity to AOC 516. At the same sampling location lead was detected at 1,120 mg/kg,  
5 which is above the cleanup level of 400 mg/kg typically established for unrestricted  
6 (residential) land use (EPA, 1996). However, due to the limited area of lead-impacted soil, it  
7 was not identified as a chemical of concern (COC) in the *Zone C Final RFI Report* (EnSafe,  
8 1997).

9 No COCs were identified for subsurface soils of the combined AOC 516/ SWMU 47 site.  
10 The subsurface soil was determined not to represent a risk to shallow groundwater.

11 CH2M-Jones determined that removal at the small area of soil containing metals around soil  
12 boring 047SB007 was appropriate, and should enable the closeout of AOC 516 in a condition  
13 that is suitable for future unrestricted use, or with no land-use controls. Accordingly,  
14 CH2M-Jones prepared an IM Work Plan for the removal of arsenic- and lead-impacted soil  
15 at AOC 516. The *Interim Measure Work Plan — AOC 516, Building 233, Zone C* was submitted  
16 by CH2M-Jones on November 20, 2000 and subsequently approved by SCDHEC. The target  
17 cleanup levels for site soil were 14.1 mg/kg for arsenic and 400 mg/kg for lead. The IM was  
18 completed on March 14, 2001, and is summarized in this report.

## 19 **1.2 Purpose of the IM Completion Report**

20 This report provides information about the soil removal activities and documents the results  
21 of the IM conducted at AOC 516.

## 22 **1.3 Report Organization**

23 This IM Completion Report consists of the following sections, including this introductory  
24 section:

25 **1.0 Introduction** — Presents the purpose of the report and background information relating  
26 to the IM.

27 **2.0 Interim Measure Implementation** — Summarizes the excavation activities at AOC 516.

28 **3.0 Interim Measure Outcome** — Provides a discussion of post-IM activities including  
29 confirmation sampling and backfill of the excavation.

- 1 **4.0 Residual Issues** — Provides a discussion of SCDHEC's comments on the IM Work Plan,  
2 primarily regarding BEQs.
- 3 **5.0 Recommendations** — Provides recommendations for proceeding with site closure.
- 4 **6.0 References** — Lists the references used in this document.
- 5 **Appendix A** contains documentation for the abandonment of Monitor Well C04GW007.
- 6 **Appendix B** contains the analytical data from the delineation samples collected at AOC 516.
- 7 **Appendix C** contains the analytical data from the toxicity characteristic leachate procedure  
8 (TCLP) sample collected for soil disposal.
- 9 **Appendix D** contains the waste manifest from Waste Management Inc. (WMI) for soil  
10 disposal.
- 11 **Appendix E** contains the analytical data from the conformation samples collected at AOC  
12 516.
- 13 **Appendix F** contains responses to comments made by SCDHEC regarding the IM Work  
14 Plan.
- 15 **Appendix G** contains Section 4.0, Summary of Information Related to Site Closeout Issues,  
16 and Figure 2-2 of the IM Work Plan for AOC 516.
- 17 All tables and figures appear at the end of their respective sections.

# Internal Network Implementation

## 2.0 Interim Measure Implementation

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On January 22, 2001 equipment and personnel were mobilized to AOC 516 to begin preparing the site for the removal activities which were presented in the approved AOC 516 IM Work Plan. All work was performed in accordance with the work plan, except that soil boring C516SBD01 was installed approximately 5 feet to the southwest of the location indicated in the work plan.

Monitor well C047GW007, which was located within the proposed excavation area, was abandoned on January 30, 2001 by Environmental Enterprise Group Inc. (EEG) in accordance with South Carolina Well Standards and Regulations. The location of the abandoned well is illustrated in Figure 2-1. Well abandonment documentation is provided in Appendix A.

On January 31, 2001 four delineation samples were collected from the two locations (C516SBD01 and C516SBD02) shown in Figure 2-1. Each sample location included a surface (1 to 2 feet below land surface [ft bls]) and subsurface (3 to 4 ft bls) sample. An equipment blank was also submitted for analysis. Additionally, a TCLP sample (C047SB007) was collected for waste characterization from the area with the highest reported concentrations of arsenic and lead. The sample ID for the TCLP sample was chosen in the field, and it is identical to a sample collected as part of the SWMU 47 RFI investigation. Summaries of the analytical results from the delineation samples collected during the IM and the TCLP data are presented in Tables 2-1 and 2-2, respectively. Appendix B contains the complete data set for the delineation samples, and Appendix C contains the complete TCLP data.

The reported concentrations for arsenic and lead from the delineation samples were below the cleanup levels established in the IM Work Plan. This resulted in a reduction of the estimated soil removal area from the area presented in the IM Work Plan. Based on this information, the area requiring soil removal was defined by soil borings C516SBC03, C516SBC04, C516SBD01, and C516SBD02. Additionally, no samples collected at a depth of 3 feet or greater reported arsenic or lead concentrations above their respective cleanup levels. The absence of subsurface concentrations of arsenic or lead above their respective cleanup levels indicated that excavation of soil below 3 ft bls was not necessary. The resulting excavation was approximately 14 feet long by 9 feet wide and 3 feet deep (380 ft<sup>3</sup> ~ 14 yd<sup>3</sup>). The waste manifest from Waste Management Inc. (WMI), which is provided in Appendix D, indicates that 14.53 tons of soil were excavated from the site and disposed of offsite.

- 1 Results from the waste characterization sample (C047SB007) indicated that the excavated
- 2 soil was suitable for Subtitle D landfill disposal, as the reported leachate concentrations of
- 3 the eight RCRA metals were all reported at concentrations below their respective regulatory
- 4 levels (40 CFR 261.30). The soil was disposed of by WMI at the Oakridge Landfill, 2183
- 5 Highway 78, P.O. Box 145, Dorchester, South Carolina 29437.

**TABLE 2-1**  
 Surface Soil Delineation Data  
 IM Completion Report, AOC 516, Building 233, Zone C, Charleston Naval Complex

Sample Station	Station ID	Date Collected	Arsenic <sup>a</sup>		Lead <sup>a</sup>	
			Result (mg/kg)	Qualifier	Result (mg/kg)	Qualifier
C516SBC03	516SBC0301	9-Mar-1999	3.8	=	11.2	=
C516SBC04	516SBC0401	9-Mar-1999	8.7	=	3.7	=
C516SBD01	516SBD0101	31-Jan-2001	2.37	=	16.5	=
C516SBD02	516SBD0201	31-Jan-2001	4.91	=	29.8	=

mg/kg milligrams per kilogram

= indicates that the analyte was detected, and the reported value is equal to the sample concentration.

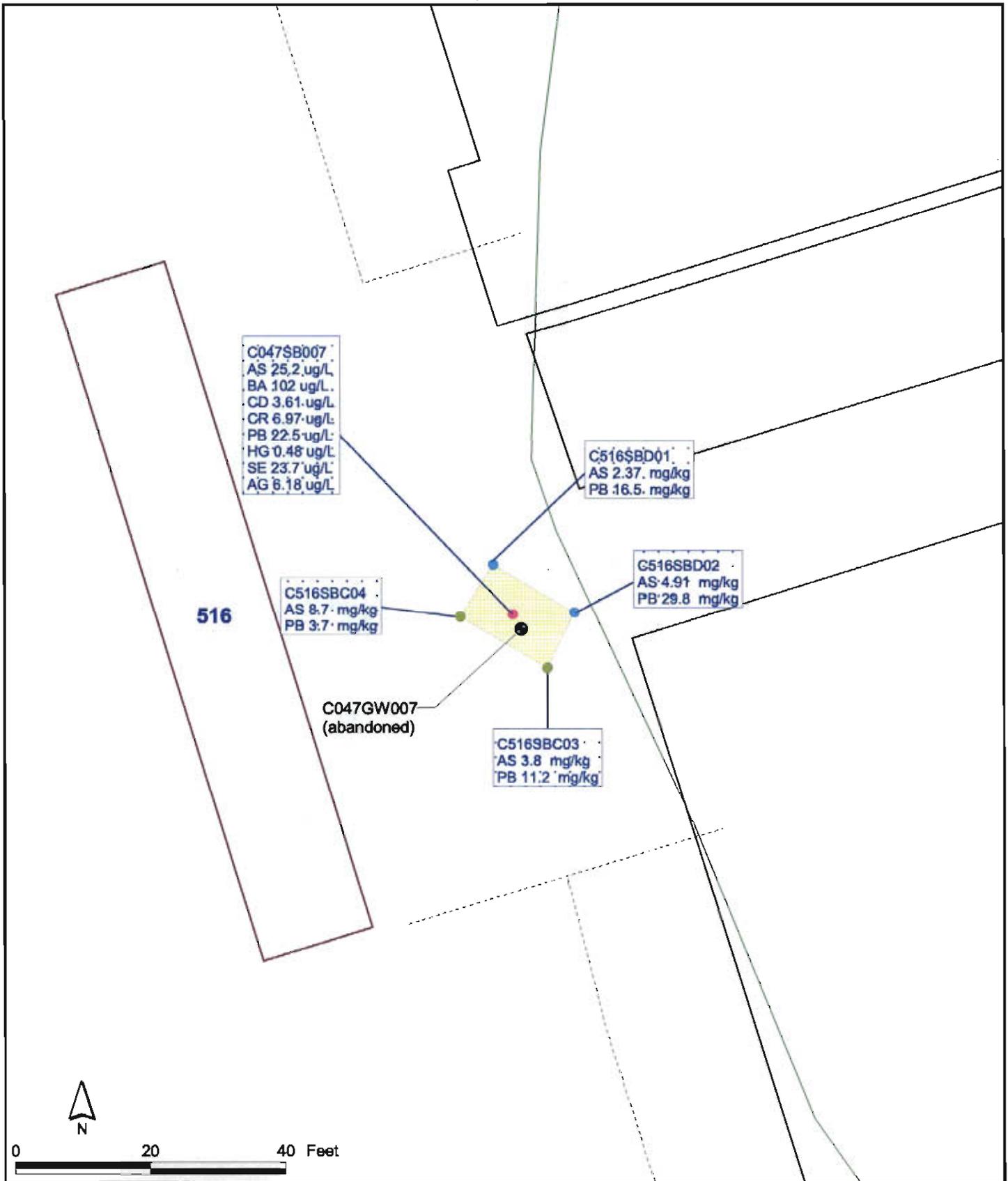
<sup>a</sup> Target Cleanup Goals for Arsenic and Lead are 14 mg/kg and 400 mg/kg, respectively.

**TABLE 2-2**  
 TCLP Data  
*IM Completion Report, AOC 516, Building 233, Zone C, Charleston Naval Complex*

Sample Station	Station ID	Date Coll.	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
			Result (µg/L)							
TCLP Value <sup>a</sup>			5,000	100,000	1,000	5,000	5,000	200	1,000	5,000
C047SB007	047SB007	31-Jan-2001	25.2	102	3.61	6.97	22.5	.48	23.7	6.18

µg/L micrograms per liter

<sup>a</sup> Values are from Table 1 of 40 CFR 261.29.



- Waste Characterization Sample Location
- Delineation Sample Locations
- RFI Samples used for Delineation
- Abandoned Groundwater Well
- Approximate IM Excavation Area
- AOC Boundary
- Buildings
- Zone Boundary
- Fence
- Railroads
- Roads

**Figure 2-1**  
 Interim Measure Sample Locations and Excavation  
 AOC 516, Zone C  
 Charleston Naval Complex

Note: original figure produced in color.

SECTION 54  
**Interim Measure Outcome**

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## 3.0 Interim Measure Outcome

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Following the completion of the excavation, two confirmation samples (C516SBD03L1 and C516SBD04L1) and one duplicate sample (C516CBD04L1) were collected from the floor of the excavation. The locations of the confirmation samples are presented in Figure 3-1. A summary of the analytical results is presented in Table 3-1, and the complete data are provided in Appendix E.

Confirmation samples collected from the interior of the excavation, combined with the delineation samples, indicated that the remaining soil met the cleanup criteria for arsenic (14.1 mg/kg) and lead (400 mg/kg). Arsenic concentrations in the confirmation samples ranged from 2.57 mg/kg in sample C516SBD03L1 (1.93 mg/kg in the duplicate sample) to 5.86 mg/kg in sample C516SBD04L1. Delineation samples reported arsenic concentrations that ranged from 2.37 mg/kg in sample C516SBD01 to 4.91 mg/kg in sample C516SBD02. Lead concentrations in the confirmation samples ranged from 4.37 mg/kg in sample C516SBD03L1 (3.75 mg/kg in the duplicate sample) to 20.7 mg/kg in sample C516SBD04L1. Delineation samples reported lead concentrations that ranged from 16.5 mg/kg in sample C516SBD01 to 29.8 mg/kg in sample C516SBD02. None of these samples exceeded the appropriate cleanup criteria.

Based on these data, arsenic- and lead-impacted soil around soil boring C047SB007 has been adequately removed and no further investigative or remedial actions are warranted at AOC 516.

Following the confirmation sampling, the excavation was backfilled with fill obtained from the Butler Ware Trucking Co. The backfill was compacted, graded, and the asphalt replaced to match the existing grade.

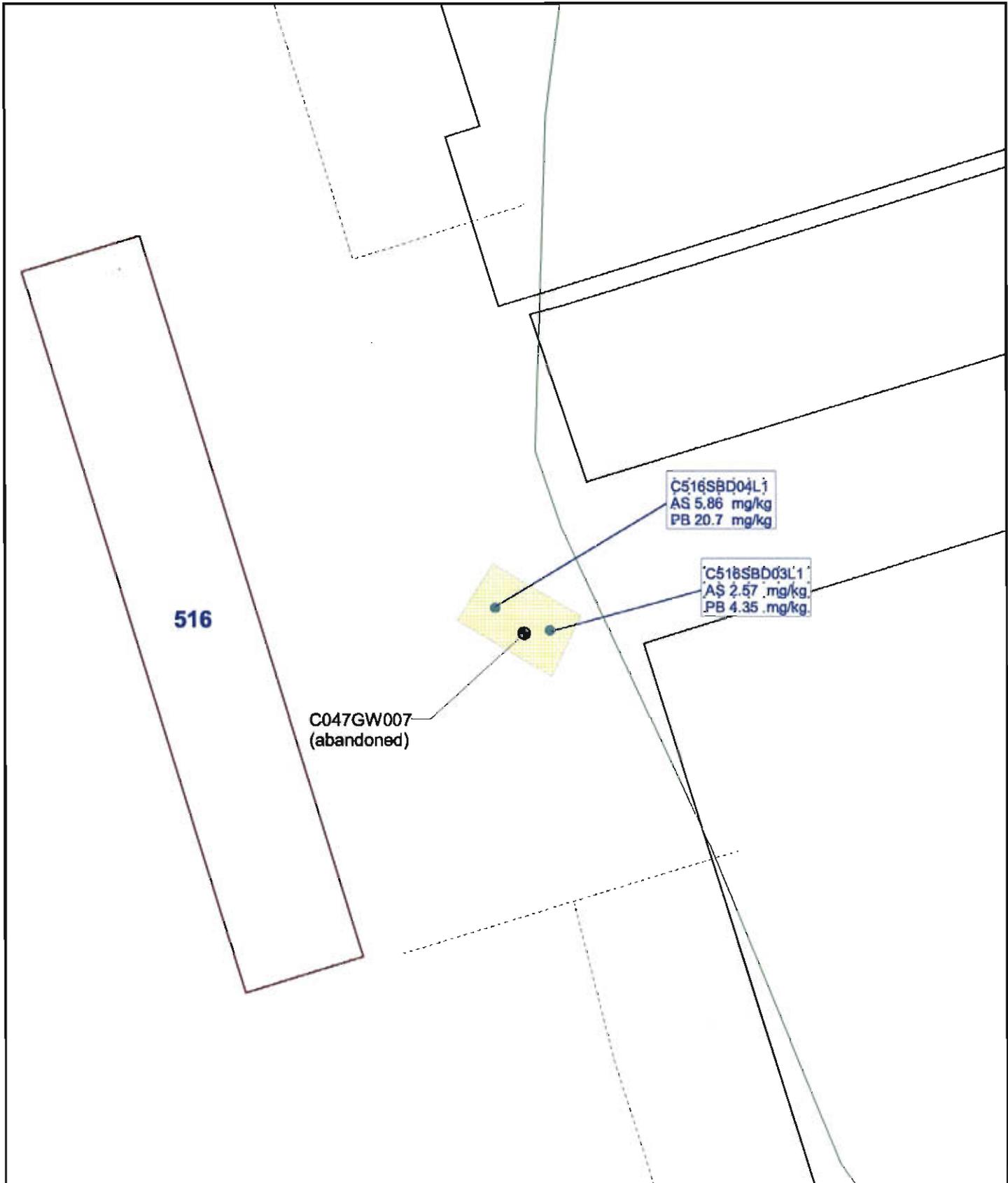
**TABLE 3-1**  
 Surface Soil Confirmation Data  
*IM Completion Report, AOC 516, Building 233, Zone C, Charleston Naval Complex*

Sample Station	Station ID	Date Collected	Arsenic <sup>a</sup>		Lead <sup>a</sup>	
			Result (mg/kg)	Qualifier	Result (mg/kg)	Qualifier
C516SBD03L1	516SBD03L1	7-Mar-2001	2.57	=	4.35	=
C516SBD04L1	516SBD04L1	7-Mar-2001	5.86	=	20.7	=
C516CBD04L1	516CBD04L1	7-Mar-2001	1.93	=	3.75	=

mg/kg milligrams per kilogram

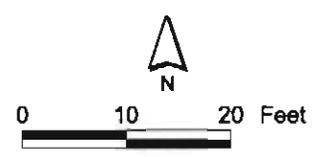
= indicates that the analyte was detected, and the reported value is equal to the sample concentration.

<sup>a</sup> Target Cleanup Goals for Arsenic and Lead are 14 mg/kg and 400 mg/kg, respectively.



**Figure 3-1**  
 Confirmation Sample Locations  
 AOC 516, Zone C  
 Charleston Naval Complex

- Confirmation Sample Location
- Groundwater Well
- Approximate IM Excavation Area
- AOC Boundary
- Buildings
- Zone Boundary
- Fence
- Railroads
- Roads



Note: original figure produced in color.



