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INTERIM MEASURE COMPLETION REPORT AREA OF CONCERN 700 (AOC 700) ZONE C
CNC CHARLESTON SC
10/1/2001
CH2M HILL

INTERIM MEASURE COMPLETION REPORT

Area of Concern 700, Zone C



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



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

PREPARED BY
CH2M-Jones

October 2001

*Revision 0
Contract N62467-99-C-0960
158814.ZC.PR.03*

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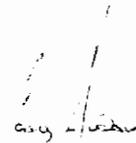
*Revision 0
Contract N62467-99-C-0960
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Certification Page for Interim Measure Completion Report (Revision 0) — AOC 700, Zone C

I, Casey Hudson, 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. T2000358



Casey Hudson, P.E.

09.28.01

Date



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- 4 **C** Waste Manifest and Load Tickets
- 5 **D** Response to Comments on IM WP for AOC 700

1 **Acronyms and Abbreviations**

2	AOC	area of concern
3	BCT	BRAC Cleanup Team
4	BRAC	Base Realignment and Closure Act
5	BRC	background reference concentration
6	CA	corrective action
7	CNC	Charleston Naval Complex
8	COC	chemical of concern
9	DAF	dilution attenuation factor
10	EnSafe	Ensafe Inc.
11	EPA	U.S. Environmental Protection Agency
12	ft bls	feet below land surface
13	IM	interim measure
14	µg/kg	microgram per kilogram
15	mg/kg	milligram per kilogram
16	NAVBASE	Naval Base
17	NFA	no further action
18	RCRA	Resource Conservation and Recovery Act
19	RFA	RCRA Facility Assessment
20	RFI	RCRA Facility Investigation
21	SCDHEC	South Carolina Department of Health and Environmental Control
22	SPLP	synthetic precipitation leaching procedure
23	SSL	soil screening level
24	SWMU	solid waste management unit
25	TCLP	toxicity characteristic leachate procedure
26	WMI	Waste Management Inc.

Section 1.0

1.0 Introduction

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

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

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. Review of site data resulted in Area of Concern (AOC) 700, in Zone C of the CNC, being recommended for an Interim Measure (IM) to delineate and remove arsenic-impacted surface soil above 14.2 milligrams per kilogram (mg/kg), and subsurface soil above 29 mg/kg. This report documents the completion of the IM.

1.1 Background

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. AOC 700, Located in the northern part of Zone C, consists of a former golf course maintenance building and is located near the intersection of Avenue D and Twiggs Street.

In October 2000, an IM Work Plan was prepared to address removal of arsenic-impacted soil at AOC 700 (CH2M-Jones, 2000). Arsenic in surface soil at soil boring LC037SB001 (38.9 mg/kg) was detected above its background reference concentration (BRC) of 14.2 mg/kg during the RFI sampling.

The BRAC Cleanup Team (BCT) determined that removal of surface soil containing arsenic concentrations above the BRC (14.2 mg/kg) and subsurface soil above the soil screening level (SSL) (29 mg/kg, dilution attenuation factor [DAF]=20) was appropriate, and should

1 enable closeout of AOC 700 in a condition that is suitable for future unrestricted use (i.e.,
2 with no land use controls). Accordingly, CH2M-Jones prepared an IM Work Plan for the
3 removal of arsenic-impacted soil at AOC 700, which was submitted on October 27, 2000,
4 and subsequently approved by SCDHEC on December 7, 2000. The target cleanup levels for
5 arsenic-impacted soil at the site were 14.2 mg/kg for surface soil and 29 mg/kg for
6 subsurface soil. The IM was completed on June 5, 2001. This report summarizes the IM
7 completed at AOC 700.

8 **1.2 IM Completion Report Organization**

9 This IM Completion Report consists of the following sections, including this introductory
10 section:

11 **1.0 Introduction** — Presents the purpose of the report and background information relating
12 to the IM.

13 **2.0 Interim Measure Implementation** — Summarizes the excavation activities at AOC 700.

14 **3.0 Interim Measure Outcome** — Provides a discussion of post-IM activities, including
15 confirmation sampling and backfill of the excavation.

16 **4.0 Remaining Site Issues** — Provides information regarding any outstanding issues related
17 to AOC 700, and addresses site closeout issues.

18 **5.0 References** — Lists the references used in this document.

19 **Appendix A** contains the analytical data from the delineation samples collected at AOC
20 700.

21 **Appendix B** contains the validation reports for the analytical data.

22 **Appendix C** contains the waste manifest from Waste Management Inc. (WMI) for soil
23 disposal.

24 **Appendix D** contains the responses to SCDHEC's comments on the IM Work Plan.

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

Section 2.0

2.0 Interim Measure Implementation

2.1 Source Area Delineation Sampling

Soil samples were collected from two depth intervals (0 to 1 feet below land surface [ft bls] and 2 to 3 ft bls) at each sample location. Sample locations are shown on Figure 2-1. Summaries of the arsenic analytical results from the delineation samples for surface and subsurface soil are presented in Tables 2-1 and 2-2, respectively. The analytical data and the data validation reports are presented in Appendices A and B, respectively.

Delineation sampling was conducted on January 22, March 1, March 9, March 28, and May 2, 2001, stepping out sequentially to bound the target excavation area. In addition, on August 30, 2001, after completion of the excavation, two additional soil borings were sampled at the two depth intervals (surface and subsurface) to confirm that excavation in the vicinity of soil boring LC037SB010 was adequate. All four samples collected at these locations were reported to be below the arsenic cleanup levels.

Because arsenic concentrations in a few of the delineation samples were greater than expected, CH2M-Jones also collected and analyzed several additional samples for pesticides. The pesticide data are discussed in Section 3.0 of this IM Completion Report.

2.2 Waste Characterization Sampling

Three samples were collected for waste characterization analysis, and were extracted using the toxicity characteristic leachate procedure (TCLP). The extract from two samples was analyzed for the eight RCRA metals; the extract from the remaining sample was analyzed for pesticides.

A summary of the analytical results from the waste characterization samples is presented in Table 2-3. The analytical data and the data validation reports are in Appendices A and B, respectively.

All of the waste characterization samples were reported below the appropriate regulatory levels. Therefore, the soil was classified as non-hazardous (40 CFR 261), as no constituent exceeded its TCLP regulatory level.

1 **2.3 Excavation**

2 On June 4, 2001, personnel and equipment were mobilized to AOC 700 to begin preparing
3 the site for removal activities in accordance with the approved AOC 700 IM Work Plan.
4 Approximately 300 tons of arsenic- and pesticide-impacted soil were removed from the site.
5 The excavated soil was disposed of by WMI at the Oakridge Landfill, 2183 Highway 78,
6 P.O. Box 145, Dorchester, SC 29437. Waste manifests and load tickets are included as
7 Appendix C. The extent of the excavation is discussed in more detail in Section 3.0.

8 Following the removal of arsenic- and pesticide-impacted soil, the excavation was
9 backfilled with fill obtained from the Butler Ware Trucking Co. The backfill was compacted
10 and graded to match the existing grade.

TABLE 2-1
 Arsenic Detected in Surface Soil
IM Completion Report, AOC 700, Zone C, Charleston Naval Complex

Parameter	Station ID	Date Collected	Concentration (mg/kg)	Qualifier	Cleanup Criteria
Arsenic	LC037SB003	01/31/2001	30.2	J	14.2
	LC037SB004	01/31/2001	5.29	J	
	LC037SB005	01/31/2001	6.66	J	
	LC037SB007	01/31/2001	158	J	
	LC037SS008	03/01/2001	5.93	=	
	LC037SS009	03/01/2001	7.21	=	
	LC037SB010	03/01/2001	11.3	=	
	LC037SB011	03/01/2001	56.3	=	
	LC037SB012	03/01/2001	13	=	
	LC037SB013	03/01/2001	17.9	=	
	LC037SB014	03/01/2001	184	=	
	LC037SB015	03/01/2001	20.8	=	
	LC037SB016	03/01/2001	19	=	
	LC037SB017	03/01/2001	2.15	=	
	LC037SB019	03/09/2001	9.23	=	
	LC037SB020	03/09/2001	14.7	=	
	LC037SB021	03/09/2001	22.7	=	
	LC037SB022	03/09/2001	58.4	=	
	LC037SB023	03/09/2001	55.6	=	
	LC037SB024	03/09/2001	4.02	=	
	LC037SB025	03/28/2001	38.6	J	
	LC037SB026	05/02/2001	2.43	=	
	LC037SB027	05/02/2001	6.15	=	
	LC037SB028	05/02/2001	24.6	=	
	LC037SB029	05/02/2001	33.1	=	
	LC037SB033	08/30/2001	10.0	=	

Bold values are exceedances of the cleanup level.

Cleanup criteria for arsenic is from the AOC 700, Building 1646, Zone C Interim Measure Work Plan (surface soil, 14.2 mg/kg; subsurface soil, 29 mg/kg [CH2M-Jones, 2000]).

- = Indicates that the analyte was detected, the reported value is equal to the sample concentration
- J Indicates that the analyte was detected, the reported value is an estimated concentration.

TABLE 2-2
 Arsenic detected in Subsurface Soil
 IM Completion Report, AOC 700, Zone C, Charleston Naval Complex

Parameter	Station ID	Date Collected	Units	Concentration	Qualifier	Cleanup Criteria
Arsenic	LC037SB003	01/31/2001	mg/kg	7.8	J	29
	LC037SB004	01/31/2001		81.1	J	
	LC037SB005	01/31/2001		14.1	J	
	LC037SB007	01/31/2001		540	J	
	LC037SS008	03/01/2001		13.9	=	
	LC037SS009	03/01/2001		4.35	=	
	LC037SB010	03/01/2001		152	=	
	LC037SB011	03/01/2001		20.7	=	
	LC037SB012	03/01/2001		60.6	=	
	LC037SB013	03/01/2001		15.9	=	
	LC037SB014	03/01/2001		201	=	
	LC037SB015	03/01/2001		37.7	=	
	LC037SB016	03/01/2001		3.99	=	
	LC037SB017	03/01/2001		5.76	=	
	LC037SB019	03/09/2001		2.15	=	
	LC037SB020	03/09/2001		10.1	=	
	LC037SB021	03/09/2001		10.7	=	
	LC037SB022	03/09/2001		101	=	
	LC037SB023	03/09/2001		31.8	=	
	LC037SB024	03/09/2001		3.2	=	
	LC037SB025	03/28/2001		70	J	
	LC037SB026	05/02/2001		4.28	=	
	LC037SB027	05/02/2001		5.98	=	
	LC037SB028	05/02/2001		19.5	=	
	LC037SB029	05/02/2001		64.3	=	
	LC037SB033	08/30/2001		13	=	

Bold values are exceedances of the cleanup level.