SECTION 41

## Residual Issues

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## 4.0 Residual Issues

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The IM Work Plan for AOC 516 was submitted by CH2M-Jones on November 20, 2000. On December 18, 2000, SCDHEC issued comments regarding the Work Plan. The responses to comments were presented to SCDHEC by CH2M-Jones on December 19, 2000; a complete copy of the responses is provided in Appendix F.

The only comment that has not been addressed completely in this report, or in the response to comments, is the issue of benzo(a)pyrene equivalents (BEQs) at AOC 516. At the time that the IM Work Plan was written an anthropogenic background or reference concentration for BEQs had not yet been established. This issue has recently been resolved and a brief discussion regarding BEQs at AOC 516 is provided below.

### 4.1 BEQs at AOC 516

Polynuclear aromatic hydrocarbons (PAHs), expressed as BEQs, were identified as a COC in the RFI report prepared by EnSafe (1997) at the combined AOC 516/SWMU 47. Their identification as such was based on exceedances of the risk-based concentration (RBC) of 88 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ). PAHs are routinely detected in non-impacted as well as impacted areas of the CNC. The detected PAHs, and resulting calculated BEQs, in the non-impacted areas (grid-based samples) of the CNC were used to calculate a BEQ value for use as a base-wide reference concentration. The data and analysis was presented in the *Background PAHs Study Report - Technical Information for Development of Background BEQ Values*, written by CH2M-Jones (2001) and presented to the BCT. The BEQ reference concentration of 1,304  $\mu\text{g}/\text{kg}$  was established for surface soil.

Comparison of calculated BEQ values from AOC 516 to the CNC reference concentration resulted in no BEQ exceedances in any samples collected or analyzed for PAHs at AOC 516. Based on this information, further evaluation (i.e., remediation) of BEQs is not warranted at AOC 516.

**TABLE 4-1**  
Surface Soil BEQ Data  
*IM Completion Report, AOC 516, Zone C, Charleston Naval Complex*

Station ID	Result ( $\mu\text{g}/\text{kg}$ )	Qualifier	Date Collected	Background or Reference Value
C047SB007	841	=	04/14/1995	1304 <sup>a</sup>
C516SB001	408.7	=	04/05/1995	1304 <sup>a</sup>
C516SB002	701.6	U	04/05/1995	1304 <sup>a</sup>

$\mu\text{g}/\text{kg}$  micrograms per kilogram

= indicates that the reported concentration is equal to the concentration in the sample.

U indicates that the constituent was not detected.

<sup>a</sup> Anthropogenic background concentration based on CH2M-Jones' base-wide PAH evaluation (*Background PAHs Study Report – Technical Information for Development of Background BEQ Values*, Revision 0, February 2001).

Section  
**Recommendations**

## 5.0 Recommendations

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Because the data supports the conclusion that AOC 516 has been adequately remediated, this IM is expected to be the final remedial action at AOC 516. Therefore, CH2M-Jones is recommending that the status of the site be changed to No Further Action (NFA).

Prior to changing the status of any site to NFA 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 at the site

Information regarding these closeout issues has been addressed previously in Section 4.0 of the IM Work Plan, Summary of Information Related to Site Closeout Issues, and is provided in Appendix G to expedite review of these issues.

It is expected that review of the information related to the closeout issues will result in BCT consensus that they have been adequately addressed and the site is now suitable for unrestricted land use. Once the BCT concurs that NFA is appropriate for the site a Statement of Basis can be prepared and made available for public comment in accordance with SCDHEC policy.

Section 4  
**References**

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## 1 **6.0 References**

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- 2 CH2M-Jones. *Interim Measure Work Plan – AOC 516, Building 233, Zone C, Charleston Naval*
- 3 *Complex*. Revision 0. November 2000.
- 4 CH2M-Jones. *Background PAHs Study Report - Technical Information for Development of*
- 5 *Background BEQ Values*. Revision 0. February 2001.
- 6 EnSafe Inc. *Zone C Final RFI Report, NAVBASE Charleston*. June 6, 1997.
- 7 U.S. Environmental Protection Agency. *Soil Screening Guidance: Technical Background*
- 8 *Document*. May 1996.

APPENDIX  
**Monthly Well Abandonment Documentation**



APPENDIX B  
**IM Delineation Sampling Results**

---



## Certificate of Analysis

Company : CH2M Hill  
 Address : 3011 S. W. Williston Road  
 Gainesville, FL 32608-3928

Report Date: February 8, 2001

Contact: Herb Kelley  
 Project: Charleston Naval Shipyard

Page 1 of 1

Client Sample ID:	516SBD0101	Project:	CH2M00400
Sample ID:	37109001	Client ID:	CH2M006
Matrix:	Soil		
Collect Date:	31-JAN-01		
Receive Date:	31-JAN-01		
Collector:	Client		
Moisture:	16.3%		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Metals Analysis-ICP Federal</b>											
<i>3050S/6010 Lead Federal</i>											
Arsenic		2370	321	586	ug/kg	2	HSC	02/03/01	0051	63459	1
Lead		16500	399	586	ug/kg	2					

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	KLD1	02/02/01	1500	63308

**The following Analytical Methods were performed**

Method	Description
1	SW846 3050B/6010B

**Notes:**

The Qualifiers in this report are defined as follows :

- \*\* Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on a dry weight basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at 843-556-8171 Ext. 4485.

Reviewed by \_\_\_\_\_

## Certificate of Analysis

Company : CH2M Hill  
 Address : 3011 S. W. Williston Road  
 Gainesville, FL 32608-3928

Report Date: February 8, 2001

Contact: Herb Kelley  
 Project: Charleston Naval Shipyard

Page 1 of 1

Client Sample ID:	516SBD0102	Project:	CH2M00400
Sample ID:	37109002	Client ID:	CH2M006
Matrix:	Soil		
Collect Date:	31-JAN-01		
Receive Date:	31-JAN-01		
Collector:	Client		
Moisture:	12.9%		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Metals Analysis-ICP Federal</b>											
<i>3050S/6010 Lead Federal</i>											
Arsenic		1920	305	557	ug/kg	2	HSC	02/03/01	0108	63459	1
Lead		9990	391	574	ug/kg	2	HSC	02/06/01	0328	63666	2

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	AJM	02/05/01	1545	63580
SW846 3050B	846 3050BS PREP	KLD1	02/02/01	1500	63308

**The following Analytical Methods were performed**

Method	Description
1	SW846 3050B/6010B
2	SW846 3050B/6010B

**Notes:**

The Qualifiers in this report are defined as follows :

- \*\* Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on a dry weight basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at 843-556-8171 Ext. 4485.

Reviewed by \_\_\_\_\_

## Certificate of Analysis

Company : CH2M Hill  
 Address : 3011 S. W. Williston Road  
 Gainesville, FL 32608-3928

Report Date: February 8, 2001

Contact: Herb Kelley  
 Project: Charleston Naval Shipyard

Page 1 of 1

Client Sample ID: 516SDB0201  
 Sample ID: 37109003  
 Matrix: Soil  
 Collect Date: 31-JAN-01  
 Receive Date: 31-JAN-01  
 Collector: Client  
 Moisture: 21.5%

Project: CH2M00400  
 Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Metals Analysis-ICP Federal</b>											
<i>3050S/6010 Lead Federal</i>											
Arsenic		4910	326	595	ug/kg	2	HSC	02/03/01	0114	63459	1
Lead		29800	405	595	ug/kg	2	JAB	02/05/01	1049	63459	2

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	KLD1	02/02/01	1500	63308

**The following Analytical Methods were performed**

Method	Description
1	SW846 3050B/6010B
2	SW846 3050B/6010B

**Notes:**

The Qualifiers in this report are defined as follows :

- \*\* Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on a dry weight basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at 843-556-8171 Ext. 4485.

Reviewed by \_\_\_\_\_

## Certificate of Analysis

Company : CH2M Hill  
 Address : 3011 S. W. Williston Road  
 Gainesville, FL 32608-3928

Contact: Herb Kelley  
 Project: Charleston Naval Shipyard

Report Date: February 8, 2001

Page 1 of 1

Client Sample ID: 516SBD0202  
 Sample ID: 37109004  
 Matrix: Soil  
 Collect Date: 31-JAN-01  
 Receive Date: 31-JAN-01  
 Collector: Client  
 Moisture: 14.7%

Project: CH2M00400  
 Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Metals Analysis-ICP Federal</b>											
<i>3050/30510 Lead Federal</i>											
Arsenic		2230	303	553	ug/kg	2	HSC	02/03/01	0119	63459	1
Lead		6670	395	581	ug/kg	2	HSC	02/06/01	0335	63666	2

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	AJM	02/05/01	1545	63580
SW846 3050B	846 3050BS PREP	KLD1	02/02/01	1500	63308

**The following Analytical Methods were performed**

Method	Description
1	SW846 3050B/6010B
2	SW846 3050B/6010B

**Notes:**

The Qualifiers in this report are defined as follows :

- \*\* Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on a dry weight basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at 843-556-8171 Ext. 4485.

Reviewed by \_\_\_\_\_

## Certificate of Analysis

Company : CH2M Hill  
 Address : 3011 S. W. Williston Road  
 Gainesville, FL 32608-3928

Report Date: February 8, 2001

Contact: Herb Kelley  
 Project: Charleston Naval Shipyard

Page 1 of 1

Client Sample ID:	516EBD0101	Project:	CH2M00400
Sample ID:	37111001	Client ID:	CH2M005
Matrix:	Ground Water		
Collect Date:	31-JAN-01		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
<b>Metals Analysis-ICP Federal</b>											
<i>3005/6010 Lead Federal</i>											
Arsenic	U	1.51	4.57	5.00	ug/L	1	HSC	02/02/01	1751	63436	1
Lead	U	1.41	3.44	5.00	ug/L	1					

**The following Prep Methods were performed**

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3005A	ICP-TRACE SW846 3005A	FDG	02/02/01	1200	63307

**The following Analytical Methods were performed**

Method	Description
I	SW846 3005/6010B

**Notes:**

The Qualifiers in this report are defined as follows :

- \*\* Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at 843-556-8171 Ext. 4485.

Reviewed by \_\_\_\_\_

Page 10  
ECF Data

TOTAL METALS  
- 1 -  
INORGANIC ANALYSIS DATA PACKAGE

SDG No.: 37110

Method Type: SW-846

Sample ID: 37110001

Client ID: 047SB00701

Contract: CH2M00400

Lab Code: GEL

Case No.: GEL

SAS No.:

Matrix: TCLP

Date Received: 1/31/01

Level: LOW

% Solids: 100.00

CAS No.	Analyte	Concentration	Units	C	Qual	M	DL	Instrument ID	Analytical Run
7440-38-2	Arsenic	25.2	ug/L	B		P	24.6	TJA61 Trace ICP2	20201
7440-39-3	Barium	102	ug/L	B		P	4.870	TJA61 Trace ICP2	20201
7440-43-9	Cadmium	3.610	ug/L	U		P	3.610	TJA61 Trace ICP2	20201
7440-47-3	Chromium	6.970	ug/L	U		P	6.970	TJA61 Trace ICP2	20201
7439-92-1	Lead	22.5	ug/L	U		P	22.5	TJA61 Trace ICP2	20201
7439-97-6	Mercury	0.480	µg/L	U		AV	0.480	PE CVAA	20501wpHg
7782-49-2	Selenium	23.7	ug/L	U		P	23.7	TJA61 Trace ICP2	20201
7440-22-4	Silver	6.180	ug/L	U		P	6.180	TJA61 Trace ICP2	20201

Color Before:

Clarity Before:

Texture:

Color After:

Clarity After:

Artifacts:

Comments:

APPENDIX D  
**Waste Manifest**

---



OAKRIDGE LANDFILL  
2183 Highway 78, Darlington, SC 29437  
Tel 843-653-5897 Fax 843-653-3378

Truck 23

ADL 516

SPECIAL WASTE MANIFEST  
APPROVAL # OR 0102025  
EXPIRATION 05/28/2001

7 March 01

Generator: SOUTH DIV NAVAL ENG

Account Number: 499-439

Location / Address: FOB 190010

CHARLESTON SC (10)

Tele Number: 843-743-9965

Contact: RICK NIELSON

Generator Signature: [Signature]

\*\*\*\*\* TO BE COMPLETED BY TRANSPORTER \*\*\*\*\*

Transporter of Waste: BUTLER WARE TRK

Truck # 23

Date: 3/7/01

Driver Signature: \_\_\_\_\_

\*\*\*\*\* TO BE COMPLETED BY OAKRIDGE LANDFILL \*\*\*\*\*

Disposal Site: Oakridge Landfill DWP 130

Description of Waste: SOL / FUEL OIL CONTAMINATED SOIL

Ticket Number: 11004 / 943898

Tonnage: 14.53

Received by: [Signature]

Date: 3/7/01

Construction Sample Results



TOTAL METALS  
- 1 -  
INORGANIC ANALYSIS DATA PACKAGE

SDG No.: 38777

Method Type: SW-846

Sample ID: 38777001

Client ID: C516SBD03L1

Contract: CH2M00400

Lab Code: GEL

Case No.: GEL

SAS No.:

Matrix: SOIL

Date Received: 3/7/2001

Level: LOW

% Solids: 71.20

CAS No.	Analyte	Concentration	Units	C	Qual	M	DL	Instrument ID	Analytical Run
7440-38-2	Arsenic	2.57	mg/kg			P	0.57	TJA61 Trace ICP1	30801
7439-92-1	Lead	4.35	mg/kg			P	0.28	TJA61 Trace ICP1	30801

Color Before:

Clarity Before:

Texture:

Color After:

Clarity After:

Artifacts:

Comments:

**TOTAL METALS**  
- 1 -  
**INORGANIC ANALYSIS DATA PACKAGE**

SDG No.: 38777

Method Type: SW-846

Sample ID: 38777002

Client ID: C516SB04L1

Contract: CH2M00400

Lab Code: GEL

Case No.: GEL

SAS No.:

Matrix: SOIL

Date Received: 3/7/2001

Level: LOW

% Solids: 65.70

CAS No.	Analyte	Concentration	Units	C	Qual	M	DL	Instrument ID	Analytical Run
7440-38-2	Arsenic	5.86	mg/kg			P	0.59	TJA61 Trace ICP1	30801
7439-92-1	Lead	20.7	mg/kg			P	0.29	TJA61 Trace ICP1	30801

Color Before:

Clarity Before:

Texture:

Color After:

Clarity After:

Artifacts:

Comments:

TOTAL METALS  
- 1 -  
INORGANIC ANALYSIS DATA PACKAGE

SDG No.: 38777

Method Type: SW-846

Sample ID: 38777003

Client ID: C516CBD04L1

Contract: CH2M00400

Lab Code: GEL

Case No.: GEL

SAS No.:

Matrix: SOIL

Date Received: 3/7/2001

Level: LOW

% Solids: 72.60

CAS No.	Analyte	Concentration	Units	C	Qual	M	DL	Instrument ID	Analytical Run
7440-38-2	Arsenic	1.93	mg/kg			P	0.56	TJA61 Trace ICP1	30801
7439-92-1	Lead	3.75	mg/kg			P	0.27	TJA61 Trace ICP1	30801

Color Before:

Clarity Before:

Texture:

Color After:

Clarity After:

Artifacts:

Comments:

## SCDHHC Response to Comments

1

Response to SCDEHC Comments to  
Interim Measure Work Plan  
AOC 516, Zone C

Response to Comments provided by Mr. Paul Bergstrand

1. Page 2-3, BEQ

This section references a mean Zone C BEQ value of 613 ppb and concludes that BEQs are no longer considered to be a COC in surface soils at AOC 516. The discussions on the BEQ anthropogenic background values has not been finalized. The conclusion that BEQs are no longer considered to be a COC in surface soils at AOC 516 may be premature. This IM may be allowed to proceed based on lead and arsenic with the understanding that the Navy may be required to conduct additional sampling and possibly soil excavation for BEQs at this site.

Response: Comment noted. CH2M-Jones understands that additional sampling, and possible excavation, may be required once the BCT agrees upon an anthropogenic background value, if that value is lower than the BEQ values reported at AOC 516. If the anthropogenic background value established for CNC is higher than those BEQ values reported at AOC 516, the IM Completion Report will document that no further action is warranted at the site for BEQs.

2. Page 3-1, Interim Measure Work Plan

The proposed excavation will require the removal of monitoring well C-047GW007. There is no discussion of monitoring well abandonment in this document. This IM workplan should be modified to reference appropriate well abandonment protocols.

Response: The excavation discussed in this work plan will necessitate the removal of monitoring well C047GW007. In accordance with R.61-71.10 of the South Carolina Well Standards and Regulations, the monitoring well will be properly abandoned prior to initiation of excavation activities.

3. Page 3-4, Excavation

This section states that confirmation samples will not be collected prior to backfilling the excavation as soil samples previously collected and the two delineation samples are expected to adequately define the extent of contamination requiring cleanup. This approach is not acceptable. The IM workplan should be modified to include adequate confirmation samples.

Response: Two confirmation samples will be collected. This number of samples is appropriate for the small area of soil to be excavated. Figure 3-1 has been amended to represent the location of two confirmation samples. These samples will be collected on the floor of the excavation.

Response to Comments provided by Ms. Elizabeth Frady

1. Section 2.1.1, Page 2-3 discusses the issue of BEQs as a Contaminant of Concern for AOC 516. The Department and CH2M Hill are currently reviewing documentation to establish background values for BEQs but have not yet reached a consensus on this matter. At this time the Department will not rule out BEQs as a COC for AOC 516 and suggests that this discussion be revisited as part of the IM Report.

Response: Comment Noted. Please see response to Comment No. 1 above (provided by Mr. Paul Bergstrand).

2. In order to expedite the work proposed in the IM Work Plan, the Department has reviewed only that portion of this document which pertains to the soil removal action. Full documentation and discussion of close-out issues should be included in the IM Report.

Response: Comment Noted. Close-out issues will be addressed in the IM Completion Report.

APPENDIX  
Section 401 and Figure 2-2  
IM Work Plan for AOC 516

## 4.0 Summary of Information Related to Site Closeout Issues

---

### 4.1 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to 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.

Groundwater samples collected in the vicinity of AOC 516 (C047GW006 through C047GW010) were evaluated as part of this IM for groundwater quality. One additional groundwater sample from a direct-push technology (DPT) sample was collected. Data from these wells are presented in Table 4-1.