Cleanup criteria for arsenic is from the AOC 700, Building 1646, Zone C Interim Measure Work Plan (surface soil, 14.2 mg/kg; subsurface soil, 29 mg/kg [CH2M-Jones, 2000]).

- = Indicates that the analyte was detected, the reported value is equal to the sample concentration
- J Indicates that the analyte was detected, the reported value is an estimated concentration.

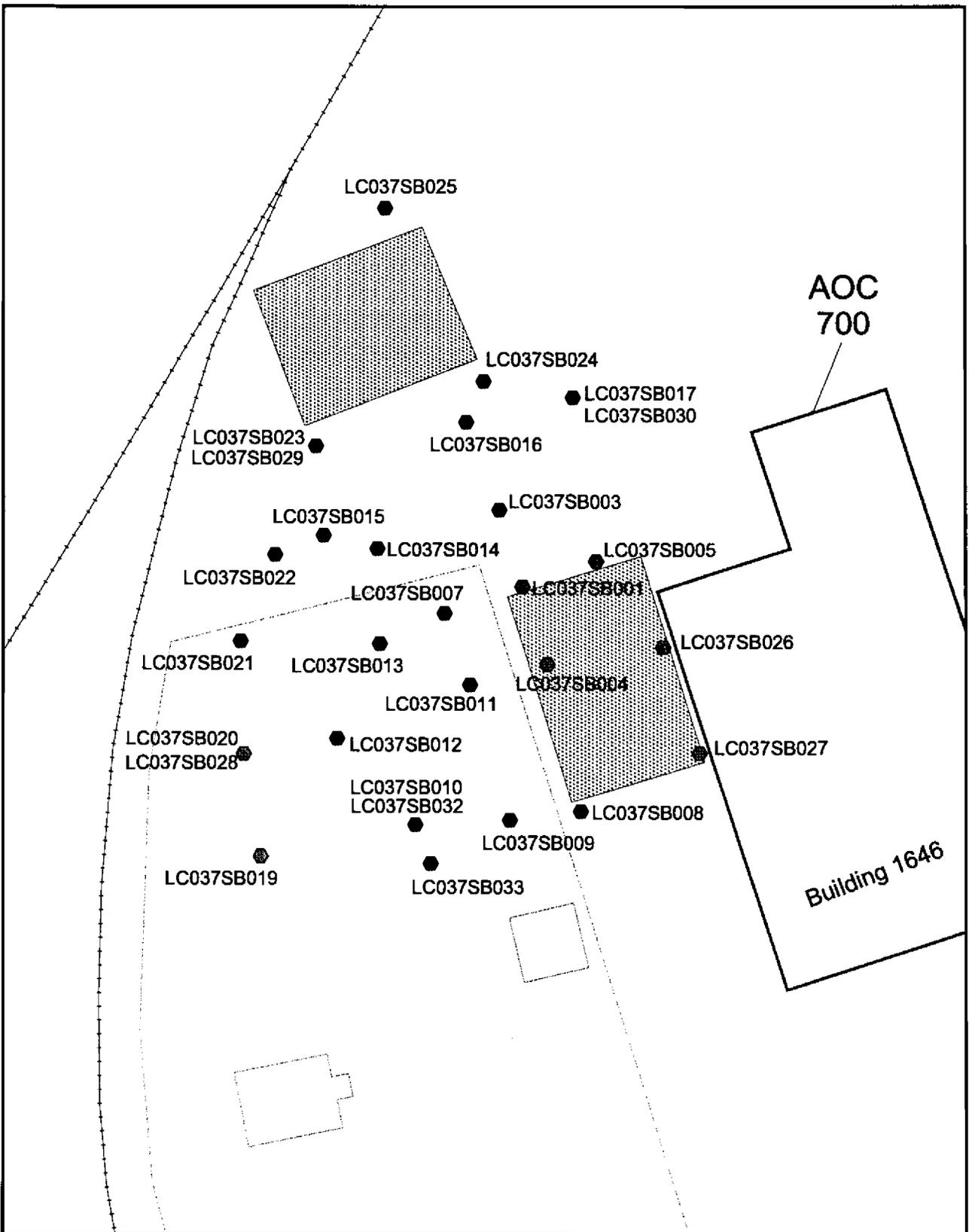
TABLE 2-3
 Waste Characterization (TCLP) Sample Results
 IM Completion Report, AOC 700, Zone C, Charleston Naval Complex

Station ID	Parameter	Date Collected	Units	Result	Qualifier	TCLP
LC037SB007	Arsenic	03/31/2001	µg/L	25.2	J	5,000
	Barium		µg/L	102	J	100,000
	Cadmium		µg/L	3.61	U	1,000
	Chromium, Total		µg/L	6.97	U	5,000
	Lead		µg/L	22.5	U	5,000
	Mercury		µg/L	0.48	U	200
	Selenium		µg/L	23.7	U	1,000
	Silver		µg/L	6.18	U	5,000
LC037SB018	Arsenic	03/01/2001	µg/L	23.3	U	5,000
	Barium		µg/L	141	=	100,000
	Cadmium		µg/L	71.7	=	1,000
	Chromium, Total		µg/L	6.17	J	5,000
	Lead		µg/L	22.4	U	5,000
	Mercury		µg/L	0.573	U	200
	Selenium		µg/L	29.3	U	1,000
	Silver		µg/L	8.71	U	5,000
LC037SB031	Chlordane	05/02/2001	mg/L	0.02	U	0.03
	Endrin		mg/L	0.002	U	0.02
	Gamma BHC (Lindane)		mg/L	0.002	U	0.4
	Heptachlor		mg/L	0.002	U	0.008
	Heptachlor Epoxide		mg/L	0.002	U	0.008
	Methoxychlor		mg/L	0.02	U	10
	Toxaphene	mg/L	0.1	U	0.5	

Bold values are exceedances of the screening value (TCLP level).

* indicates that screening criteria is the calculated minimum soil concentration that could possibly exceed applicable TCLP criteria.

- U Indicates that the analyte was not detected, the reported value is the detection limit.
- J Indicates that the analyte was detected, the reported value is an estimated concentration.
- = Indicates that the analyte was detected, the reported value is equal to the sample concentration.
- NA Indicates that the information is not available or not applicable.



- Interim Measures Sample Locations
- ≡ Railroads
- ≡ Pavement
- ▨ Concrete Slab
- AOC Boundary / Building Boundary

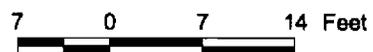


Figure 2-1
 Sample Locations
 AOC 700, Zone C
 Charleston Naval Complex

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Section 3.0

3.0 Interim Measure Outcome

3.1 Extent of Soil Excavation

The extent of excavation required to achieve the target cleanup level for surface soil (14.2 mg/kg) is presented in Figure 3-1. The target excavation area is bounded on the northern, eastern, and southern edges by delineation samples that are below the target cleanup level. On the western edge, the excavation is restricted by the presence of the railroad. Based on discussions of the railroad, excavation could proceed only up to the edge of the railroad ballast.

The extent of excavation required to achieve the target subsurface soil cleanup level (29 mg/kg) is shown in Figure 3-2. The target excavation area is bounded on the northern, eastern, and southern edges by delineation samples that are below the target cleanup level. On the western edge, the excavation is restricted by the presence of the railroad. Based on discussions of the railroad, excavation could proceed only up to a point that would not undermine the structural stability of the railroad ballast.

The actual excavation footprint at the site is shown in Figure 3-3. A small area within 5 feet of monitoring well C044GW008 was excluded from the excavation footprint to protect this well. Also, a portion of the concrete slab on the eastern portion was demolished and removed to allow for excavation of soils in this area.

Excavation of soils was completed to the top of the water table (approximately 4 ft bls).

3.2 Analysis of Soil for Pesticides

Five delineation soil borings (LC037SB014, LC037SB026, LC037SB028, LC037SB029, and LC037SB030) were sampled for pesticides (see Figure 2-1 for sample locations). All of these sample locations, except for LC037SB014, were located at or near the outside perimeter of the target excavation area. Sample LC037SB014 was located in the interior portion of the target excavation area. Pesticide sample results are discussed below.

3.2.1 Toxaphene

Toxaphene was detected in both the surface and subsurface samples collected at LC037SB014, but not in any other sample. The toxaphene concentrations in surface soil at LC037SB014 (275,000 µg/kg) exceeded the residential risk-based concentration (RBC) (580

1 µg/kg) and SSL (31,000 µg/kg, DAF=20). The subsurface sample at this location had a
2 reported toxaphene concentration of 14,000 µg/kg, below its SSL.

3 Because none of the other delineation samples had detectable concentrations of toxaphene,
4 and because it was not detected in previous samples during the RFI, the data indicate that
5 the area with elevated toxaphene in soil was co-located with the soil excavated during the
6 IM. The area with elevated toxaphene concentrations has effectively been remediated by
7 soil excavation and offsite disposal.

8 **3.2.2 Dieldrin Analyses**

9 Dieldrin was detected in the surface samples collected at LC037SB026 and LC037SB029 at
10 concentrations of 8.3 and 7.6 µg/kg, respectively, which are below the residential RBC but
11 exceed the SSL (4.0 µg/kg, DAF=20). The subsurface samples collected at these locations
12 were below the SSL, indicating that the existing concentrations of dieldrin do not represent
13 a threat to surficial groundwater. Dieldrin was not detected at the other locations analyzed
14 for pesticides.

15 **3.2.3 Other Pesticides Detected**

16 Aldrin, alpha-chlordane, gamma-chlordane, DDE, and DDT were detected in at least one of
17 the five samples analyzed for pesticides. None of these detections exceeded the pesticide's
18 respective residential RBC or SSL.

TABLE 3-1
 Pesticides Detected in Surface Soil
IM Completion Report, AOC 700, Zone C, Charleston Naval Complex

Parameter	Station ID	Date Collected	Concentration (ug/kg)	Qualifier	RBC	SSL (DAF=20)
Aldrin	LC037SB029	05/02/2001	0.38	J	38	500
Alpha-chlordane	LC037SB026	05/02/2001	8.9	=	1,800	10,000
Dieldrin	LC037SB026	05/02/2001	8.3	=	40	4.0
	LC037SB029	05/02/2001	7.6	J		
Gamma-chlordane	LC037SB026	05/02/2001	9.4	=	1,800	10,000
	LC037SB028	05/02/2001	4.6	=		
p,p'-DDE	LC037SB026	05/02/2001	18	=	1,900	54,000
	LC037SB028	05/02/2001	14	=		
	LC037SB029	05/02/2001	14	=		
	LC037SB030	05/02/2001	4.2	=		
p,p'-DDT	LC037SB026	05/02/2001	28	=	1,900	32,000
	LC037SB028	05/02/2001	34	=		
	LC037SB029	05/02/2001	32	=		
	LC037SB030	05/02/2001	3.7	=		
Toxaphene	LC037SB014	03/01/2001	275,000	=	580	31,000

Bold values are exceedances of the screening value (RBC or SSL).

Screening criteria (RBCs) for organic compounds in surface soil are from U.S. EPA Region III RBC Table (EPA, April 2000).

Screening criteria (SSLs) for organic compounds in subsurface soil are from the U.S. EPA Soil Screening Guidance: Technical Background Document (EPA, may 1996).

RBC and SSL for chlordane was used as a surrogate for alpha- and gamma-chlordane.

- = Indicates that the analyte was detected, the reported value is equal to the sample concentration
- J Indicates that the analyte was detected, the reported value is an estimated concentration.

TABLE 3-2
 Pesticides detected in Subsurface Soil
 (IM Completion Report), AOC 700, Zone C, Charleston Naval Complex

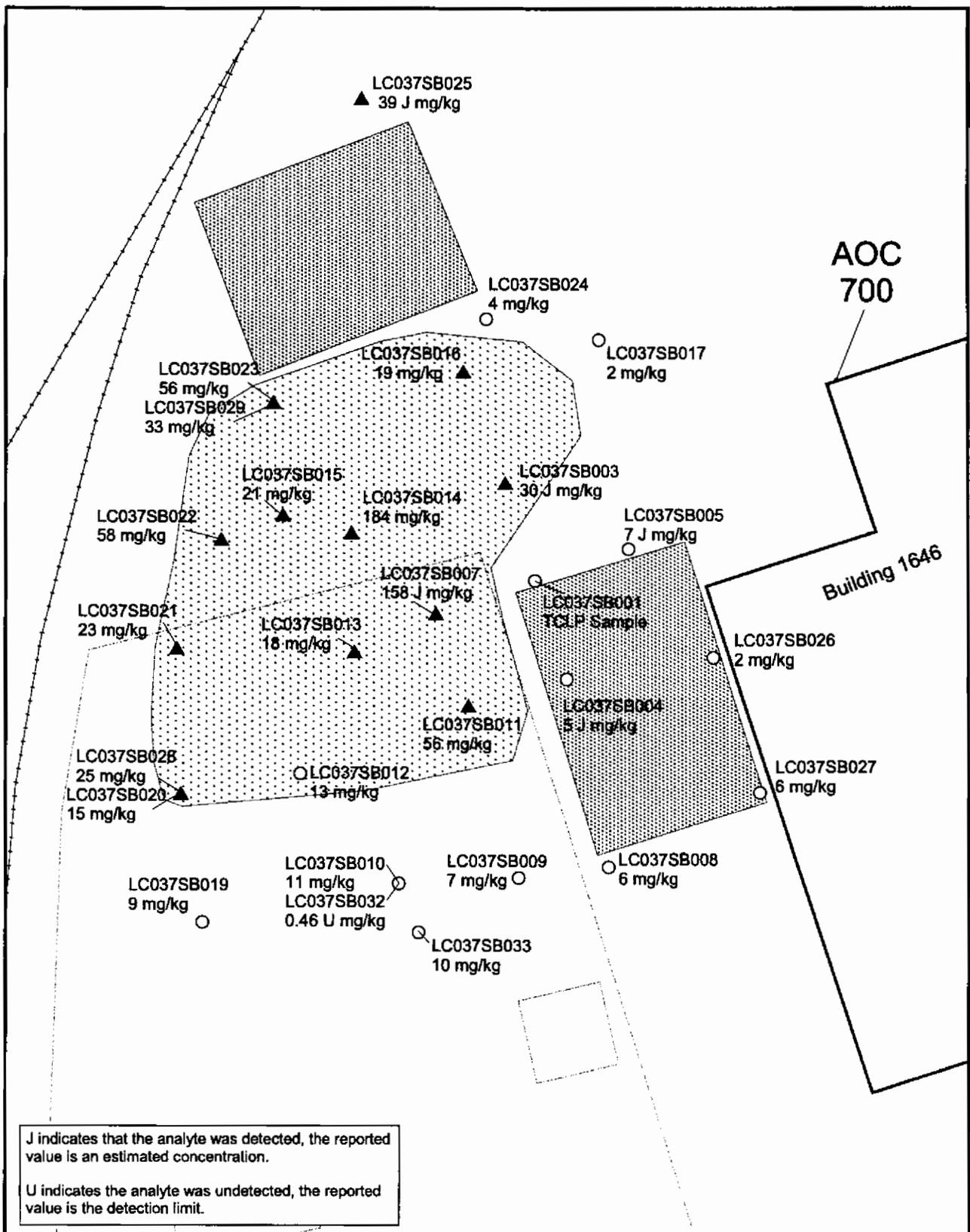
Parameter	Station ID	Date Collected	Units	Concentration	Qualifier	SSL (DAF=20)
Alpha-chlordane	LC037SB029	05/02/2001	µg/kg	0.57	J	10,000
Dieldrin	LC037SB029	05/02/2001	µg/kg	2.2	J	4.0
Gamma-chlordane	LC037SB026	05/02/2001	µg/kg	110	=	10,000
	LC037SB028	05/02/2001		3.6	=	
	LC037SB029	05/02/2001		2.6	J	
p,p'-DDD	LC037SB026	05/02/2001	µg/kg	110	=	16,000
	LC037SB028	05/02/2001		4.5	=	
	LC037SB030	05/02/2001		38	=	
p,p'-DDE	LC037SB028	05/02/2001	µg/kg	17	=	54,000
	LC037SB029	05/02/2001		38	=	
	LC037SB030	05/02/2001		8.8	=	
p,p'-DDT	LC037SB028	05/02/2001	µg/kg	33	=	32,000
	LC037SB029	05/02/2001		58	=	
	LC037SB030	05/02/2001		5.4	=	
Toxaphene	LC037SB014	03/01/2001	µg/kg	14,000	=	31,000

Bold values are exceedances of the SSL.

SSLs are from the U.S. EPA Soil Screening Guidance: Technical Background Document (EPA, may 1996).

SSL for chlordane was used as a surrogate for alpha- and gamma-chlordane.

- = Indicates that the analyte was detected, the reported value is equal to the sample concentration
- J Indicates that the analyte was detected, the reported value is an estimated concentration.



J indicates that the analyte was detected, the reported value is an estimated concentration.

U indicates the analyte was undetected, the reported value is the detection limit.

Interim Measures Surface Soil Sample Locations

- ▲ Arsenic Concentrations Above 14.2 mg/kg
- Arsenic Concentrations Below 14.2 mg/kg
- ▨ Surface Excavation Area
- ▤ Concrete Slab
- ▭ AOC Boundary / Building Boundary
- Railroads
- Pavement

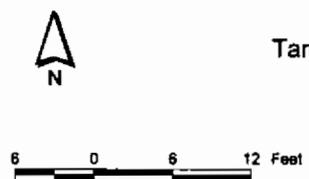
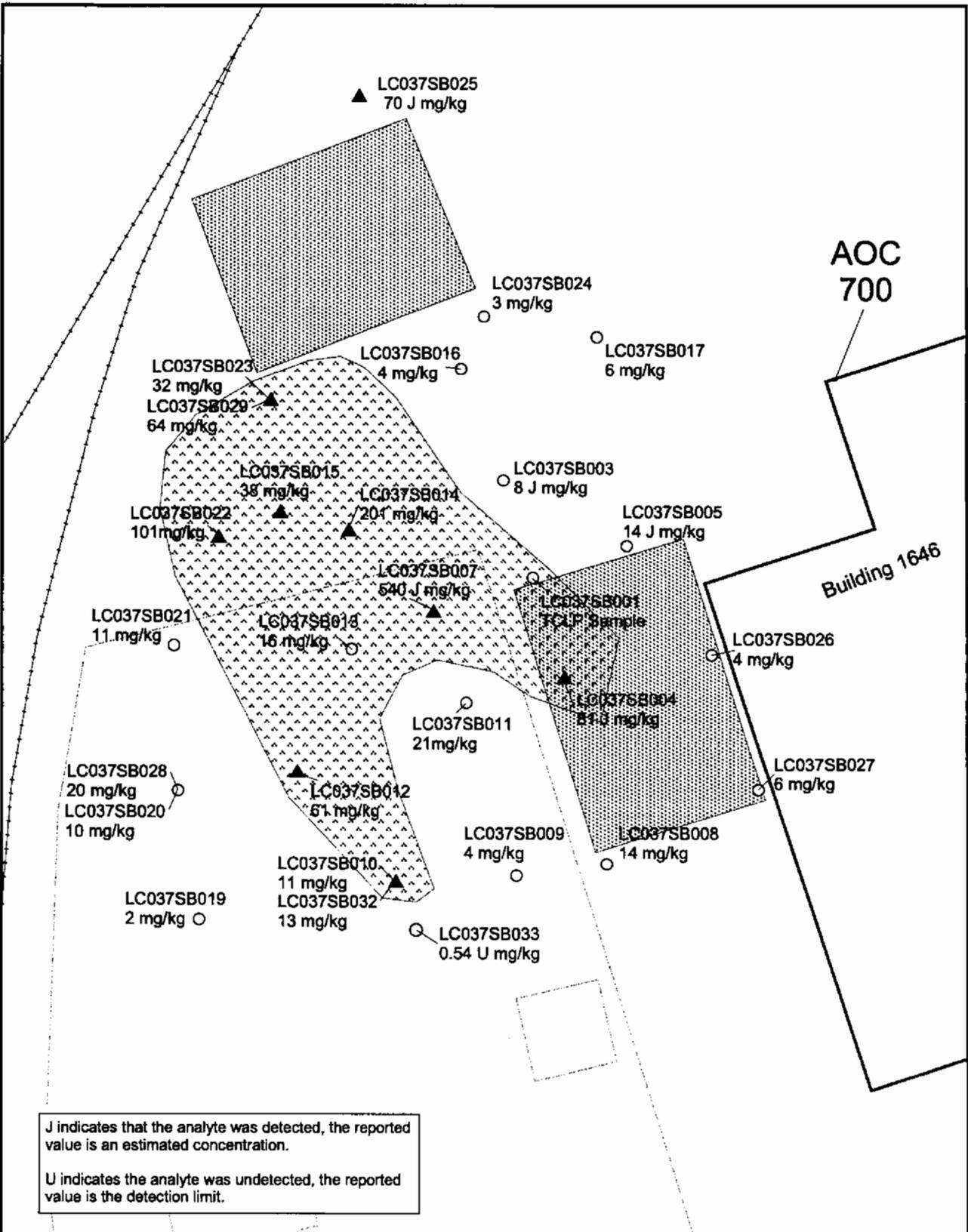