The data reported in Table 4-1 show that only one constituent (thallium, 3.9 J  $\mu\text{g}/\text{L}$ ) exceeded its primary MCL (2  $\mu\text{g}/\text{L}$ ) in one groundwater well (C047GW007). This is an estimated value; and thallium was not detected in earlier, or subsequent, sampling rounds, indicating that the one detection is likely anomalous. Thallium also exceeded the MCL in the DPT sample (LC037GP22A) collected as part of the sanitary sewer investigation. The DPT sample results were not compared to MCLs as these samples likely contained suspended solids that elevated the concentration of metals, including thallium, in these samples. Thallium was not detected in any downgradient well.

Arsenic did not exceed its MCL (50  $\mu\text{g}/\text{L}$ ) in any groundwater well in, or adjacent to, AOC 516 evaluated as part of this investigation. It exceeded its MCL in the DPT sample (C047GP22AC1, 95.7  $\mu\text{g}/\text{L}$ ) collected as part of the sanitary sewer investigation (Zone L). It is likely that this sample contained suspended solids that elevated the concentration of arsenic, as no sample collected from any groundwater well in the area of AOC 516 demonstrated similar levels of arsenic. The proposed IM to remove soil containing arsenic at elevated levels will help to ensure that groundwater impacts from site soils are minimized.

Based on the review of this data, the issue of inorganics in groundwater is not a concern at AOC 516. Consequently, no further evaluation of this issue is necessary.

## 4.2 Potential Linkage to Sanitary Sewers (SWMU 37)

The nearest investigated sanitary sewer to AOC 516 is adjacent to the site (refer to Figure 4-1). As part of the SWMU 37 investigation, soil (boring and DPT) and water (DPT) samples were collected. A surface soil sample was collected from the west end of Building NSC 67, approximately 150 feet southeast of AOC 516 (LC037SP22B, refer to Figure 2-2), as part of the sub-zone C investigation in Zone L. In addition, DPT groundwater sample (LC037GP22AC1, refer to Figure 2-2) was collected adjacent to the sanitary sewer line of AOC 516, on the east side of the site.

These samples were used to assess whether discharge of wastes to the sanitary sewer could have caused a release to the environment prior to the waste entering the main sanitary sewer line. The results of these samples are discussed below.

### 4.2.1 Sample LC037SP22B (Soil)

Data for this surface soil sample were reported in the *Draft Zone L RFI Report* (EnSafe, 1998). The DPT soil samples were analyzed for volatile organic compounds (VOCs), metals and cyanide. No VOCs were detected in DPT soil sample LC037SP22B.

All detected inorganic constituents in sample LC037SP22B were below their respective SSLs and/or reference concentrations except iron, which has no SSL and is an essential nutrient. Cyanide was not detected in sample LC037SP22B.

### 4.2.2 Sample LC037GP22A (Groundwater)

Data for this sample were reported in the *Draft Zone L RFI Report* (EnSafe, 1998). A groundwater sample was collected in the vicinity of AOC 516 as part of the sewer investigation; a DPT sample was collected at the west end of Building NSC 66 (identified as 037GP22A). No VOCs were detected in the sample. Although metals were targeted in the analysis, and 20 were detected, they were not compared to tap water standards, as the DPT samples contained significant solids.

### 4.2.3 Conclusions Regarding Potential Linkage to Sanitary Sewers

No data or evidence suggest that a release of waste from AOC 516 to the sanitary sewer has resulted in a release to the environment between the AOC and the main sewer line.

The lack of discernible groundwater contamination at the AOC 516 suggests that there has been no impact to groundwater from the section of sewer line connecting the site to the main sewer line.

1 Based on these data, in addition to the planned removal of soil with elevated metals  
2 adjacent to the soil boring C047SB007, no further evaluation of potential linkage of AOC 516  
3 to the sanitary sewers is warranted.

### 4 **4.3 Potential Linkage to Storm Sewers (AOC 699)**

5 Potential linkage of a SWMU or AOC to the storm sewer refers to the possibility of a  
6 groundwater plume at a SWMU or AOC migrating into a stormwater sewer from within  
7 which it would subsequently migrate into the water bodies around the CNC, or to the  
8 presence of a cross connection between the sanitary sewer and storm sewer, which could  
9 transport pollutants directly to surface waters. Regarding the first of these potential  
10 linkages, because arsenic was the only COC identified in AOC 516 groundwater, and it was  
11 not detected above its MCL, there is no excessively contaminated groundwater plume to  
12 migrate to a storm sewer. Therefore no potential linkage of this AOC to a storm sewer exists.

13 Regarding the second potential linkage issue, the available storm sewer maps show that  
14 there are storm sewers adjacent to AOC 516. In accordance with the approved *Zone L RFI*  
15 *Work Plan*, no samples were collected in Sub-zone C as part of the storm sewer investigation  
16 at AOC 699. The sampling scheme for AOC 699 was to investigate pipelines downgradient  
17 of industrial sources. No industrial source was identified at, or up gradient of AOC 516.  
18 Therefore, there is no reason to believe that a discharge of waste material into the storm  
19 sewer has occurred.

20 Based on this information, further evaluation of linkage between the stormwater sewer and  
21 the subject site is not warranted.

### 22 **4.4 Potential Linkage to Railroad Lines (AOC 504)**

23 The potential linkage of a SWMU or AOC to a railroad potentially applies only to SWMUs  
24 or AOCs at which an investigated portion of the railroad system, identified as AOC 504 in  
25 the *Zone L RFI Work Plan*, passes through or directly adjacent to the AOC or SWMU.

26 No railroad lines are adjacent to AOC 516. The nearest railroad lines, identified as part of  
27 AOC 504 in the *Zone L RFI Work Plan*, are located more than 800 feet to the northeast of the  
28 site. Based on this information, further evaluation of a potential linkage between the AOC  
29 504 and the subject site is not necessary.

## 4.5 Potential Migration Pathways to Surface Water Bodies

Surface water was studied separately as part of the *Zone J Draft RCRA Facility Investigation Report* (EnSafe, 2000). The *Zone J Draft RCRA Facility Investigation Report* includes the investigated surface water bodies. The nearest investigated surface water bodies to AOC 516 are the tributaries of Noisette Creek, approximately 1,700 feet to the north-northwest. The Cooper River is approximately 2,500 feet to the east.

There are two possible migration pathways for contaminants to affect surface water: overland flow via stormwater runoff, and subsurface flow via groundwater. Due to the fact that significant source area contamination was not identified at AOC 516, and that the nearest water-receiving body is 1,700 feet to the north-northwest, surface water runoff from AOC 516 would not be an ecological concern at Noisette Creek. The only surface soil sample with elevated concentrations of COCs at AOC 516 was a single sampling location at AOC 516, indicating an extremely small impacted area. The proposed IM will remove the contaminated soil at this location; therefore, further evaluation of a potential pathway for contaminant migration via stormwater runoff is not warranted.

A groundwater contaminant plume above applicable MCLs was not identified at AOC 516. Therefore, further evaluation of a potential contaminant migration via groundwater migration is not warranted.

## 4.6 Potential Contamination in OWSs

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

Neither the RFA nor the RFI refers to the presence or possible presence of an OWS at AOC 516.

Additionally, as part of a sitewide evaluation of the presence of OWSs, during the year 2000 the Navy completed a comprehensive review of its records and facilities to identify the presence of OWSs. A list of 27 known OWSs were provided to the BCT members, including SCDHEC staff, at the BCT meeting in September 2000. Currently the best available data source on the presence of OWSs at the CNC, a copy of this list is provided in Appendix C. No OWS was identified at AOC 516; therefore, no further evaluation of this issue for AOC 516 is warranted.

1 **4.7 Land-Use Control Management Plan**

- 2 Upon completion of a removal action, the goal of which is to reduce COC concentrations to  
3 levels acceptable for future unrestricted use, land-use controls will not be necessary at AOC  
4 516.

**TABLE 4-1**  
 AOC 516 Groundwater Well and Probe Results for As, Sb, and Tl  
 IM Work Plan, AOC 516, Building 233, Zone C

Chemical	Station ID	Result (mg/L)	Qualifier	Date Collected	MCL
<b>Antimony</b>	C047GW006	1.9	U	6/15/95	6.0
	C047GW006	2.1	U	1/24/96	6.0
	C047GW006	13.0	UJ	5/14/96	6.0
	C047GW006	4.4	U	6/11/96	6.0
	C047GW007	1.9	U	6/14/95	6.0
	C047GW007	2.1	U	1/25/96	6.0
	C047GW007	13.0	UJ	5/14/96	6.0
	C047GW007	2.1	U	6/11/96	6.0
	C047GW008	1.9	U	6/15/95	6.0
	C047GW008	2.1	U	1/25/96	6.0
	C047GW008	13.0	UJ	5/15/96	6.0
	C047GW008	2.1	U	6/12/96	6.0
	C047GW009	1.9	U	6/15/95	6.0
	C047GW009	2.1	U	1/26/96	6.0
	C047GW009	13.0	UJ	5/15/96	6.0
	C047GW009	3.9	U	6/12/96	6.0
	C047GW010	1.9	U	6/14/95	6.0
	C047GW010	2.1	U	1/25/96	6.0
	C047GW010	13.0	UJ	5/14/96	6.0
	C047GW010	2.2	U	6/12/96	6.0
	<b>LC037GP22A</b>	<b>8.2</b>	<b>=</b>	<b>6/3/97</b>	
<b>Arsenic</b>	C047GW001	6.1	J	6/14/95	50.0
	C047GW001	10.9	=	1/25/96	50.0
	C047GW001	7.5	J	5/9/96	50.0
	C047GW001	8.6	J	6/7/96	50.0
	C047GW001	25.3	J	1/15/99	50.0
	C047GW001	25.3	J	1/15/99	50.0
	C047GW006	7.1	J	6/15/95	50.0
	C047GW006	3.8	J	1/24/96	50.0
	C047GW006	2.5	UJ	5/14/96	50.0
	C047GW006	4.3	J	6/11/96	50.0
	C047GW007	3.2	U	6/14/95	50.0
	C047GW007	2.5	U	1/25/96	50.0
	C047GW007	2.5	UJ	5/14/96	50.0
	C047GW007	2.5	UJ	6/11/96	50.0
	C047GW008	3.2	U	6/15/95	50.0
	C047GW008	2.5	U	1/25/96	50.0
	C047GW008	2.5	UJ	5/15/96	50.0
	C047GW008	2.5	UJ	6/12/96	50.0

**TABLE 4-1 (CONTINUED)**

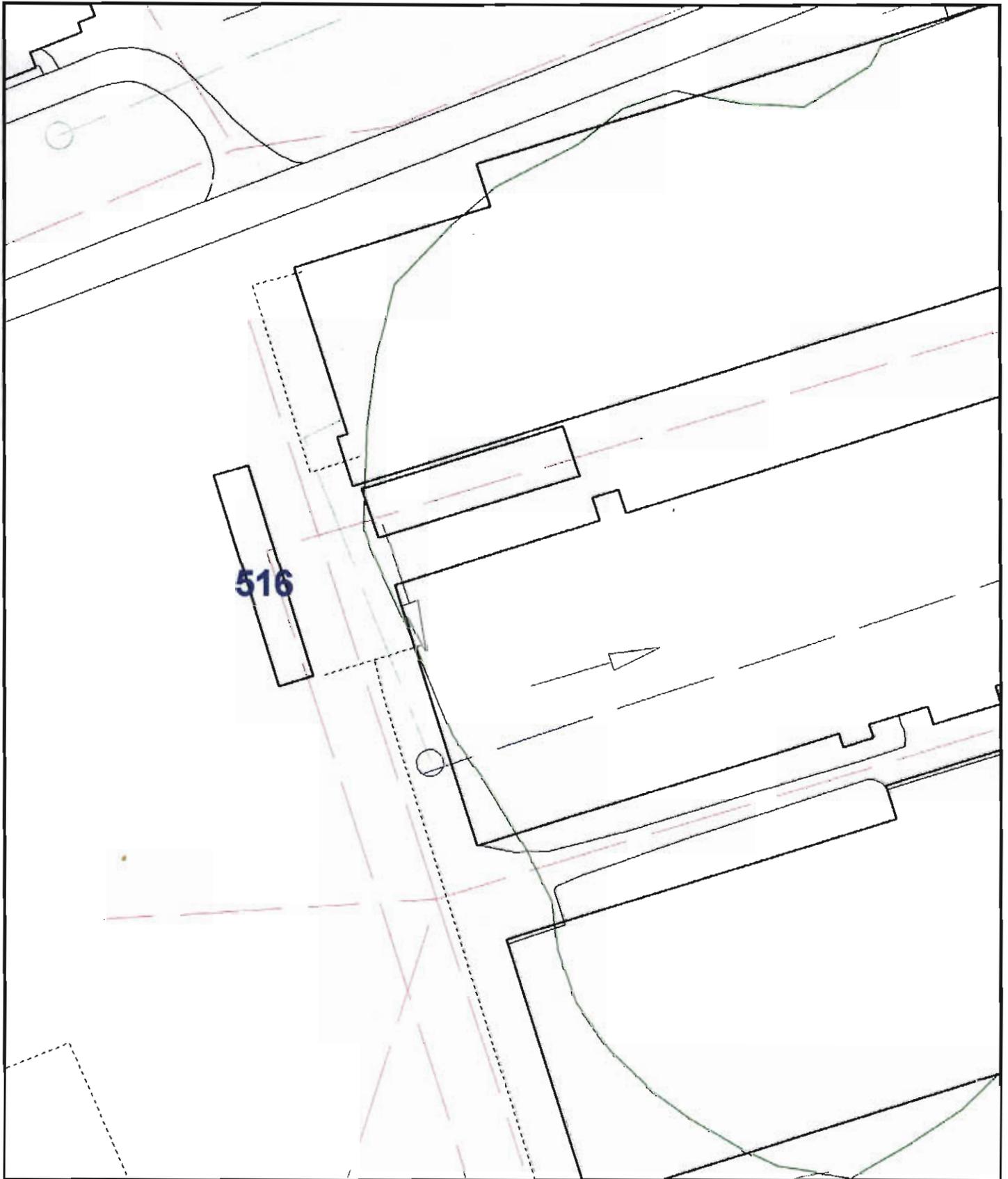
AOC 516 Groundwater Well and Probe Results for As, Sb, and Tl  
 IM Work Plan, AOC 516, Building 233, Zone C

Chemical	Station ID	Result (mg/L)	Qualifier	Date Collected	MCL
	C047GW009	3.2	U	6/15/95	50.0
	C047GW009	2.5	U	1/26/96	50.0
	C047GW009	2.5	UJ	5/15/96	50.0
	C047GW009	2.5	UJ	6/12/96	50.0
	C047GW010	3.2	U	6/14/95	50.0
	C047GW010	2.5	U	1/25/96	50.0
	C047GW010	2.5	UJ	5/14/96	50.0
	C047GW010	2.5	UJ	6/12/96	50.0
	<b>LC037GP22A</b>	<b>95.7</b>	<b>=</b>	<b>6/3/97</b>	
	C047GW001	4.5	U	6/14/95	2.0
	C047GW001	2.7	U	1/25/96	2.0
	C047GW001	2.7	UJ	5/9/96	2.0
	C047GW001	2.7	UJ	6/7/96	2.0
	C047GW001	3.1	U	1/15/99	2.0
	C047GW001	3.1	U	1/15/99	2.0
<b>Thallium</b>	C047GW006	4.5	U	6/15/95	2.0
	C047GW006	5.1	U	1/24/96	2.0
	C047GW006	3.4	U	5/14/96	2.0
	C047GW006	2.7	UJ	6/11/96	2.0
	C047GW007	4.5	U	6/14/95	2.0
	C047GW007	2.7	U	1/25/96	2.0
	C047GW007	3.9	J	5/14/96	2.0
	C047GW007	2.7	UJ	6/11/96	2.0
	C047GW008	4.5	U	6/15/95	2.0
	C047GW008	2.7	U	1/25/96	2.0
	C047GW008	3.4	U	5/15/96	2.0
	C047GW008	2.7	UJ	6/12/96	2.0
	C047GW009	4.5	U	6/15/95	2.0
	C047GW009	4.6	U	1/26/96	2.0
	C047GW009	3.4	U	5/15/96	2.0
	C047GW009	2.7	UJ	6/12/96	2.0
	C047GW010	4.5	U	6/14/95	2.0
	C047GW010	2.7	U	1/25/96	2.0
	C047GW010	3.4	U	5/14/96	2.0
	C047GW010	2.7	UJ	6/12/96	2.0
	<b>LC037GP22A</b>	<b>10.0</b>	<b>U</b>	<b>6/3/97</b>	

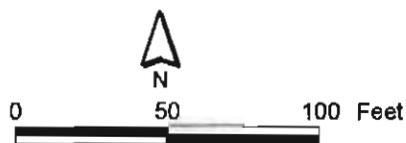
Bold values are detected concentrations above the MCL.

Highlighted Station Ids represent DPT samples.