Figure 3-1
Target Surface Soil Excavation Area
AOC 700, Zone C
Charleston Naval Complex

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Interim Measures Subsurface Soil Sample Locations

- ▲ Arsenic Concentrations Above 29 mg/kg
- Arsenic Concentrations Below 29 mg/kg
- ▨ Subsurface Excavation Area
- ▩ Concrete Slab
- ▭ AOC Boundary / Building Boundary
- Railroads
- Pavement

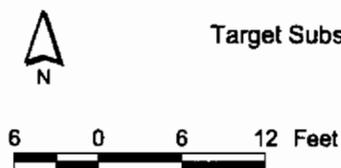
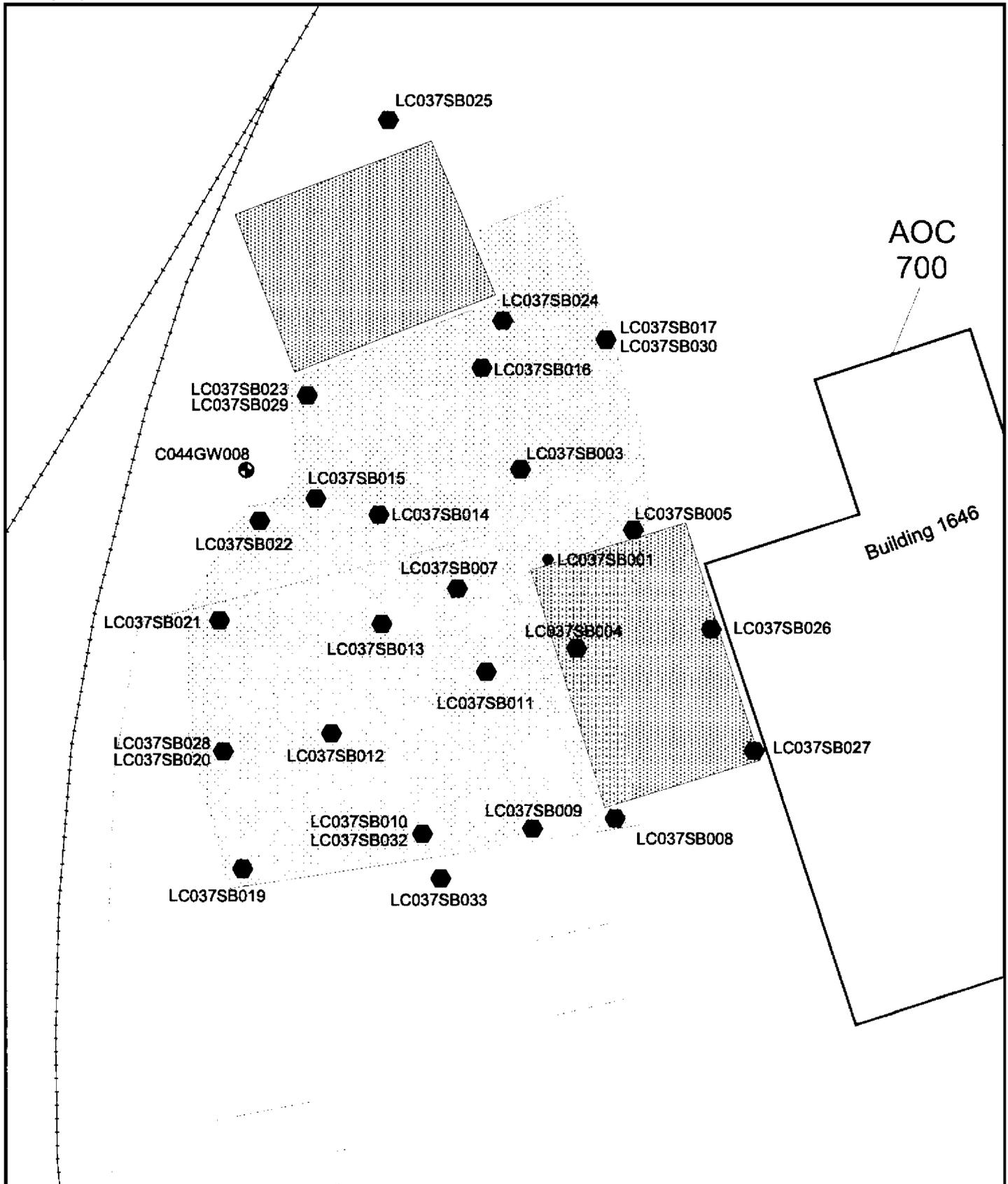


Figure 3-2
 Target Subsurface Soil Excavation Area
 AOC 700, Zone C
 Charleston Naval Complex

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NOTE: Original figure created in color



- | | |
|--|---|
| <p>Interim Measures Surface Soil Samples</p> <ul style="list-style-type: none"> ● Arsenic Concentrations Below 14.2 mg/kg ● Arsenic Concentrations Above 14.2 mg/kg <p>Interim Measures Subsurface Soil Samples</p> <ul style="list-style-type: none"> ● Arsenic Concentrations Below 29 mg/kg ● Arsenic Concentrations Above 29 mg/kg | <ul style="list-style-type: none"> ⊕ Groundwater Well ⚡ Railroads ▭ Pavement ▭ AOC Boundary / Building Boundary ▨ Concrete Slab ▨ Excavation Area |
|--|---|

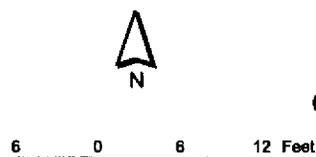


Figure 3-3
Actual Excavation Area
AOC 700, Zone C
Charleston Naval Complex

CH2MHILL

Section 4.0

1 4.0 Remaining Site Issues

2 The IM Work Plan for AOC 700 (Revision 0) was submitted on October 27, 2000, by CH2M-
3 Jones. SCDHEC issued comments on the Work Plan on December 7, 2000. The responses to
4 SCDHEC's comments, which addressed the residual issues in relation to AOC 700, are
5 included in Appendix D of this IM Completion Report.

6 All of SCDHEC's comments have been addressed completely in this completion report or in
7 the response to comments.

8 Because the data support the conclusion that AOC 700 has been adequately remediated,
9 CH2M-Jones recommends that the status of the site be changed to No Further Action
10 (NFA).

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

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

21 Information regarding these closeout issues was provided previously in Section 4.0 of the
22 IM Work Plan for AOC 700 (Revision 0) (CH2M-Jones, 2000).

Section 5.0

1 **5.0 References**

- 2 CH2M-Jones. *Interim Measure Work Plan – AOC 700, Building 1646, Zone C, Charleston Naval*
3 *Complex*. Revision 0. October 2000.
- 4 CH2M-Jones. Results for Additional Background PAH Sampling from CNC Main Base
5 Railroad Lines and Annex (Zone K). Technical Memorandum. August 2001.
- 6 EnSafe Inc. *Zone C RFI Report, NAVBASE Charleston*. Revision 0. 1997.
- 7 U.S. Environmental Protection Agency. Soil Screening Guidance. Technical Background
8 Document. May 1996.

Appendix A

Analytical Data Summary

09/27/2001 11:38 AM

	StationID	LC037SB014	LC037SB014
	SampleID	037SB01401 (0-1ft)	037SB01402 (3-5ft)
	DateCollected	03/01/2001 0:00	03/01/2001 0:00
	DateAnalyzed	03/19/2001	03/17/2001
	SDGNumber	39025	39025
Parameter	Units		
2,4,5-T	mg/kg	0.0197 U	0.022 U
2,4,5-TP (Silvex)	mg/kg	0.0173 U	0.0192 U
2,4-D	mg/kg	0.0194 J	0.0765 U
Dinoseb	mg/kg	0.0456 U	0.0508 U

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB001	LC037SB003	LC037SB003	LC037SB004	LC037SB004
SampleID	037SB00101 (0-1ft)	037SB00301 (0-1ft)	037SB00302 (3-5ft)	037SB00401 (0-1ft)	037SB00402 (3-5ft)
DateCollected	01/31/2001 0:00	01/31/2001 0:00	01/31/2001 0:00	01/31/2001 0:00	01/31/2001 0:00
DateAnalyzed	02/03/2001	02/02/2001	02/02/2001	02/03/2001	02/03/2001
SDGNumber	37107	37107	37107	37107	37107
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	5.43 J	30.2 J	7.8 J	5.29 J 81.1 J
Barium	mg/kg	42 J			
Cadmium	mg/kg	0.38 J			
Chromium, Total	mg/kg	32.6 J			
Lead	mg/kg	248 J			
Mercury	mg/kg	0.153 J			
Selenium	mg/kg	0.31 J			
Silver	mg/kg	0.07 U			
Arsenic(TCLP)	ug/L				
Barium(TCLP)	ug/L				
Cadmium(TCLP)	ug/L				
Chromium, Total(TCLP)	ug/L				
Lead(TCLP)	ug/L				
Mercury(TCLP)	ug/L				
Selenium(TCLP)	ug/L				
Silver(TCLP)	ug/L				

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB005	LC037SB005	LC037SB007	LC037SB007	LC037SB008
SampleID	037SB00501 (0-1ft)	037SB00502 (3-5ft)	037SB00701 (0-1ft)	037SB00702 (3-5ft)	037SB00802 (3-5ft)
DateCollected	01/31/2001 0:00	01/31/2001 0:00	01/31/2001 0:00	01/31/2001 0:00	05/02/2001 0:00
DateAnalyzed	02/03/2001	02/03/2001	02/03/2001	02/03/2001	05/07/2001
SDGNumber	37107	37107	37107	37107	41626
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	6.66 J	14.1 J	158 J	540 J 13.9 =
Barium	mg/kg				
Cadmium	mg/kg				
Chromium, Total	mg/kg				
Lead	mg/kg				
Mercury	mg/kg				
Selenium	mg/kg				
Silver	mg/kg				
Arsenic(TCLP)	ug/L			25.2 J	
Barium(TCLP)	ug/L			102 J	
Cadmium(TCLP)	ug/L			3.61 U	
Chromium, Total(TCLP)	ug/L			6.97 U	
Lead(TCLP)	ug/L			22.5 U	
Mercury(TCLP)	ug/L			0.48 U	
Selenium(TCLP)	ug/L			23.7 U	
Silver(TCLP)	ug/L			6.18 U	

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB008	LC037SB009	LC037SB009	LC037SB010	LC037SB010
SampleID	037SB00803 (1-3ft)	037SB00901 (0-1ft)	037SB00902 (3-5ft)	037SB01001 (0-1ft)	037SB01002 (3-5ft)
DateCollected	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00
DateAnalyzed	03/02/2001	03/02/2001	03/02/2001	03/02/2001	03/02/2001
SDGNumber	38495	38495	38495	38495	38495
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	5.93 =	7.21 =	4.35 =	11.3 =
Barium	mg/kg				
Cadmium	mg/kg				
Chromium, Total	mg/kg				
Lead	mg/kg				
Mercury	mg/kg				
Selenium	mg/kg				
Silver	mg/kg				
Arsenic(TCLP)	ug/L				
Barium(TCLP)	ug/L				
Cadmium(TCLP)	ug/L				
Chromium, Total(TCLP)	ug/L				
Lead(TCLP)	ug/L				
Mercury(TCLP)	ug/L				
Selenium(TCLP)	ug/L				
Silver(TCLP)	ug/L				

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB011	LC037SB011	LC037SB012	LC037SB012	LC037SB013
SampleID	037SB01101 (0-1ft)	037SB01102 (3-5ft)	037SB01201 (0-1ft)	037SB01202 (3-5ft)	037SB01301 (0-1ft)
DateCollected	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00
DateAnalyzed	03/02/2001	03/02/2001	03/02/2001	03/02/2001	03/02/2001
SDGNumber	38495	38495	38495	38495	38495
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	56.3 =	20.7 =	13 =	60.6 = 17.9 =
Barium	mg/kg				
Cadmium	mg/kg				
Chromium, Total	mg/kg				
Lead	mg/kg				
Mercury	mg/kg				
Selenium	mg/kg				
Silver	mg/kg				
Arsenic(TCLP)	ug/L				
Barium(TCLP)	ug/L				
Cadmium(TCLP)	ug/L				
Chromium, Total(TCLP)	ug/L				
Lead(TCLP)	ug/L				
Mercury(TCLP)	ug/L				
Selenium(TCLP)	ug/L				
Silver(TCLP)	ug/L				

Analytical Data Summary

09/27/2001 11:39 AM

	StationID	LC037SB013	LC037SB014	LC037SB014	LC037SB015	LC037SB015
	SampleID	037SB01302 (3-5ft)	037SB01401 (0-1ft)	037SB01402 (3-5ft)	037SB01501 (0-1ft)	037SB01502 (3-5ft)
	DateCollected	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00
	DateAnalyzed	03/02/2001	03/02/2001	03/02/2001	03/02/2001	03/02/2001
	SDGNumber	38495	38495	38495	38495	38495
Parameter	Units					
Arsenic	mg/kg					
Arsenic	mg/kg	15.9 =	184 =	201 =	20.8 =	37.7 =
Barium	mg/kg					
Cadmium	mg/kg					
Chromium, Total	mg/kg					
Lead	mg/kg					
Mercury	mg/kg					
Selenium	mg/kg					
Silver	mg/kg					
Arsenic(TCLP)	ug/L					
Barium(TCLP)	ug/L					
Cadmium(TCLP)	ug/L					
Chromium, Total(TCLP)	ug/L					
Lead(TCLP)	ug/L					
Mercury(TCLP)	ug/L					
Selenium(TCLP)	ug/L					
Silver(TCLP)	ug/L					

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB016	LC037SB016	LC037SB017	LC037SB017	LC037SB018
SampleID	037SB01601 (0-1ft)	037SB01602 (3-5ft)	037SB01701 (0-1ft)	037SB01702 (3-5ft)	037SB01802 (3-5ft)
DateCollected	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00	03/01/2001 0:00
DateAnalyzed	03/02/2001	03/02/2001	03/02/2001	03/02/2001	03/06/2001
SDGNumber	38495	38495	38495	38495	38500
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	19 =	3.99 =	2.15 =	5.76 =
Barium	mg/kg				
Cadmium	mg/kg				
Chromium, Total	mg/kg				
Lead	mg/kg				
Mercury	mg/kg				
Selenium	mg/kg				
Silver	mg/kg				
Arsenic(TCLP)	ug/L				
Barium(TCLP)	ug/L				
Cadmium(TCLP)	ug/L				
Chromium, Total(TCLP)	ug/L				
Lead(TCLP)	ug/L				
Mercury(TCLP)	ug/L				
Selenium(TCLP)	ug/L				
Silver(TCLP)	ug/L				
					0.573 U

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB018	LC037SB019	LC037SB019	LC037SB020	LC037SB020
SampleID	037SB01802 (3-5ft)	037SB01901 (0-1ft)	037SB01902 (3-5ft)	037SB02001 (0-1ft)	037SB02002 (3-5ft)
DateCollected	03/01/2001 0:00	03/09/2001 0:00	03/09/2001 0:00	03/09/2001 0:00	03/09/2001 0:00
DateAnalyzed	03/06/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001
SDGNumber	38500	38953	38953	38953	38953
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	9.23 =	2.15 =	14.7 =	10.1 =
Barium	mg/kg				
Cadmium	mg/kg				
Chromium, Total	mg/kg				
Lead	mg/kg				
Mercury	mg/kg				
Selenium	mg/kg				
Silver	mg/kg				
Arsenic(TCLP)	ug/L	23.3 U			
Barium(TCLP)	ug/L	141 =			
Cadmium(TCLP)	ug/L	71.7 =			
Chromium, Total(TCLP)	ug/L	6.17 J			
Lead(TCLP)	ug/L	22.4 U			
Mercury(TCLP)	ug/L				
Selenium(TCLP)	ug/L	29.3 U			
Silver(TCLP)	ug/L	8.71 U			

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB021	LC037SB021	LC037SB022	LC037SB022	LC037SB023
SampleID	037SB02101 (0-1ft)	037SB02102 (3-5ft)	037SB02201 (0-1ft)	037SB02202 (3-5ft)	037SB02301 (0-1ft)
DateCollected	03/09/2001 0:00	03/09/2001 0:00	03/09/2001 0:00	03/09/2001 0:00	03/09/2001 0:00
DateAnalyzed	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/12/2001
SDGNumber	38953	38953	38953	38953	38953
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	22.7 =	10.7 =	58.4 =	101 =
Barium	mg/kg				
Cadmium	mg/kg				
Chromium, Total	mg/kg				
Lead	mg/kg				
Mercury	mg/kg				
Selenium	mg/kg				
Silver	mg/kg				
Arsenic(TCLP)	ug/L				
Barium(TCLP)	ug/L				
Cadmium(TCLP)	ug/L				
Chromium, Total(TCLP)	ug/L				
Lead(TCLP)	ug/L				
Mercury(TCLP)	ug/L				
Selenium(TCLP)	ug/L				
Silver(TCLP)	ug/L				

Analytical Data Summary

09/27/2001 11:39 AM

StationID	LC037SB023	LC037SB024	LC037SB024	LC037SB025	LC037SB025
SampleID	037SB02302 (3-5ft)	037SB02401 (0-1ft)	037SB02402 (3-5ft)	037SB02501 (0-1ft)	037SB02501 (0-1ft)
DateCollected	03/09/2001 0:00	03/09/2001 0:00	03/09/2001 0:00	03/28/2001 0:00	03/28/2001 0:00
DateAnalyzed	03/12/2001	03/12/2001	03/12/2001	03/12/2001	03/13/2001
SDGNumber	38953	38953	38953	38953	38953
Parameter	Units				
Arsenic	mg/kg				
Arsenic	mg/kg	31.8 =	4.02 =	3.2 =	31.6 =
Barium	mg/kg				52.9 J
Cadmium	mg/kg				0.701 =
Chromium, Total	mg/kg				75 J
Lead	mg/kg				69.1 =
Mercury	mg/kg				
Selenium	mg/kg				0.969 =
Silver	mg/kg				0.1 U
Arsenic(TCLP)	ug/L				
Barium(TCLP)	ug/L				
Cadmium(TCLP)	ug/L				
Chromium, Total(TCLP)	ug/L				
Lead(TCLP)	ug/L				
Mercury(TCLP)	ug/L				
Selenium(TCLP)	ug/L				
Silver(TCLP)	ug/L				

Analytical Data Summary

09/27/2001 11:39 AM

	StationID	LC037SB025	LC037SB025	LC037SB026	LC037SB026	LC037SB026
	SampleID	037SB02501 (0-1ft)	037SB02502 (3-5ft)	037CB02602 (3-5ft)	037SB02601 (0-1ft)	037SB02602 (3-5ft)
	DateCollected	03/28/2001 0:00	03/28/2001 0:00	05/02/2001 0:00	05/02/2001 0:00	05/02/2001 0:00
	DateAnalyzed	04/03/2001	04/03/2001	05/07/2001	05/07/2001	05/07/2001
	SDGNumber	39984	39984	41626	41626	41626
Parameter	Units					
Arsenic	mg/kg					
Arsenic	mg/kg	38.6 J	70 J	5.57 =	2.43 =	4.28 =
Barium	mg/kg					
Cadmium	mg/kg					
Chromium, Total	mg/kg					
Lead	mg/kg					
Mercury	mg/kg					
Selenium	mg/kg					
Silver	mg/kg					
Arsenic(TCLP)	ug/L					
Barium(TCLP)	ug/L					
Cadmium(TCLP)	ug/L					
Chromium, Total(TCLP)	ug/L					
Lead(TCLP)	ug/L					
Mercury(TCLP)	ug/L					
Selenium(TCLP)	ug/L					
Silver(TCLP)	ug/L					