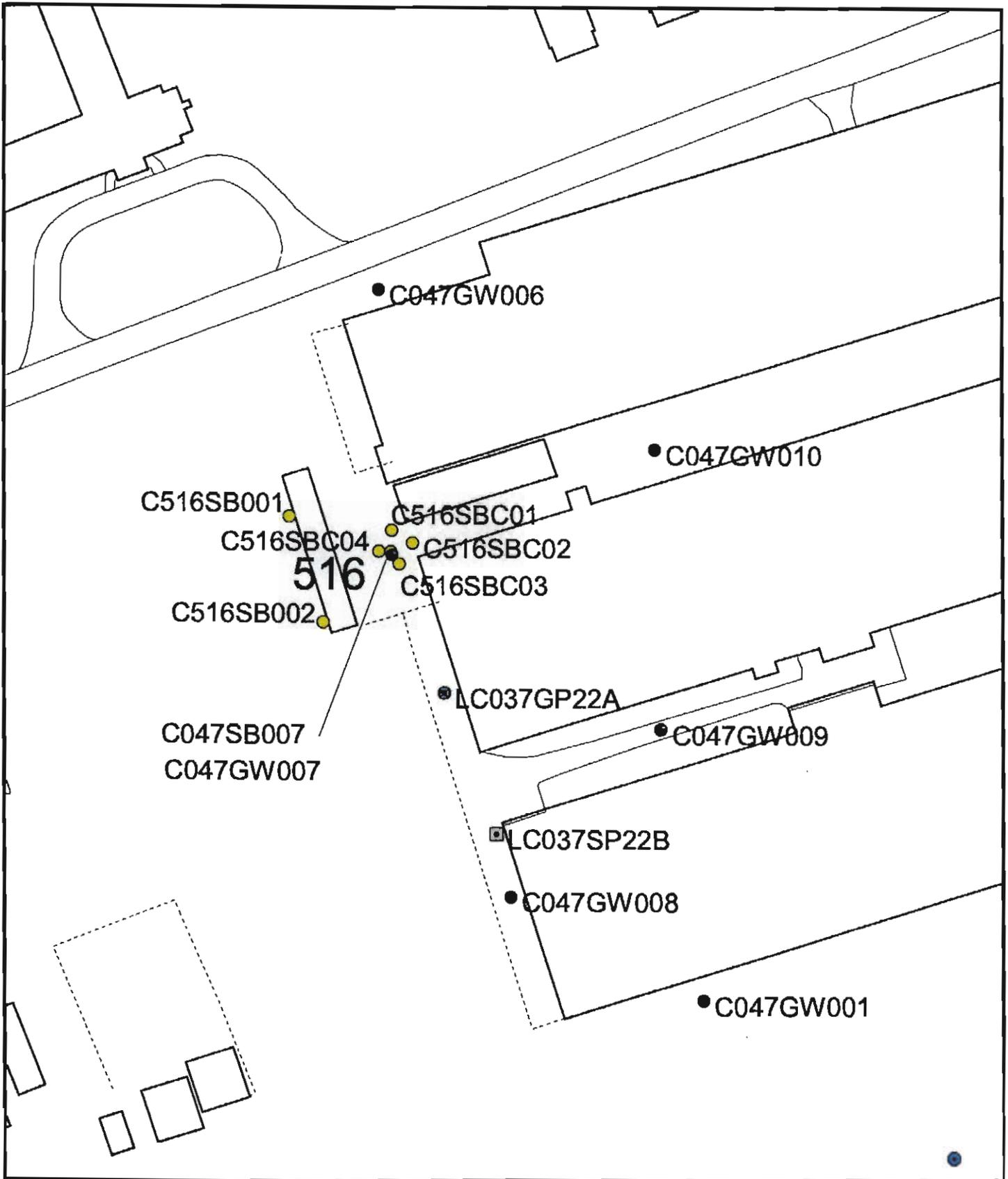
- = Result is equal to reported value.
- U Not detected.
- J Detected with estimated concentration reported.
- UJ Not detected with estimated detection limit reported.



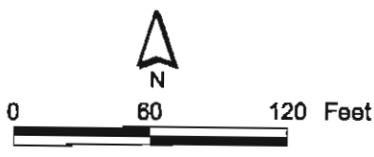
-  STORM-LINE/MANHOLE
-  STORM-LINE/MANHOLE-NS
-  SEWER-LINE/MANHOLE-NS
-  SEWER-LINE/MANHOLE
-  AOC Boundary
-  SWMU Boundary
-  FENCE



**Figure 4-1**  
 Sanitary and Storm Sewers  
 AOC 516 - Zone C  
 Charleston Naval Complex



- Groundwater Well
- Soil Boring
- Groundwater Probe
- Soil Probe
- - - Fence



**Figure 2-2**  
 Sample Locations  
 AOC 516, Zone C  
 Charleston Naval Complex

# INTERIM MEASURE WORK PLAN

## AOC 516, Building 233, Zone C



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

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

PREPARED BY  
***CH2M-Jones***

E112000014GNV

***November 2000***  
158814.ZC.PR.00

***Revision 0***  
Contract N62467-99-C-0960



**DEPARTMENT OF THE NAVY**

SOUTHERN DIVISION

NAVAL FACILITIES ENGINEERING COMMAND

P.O. BOX 190010

2155 EAGLE DRIVE

NORTH CHARLESTON, S.C. 29419-9010

5090/11  
Code 18B1  
27 November, 2000

Mr. John Litton, P.E.  
Director, Division of Hazardous and Infectious Waste Management  
Bureau of Land and Waste Management  
South Carolina Department of Health and Environmental Control  
2600 Bull Street  
Columbia, SC 29201

Subj: SUBMITTAL OF AREA OF CONCERN 516 INTERIM MEASURE WORK PLAN

Dear Mr. Litton,

The purpose of this letter is to submit an Interim Measure Work Plan for Area of Concern (AOC) 516 located at the Charleston Naval Complex. The work plan is submitted to fulfill the requirements of condition IV.E.2 of the RCRA Part B permit issued to the Navy by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency.

The document is distributed under separate cover letter by CH2M Hill. Appropriate certification is provided under that correspondence. We request that the Department and the EPA review this document and provide comments or approval whichever is appropriate. If you should have any questions, please contact Matthew Humphrey or Matthew A. Hunt at (843) 743-9985 and (843) 820-5525 respectively.

Sincerely,

A handwritten signature in black ink that reads "Matthew A. Hunt".

Matthew A. Hunt, P.E.  
Environmental Engineer  
BRAC Division

Copy to:  
SCDHEC (4),  
USEPA (Dann Spariosu)  
CSO Naval Base Charleston (Matt Humphrey)  
CH2M-Hill (Dean Williamson)



November 21, 2000

**CH2M HILL**  
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John Litton, P.E.  
Director  
Division of Hazardous and Infectious Wastes  
South Carolina Department of Health and  
Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

Dear Mr. Litton:

Enclosed please find four copies of an Interim Measure Work Plan for AOC 516 at 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.

Please contact me if you have any questions or comments.

Sincerely,

A handwritten signature in cursive script that reads "Dean Williamson".

Dean Williamson, P.E.

xc: Tony Hunt/Navy, w/att  
Mihir Mehta/SCDHEC  
Gary Foster/CH2M HILL w/att

# Certification Page for the Interim Measure Work Plan for AOC 516, Lead-Acid Battery Charging Area, Building 233, Zone C

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

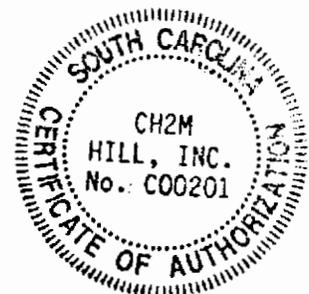
Temporary Permit No. T2000342



Dean Williamson, P.E.



Date



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# 1 Acronyms and Abbreviations

---

2	AOC	Area of Concern
3	BCT	BRAC Clean-Up Team
4	BEQ	benzo(a)pyrene equivalent
5	BRAC	Base Realignment and Closure Act
6	CA	Corrective Action
7	CNC	Charleston Naval Complex
8	COC	chemical of concern
9	COPC	chemical of potential concern
10	CSAP	Comprehensive Sampling and Analysis Plan
11	DAF	dilution attenuation factor
12	DPT	direct-push technology
13	EnSafe	EnSafe Inc.
14	EPA	U.S. Environmental Protection Agency
15	IM	Interim Measure
16	IM WP	Interim Measure Work Plan
17	µg/kg	micrograms per kilogram
18	µg/L	micrograms per liter
19	MCL	maximum contaminant limit
20	mg/kg	milligrams per kilogram
21	NAVBASE	Naval Base
22	RC	reference concentration
23	NFA	no further action
24	OWS	oil-water separator
25	PAH	polynuclear aromatic hydrocarbon
26	PPE	personal protective equipment
27	RAB	Restoration Advisory Board
28	RBC	risk-based concentration

- |   |        |   |
|---|--------|---|
| 1 | RCRA   | Resource Conservation and Recovery Act                        |
| 2 | RFA    | RCRA Facility Assessment                                      |
| 3 | RFI    | RCRA Facility Investigation                                   |
| 4 | SCDHEC | South Carolina Department of Health and Environmental Control |
| 5 | SSL    | Soil Screening Level  |
| 6 | SWMU   | Solid Waste Management Unit                                   |
| 7 | UST    | underground storage tank                                      |
| 8 | VOC    | volatile organic compound                                     |

SECTION 20  
**Introduction**

---

# 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.

CNC Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA); the South Carolina Department of Health and Environmental Control (SCDHEC) is the lead agency for CA activities at the site. 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 CNC. This submittal has been prepared by CH2M-Jones to document the basis for an Interim Measure Work Plan (IM WP) at Area of Concern (AOC) 516 in Zone C of the CNC.

## 1.1 Background and Summary for Interim Measure Work Plan

As part of RCRA CA activities, a RCRA Facility Investigation (RFI) report was finalized for Zone C (EnSafe Inc. [EnSafe], 1997). Zone C is located on the western edge of the northern portion of the CNC. It is bounded by McMillian Avenue to the south; Hobson Avenue to the east; Avenue "D" to the northeast; and the CNC property boundary to the west and north.

Figure 1-1 shows the location of Zone C with respect to the CNC. Detailed figures depicting AOC 516 are presented in Section 2.0 of this IM WP.

The RFI for AOC 516 was conducted concurrently and in combination with the RFI for Solid Waste Management Unit (SWMU) 47. However, this IM WP strictly focuses on the evaluation of data that is relevant to AOC 516. The data are discussed in detail in Section 2.0.

Arsenic in surface soil at a single sampling location, C047SB007, was detected above its reference concentration. For Zone C, the reference concentration for arsenic is 14.1 milligrams per kilogram (mg/kg). Although this soil was sampled as part of the SWMU 47 RFI, it is located very close to AOC 516. At the same sampling location lead was detected at 1,120 mg/kg, which is above the cleanup level of 400 mg/kg typically established for unrestricted

1 (residential) land use. However, due to the limited area of lead contamination, it was not  
2 identified as a chemical of concern (COC) in the RFI report. No COCs were identified for  
3 subsurface soils of the combined AOC 516/ SWMU 47 site. The subsurface soil was  
4 determined not to represent a risk to shallow groundwater.

5 CH2M-Jones has determined that removal of the small area of soil containing metals around  
6 soil boring 047SB007 is appropriate, and should enable closeout of AOC 516 in a condition  
7 that is suitable for future unrestricted use (i.e., with no land-use controls). Accordingly,  
8 CH2M-Jones has prepared this IM WP to describe the proposed approach to excavating and  
9 disposing of this soil. Comments received from SCDHEC on the portions of this IM WP that  
10 address the proposed approach to soil remediation will be adjudicated with SCDHEC prior  
11 to implementing the IM.

12 Once the IM is complete, it is anticipated that no further remedial action will be required and  
13 the IM may be considered as the final remedy for the site. At that time, the status of the site  
14 could be modified to no further action (NFA). Prior to changing the status of any site to NFA  
15 in the CNC RCRA CA permit, the BRAC Clean-Up Team (BCT) agrees that the following  
16 issues should be considered:

- 17 • Status of the RFI
- 18 • Presence of metals (inorganics) in groundwater
- 19 • Potential linkage of SWMU/ AOC to SWMU 37 (investigated sanitary sewers)
- 20 • Potential linkage of SWMU/ AOC to AOC 699 (investigated stormwater sewers)
- 21 • Potential linkage of SWMU/ AOC to AOC 504 (investigated railroad lines)
- 22 • Potential linkage to surface water bodies (Zone J)
- 23 • Potential contamination associated with oil-water separators (OWSs)
- 24 • Relevance or need for land-use controls at the site

25 Information regarding these issues is also provided in this IM WP to expedite the evaluation  
26 of site closure once the IM is complete. Comments received from SCDHEC on these closeout  
27 issues will be addressed in the IM Completion Report, which will be prepared upon  
28 completion of the IM.

29 Once the above issues have been adequately addressed, and the BCT concurs that NFA is  
30 appropriate for the site, a Statement of Basis will be prepared. In accordance with SCDHEC  
31 policy, the Statement of Basis will be made available for public comment, allowing the  
32 public to participate in the final remedy selection. In addition, the BCT will inform the

1 Restoration Advisory Board (RAB) of its intent to implement this IM once the IM WP has  
2 been approved. The RAB may also then provide comments to the BCT on behalf of the  
3 public concerning the proposed IM activities.

## 4 **1.2 Document Organization**

5 This IM WP consists of the following five sections, including this introductory section:

6 **1.0 Introduction** -- Presents the purpose of the IM WP and background information  
7 pertaining to the site.

8 **2.0 Technical Basis and Rationale for Interim Measure** -- Provides a brief overview of the  
9 site and previous investigations.

10 **3.0 Interim Measure Work Plan** -- Presents details associated with the proposed site cleanup  
11 plan.

12 **4.0 Summary of Information Related to Site Closeout Issues** -- Summarizes the site  
13 closeout issues.

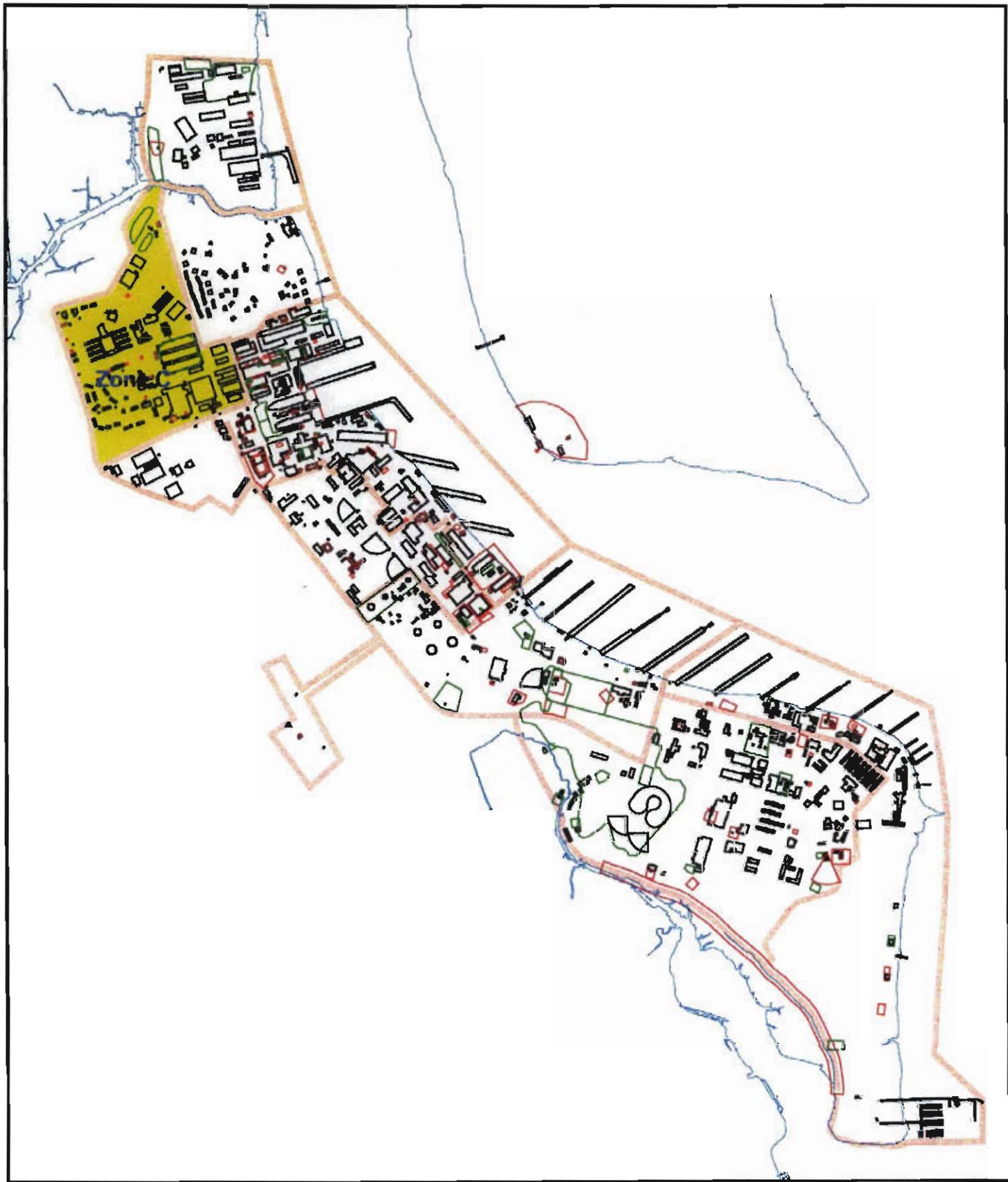
14 **5.0 References** -- Lists the references used in this document.

15 **Appendix A** contains excerpts from the Zone C RFI.

16 **Appendix B** contains the data (as well as a figure that presents sample locations) used in the  
17 evaluation of the benzo(a)pyrene equivalent (BEQ) reference concentration calculation.

18 **Appendix C** contains a list of the 27 known OWSs at the CNC.

19 Tables and figures appear at the end of their respective sections.



-  Shoreline
-  AOC Boundary
-  SWMU Boundary
-  Buildings
-  Zone Boundary



**Figure 1-1**  
 Location of Zone C  
 Charleston Naval Complex  
 North Charleston, South Carolina

SECTION 24  
**Technical Basis and Rationale  
for Interim Measure**

---

## 2.0 Technical Basis and Rationale for Interim Measure

---

### 2.1 Brief Overview of Site and Previous Investigations

AOC 516, Building 233, is located to the west of Buildings NSC-64, 66, and 67, in the block formed by Turnbull Avenue West, Second Street West, Avenue D, and Avenue F. An aerial view of AOC 516 and the surrounding area is presented in Figure 2-1. The site was used for spray-washing vehicles and equipment from 1972 until the 1980s. Following this time period the area has been used for recharging lead-acid batteries. The RCRA Facility Assessment (RFA) completed by EnSafe in 1995 identified the following chemicals of potential concern (COPCs) resulting from operations: lead and other metals, battery acids, solvents, and petroleum hydrocarbons. An RFI work plan was developed for AOC 516, which included these COPCs as target analytes.