Analytical Data Summary

09/27/2001 11:39 AM

	StationID	LC037SB027	LC037SB027	LC037SB028	LC037SB028	LC037SB029
	SampleID	037SB02701 (0-1ft)	037SB02702 (3-5ft)	037SB02801 (0-1ft)	037SB02802 (3-5ft)	037SB02901 (0-1ft)
	DateCollected	05/02/2001 0:00	05/02/2001 0:00	05/02/2001 0:00	05/02/2001 0:00	05/02/2001 0:00
	DateAnalyzed	05/07/2001	05/07/2001	05/07/2001	05/07/2001	05/07/2001
	SDGNumber	41626	41626	41626	41626	41626
Parameter	Units					
Arsenic	mg/kg	6.15 =	5.98 =	24.6 =	19.5 =	33.1 =
Arsenic	mg/kg					
Barium	mg/kg					
Cadmium	mg/kg					
Chromium, Total	mg/kg					
Lead	mg/kg					
Mercury	mg/kg					
Selenium	mg/kg					
Silver	mg/kg					
Arsenic(TCLP)	ug/L					
Barium(TCLP)	ug/L					
Cadmium(TCLP)	ug/L					
Chromium, Total(TCLP)	ug/L					
Lead(TCLP)	ug/L					
Mercury(TCLP)	ug/L					
Selenium(TCLP)	ug/L					
Silver(TCLP)	ug/L					

Analytical Data Summary

09/27/2001 11:39 AM

Parameter	Units	
StationID		LC037SB029
SampleID		037SB02902 (3-5ft)
DateCollected		05/02/2001 0:00
DateAnalyzed		05/07/2001
SDGNumber		41626
Arsenic	mg/kg	
Arsenic	mg/kg	64.3 =
Barium	mg/kg	
Cadmium	mg/kg	
Chromium, Total	mg/kg	
Lead	mg/kg	
Mercury	mg/kg	
Selenium	mg/kg	
Silver	mg/kg	
Arsenic(TCLP)	ug/L	
Barium(TCLP)	ug/L	
Cadmium(TCLP)	ug/L	
Chromium, Total(TCLP)	ug/L	
Lead(TCLP)	ug/L	
Mercury(TCLP)	ug/L	
Selenium(TCLP)	ug/L	
Silver(TCLP)	ug/L	

Analytical Data Summary

09/27/2001 11:39 AM

	StationID	LC037SB014	LC037SB014	LC037SB026	LC037SB026
	SampleID	037SB01401 (0-1ft)	037SB01402 (3-5ft)	037CB02602 (3-5ft)	037SB02601 (0-1ft)
	DateCollected	03/01/2001 0:00	03/01/2001 0:00	05/02/2001 0:00	05/02/2001 0:00
	DateAnalyzed	03/26/2001	03/27/2001	05/08/2001	05/08/2001
	SDGNumber	39025	39025	S112750	S112750
Parameter	Units				
Aldrin	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Alpha BHC (Alpha Hexachlorocyclohexane)	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Alpha-chlordane	mg/kg	1.6 U	0.0891 U	0.032 U	0.0089 =
Beta BHC (Beta Hexachlorocyclohexane)	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Chlordane	mg/kg	1.6 U	0.0891 U	0.32 U	0.026 U
Delta BHC (Delta Hexachlorocyclohexane)	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Dieldrin	mg/kg	3.08 U	0.172 U	0.062 U	0.0083 =
Endosulfan I	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Endosulfan II	mg/kg	3.08 U	0.172 U	0.062 U	0.005 U
Endosulfan Sulfate	mg/kg	3.08 U	0.172 U	0.062 U	0.005 U
Endrin	mg/kg	3.08 U	0.172 U	0.062 U	0.005 U
Endrin Aldehyde	mg/kg	3.08 U	0.172 U	0.062 U	0.005 U
Endrin Ketone	mg/kg	3.08 U	0.172 U	0.062 U	0.005 U
Gamma BHC (Lindane)	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Gamma-chlordane	mg/kg	1.6 U	0.0891 U	0.032 U	0.0094 =
Heptachlor	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Heptachlor Epoxide	mg/kg	1.6 U	0.0891 U	0.032 U	0.0026 U
Methoxychlor	mg/kg	16 U	0.891 U	0.32 U	0.026 U
p,p'-DDD	mg/kg	3.08 U	0.172 U	0.1 =	0.005 U
p,p'-DDE	mg/kg	3.08 U	0.172 U	0.062 U	0.018 =
p,p'-DDT	mg/kg	3.08 U	0.172 U	0.062 U	0.028 =
Toxaphene	mg/kg	275 =	14 =	2.1 U	0.17 U
Chlordane(TCLP)	ug/L				
Endrin(TCLP)	ug/L				
Gamma BHC (Lindane)(TCLP)	ug/L				
Heptachlor Epoxide(TCLP)	ug/L				
Heptachlor(TCLP)	ug/L				
Methoxychlor(TCLP)	ug/L				
Toxaphene(TCLP)	ug/L				

Analytical Data Summary

09/27/2001 11:39 AM

	StationID	LC037SB026	LC037SB028	LC037SB028	LC037SB029
	SampleID	037SB02602 (3-5ft)	037SB02801 (0-1ft)	037SB02802 (3-5ft)	037SB02901 (0-1ft)
	DateCollected	05/02/2001 0:00	05/02/2001 0:00	05/02/2001 0:00	05/02/2001 0:00
	DateAnalyzed	05/08/2001	05/08/2001	05/08/2001	05/14/2001
	SDGNumber	S112750	S112750	S112750	S112882
Parameter	Units				
Aldrin	mg/kg	0.032 U	0.0026 U	0.0013 U	0.00038 J
Alpha BHC (Alpha Hexachlorocyclohexane)	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Alpha-chlordane	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Beta BHC (Beta Hexachlorocyclohexane)	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Chlordane	mg/kg	0.32 U	0.026 U	0.013 U	0.028 U
Delta BHC (Delta Hexachlorocyclohexane)	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Dieldrin	mg/kg	0.062 U	0.005 U	0.0025 U	0.0076 J
Endosulfan I	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Endosulfan II	mg/kg	0.062 U	0.005 U	0.0025 U	0.0054 U
Endosulfan Sulfate	mg/kg	0.062 U	0.005 U	0.0025 U	0.0054 U
Endrin	mg/kg	0.062 U	0.005 U	0.0025 U	0.0054 U
Endrin Aldehyde	mg/kg	0.062 U	0.005 U	0.0025 U	0.0054 U
Endrin Ketone	mg/kg	0.062 U	0.005 U	0.0025 U	0.0054 U
Gamma BHC (Lindane)	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Gamma-chlordane	mg/kg	0.11 =	0.0046 =	0.0036 =	0.00052 J
Heptachlor	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Heptachlor Epoxide	mg/kg	0.032 U	0.0026 U	0.0013 U	0.0028 U
Methoxychlor	mg/kg	0.32 U	0.026 U	0.013 U	0.028 U
p,p'-DDD	mg/kg	0.11 =	0.005 U	0.0045 =	0.0054 U
p,p'-DDE	mg/kg	0.062 U	0.014 =	0.017 =	0.014 =
p,p'-DDT	mg/kg	0.062 U	0.034 =	0.033 =	0.032 =
Toxaphene	mg/kg	2.1 U	0.17 U	0.083 U	0.18 U
Chlordane(TCLP)	ug/L				
Endrin(TCLP)	ug/L				
Gamma BHC (Lindane)(TCLP)	ug/L				
Heptachlor Epoxide(TCLP)	ug/L				
Heptachlor(TCLP)	ug/L				
Methoxychlor(TCLP)	ug/L				
Toxaphene(TCLP)	ug/L				

Analytical Data Summary

09/27/2001 11:39 AM

	StationID	LC037SB029	LC037SB030	LC037SB031
	SampleID	037SB02902 (3-5ft)	037SB03001 (0-1ft)	037SB03101 (0-1ft)
	DateCollected	05/02/2001 0:00	05/02/2001 0:00	05/02/2001 0:00
	DateAnalyzed	05/14/2001	05/08/2001	05/09/2001
	SDGNumber	S112882	S112750	S112750
Parameter	Units			
Aldrin	mg/kg	0.003 U	0.0013 U	
Alpha BHC (Alpha Hexachlorocyclohexane)	mg/kg	0.003 U	0.0013 U	
Alpha-chlordane	mg/kg	0.00057 J	0.0013 U	
Beta BHC (Beta Hexachlorocyclohexane)	mg/kg	0.003 U	0.0013 U	
Chlordane	mg/kg	0.03 U	0.013 U	
Delta BHC (Delta Hexachlorocyclohexane)	mg/kg	0.003 U	0.0013 U	
Dieldrin	mg/kg	0.0022 J	0.0025 U	
Endosulfan I	mg/kg	0.003 U	0.0013 U	
Endosulfan II	mg/kg	0.0059 U	0.0025 U	
Endosulfan Sulfate	mg/kg	0.0059 U	0.0025 U	
Endrin	mg/kg	0.0059 U	0.0025 U	
Endrin Aldehyde	mg/kg	0.0059 U	0.0025 U	
Endrin Ketone	mg/kg	0.0059 U	0.0025 U	
Gamma BHC (Lindane)	mg/kg	0.003 U	0.0013 U	
Gamma-chlordane	mg/kg	0.0026 J	0.0013 U	
Heptachlor	mg/kg	0.003 U	0.0013 U	
Heptachlor Epoxide	mg/kg	0.003 U	0.0013 U	
Methoxychlor	mg/kg	0.03 U	0.013 U	
p,p'-DDD	mg/kg	0.0059 U	0.0025 U	
p,p'-DDE	mg/kg	0.038 =		
p,p'-DDT	mg/kg	0.058 =		
Toxaphene	mg/kg	0.2 U	0.083 U	
Chlordane(TCLP)	ug/L			20 U
Endrin(TCLP)	ug/L			2 U
Gamma BHC (Lindane)(TCLP)	ug/L			2 U
Heptachlor Epoxide(TCLP)	ug/L			2 U
Heptachlor(TCLP)	ug/L			2 U
Methoxychlor(TCLP)	ug/L			20 U
Toxaphene(TCLP)	ug/L			100 U

Appendix B

Data Validation Summary - Charleston Naval Complex - Zone C

TO: Jim Edens/CH2M HILL/GNV
FROM: Herb Kelly/CH2M HILL/GNA
DATE: October 2, 2001

The purpose of this memorandum is to present the results of the data validation process for the samples collected at AOC 700 in Zone C. The samples were collected between the dates of January 31 and August 30, 2001.

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

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

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8081 Organochlorine Pesticides, SW-846 8151 Herbicides, and Metals following SW-846 6010/7000 Series methodology. A single sample was also submitted for the Toxicity Characteristic Leaching Procedure (TCLP) and then analyzing the "leachate" for the RCRA Metals.

Samples were submitted to Severn Trent Services, STL Savannah Laboratories, Inc., in Savannah, Georgia for the following analyses: SW-846 8270 Semivolatile Organic Compounds (SVOC) and Metals following SW-846 6010/7000 Series methodology. A single sample was also submitted for the Toxicity Characteristic Leaching Procedure (TCLP) and then analyzing the "leachate" for Pesticides.

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

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

The following primary flags were used to qualify the data:

- [=] Detected. The analyte was analyzed for and detected at the concentration shown.
- [J] Estimated. The analyte was present but the reported value may not be accurate or precise.
- [U] Undetected. The analyte was analyzed for but not detected above the method detection limit.
- [UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.
- [R] Rejected. The data is not useable.

Secondary Data Validation Qualifiers

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

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

TABLE 1
 Chemical Analytical Methods – Field and Quality Control Samples
 Charleston Naval Complex, Zone C, AOC 700, Charleston, SC

SDG	Station ID	Sample ID	Lab Sample ID	Date Collected	Matrix	Sample Type	Upper Depth	Lower Depth	SW6010 TCLP Metals	SW6010 Arsenic	SW6010 RCRA Metals	SW8081 TCLP Pesticides	SW8081 Pesticides	SW8151 Herbicides
37107	LC037SB001	037SB00101	37107009	01/31/2001	SO	N	0	1			X			
37107	LC037SB003	037SB00301	37107001	01/31/2001	SO	N	0	1		X				
37107	LC037SB003	037SB00302	37107002	01/31/2001	SO	N	3	5		X				
37107	LC037SB004	037SB00401	37107003	01/31/2001	SO	N	0	1		X				
37107	LC037SB004	037SB00402	37107004	01/31/2001	SO	N	3	5		X				
37107	LC037SB005	037SB00501	37107005	01/31/2001	SO	N	0	1		X				
37107	LC037SB005	037SB00502	37107006	01/31/2001	SO	N	3	5		X				
37107	LC037SB007	037SB00701	37107007	01/31/2001	SO	N	0	1		X				
37107	LC037SB007	037SB00702	37107008	01/31/2001	SO	N	3	5		X				
37108	LC037EB003	037EB003L1	37108001	01/31/2001	SQ	EB					X			
38495	LC037SB008	037SB00803	38495001	03/01/2001	SO	N	1	3		X				
38495	LC037SB009	037SB00901	38495002	03/01/2001	SO	N	0	1		X				
38495	LC037SB009	037SB00902	38495003	03/01/2001	SO	N	3	5		X				
38495	LC037SB010	037SB01001	38495004	03/01/2001	SO	N	0	1		X				
38495	LC037SB010	037SB01002	38495005	03/01/2001	SO	N	3	5		X				

TABLE 1
 Chemical Analytical Methods – Field and Quality Control Samples
 Charleston Naval Complex, Zone C, AOC 700, Charleston, SC

SDG	Station ID	Sample ID	Lab Sample ID	Date Collected	Matrix	Sample Type	Upper Depth	Lower Depth	SW6010 TCLP Metals	SW6010 Arsenic	SW6010 RCRA Metals	SW8081 TCLP Pesticides	SW8081 Pesticides	SW8151 Herbicides
38495	LC037SB011	037SB01101	38495006	03/01/2001	SO	N	0	1		X				
38495	LC037SB011	037SB01102	38495007	03/01/2001	SO	N	3	5		X				
38495	LC037SB012	037SB01201	38495008	03/01/2001	SO	N	0	1		X				
38495	LC037SB012	037SB01202	38495009	03/01/2001	SO	N	3	5		X				
38495	LC037SB013	037SB01301	38495010	03/01/2001	SO	N	0	1		X				
38495	LC037SB013	037SB01302	38495011	03/01/2001	SO	N	3	5		X				
38495	LC037SB014	037SB01401	38495012	03/01/2001	SO	N	0	1		X				
38495	LC037SB014	037SB01402	38495013	03/01/2001	SO	N	3	5		X				
38495	LC037SB015	037SB01501	38495014	03/01/2001	SO	N	0	1		X				
38495	LC037SB015	037SB01502	38495015	03/01/2001	SO	N	3	5		X				
38495	LC037SB016	037SB01601	38495016	03/01/2001	SO	N	0	1		X				
38495	LC037SB016	037SB01602	38495017	03/01/2001	SO	N	3	5		X				
38495	LC037SB017	037SB01701	38495018	03/01/2001	SO	N	0	1		X				
38495	LC037SB017	037SB01702	38495019	03/01/2001	SO	N	3	5		X				
38498	LC037ES008	037ES008L1	38498001	03/01/2001	WQ	EB				X				
38500	LC037SB018	037SB01802	38500001	03/01/2001	SO	N	3	5	X					
38953	LC037SB019	037SB01901	38953001	03/09/2001	SO	N	0	1		X				
38953	LC037SB019	037SB01902	38953002	03/09/2001	SO	N	3	5		X				
38953	LC037SB020	037SB02001	38953003	03/09/2001	SO	N	0	1		X				

TABLE 1
 Chemical Analytical Methods – Field and Quality Control Samples
 Charleston Naval Complex, Zone C, AOC 700, Charleston, SC

SDG	Station ID	Sample ID	Lab Sample ID	Date Collected	Matrix	Sample Type	Upper Depth	Lower Depth	SW6010 TCLP Metals	SW6010 Arsenic	SW6010 RCRA Metals	SW8081 TCLP Pesticides	SW8081 Pesticides	SW8151 Herbicides
38953	LC037SB020	037SB02002	38953004	03/09/2001	SO	N	3	5		X				
38953	LC037SB021	037SB02101	38953005	03/09/2001	SO	N	0	1		X				
38953	LC037SB021	037SB02102	38953006	03/09/2001	SO	N	3	5		X				
38953	LC037SB022	037SB02201	38953007	03/09/2001	SO	N	0	1		X				
38953	LC037SB022	037SB02202	38953008	03/09/2001	SO	N	3	5		X				
38953	LC037SB023	037SB02301	38953009	03/09/2001	SO	N	0	1		X				
38953	LC037SB023	037SB02302	38953010	03/09/2001	SO	N	3	5		X				
38953	LC037SB024	037SB02401	38953011	03/09/2001	SO	N	0	1		X				
38953	LC037SB024	037SB02402	38953012	03/09/2001	SO	N	3	5		X				
38953	LC037SB025	037SB02501	38953013	03/28/2001	SO	N	0	1			X			
39025	LC037SB014	037SB01401	39025001	03/01/2001	SO	N	0	1					X	X
39025	LC037SB014	037SB01402	39025002	03/01/2001	SO	N	3	5					X	X
39984	LC037SB025	037SB02501	39984001	03/28/2001	SO	N	0	1		X				
39984	LC037SB025	037SB02502	39984002	03/28/2001	SO	N	3	5		X				
41626	LC037SB026	037SB02601	41626001	05/02/2001	SO	N	0	1		X				
41626	LC037SB026	037SB02602	41626002	05/02/2001	SO	N	3	5		X				
41626	LC037SB026	037CB02602	41626003	05/02/2001	SO	FD	3	5		X				
41626	LC037SB028	037SB02801	41626004	05/02/2001	SO	N	0	1		X				
41626	LC037SB028	037SB02802	41626005	05/02/2001	SO	N	3	5		X				

TABLE 1

Chemical Analytical Methods – Field and Quality Control Samples
 Charleston Naval Complex, Zone C, AOC 700, Charleston, SC

SDG	Station ID	Sample ID	Lab Sample ID	Date Collected	Matrix	Sample Type	Upper Depth	Lower Depth	SW6010 TCLP Metals	SW6010 Arsenic	SW6010 RCRA Metals	SW8081 TCLP Pesticides	SW8081 Pesticides	SW8151 Herbicides
41626	LC037SB027	037SB02701	41626006	05/02/2001	SO	N	0	1		X				
41626	LC037SB027	037SB02702	41626007	05/02/2001	SO	N	3	5		X				
41626	LC037SB029	037SB02901	41626008	05/02/2001	SO	N	0	1		X				
41626	LC037SB029	037SB02902	41626009	05/02/2001	SO	N	3	5		X				
41626	LC037SB008	037SB00802	41626010	05/02/2001	SO	N	3	5		X				
CNC27	LC037SB032	037SB03201	S115634*1	08/30/2001	SO	N	0	1		X				
CNC27	LC037SB032	037SB03202	S115634*2	08/30/2001	SO	N	3	5		X				
CNC27	LC037SB033	037SB03301	S115634*3	08/30/2001	SO	N	0	1		X				
CNC27	LC037SB033	037CB03301	S115634*4	08/30/2001	SO	FD	0	1		X				
CNC27	LC037SB033	037SB03302	S115634*5	08/30/2001	SO	N	3	5		X				
CNC27	LC037EB032	037EB032L1	S115634*6	08/30/2001	WQ	EB				X				
S112750	LC037SB026	037SB02601	S112750*1	05/02/2001	SO	N	0	1					X	
S112750	LC037SB026	037SB02602	S112750*2	05/02/2001	SO	N	3	5					X	
S112750	LC037SB026	037CB02602	S112750*3	05/02/2001	SO	FD	3	5					X	
S112750	LC037SB028	037SB02801	S112750*4	05/02/2001	SO	N	0	1					X	
S112750	LC037SB028	037SB02802	S112750*5	05/02/2001	SO	N	3	5					X	
S112750	LC037SB030	037SB03001	S112750*6	05/02/2001	SO	N	0	1					X	
S112750	LC037SB031	037SB03101	S112750*7	05/02/2001	SO	N	0	1				X		
S112882	LC037SB029	037SB02901	S112882*1	05/02/2001	SO	N	0	1					X	