#### 2.1.1 RFI Status and Conclusions

The status of the *Zone C RCRA Facility Investigation Report* is final (EnSafe, 1997). Results of the RFI for AOC 516 are discussed in Section 10.2 of the *Zone C Final RFI Report*. In addition to the soil and groundwater samples that were collected at AOC 516 as part of the Zone C RFI, additional soil and groundwater samples were collected adjacent to AOC 516 as part of the Zone L investigation for SWMU 37, sanitary sewers. The results of these analyses were provided in the *Draft Zone L RFI Report* (EnSafe, 1998).

#### Brief Summary of Soil Results from the Zone C RFI

Initially, two soil borings (C516SB001 and C516SB002) were installed specifically as part of the AOC 516 RFI. Soil boring C047SB007, which is very close to AOC 516 (see Figure 2-2), was installed as part of the RFI for SWMU 47. This boring is included in this analysis of AOC 516 soil. Four additional soil borings (C516SBC01 through C516SBC04) were subsequently installed around soil boring C047SB007. Soil sampling locations in the vicinity of AOC 516 are presented in Figure 2-2.

#### Surface Soil

Results of surface soil analyses were compared in the RFI to applicable screening criteria (U.S. Environmental Protection Agency [EPA] Region III residential risk-based concentrations [RBCs] or background values).

1 Analytes that exceeded the screening criteria were further evaluated in the risk assessment  
2 to determine which of these parameters were considered COCs at the combined AOC  
3 516/SWMU 47 (see section 10.2.6 of the Zone C RFI; Table 12.2.24 from the RFI is included  
4 in Appendix A). This analysis resulted in the identification of the following COCs for the  
5 combined AOC 516/SWMU 47:

- 6 • Arsenic
- 7 • Beryllium
- 8 • Thallium
- 9 • BEQs

10 As mentioned in Section 1.0, although lead was not identified as a COC in the RFI report, it  
11 was detected above its typical residential cleanup level at one location within the combined  
12 AOC 516/SWMU 47. A brief discussion of lead concentrations at AOC 516 is included in  
13 this and subsequent sections of this IM WP. This work plan will also address the presence of  
14 lead in site soils.

15 Table 2-1 presents a summary of the surface soil COC data for samples collected in the  
16 vicinity of AOC 516. Each of the analytes is discussed below.

### 17 **Arsenic**

18 Arsenic was detected in seven surface soil samples collected in, or adjacent to, AOC 516 (see  
19 Table 2-1). Of these, one sampling location (C047SB007, 28.7 mg/kg) was reported above the  
20 Zone C reference value of 14.1 mg/kg, but below the soil screening level (SSL) of 29mg/kg,  
21 using a dilution attenuation factor (DAF) of 20. The four sampling locations around this  
22 location were all reported below the reference concentration, indicating only a limited area  
23 of arsenic-containing soil. This IM WP recommends removal of this small area of soil, which  
24 will also result in the elimination of arsenic as a COC at AOC 516.

### 25 **Beryllium**

26 Beryllium was identified as a COC in the combined AOC 516/SWMU 47 RFI report.  
27 However, review of the data relevant to the evaluation of AOC 516 (see Table 2-1) indicates  
28 that beryllium did not exceed the Zone C reference value of 0.98 mg/kg at any location  
29 within, or immediately adjacent to, AOC 516. Therefore, beryllium is not considered a COC  
30 at AOC 516 and will not be discussed further in this IM WP.

1 **Thallium**

2 Table 2-1 presents analytical results for thallium in soil samples collected near AOC 516.  
3 Thallium was detected in a single surface soil sample (C047SB007, 2.1 mg/kg) collected in,  
4 or adjacent to, AOC 516. This value is above the Zone C reference value (which for thallium  
5 was the reporting limit of 0.51 mg/kg) and the SSL of 0.7 mg/kg; however, analysis of  
6 shallow groundwater did not indicate conclusively that site soils have impacted site  
7 groundwater. The detected concentration is below the EPA residential RBC of 5.5 mg/kg.  
8 Additionally, the proposed removal of arsenic-contaminated soil will include the removal of  
9 this small area of thallium-containing soil.

10 **BEQs**

11 Polynuclear aromatic hydrocarbons (PAHs), expressed as BEQs, were identified as a COC in  
12 the combined AOC 516/SWMU 47, based on exceedances of the RBC of 88 micrograms per  
13 kilogram ( $\mu\text{g}/\text{kg}$ ) (Section 10.2.6.5, of the Zone C RFI, pgs. 10.2.53 and 59 and an excerpt  
14 from Table 10.2.13 from the RFI are included in Appendix A). PAHs are routinely detected  
15 in non-impacted as well as impacted areas of the CNC. The detected PAHs, and resulting  
16 calculated BEQs, in the non-impacted areas (grid-based samples) of Zone C were used to  
17 calculate a mean BEQ value to be used as a reference concentration. The data, and analysis,  
18 of the Zone C grid-based samples and a figure indicating the sample locations are included  
19 in Appendix B. The mean BEQ value in the grid-based samples is  $613.0 \mu\text{g}/\text{kg}$ , with a range  
20 of  $348.0$  to  $749.5 \mu\text{g}/\text{kg}$ .

21 A comparison of calculated BEQ values from AOC 516 to the grid-based sample results  
22 indicates that BEQ values within AOC 516 are within the range of Zone C background  
23 values. As such, BEQs are no longer considered to be a COC in surface soils at AOC 516.

24 **Lead**

25 Although lead was not identified as a COC at AOC 516/SWMU 47, it was identified as a  
26 COPC based upon its detection above the typical residential cleanup level of  $400 \text{ mg}/\text{kg}$  at  
27 one location (C047SB007,  $1,120 \text{ mg}/\text{kg}$ ). As noted in Section 10.2.6.5 (pg. 10.2.56 of the RFI is  
28 included in Appendix A) of the Zone C RFI (EnSafe, 1997), the mean site and mean  
29 "hotspot" lead concentration ( $112$  and  $385 \text{ mg}/\text{kg}$ , respectively) were less than the  
30 residential cleanup value ( $400 \text{ mg}/\text{kg}$ ); therefore lead was determined not to be a COC. The  
31 removal of arsenic-contaminated surface soil in the area of soil boring C047SB007 will also  
32 result in the removal of lead-contaminated surface soil greater than  $400 \text{ mg}/\text{kg}$ .

## 1 **Subsurface Soil**

2 Subsurface soil samples were collected as part of the RFI at each of the soil boring locations.  
3 Figure 2-2 illustrates the locations of the soil samples analyzed as part of this IM WP.

4 Results of subsurface soil analyses in the RFI were compared to applicable screening criteria  
5 (EPA SSLs or background values). Analytes detected in subsurface soils were either not  
6 detected above their respective SSLs or not reliably identified in shallow groundwater,  
7 indicating that existing soil concentrations are protective of surficial groundwater (pgs.  
8 10.2.18 and 21, Section 10.2.5.1 of the Zone C RFI is included in Appendix A).

9 Thallium was detected in subsurface soil (C047SB007, 1.8 mg/kg) above its SSL and  
10 background value, but was detected only once in one groundwater sample (C047GW007,  
11 3.9 J  $\mu\text{g/L}$ ) collected in, or adjacent to, AOC 516. This is an estimated value, as indicated by  
12 the "J" qualifier. During two previous sampling rounds at this location, thallium was not  
13 detected. Additionally, thallium was not detected in a sample collected from the same well  
14 one month later, indicating that it is not likely that the AOC 516 soil is leaching to the  
15 surficial aquifer.

16 On the basis of these data, the risk assessment did not identify any COCs for subsurface soil  
17 at AOC 516/SWMU 47.

## 18 **2.2 Summary**

19 Surface soil sample C047SB00701, collected as part of the SWMU 47 investigation, was  
20 found to contain arsenic and thallium at concentrations above their respective reference  
21 concentrations, but below levels that represent a risk to shallow groundwater. Lead was also  
22 identified in this sample above its residential cleanup level of 400 mg/kg.

23 The results of surface samples collected around C044SB007 (C516SBC01 through  
24 C516SBC04) were all below the arsenic reference value and the lead residential cleanup  
25 level, indicating that the extent of contaminated soil in this area is limited. Figure 2-3  
26 presents the arsenic and lead concentrations in surface soils. Although these samples were  
27 not analyzed for thallium, thallium was not detected in any soil sample above its RBC value.  
28 Excavation to a depth of approximately one foot in the area defined by sample locations  
29 C516SBC01 to C516SBC04 would remove site surface soils contaminated with arsenic above  
30 the reference concentration, and lead above the residential cleanup level. A goal of this IM  
31 will be to remove soil in the target excavation area containing arsenic concentrations above  
32 the reference concentration, and lead above the residential cleanup level.

- 1 Because of the detection of elevated arsenic and lead at a single surface soil sample
- 2 (C047SB007) in AOC 516, CH2M-Jones is proposing a focused soil excavation IM to remove
- 3 this small area of soil containing arsenic and lead. Additionally, the excavation will include
- 4 the thallium-containing surface soil identified in the RFI.
  
- 5 With the reduction of the arsenic and lead levels in AOC 516, the site will be suitable for
- 6 future unrestricted land use. The cleanup level for arsenic would need to be protective of
- 7 human health and groundwater. The target arsenic cleanup level for surface soil (0-1 foot) is
- 8 the background level established in the Zone C RFI (14.1 mg/kg). The cleanup level for lead
- 9 is the residential cleanup goal of 400 mg/kg for surface soils.

**TABLE 2-1**  
 Soil Data for COCs Identified in RFI  
 IM Work Plan, AOC 516, Building 233, Zone C

Constituent	Station ID	Result	Qualifier	Date Collected	Background or Reference Value
<b>Surface Soil</b>					
Arsenic	C047SB007	27.80	=	04/14/95	14.1
	C516SB001	4.20	=	04/05/95	14.1
	C516SB002	0.34	U	04/05/95	14.1
	C516SBC01	2.10	=	03/09/99	14.1
	C516SBC02	4.90	=	03/09/99	14.1
	C516SBC03	3.80	=	03/09/99	14.1
	C516SBC04	8.70	=	03/09/99	14.1
Beryllium	C047SB007	0.38	J	04/14/95	0.98
	C516SB001	0.30	U	04/05/95	0.98
	C516SB002	0.23	U	04/05/95	0.98
Thallium	C047SB007	2.10	=	04/14/95	0.51 <sup>c</sup>
	C516SB001	0.50	U	04/05/95	0.51 <sup>c</sup>
	C516SB002	0.48	U	04/05/95	0.51 <sup>c</sup>
Lead	C047SB007	1120.0	=	04/14/95	400 <sup>b</sup>
	C516SB001	29.6	J	04/05/95	400 <sup>b</sup>
	C516SB002	3.9	J	04/05/95	400 <sup>b</sup>
	C516SBC01	28.0	=	03/09/99	400 <sup>b</sup>
	C516SBC02	36.7	=	03/09/99	400 <sup>b</sup>
	C516SBC03	11.2	=	03/09/99	400 <sup>b</sup>
	C516SBC04	3.7	=	03/09/99	400 <sup>b</sup>
BEQs	C047SB007	841	=	04/14/95	613 <sup>a</sup>
	C516SB001	408.7	=	04/05/95	613 <sup>a</sup>
	C516SB002	701.6	U	04/05/95	613 <sup>a</sup>

All units in mg/kg, except BEQs which are in µg/kg.  
 BEQ background based on CH2M Hill's evaluation of BEQs.

<sup>a</sup> Proposed reference concentration based on Zone C grid-based samples.

<sup>b</sup> Residential cleanup level.

<sup>c</sup> Detection limit is equal to reference concentration for thallium.

= Result is equal to reported value.

U Not detected.

J Detected with estimated concentration reported.

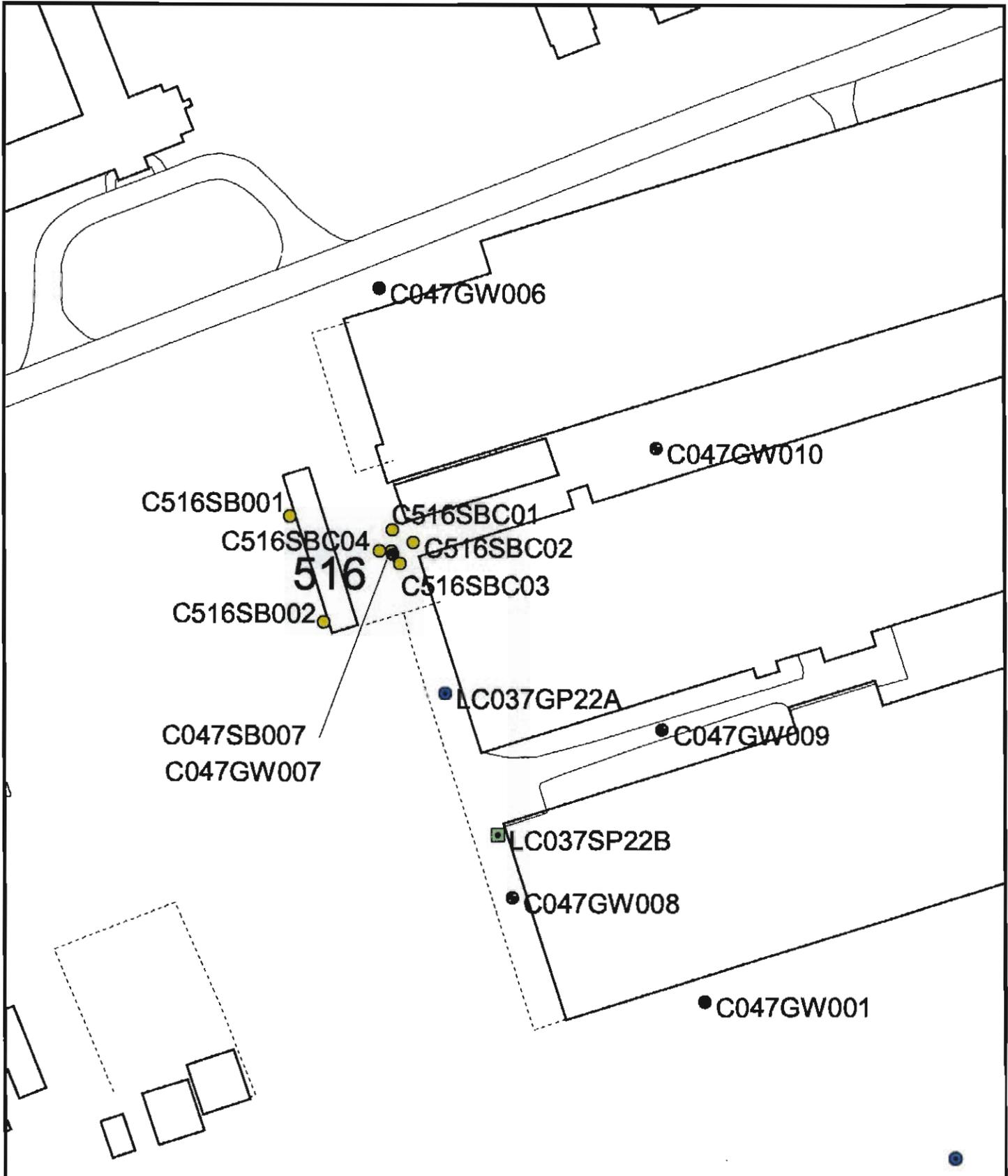


-  AOC Boundary
-  SWMU Boundary
-  Zone Boundary

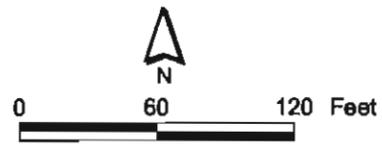


0 100 200 Feet

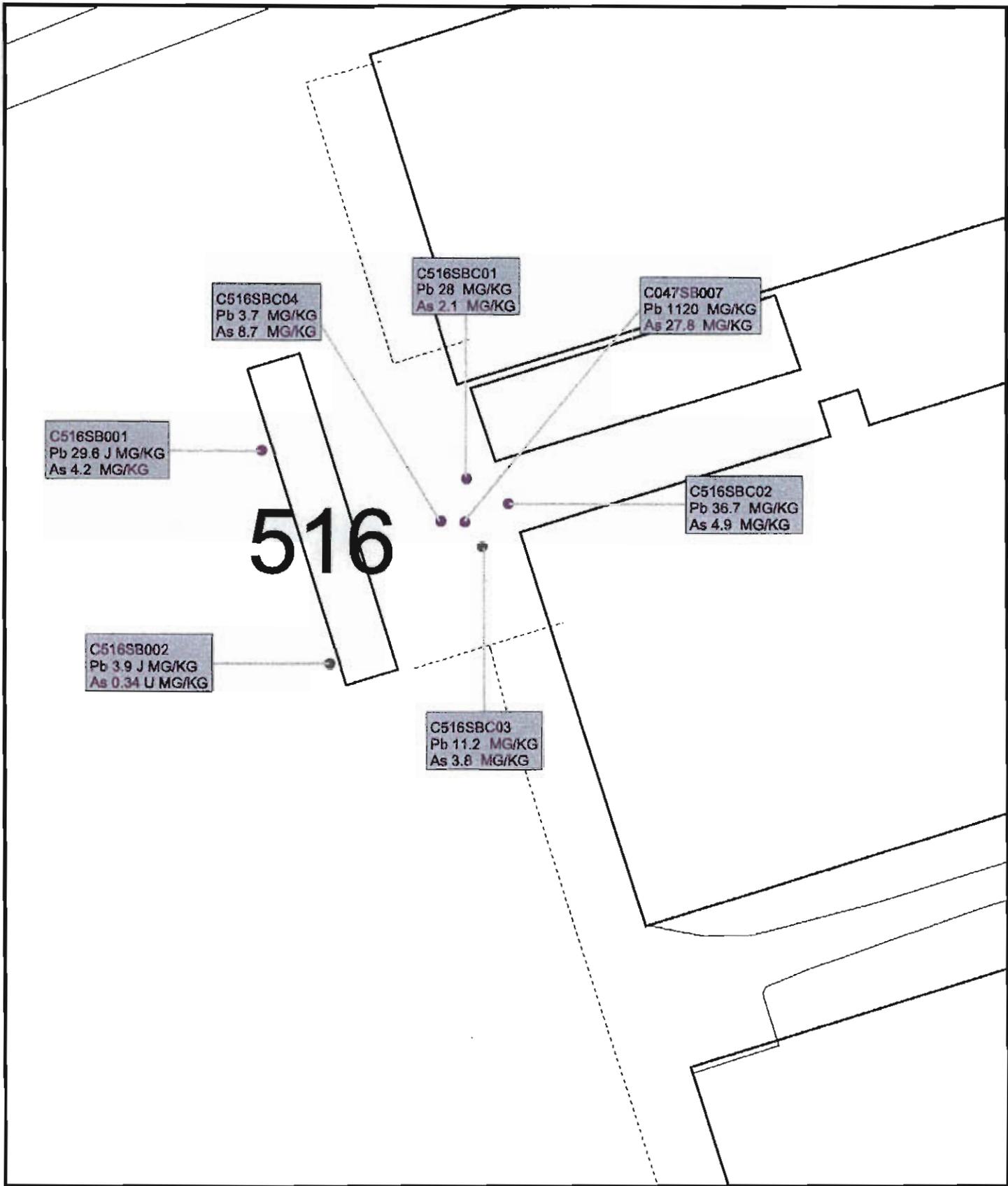
**Figure 2-1**  
Aerial View of AOC 516 and SWMU 47  
Zone C  
Charleston Naval Complex



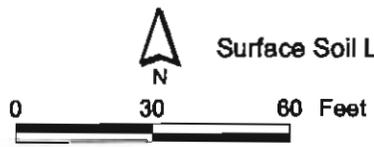
- Groundwater Well
- Soil Boring
- Groundwater Probe
- Soil Probe
- Fence



**Figure 2-2**  
 Sample Locations  
 AOC 516, Zone C  
 Charleston Naval Complex



- Fence
- Roads - Lines
- Buildings



**Figure 2-3**  
 Surface Soil Lead (Pb) and Arsenic (As) Concentrations  
 AOC 516, Zone C  
 Charleston Naval Complex

SECTION 4  
**Human Resource Work Plan**

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## 1 **3.0 Interim Measure Work Plan**

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2 The objective of the IM is to remove surface soils in the vicinity of sampling location  
3 C047SB007 with arsenic concentrations greater than Zone C background levels (surface, 14.1  
4 mg/kg). This objective includes the removal of lead-contaminated soil with concentrations  
5 above the residential cleanup level of 400 mg/kg. Following removal of the contaminated  
6 soils, the site will be backfilled with clean fill and repaved.

7 This IM is expected to be the only and final remedial action taken at AOC 516. After arsenic  
8 and lead levels have been reduced, and SCDHEC has reviewed and approved the IM  
9 Completion Report and associated site closeout documentation, the site will fulfill NFA  
10 requirements as agreed to by the BCT. A Statement of Basis recommending NFA then will  
11 be prepared for public comment. Upon receipt of public comments and preparation of  
12 appropriate responses, the RCRA CA permit will be modified.

13 The remainder of this section describes the components of the IM.

### 14 **3.1 Health and Safety**

15 All work completed as part of this IM will be performed in accordance with the CH2M-  
16 Jones Site-Specific Health and Safety Plan.

### 17 **3.2 Sampling and Analysis Plan**

18 All investigative work will be performed in accordance with the Comprehensive Sampling  
19 and Analysis Plan (CSAP) portion of the RFI Work Plan (EnSafe, 1996).

### 20 **3.3 Contaminant Delineation**

21 The soil samples previously collected adequately define the maximum extent of the  
22 excavation. The only surface soil sample collected with an arsenic concentration above the  
23 reference concentration was C047SB007. Arsenic was not detected in any of the other four  
24 surface soil borings (C516SBC01 through C516SBC04) collected around this location and no  
25 sample used in the evaluation of AOC 516 contained arsenic above its SSL.

26 The lead concentration for the surface sample collected at C047SB007 (1,120 mg/kg) was  
27 above the residential cleanup level (400 mg/kg). Lead was not detected above the

1 residential cleanup level in any of the four surface soil borings (C516SBC01 through  
2 C516SBC04). Therefore, the maximum limit of the excavation is determined by four soil  
3 borings, C516SBC01 through C516SBC04 (see Figure 3-1).

4 Prior to excavation, additional soil samples will be collected and analyzed for arsenic and  
5 lead from two soil locations to determine if the areal extent of the excavation can be  
6 reduced. The maximum areal extent has been established, but may be an overestimation of  
7 the necessary excavation area. As such, surface soil samples will be collected from two new  
8 sampling locations (identified as C516SBD01 and C516SBD02). These samples will be  
9 located approximately 10 feet to the east, and north, of C047SB007 (see Figure 3-2).

10 Once the limits of excavation have been established, the footprint of the site to be excavated  
11 will be clearly marked by staking the site.

## 12 **3.4 Pre-Excavation Activities**

13 To prepare for the start of onsite operations, CH2M-Jones will notify the necessary agencies,  
14 departments, and utilities regarding planned activities at the project site. No permits are  
15 necessary for completing the removal of soils at AOC 516.

16 CH2M-Jones will examine the site for existing water, electricity, natural gas, telephone, or  
17 other utility lines that are potential hazards at the site. Utilities will be clearly marked and  
18 identified.

19 CH2M-Jones requires and places significant emphasis on the health and safety for our own  
20 personnel, our subcontractors, and the local community. Once all site personnel have arrived  
21 on site as part of the mobilization, a project briefing and health and safety orientation  
22 meeting will be held. Work areas will be designated, and site control procedures, including  
23 work area barricades, daily site security, and site cleanliness and maintenance procedures  
24 will be reviewed and implemented. Vehicle access areas will be identified and site traffic will  
25 be monitored.

### 26 **3.4.1 Site Security Zones**

27 The contaminant levels reported at AOC 516 are within a range considered protective of  
28 industrial workers. Therefore, personnel working at the site will be required to comply with  
29 wearing Level D personal protective equipment (PPE).

30 The excavation area will be clearly marked with warning tape to warn of possible tripping  
31 or falling hazards.

### 1 **3.4.2 Site Preparation**

2 Site preparation and removal of asphalt will begin, as required, in areas where excavation  
3 and site preparation activities will take place. In areas not disturbed by site activities,  
4 reasonable attempts will be made to limit the disturbance of ground cover. No activities in  
5 or under existing site structures are planned for this IM.

## 6 **3.5 Support Activities**

### 7 **3.5.1 Waste Management**

8 Three waste streams will be generated as part of this IM: excavated soils and asphalt,  
9 decontamination wastes, and PPE. No hazardous wastes are expected to be generated as a  
10 result of this IM. Excavated soils will be characterized in accordance with South Carolina  
11 Hazardous Waste Management Regulations (Section SCDHEC R.61-79.261), and disposed  
12 of in accordance with all applicable regulations and permits. Assuming soils will be  
13 characterized as non-hazardous, they will be sent, along with the excavated asphalt, to a  
14 subtitle D landfill. Decontamination wastes and PPE also will be disposed of in accordance  
15 with regulations.

16 Offsite transportation and disposal will be performed by properly permitted and licensed  
17 subcontractors. Materials designated for offsite disposal will be documented, tracked, and  
18 their disposition verified. This information will be reported in the IM Completion Report.

### 19 **3.5.2 Equipment Decontamination**

20 Decontamination of personnel, sampling and removal equipment, and materials will be in  
21 accordance with the CH2M-Jones Site-Specific Project Health and Safety Plan.

## 22 **3.6 Excavation of Soils**

### 23 **3.6.1 Cleanup Criteria**

24 As described in Section 2.1.1 of this IM WP, the arsenic cleanup criterion is 14.1 mg/kg for  
25 surface soil. The lead cleanup criterion is 400 mg/kg for surface soil.

### 26 **3.6.2 Excavation**

27 Figure 3-1 presents the maximum areal extent of the excavation. The area may be somewhat  
28 reduced based on the results of the delineation sampling.

- 1 Removal of soils around the soil boring C047SB007 will be accomplished with a backhoe or  
2 similar equipment to the depth determined appropriate during the delineation sampling.  
3 Excavation will not extend below the top of the water-bearing zone.
- 4 Excavated soils will be transferred immediately to a disposal container (e.g., a roll-off box or  
5 similar container) and subsequently transported to an appropriately permitted offsite  
6 disposal facility for landfilling. The transported waste will be covered with a tarp to  
7 minimize airborne transfer of soil particulates.
- 8 Confirmation samples will not be collected prior to backfilling the excavation, as the soil  
9 samples previously collected and the two delineation samples are expected to adequately  
10 define the extent of contamination requiring cleanup.

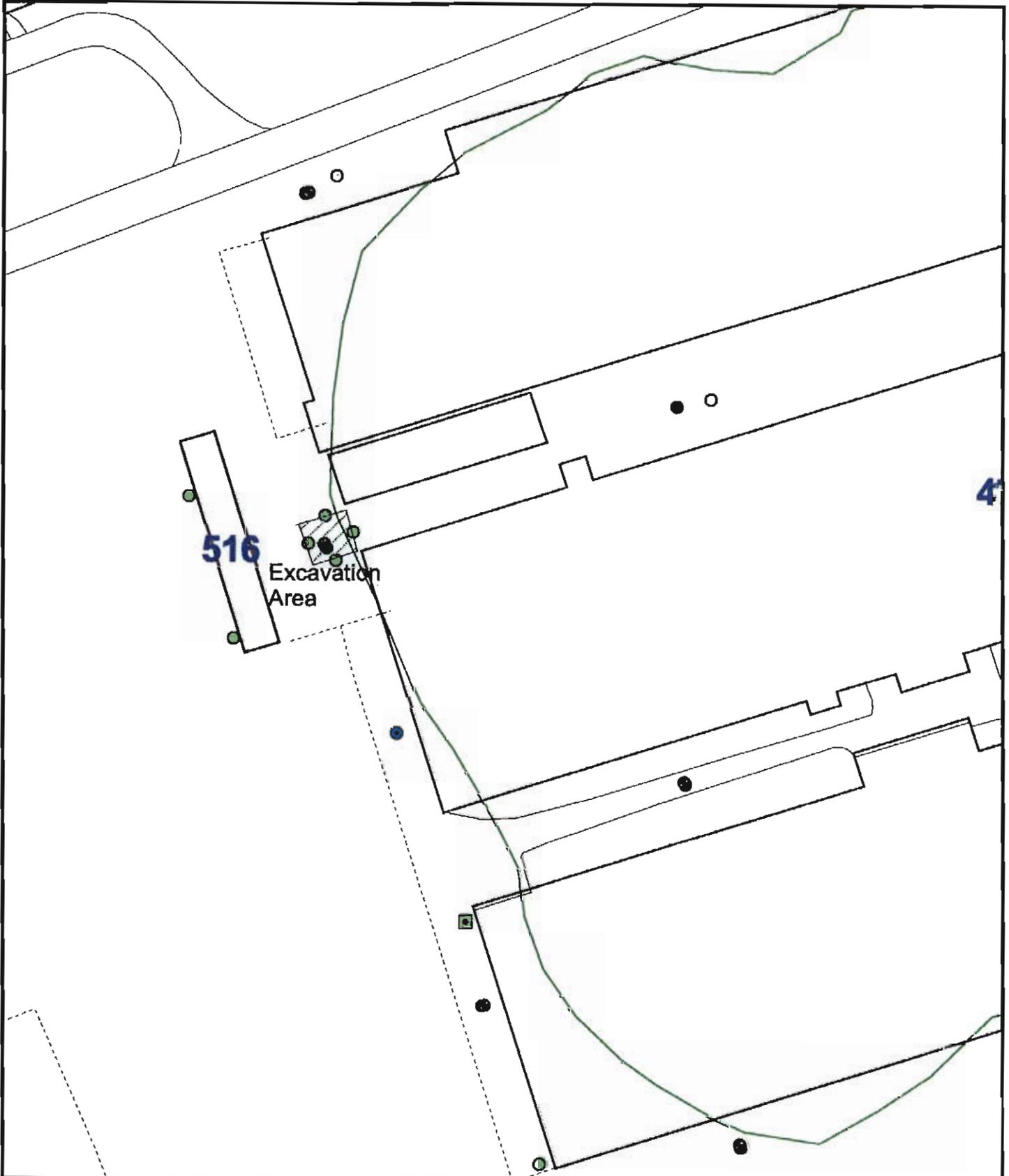
### 11 **3.6.3 Site Restoration**

- 12 The excavation will be backfilled with appropriate fill material and the pavement will be  
13 restored to match the original pavement and grade.

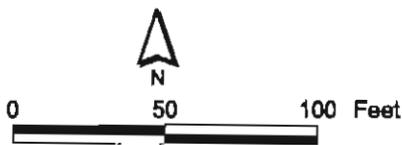
## 14 **3.7 Interim Measure Completion Report**

- 15 A final report will be submitted within 90 days of approval of the IM WP. The report will  
16 summarize the actions that were taken and provide the following information:

- 17 • Excavated volumes
- 18 • Nature and volume of waste generated
- 19 • Waste disposal
- 20 • Sampling results
- 21 • Site photographs
- 22 • Problems encountered
- 23 • Other information that would be helpful in evaluating the IM



- Groundwater Well
- Groundwater Probe
- Surface Soil
- Soil Probe
- AOC Boundary
- SWMU Boundary

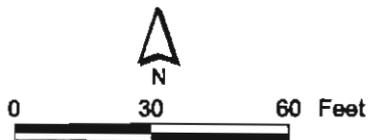


**Figure 3-1**  
 Proposed Excavation Area  
 AOC 516, Zone C  
 Charleston Naval Complex

516

C516SBD01  
C516SBD02  
O047SB007

- Proposed soil boring.dbf
- Soil Boring
- Fence



**Figure 3-2**  
Proposed Soil Boring Locations  
AOC 516, Zone C  
Charleston Naval Complex

TECHNICAL  
**Summary of Information  
Related to Site Closeout Issues**

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## 4.0 Summary of Information Related to Site Closeout Issues

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### 4.1 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to 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.

Groundwater samples collected in the vicinity of AOC 516 (C047GW006 through C047GW010) were evaluated as part of this IM for groundwater quality. One additional groundwater sample from a direct-push technology (DPT) sample was collected. Data from these wells are presented in Table 4-1.

The data reported in Table 4-1 show that only one constituent (thallium, 3.9 J  $\mu\text{g}/\text{L}$ ) exceeded its primary MCL (2  $\mu\text{g}/\text{L}$ ) in one groundwater well (C047GW007). This is an estimated value; and thallium was not detected in earlier, or subsequent, sampling rounds, indicating that the one detection is likely anomalous. Thallium also exceeded the MCL in the DPT sample (LC037GP22A) collected as part of the sanitary sewer investigation. The DPT sample results were not compared to MCLs as these samples likely contained suspended solids that elevated the concentration of metals, including thallium, in these samples. Thallium was not detected in any downgradient well.

Arsenic did not exceed its MCL (50  $\mu\text{g}/\text{L}$ ) in any groundwater well in, or adjacent to, AOC 516 evaluated as part of this investigation. It exceeded its MCL in the DPT sample (C047GP22AC1, 95.7  $\mu\text{g}/\text{L}$ ) collected as part of the sanitary sewer investigation (Zone L). It is likely that this sample contained suspended solids that elevated the concentration of arsenic, as no sample collected from any groundwater well in the area of AOC 516 demonstrated similar levels of arsenic. The proposed IM to remove soil containing arsenic at elevated levels will help to ensure that groundwater impacts from site soils are minimized.

Based on the review of this data, the issue of inorganics in groundwater is not a concern at AOC 516. Consequently, no further evaluation of this issue is necessary.

## 4.2 Potential Linkage to Sanitary Sewers (SWMU 37)

The nearest investigated sanitary sewer to AOC 516 is adjacent to the site (refer to Figure 4-1). As part of the SWMU 37 investigation, soil (boring and DPT) and water (DPT) samples were collected. A surface soil sample was collected from the west end of Building NSC 67, approximately 150 feet southeast of AOC 516 (LC037SP22B, refer to Figure 2-2), as part of the sub-zone C investigation in Zone L. In addition, DPT groundwater sample (LC037GP22AC1, refer to Figure 2-2) was collected adjacent to the sanitary sewer line of AOC 516, on the east side of the site.

These samples were used to assess whether discharge of wastes to the sanitary sewer could have caused a release to the environment prior to the waste entering the main sanitary sewer line. The results of these samples are discussed below.

### 4.2.1 Sample LC037SP22B (Soil)

Data for this surface soil sample were reported in the *Draft Zone L RFI Report* (EnSafe, 1998). The DPT soil samples were analyzed for volatile organic compounds (VOCs), metals and cyanide. No VOCs were detected in DPT soil sample LC037SP22B.

All detected inorganic constituents in sample LC037SP22B were below their respective SSLs and/or reference concentrations except iron, which has no SSL and is an essential nutrient. Cyanide was not detected in sample LC037SP22B.

### 4.2.2 Sample LC037GP22A (Groundwater)

Data for this sample were reported in the *Draft Zone L RFI Report* (EnSafe, 1998). A groundwater sample was collected in the vicinity of AOC 516 as part of the sewer investigation; a DPT sample was collected at the west end of Building NSC 66 (identified as 037GP22A). No VOCs were detected in the sample. Although metals were targeted in the analysis, and 20 were detected, they were not compared to tap water standards, as the DPT samples contained significant solids.

### 4.2.3 Conclusions Regarding Potential Linkage to Sanitary Sewers

No data or evidence suggest that a release of waste from AOC 516 to the sanitary sewer has resulted in a release to the environment between the AOC and the main sewer line.

The lack of discernible groundwater contamination at the AOC 516 suggests that there has been no impact to groundwater from the section of sewer line connecting the site to the main sewer line.

1 Based on these data, in addition to the planned removal of soil with elevated metals  
2 adjacent to the soil boring C047SB007, no further evaluation of potential linkage of AOC 516  
3 to the sanitary sewers is warranted.

### 4 **4.3 Potential Linkage to Storm Sewers (AOC 699)**

5 Potential linkage of a SWMU or AOC to the storm sewer refers to the possibility of a  
6 groundwater plume at a SWMU or AOC migrating into a stormwater sewer from within  
7 which it would subsequently migrate into the water bodies around the CNC, or to the  
8 presence of a cross connection between the sanitary sewer and storm sewer, which could  
9 transport pollutants directly to surface waters. Regarding the first of these potential  
10 linkages, because arsenic was the only COC identified in AOC 516 groundwater, and it was  
11 not detected above its MCL, there is no excessively contaminated groundwater plume to  
12 migrate to a storm sewer. Therefore no potential linkage of this AOC to a storm sewer exists.

13 Regarding the second potential linkage issue, the available storm sewer maps show that  
14 there are storm sewers adjacent to AOC 516. In accordance with the approved *Zone L RFI*  
15 *Work Plan*, no samples were collected in Sub-zone C as part of the storm sewer investigation  
16 at AOC 699. The sampling scheme for AOC 699 was to investigate pipelines downgradient  
17 of industrial sources. No industrial source was identified at, or up gradient of AOC 516.  
18 Therefore, there is no reason to believe that a discharge of waste material into the storm  
19 sewer has occurred.

20 Based on this information, further evaluation of linkage between the stormwater sewer and  
21 the subject site is not warranted.

### 22 **4.4 Potential Linkage to Railroad Lines (AOC 504)**

23 The potential linkage of a SWMU or AOC to a railroad potentially applies only to SWMUs  
24 or AOCs at which an investigated portion of the railroad system, identified as AOC 504 in  
25 the *Zone L RFI Work Plan*, passes through or directly adjacent to the AOC or SWMU.

26 No railroad lines are adjacent to AOC 516. The nearest railroad lines, identified as part of  
27 AOC 504 in the *Zone L RFI Work Plan*, are located more than 800 feet to the northeast of the  
28 site. Based on this information, further evaluation of a potential linkage between the AOC  
29 504 and the subject site is not necessary.

## 4.5 Potential Migration Pathways to Surface Water Bodies

Surface water was studied separately as part of the *Zone J Draft RCRA Facility Investigation Report* (EnSafe, 2000). The *Zone J Draft RCRA Facility Investigation Report* includes the investigated surface water bodies. The nearest investigated surface water bodies to AOC 516 are the tributaries of Noisette Creek, approximately 1,700 feet to the north-northwest. The Cooper River is approximately 2,500 feet to the east.

There are two possible migration pathways for contaminants to affect surface water: overland flow via stormwater runoff, and subsurface flow via groundwater. Due to the fact that significant source area contamination was not identified at AOC 516, and that the nearest water-receiving body is 1,700 feet to the north-northwest, surface water runoff from AOC 516 would not be an ecological concern at Noisette Creek. The only surface soil sample with elevated concentrations of COCs at AOC 516 was a single sampling location at AOC 516, indicating an extremely small impacted area. The proposed IM will remove the contaminated soil at this location; therefore, further evaluation of a potential pathway for contaminant migration via stormwater runoff is not warranted.

A groundwater contaminant plume above applicable MCLs was not identified at AOC 516. Therefore, further evaluation of a potential contaminant migration via groundwater migration is not warranted.

## 4.6 Potential Contamination in OWSs

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

Neither the RFA nor the RFI refers to the presence or possible presence of an OWS at AOC 516.

Additionally, as part of a sitewide evaluation of the presence of OWSs, during the year 2000 the Navy completed a comprehensive review of its records and facilities to identify the presence of OWSs. A list of 27 known OWSs were provided to the BCT members, including SCDHEC staff, at the BCT meeting in September 2000. Currently the best available data source on the presence of OWSs at the CNC, a copy of this list is provided in Appendix C. No OWS was identified at AOC 516; therefore, no further evaluation of this issue for AOC 516 is warranted.

1 **4.7 Land-Use Control Management Plan**

- 2 Upon completion of a removal action, the goal of which is to reduce COC concentrations to  
3 levels acceptable for future unrestricted use, land-use controls will not be necessary at AOC  
4 516.

**TABLE 4-1**  
 AOC 516 Groundwater Well and Probe Results for As, Sb, and Tl  
 IM Work Plan, AOC 516, Building 233, Zone C

Chemical	Station ID	Result (mg/L)	Qualifier	Date Collected	MCL
<b>Antimony</b>	C047GW006	1.9	U	6/15/95	6.0
	C047GW006	2.1	U	1/24/96	6.0
	C047GW006	13.0	UJ	5/14/96	6.0
	C047GW006	4.4	U	6/11/96	6.0
	C047GW007	1.9	U	6/14/95	6.0
	C047GW007	2.1	U	1/25/96	6.0
	C047GW007	13.0	UJ	5/14/96	6.0
	C047GW007	2.1	U	6/11/96	6.0
	C047GW008	1.9	U	6/15/95	6.0
	C047GW008	2.1	U	1/25/96	6.0
	C047GW008	13.0	UJ	5/15/96	6.0
	C047GW008	2.1	U	6/12/96	6.0
	C047GW009	1.9	U	6/15/95	6.0
	C047GW009	2.1	U	1/26/96	6.0
	C047GW009	13.0	UJ	5/15/96	6.0
	C047GW009	3.9	U	6/12/96	6.0
	C047GW010	1.9	U	6/14/95	6.0
	C047GW010	2.1	U	1/25/96	6.0
	C047GW010	13.0	UJ	5/14/96	6.0
	C047GW010	2.2	U	6/12/96	6.0
	<b>LC037GP22A</b>	<b>8.2</b>	<b>=</b>	<b>6/3/97</b>	
<b>Arsenic</b>	C047GW001	6.1	J	6/14/95	50.0
	C047GW001	10.9	=	1/25/96	50.0
	C047GW001	7.5	J	5/9/96	50.0
	C047GW001	8.6	J	6/7/96	50.0
	C047GW001	25.3	J	1/15/99	50.0
	C047GW001	25.3	J	1/15/99	50.0
	C047GW006	7.1	J	6/15/95	50.0
	C047GW006	3.8	J	1/24/96	50.0
	C047GW006	2.5	UJ	5/14/96	50.0
	C047GW006	4.3	J	6/11/96	50.0
	C047GW007	3.2	U	6/14/95	50.0
	C047GW007	2.5	U	1/25/96	50.0
	C047GW007	2.5	UJ	5/14/96	50.0
	C047GW007	2.5	UJ	6/11/96	50.0
	C047GW008	3.2	U	6/15/95	50.0
	C047GW008	2.5	U	1/25/96	50.0
	C047GW008	2.5	UJ	5/15/96	50.0
	C047GW008	2.5	UJ	6/12/96	50.0

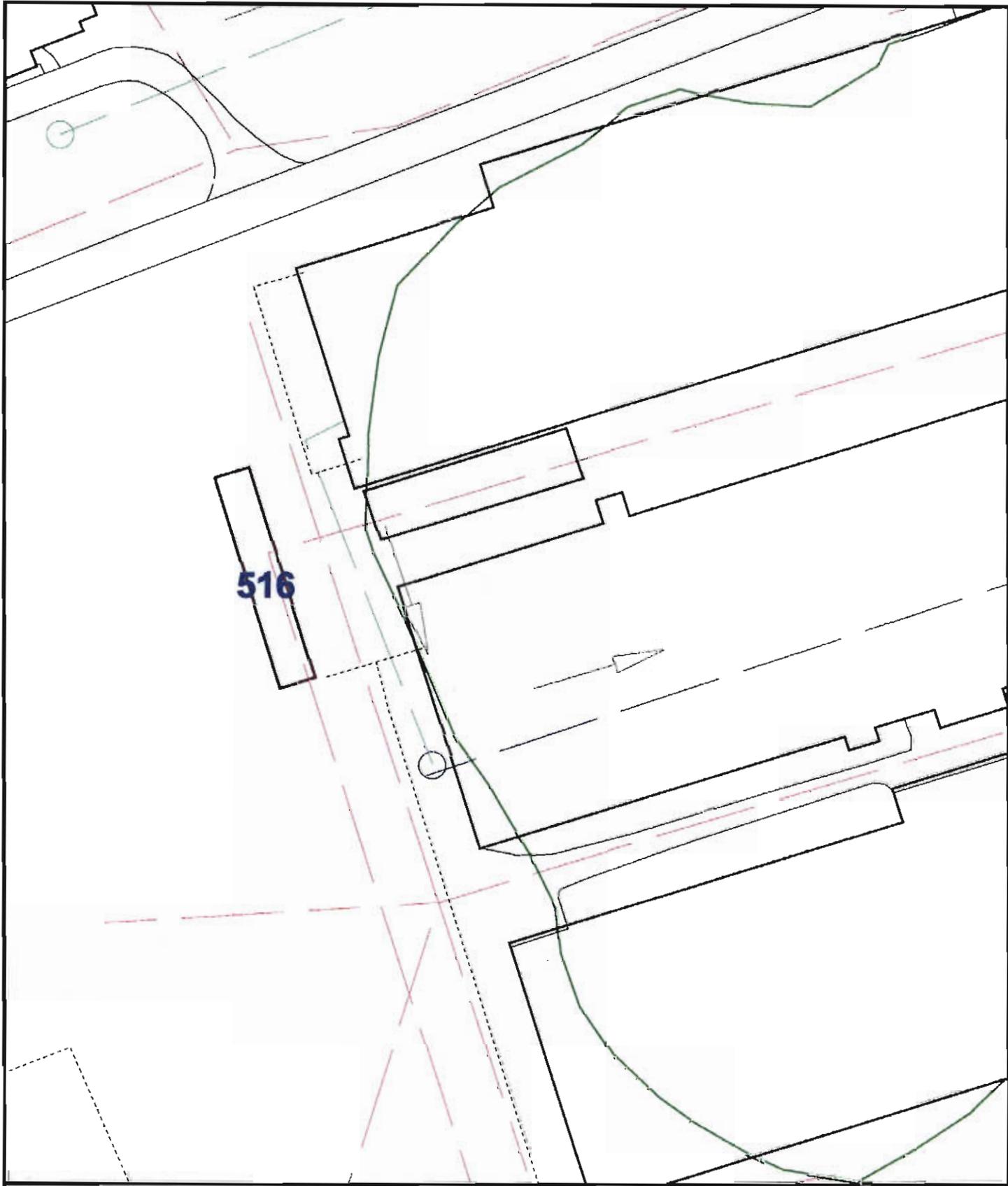
**TABLE 4-1 (CONTINUED)**  
 AOC 516 Groundwater Well and Probe Results for As, Sb, and Tl  
 IM Work Plan, AOC 516, Building 233, Zone C

Chemical	Station ID	Result (mg/L)	Qualifier	Date Collected	MCL
	C047GW009	3.2	U	6/15/95	50.0
	C047GW009	2.5	U	1/26/96	50.0
	C047GW009	2.5	UJ	5/15/96	50.0
	C047GW009	2.5	UJ	6/12/96	50.0
	C047GW010	3.2	U	6/14/95	50.0
	C047GW010	2.5	U	1/25/96	50.0
	C047GW010	2.5	UJ	5/14/96	50.0
	C047GW010	2.5	UJ	6/12/96	50.0
	<b>LC037GP22A</b>	<b>95.7</b>	<b>=</b>	<b>6/3/97</b>	
	C047GW001	4.5	U	6/14/95	2.0
	C047GW001	2.7	U	1/25/96	2.0
	C047GW001	2.7	UJ	5/9/96	2.0
	C047GW001	2.7	UJ	6/7/96	2.0
	C047GW001	3.1	U	1/15/99	2.0
	C047GW001	3.1	U	1/15/99	2.0
<b>Thallium</b>	C047GW006	4.5	U	6/15/95	2.0
	C047GW006	5.1	U	1/24/96	2.0
	C047GW006	3.4	U	5/14/96	2.0
	C047GW006	2.7	UJ	6/11/96	2.0
	C047GW007	4.5	U	6/14/95	2.0
	C047GW007	2.7	U	1/25/96	2.0
	C047GW007	3.9	J	5/14/96	2.0
	C047GW007	2.7	UJ	6/11/96	2.0
	C047GW008	4.5	U	6/15/95	2.0
	C047GW008	2.7	U	1/25/96	2.0
	C047GW008	3.4	U	5/15/96	2.0
	C047GW008	2.7	UJ	6/12/96	2.0
	C047GW009	4.5	U	6/15/95	2.0
	C047GW009	4.6	U	1/26/96	2.0
	C047GW009	3.4	U	5/15/96	2.0
	C047GW009	2.7	UJ	6/12/96	2.0
	C047GW010	4.5	U	6/14/95	2.0
	C047GW010	2.7	U	1/25/96	2.0
	C047GW010	3.4	U	5/14/96	2.0
	C047GW010	2.7	UJ	6/12/96	2.0
	<b>LC037GP22A</b>	<b>10.0</b>	<b>U</b>	<b>6/3/97</b>	

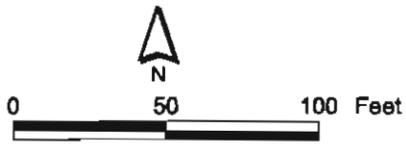
Bold values are detected concentrations above the MCL.

Highlighted Station Ids represent DPT samples.

- = Result is equal to reported value.
- U Not detected.
- J Detected with estimated concentration reported.
- UJ Not detected with estimated detection limit reported.



- STORM-LINE/MANHOLE
- STORM-LINE/MANHOLE-NS
- SEWER-LINE/MANHOLE-NS
- SEWER-LINE/MANHOLE
- AOC Boundary
- SWMU Boundary
- FENCE



**Figure 4-1**  
 Sanitary and Storm Sewers  
 AOC 516 - Zone C  
 Charleston Naval Complex

References

## 1 **5.0 References**

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- 2 EnSafe Inc. *RCRA Facility Investigation Work Plan*. 1996.
- 3 EnSafe Inc. *Zone C RCRA Facility Investigation Report, NAVBASE Charleston*. Revision 0.
- 4 November 14, 1997.
- 5 EnSafe Inc. *Draft Zone L RCRA Facility Investigation Report, NAVBASE Charleston*.
- 6 December 18, 1998.
- 7 EnSafe Inc. *Zone J Draft RCRA Facility Investigation Report, NAVBASE Charleston*.
- 8 April 24, 2000.

APPENDIX A  
Excerpts from Zong CRI

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AOC 516 was used for spray washing vehicles and more recently was used for recharging lead-acid batteries. Building 233 is located on this site. These two sites are combined for the evaluation of fate and transport based on their proximity. Environmental media sampled as part of the SWMU 47 investigation include surface soil, subsurface soil, and groundwater. Potential migration pathways for SWMU 47 include constituents leaching from soil to groundwater, groundwater migration to surface water, and emission of volatile constituents from surface soil to air.

#### **10.2.5.1 Soil to Groundwater Cross Media Transport**

Table 10.2.8 compares the maximum detected concentrations of chemicals in soil to the greater of the groundwater protection SSLs or background reference concentrations. Five organic compounds (benzo(a)anthracene, benzo(f)fluoranthene, alpha-BHC, beta-BHC, and pentachlorophenol) and five inorganic chemicals (chromium, cobalt, copper, mercury, and tin) were detected above SSLs in soil but were not found above reference or risk-based concentrations in shallow groundwater in first-quarter samples. A review of subsequent quarterly results confirmed their absence at significant levels. As a result, existing soil concentrations are considered protective of the water table aquifer.

Lead was detected above reference concentrations exclusively in boring 047SB007. The closest monitoring well, 047007, produced samples with nondetect lead for four consecutive quarters. Monitoring well 047001 produced an exceedingly high lead result first quarter (467  $\mu\text{g/L}$ ). Subsequent quarterly results were nondetect indicating the initial data gave an erroneous account of groundwater quality. A single exceedance of the lead TTAL (15  $\mu\text{g/L}$ ) was noted in the second quarter samples from 047010, but following quarterly results were below the groundwater standard.

Manganese was detected above the reference concentration in samples from soil borings 047007, 047008, and 516001. Groundwater reference concentration exceedances were reported in shallow wells 047011 and 047015, which are not proximate to elevated soil results. In no instance did groundwater concentrations exceed background by greater than 5%.

Thallium was detected exclusively in soil samples from boring 047007. The mean soil thallium concentration is below the SSL and the maximum source area is less than 0.5 acres. Sporadic shallow groundwater hits were reported in second, third, and fourth-quarter samples from monitoring wells 047002, 047005, 047007, and 047015. In no instance were thallium results reproducible between quarterly events.

Based on the preceding analysis, existing soil quality is generally considered protective of shallow groundwater. This conclusion is by and large corroborated by groundwater results. The exception is thallium which has not followed a pattern relative to soil source or consistent groundwater detection.

#### **10.2.5.2 Groundwater-to-Surface Water Cross-Media Transport**

Aluminum, antimony, arsenic, carbon disulfide, 3,3'-dimethylbenzidine, lead, and manganese were detected in SWMU 47 shallow groundwater above tapwater RBCs or background reference concentrations in first-quarter samples. Thallium was also detected in second through fourth quarter samples. 3,3'-dimethylbenzidine was not detected in subsequent quarterly samples. Carbon disulfide was not detected above its tap water RBC in second, third, or fourth-quarter groundwater samples. Exceedances occurring in shallow groundwater are isolated to one or two monitoring wells. Antimony, arsenic, lead, and manganese will not migrate with the groundwater based on a tendency to adsorb to the soil matrix.

Table 10.2.13

## Summary of Chemicals Present in Site Samples, SWMU 47 and AOC 516

## Surface Soil

NAVBASE - Charleston, Zone C

Charleston, South Carolina

NAME	CONC UNITS	FREQ	DETECTS			SCREENING			NON-DETECTS		BACKGROUND	
			Min	Max	Avg	Value	# Over	Source	Min	Max	Value	# Over
<b>Carcinogenic PAHs</b>												
B(a)P Equiv.	UG/KG	15 - 24	17.772	7648.5	1160.00	88	14		1345.07	1615.48		
Benzo(a)anthracene	UG/KG	15 - 24	74	6100	842.00	880	2	C	690	830		
Benzo(b)fluoranthene	UG/KG	15 - 24	93	10000	1590.00	880	4	C	810	960		
Chrysene	UG/KG	15 - 24	72	8500	1030.00	88000		C	570	680		
Dibenz(a,h)anthracene	UG/KG	4 - 24	65	1000	419.25	88	2	C	430	540		
Indeno(1,2,3-cd)pyrene	UG/KG	10 - 24	110	3200	656.00	880	2	C	480	580		
Benzo(k)fluoranthene	UG/KG	15 - 24	100	11000	1720.00	8800	1	C	650	780		
Benzo(a)pyrene	UG/KG	14 - 24	72	4600	800.00	88	11	C	690	830		
<b>Dioxins</b>												
Dioxin Equiv.	NG/KG	2 - 2	2.5868	3.8856	3.24	1000						
1234678-HpCDD	NG/KG	2 - 2	4.898	21.729	13.31							
1234678-HpCDF	NG/KG	2 - 2	89.4	112.325	100.86							
123478-HxCDD	NG/KG	1 - 2	0.486	0.486	0.49				0.167	0.167		
123678-HxCDD	NG/KG	1 - 2	0.663	0.663	0.66				0.135	0.135		
123789-HxCDD	NG/KG	1 - 2	0.727	0.727	0.73				0.138	0.138		
123478-HxCDF	NG/KG	2 - 2	8.81	11.416	10.11							
123789-HxCDF	NG/KG	1 - 2	0.71	0.71	0.71				0.975	0.975		
123678-HxCDF	NG/KG	2 - 2	2.493	5.784	4.14							
234678-HxCDF	NG/KG	2 - 2	0.711	1.687	1.20							
OCDD	NG/KG	2 - 2	79.68	246.65	163.17							
OCDF	NG/KG	2 - 2	222.084	291.722	256.90							
<b>Petroleum Hydrocarbons</b>												
Petroleum Hydrocarbons, TPH	MG/KG	16 - 16	17.8	2050	326.55	100	10					
<b>Inorganics</b>												
Aluminum (Al)	MG/KG	16 - 16	3045	13900	6413.13	7800	4	N			9990	2
Antimony (Sb)	MG/KG	4 - 16	0.4	1.9	1.02	3.1		N	0.2	0.32	0.55	2
Arsenic (As)	MG/KG	9 - 16	0.38	27.8	6.16	0.43	8	C	0.34	4.1	14.2	1
Barium (Ba)	MG/KG	16 - 16	7.4	170	32.69	550		N			77.2	1

**10.2.6.5 Risk Characterization**

**Surface Soil Pathways**

Exposure to surface soil onsite was evaluated under both residential and industrial (site worker) scenarios. The incidental ingestion and dermal contact exposure pathways were evaluated. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.2.21 and 10.2.22 present the computed carcinogenic risks and/or HQs associated with the incidental ingestion of and dermal contact with site surface soil, respectively.

*Hypothetical Site Residents*

The ingestion ILCR (based on the adult and child lifetime weighted average) for SWMU 47 surface soil is 5E-5. The dermal pathway ILCR is 1E-5. BEQs and arsenic were the primary contributors for each pathway.

The computed HQs for the adult resident were less than 0.1 for the soil ingestion and dermal contact pathways. The computed HQs for the child ingestion and dermal contact pathways were 1 and 0.1, respectively. Arsenic was the primary contributor for both pathways, with aluminum and thallium as the only other significant contributors.

*Hypothetical Site Workers*

Site worker ILCRs are 6E-6 and 4E-6 for the ingestion and dermal contact pathways, respectively. BEQs and arsenic were the primary contributors for both pathways. The HQs for the ingestion and dermal pathways were both projected to be less than 0.04 for the hypothetical site worker scenario.

The SWMU 47 area is almost entirely covered by building and/or asphalt parking lots. Small grassy areas are maintained around each building and in median strips throughout the parking

areas. Locations 047SB005 and 047SB016, where the maximum BEQ concentrations were reported, are within small grassy areas. Current site users would be expected to have limited opportunity for exposure to affected surface soil in these areas. As a result, the risk/hazard projections discussed above are considered overestimates should existing site features be maintained under future use scenarios.

***Lead Toxicity – Soil***

At SWMU 47, one surface soil sample (047SB00701 1,120 mg/kg) contained lead at a concentration exceeding the residential cleanup goal of 400 mg/kg. The mean lead concentration at SWMU 47 was calculated to be 112 mg/kg. An area of concentrated impact was identified as represented by borings 047007, 516,001, and 516002. This area encompasses approximately one-half acre, and is considered to delineate the reasonable maximum exposure area. The mean lead concentration for these three locations is 385 mg/kg; which is below the residential goal. Because the hot-spot mean falls below the residential cleanup goal, chronic soil pathway exposures are not expected to pose a significant health threat to potential future child residents.

**Groundwater Pathways**

Exposure to shallow groundwater onsite was evaluated under both residential and industrial scenarios. The ingestion exposure pathway was evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed separately for child and adult receptors. Table 10.2.23 presents the risk and hazard for the exposure pathway.

ILCR exceeds 1E-6 or whose HQ exceeds 0.1. For carcinogens, this approach is relatively conservative, because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. The COC selection method presented was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the remedial goal options development process. Table 10.2.24 summarizes of COCs identified in each medium based on contribution to cumulative ILCR or HI.

### *Surface Soils*

#### **Hypothetical Site Residents (Future Land Use)**

BEQs, arsenic, beryllium, and thallium were identified as COCs based on their contribution to cumulative ILCR and/or hazard. BEQs and arsenic in surface soil are shown on Figures 10:2.4 and 10.2.5.

#### **Hypothetical Site Workers (Current Land Use)**

BEQs and arsenic were identified as COCs based on their contribution to cumulative ILCR and/or hazard.

Aluminum and arsenic were detected in soil throughout SWMU 47. The mean concentrations for these elements were, however, less than their respective background reference concentrations. Beryllium was detected in three of 16 surface soil samples with a maximum concentration of 0.5 mg/kg. The calculated beryllium UCL (0.267 mg/kg) is comparable to the four beryllium detections reported at Zone C background locations. Thallium was detected at only one surface soil sampling location at a concentration of 2.1 mg/kg. Its absence at other locations indicates that the potential for chronic exposure is low.

Table 10.2.24

Summary of Risk and Hazard-based COCs for SWMU 47 and AOC 516  
 NAVBASE - Charleston Zone C  
 Charleston, South Carolina

Medium	Exposure Pathway		Potential Futu	Potential Futu	Potential Future	Site Worker		Identification of COCs			
			Resident Adul	Resident Chil	Resident lwa	Hazard Quoti	ILCR				
			Hazard Quoti	Hazard Quoti	ILCR	Hazard Quoti	ILCR				
Surface Soil	Incidental Ingestion	Benzo(a)pyrene Eq	ND	ND	1.5E-05	ND	1.7E-06	2	4		
		Aluminum	0.01	0.1	ND	0.004	ND	1			
		Arsenic	0.1	0.6	3.3E-05	0.02	3.6E-06	1	2	4	
		Beryllium	0.00007	0.0007	1.8E-06	0.00003	2.0E-07	2			
		Copper	0.01	0.07	ND	0.003	ND				
		Lead	ND	ND	ND	ND	ND				
		Manganese	0.005	0.05	ND	0.002	ND				
	Thallium	0.02	0.2	ND	0.006	ND	1				
	Dermal Contact	Benzo(a)pyrene Eq	ND	ND	6.9E-06	ND	2.8E-06	2	4		
		Aluminum	0.002	0.008	ND	0.002	ND				
		Arsenic	0.01	0.04	3.7E-06	0.01	1.5E-06	2	4		
		Beryllium	0.00001	0.00005	2.0E-07	0.00001	8.2E-08		4		
		Copper	0.001	0.005	ND	0.001	ND				
		Lead	ND	ND	ND	ND	ND				
Manganese		0.0010	0.003	ND	0.0007	ND					
Thallium	0.004	0.01	ND	0.003	ND						
<b>Surface Soil Pathway Sum</b>			<b>0.13</b>	<b>1.0</b>	<b>6E-05</b>	<b>0.053</b>	<b>1E-05</b>				
Shallow Groundw Ingestion											
		Arsenic	4.2	9.9	1.0E-03	1.5	3.3E-04	1	2	3	4
<b>Shallow Groundwater Pathway Sum</b>			<b>4</b>	<b>10</b>	<b>1E-03</b>	<b>2</b>	<b>3E-04</b>				
<b>Sum of All Pathways</b>			<b>4</b>	<b>11</b>	<b>1E-03</b>	<b>2</b>	<b>3E-04</b>				

Notes:

ND indicates not determined due to the lack of available risk information.

ILCR indicates incremental excess lifetime cancer risk

HI indicates hazard index

1- Chemical is a COC by virtue of projected child residence non-carcinogenic hazard.

2- Chemical is a COC by virtue of projected future resident lifetime ILCR.

3- Chemical is a COC by virtue of projected site worker non-carcinogenic hazard.

4- Chemical is a COC by virtue of projected site worker ILCR.

The highest BEQ concentrations were reported at locations 047SB005 (7.648 mg/kg) and 047SB016 (4.373 mg/kg). Both samples were collected from small patches of grass-covered soil amidst buildings and roadways near Buildings NSC-64, NSC-66, and NSC-67. BEQ concentrations in excess of 0.5 mg/kg were reported throughout the SWMU 47 area. As a result, chronic exposure to BEQs at concentrations above residential and industrial RBCs is possible for individuals working or residing in this area.

### *Groundwater*

#### **Hypothetical Site Residents (Future Land Use)**

Arsenic was identified as the only COC for this scenario based on the sum ILCR and HI. Arsenic concentrations in Zone C shallow groundwater are shown on Figure 10.1.7.

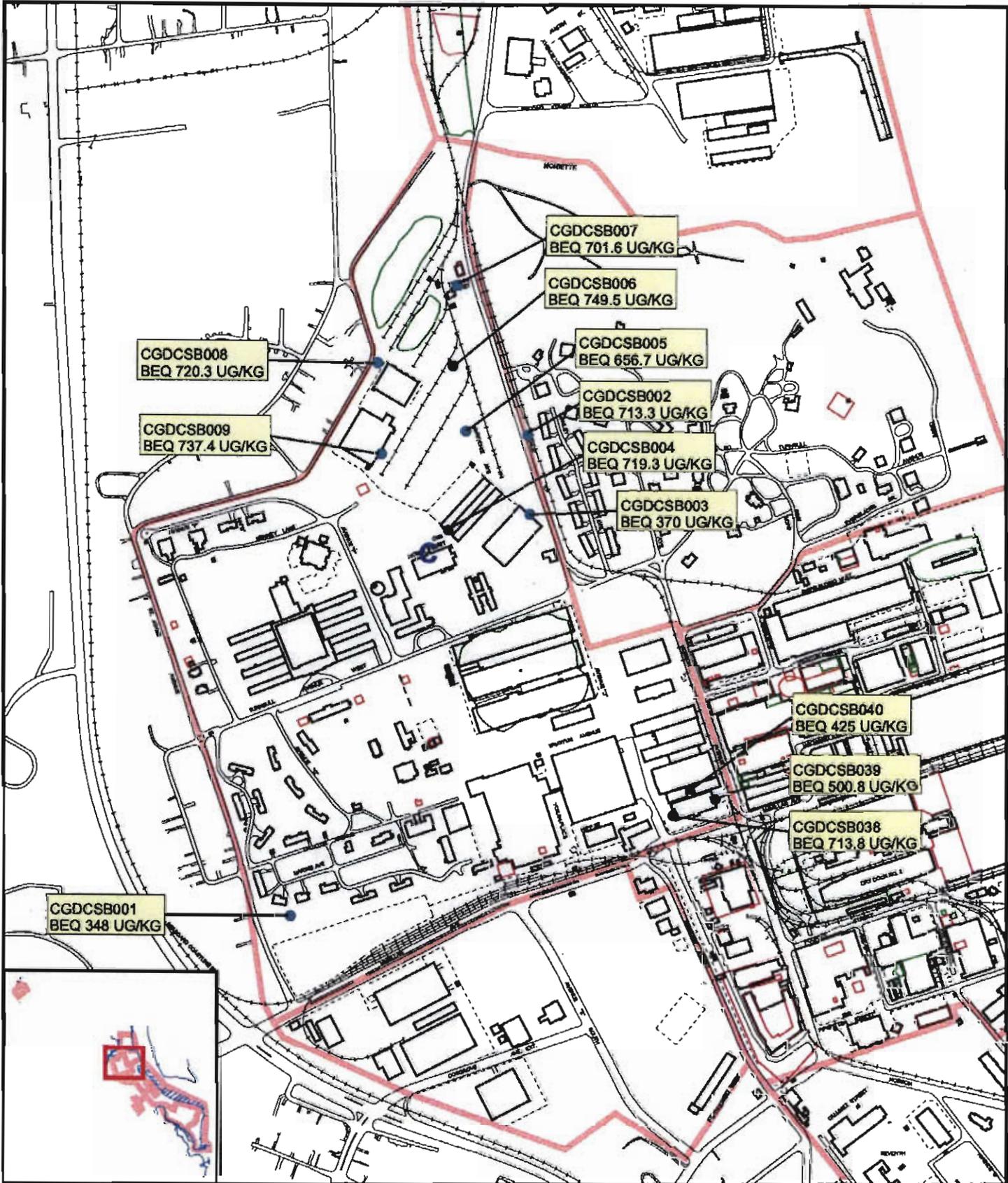
#### **Hypothetical Site Workers (Current Land Use)**

Arsenic was identified as the only COC for this scenario based on the sum ILCR and HI.

Due to the limited extent of identified shallow groundwater impacts, graphical presentation of risk projections for SWMU 47 shallow groundwater would be of limited use. Alternatively, the extent of each COC is briefly discussed below. Arsenic concentrations were generally consistent throughout SWMU 47, with the sample from well 047011 (46.3  $\mu\text{g/L}$ ) having the only concentration above 9.2  $\mu\text{g/L}$ . Although former site operations (lead-acid batter recharging) could be a potential source of heavy metals, monitoring well 047007 did not have significantly elevated arsenic concentrations. It is possible that reported shallow groundwater concentrations in the two principal metals-impacted wells could be associated with entrained sediment. Subsequent quarterly sampling results corroborated the relatively dramatic arsenic impacts in well 047011.

APPENDIX  
**Zone C Grid-Based BEO Evaluation**

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- Zone c grid surface beq.dbf
- Fence
- Railroads
- Roads - Lines
- AOC Boundary
- SWMU Boundary
- Buildings
- Zone Boundary



**Figure B-1**  
 BEQ Values at Grid-Based Sample Locations  
 Zone C  
 Charleston Naval Complex

Table B-1. Surface soil BEQs in Zone C

STATION ID	SAMPLE ID	SAMPLE DATE	Value (ug/kg)
CGDCSB001	GDCSB00101a	03/15/95	348.0
CGDCSB002	GDCSB00201	03/13/95	713.3
CGDCSB003	GDCSB00301b	03/17/95	370.0
CGDCSB004	GDCSB00401a	04/14/95	719.3
CGDCSB005	GDCSB00501a	03/17/95	656.7
CGDCSB006	GDCSB00601b	03/17/95	749.5
CGDCSB007	GDCSB00701	04/14/95	701.6
CGDCSB008	GDCSB00801a	03/17/95	720.3
CGDCSB009	GDCSB00901	03/31/95	737.4
CGDCSB038	GDCSB03801a	06/29/95	713.8
CGDCSB039	GDCSB03901b	06/29/95	500.8
CGDCSB040	GDCSB04001b	06/29/95	425.0
Average =			613.0
Minimum =			348.0
Maximum =			749.5

BEQ value calculated using detection limit for PAHs with "J" or "=" qualifier

BEQ value calculated using 1/2 of the detection limit for PAHs with "U" or "UJ" qualifier

APPENDIX C

# Oil/Water Separator List

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ZONE WITH LHM AOC

DESCRIPTION	PROGRAM DATA			SAMPLES REPRESENTATIVE OF O/W SEPARATOR RELEASE	CHEMICAL OF CONCERN BASED ON SITE OPERATIONS					ANALYSIS PERFORMED							SAMPLING REQUIRED				
	Facility/IR site / (if applicable)	IR	Petroleum		No IR site	Solvents	Petroleum Products	Metals	Pesticides	PCB's	VOC's	SVOC's	Metals	Pesticides	PCB's	VOC's	SVOC's	Metals	Pesticides	PCB's	
1	Facility NS 2/AOC 675	x	x		Y		x	x			x	x	x	x	x	x	x	x	x		
2	Facility NS 3/AOC 675	x	x		Y		x	x	x	x	x	x	x	x	x	x	x	x	x		
3	Facility NS 26/AOC 680	x	x		Y	x	x	x			x	x	x	x	x	x	x	x	x		
4	Facility 32/AOC 559,560		x		N		x	x													
5	Facility NS 44(AOC 675, 676)	x	x		Y		x	x			x	x	x	x	x	x	x	x	x		
6	Facility FBM 61(SWMU 17)	x	x		Y	x	x	x			x	x	x	x	x	x	x	x	x		
7	Facility 80 (AOC 564)	x	x		Y	x	x	x	x	x	x	x									
8	Facility 98 AND 148/AOC 625		x		Y		x	x						x	x	x	x	x	x		
9	Facility 123		x	x	Y		x	x			x	x	x	x	x	x	x	x	x		
10	Facility NS 200		x	x	N	x	x	x	x	x											
11	Facility 221/SWMU 65, AOC 544)	x	x		N	x	x	x	x	x											
12	Facility 226/SWMU23, AOC 540)	x	x		N	x	x	x													
13	Facility 240 (tank)		x	x	Y	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
14	Facility 241		x	x	INCOMPLETE	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
15	Facility 242 (tank)		x	x	Y	x	x	x													
16	Facility 246				A search of the drawing files and a walk around the building revealed no oil-water separator on site.																
17	Facility 680(AOC 613)				N	x	x	x													
18	Facility 681 (tank)	x	x	x	Y	x	x	x			x	x	x	x	x	x	x	x	x		
19	Facility 1024			x	N	x	x	x													
20	Facility 1303/SWMU 13	x			N	x	x	x	x	x											
21	Facility 1308/SWMU 13	x			Y	x	x	x	x	x	x	x	x	x							
22	Facility 1853/AOC 626	x			N		x	x													
23	Facility 1856/SWMU 37	x			Y	x	x	x			x	x	x	x	x						
24	Facility 2505/SWMU 161	x			Y		x	x			x	x	x	x	x						
25	Facility 3913/AOC 627	x			Y		x				x	x	x	x	x						
26	Facility 3926/AOC 626	x			Y		x				x	x	x	x	x						

27 Facility 236 - Pipe Shop/AOC 583?