TABLE 1

Chemical Analytical Methods – Field and Quality Control Samples
 Charleston Naval Complex, Zone C, AOC 700, Charleston, SC

SDG	Station ID	Sample ID	Lab Sample ID	Date Collected	Matrix	Sample Type	Upper Depth	Lower Depth	SW6010 TCLP Metals	SW6010 Arsenic	SW6010 RCRA Metals	SW8081 TCLP Pesticides	SW8081 Pesticides	SW8151 Herbicides
S112882	LC037SB029	037SB02902	S112882*2	05/02/2001	SO	N	3	5					X	
S112930	LC037SB030	037SB03002	S112930*1	05/10/2001	SO	N	3	5					X	

MATRIX CODE

SO - Soil

WQ - Water QC Samples

SAMPLE TYPE CODE

EB - Equipment Blank

FD - Field Duplicate

N - Native Sample

Organic Parameters

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for organic data.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks and equipment blanks, were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **Internal Standards** – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.
- **Confirmation** – If GCMS methodology is not initially used for analysis, SW-846 method 8000 requires confirmation when the composition of samples is not well characterized.

Therefore, even when the identification has been confirmed on a dissimilar column or detector, the agreement of the quantitative results on both columns is evaluated. For Pesticide and PCB analyses covered in this report, confirmation was performed using a dissimilar analytical column. The laboratory analyzed samples with a gas chromatograph (GC) utilizing simultaneous primary and confirmation data acquisition. Per SW-86 method 8000, 40% RPD criteria was used as the acceptance limit.

Organochlorine Pesticide

The QA/QC parameters for the Organochlorine Pesticide analyses by method SW-846 8081 for all of the samples were within acceptable control limits, except as noted below:

Confirmation

All confirmation criteria met quality control limits, except as noted below.

- The Relative Percent Differences for Dieldrin, alpha-chlordane, and gamma-chlordane exceeded 40 percent for samples 037SB2901 and 037SB2902 in SDG S1-12882. The detected compounds were flagged "J", as estimated.

Herbicide Analyses

The QA/QC parameters for the Herbicide analyses by method SW-846 8151 for all of the samples were within acceptable control limits, except as noted below.

Recoveries - Surrogate, MS/MSD and LCS/LCSD

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) recoveries were within acceptable quality control limits, except as noted below.

- The Matrix Spike Duplicate sample in SDG 39025 was not spiked due to a laboratory error. However, as the recoveries for the Matrix Spike and LCSD samples were within QC limits, no flags were applied.

Inorganic Parameters

Quality Control Review

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

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

Metals Analyses

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

Blanks

The Metals target parameters detected in blank samples are listed in Table 2.

TABLE 2
Equipment Blank Contamination: Metals
Charleston Naval Complex, Zone C, AOC 700, Charleston, SC

SDG	Lab Sample ID	Sample ID	Sample Type	Parameter	Lab Result	Units	Flag Concentrations Less than
37107	1000156753	BLANK37107	LB	LEAD	1.1	mg/Kg	5.5 mg/Kg
37107		CCB	CCB	CADMIUM	0.435	ug/L	0.11 mg/Kg
37107		CCB	CCB	MERCURY	0.085	ug/L	0.02 mg/Kg
37108		C037EB003L1	EB	ARSENIC	3.85	ug/L	0.96 mg/Kg
37108		C037EB003L1	EB	CHROMIUM	0.76	ug/L	0.19 mg/Kg
38500	1000167420	BLANK38500a	LB	SILVER	10.6	ug/L	53 ug/L
38500	1000167420	BLANK38500a	LB	LEAD	26.7	ug/L	133.5 ug/L
38500	1000168099	BLANK38500b	LB	SELENIUM	30.5	ug/L	152.5 ug/L
38953		CCB	CCB	ARSENIC	2.5	ug/L	1.25 mg/Kg
38953	1000170377	BLANK38953	LB	BARIUM	0.023	mg/Kg	0.115 mg/Kg
38953		CCB	CCB	BARIUM	0.641	ug/L	0.321 mg/Kg
38953	1000170377	BLANK38953	LB	CHROMIUM	0.116	mg/Kg	0.58 mg/Kg
39984		ICB	ICB	ARSENIC	2.47	ug/L	0.62 mg/Kg
41626		CCB	CCB	ARSENIC	4.4	ug/L	1.1 mg/Kg

If a target parameter was reported in a field sample, and the concentration was below the level determined to be due to blank contamination (5 times the concentration in the associated QC blank samples), it was flagged as "U", not detected. Initial and continuing calibration blanks were also evaluated for possible contamination.

The results qualified due to blank contamination are listed in Attachment 1.

Recoveries/ Relative Percent Differences (RPDs) - MS/MSD and LCS/LCSD

All Matrix Spike (MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD) recoveries and Relative Percent Differences (RPDs) were within acceptable quality control limits, except as noted below.

TABLE 3
MS/MSD and LCS/LCSD Recoveries and RPDs Out of QC Limits: Metals
Charleston Naval Complex, Zone C, AOC 700, Charleston, SC

SDG	Sample	Parameter	MS Recovery	MSD Recovery	Recovery Limits	RPD	RPD Limits	Associated Samples
37107	#1 / C037SB00301	ARSENIC	81	175*	75-125	39*	20	37107-01-09
		BARIUM	123	128*	75-125			
		CADMIUM	139*	102	75-125			
		CHROMIUM	98	156*	75-125	22*	20	
		LEAD	131*	60	75-125	23*	20	
	#9 / C037SB00101	MERCURY	142*	95	75-125			37107-09
38953	#1 / C037SB01901	BARIUM	156*	113	75-125			38953-13
		CHROMIUM	157*	101	75-125			
		MERCURY	51*	105	75-125			
39984	#1 / C037SB02501	ARSENIC	176*	112	75-125	23.6*	20	39984-01-02

* - out of control limits

No flags were applied based upon RPD values out of QC limits alone, but in conjunction with recoveries.

Conclusion

A review of the analytical data submitted regarding the investigation of site AOC 700 in Zone C at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

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

Attachment 1 - Changed Qualifiers and Results
Zone C, AOC 700

SDG	Sample ID	Lab Sample ID	Matrix	Parameter Class	Analytical Method	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
37107	037SB00101	37107009	SO	METAL	SW6010	BARIUM	42	=	42	J	mg/Kg	MS
37107	037SB00101	37107009	SO	METAL	SW6010	CHROMIUM, TOTAL	32.6	=	32.6	J	mg/Kg	MS
37107	037SB00101	37107009	SO	METAL	SW6010	CADMIUM	0.38	=	0.38	J	mg/Kg	MS
37107	037SB00101	37107009	SO	METAL	SW6010	LEAD	248	=	248	J	mg/Kg	MS
37107	037SB00101	37107009	SO	METAL	SW6010	ARSENIC	5.43	=	5.43	J	mg/Kg	MD,MS
37107	037SB00101	37107009	SO	METAL	SW7471	MERCURY	0.153	=	0.153	J	mg/Kg	MS
37107	037SB00301	37107001	SO	METAL	SW6010	ARSENIC	30.2	=	30.2	J	mg/Kg	MD,MS
37107	037SB00302	37107002	SO	METAL	SW6010	ARSENIC	7.8	=	7.8	J	mg/Kg	MD,MS
37107	037SB00401	37107003	SO	METAL	SW6010	ARSENIC	5.29	=	5.29	J	mg/Kg	MD,MS
37107	037SB00402	37107004	SO	METAL	SW6010	ARSENIC	81.1	=	81.1	J	mg/Kg	MD,MS
37107	037SB00501	37107005	SO	METAL	SW6010	ARSENIC	6.66	=	6.66	J	mg/Kg	MD,MS
37107	037SB00502	37107006	SO	METAL	SW6010	ARSENIC	14.1	=	14.1	J	mg/Kg	MD,MS
37107	037SB00701	37107007	SO	METAL	SW6010	ARSENIC	158	=	158	J	mg/Kg	MD,MS
37107	037SB00702	37107008	SO	METAL	SW6010	ARSENIC	540	=	540	J	mg/Kg	MD,MS
38500	037SB01802	38500001	SO	METAL	SW6010	LEAD, TCLP	22.4	J	22.4	U	ug/L	BL
38953	037SB02501	38953013	SO	METAL	SW6010	BARIUM	52.9	=	52.9	J	mg/Kg	MS
38953	037SB02501	38953013	SO	METAL	SW6010	CHROMIUM, TOTAL	75	=	75	J	mg/Kg	MS
38953	037SB02501	38953013	SO	METAL	SW7471	MERCURY	0.248	=	0.248	J	mg/Kg	MS
39984	037SB02501	39984001	SO	METAL	SW6010	ARSENIC	38.6	=	38.6	J	mg/Kg	MD,MS
39984	037SB02502	39984002	SO	METAL	SW6010	ARSENIC	70	=	70	J	mg/Kg	MD,MS
S112882	037SB02901	S112882*1	SO	PEST	SW8081	DIELDRIN	7.6	=	7.6	J	ug/Kg	2C

Appendix C

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

6-5-01

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

Truck # 16 0700
1st load

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE Truck # 16

Date: 6/5/01 Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 937158 Tonnage: 24.85

Received by: [Signature] Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL

2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

6-5-01 0730
Truck # 31
2nd load

**SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002**

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 **Contact:** JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE **Truck #** 31

Date: 6-5-01 **Driver Signature:** [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL

Ticket Number: 851165 **Tonnage:** 15.68

Received by: [Signature] **Date:** 6/5/01

AOC 700



OAKRIDGE LANDFILL

2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

6-5-01 0746

Truck # 14
3rd load

**SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002**

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 **Contact:** JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE **Truck #** 14
Date: 6-5-01 **Driver Signature:** [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 851168 **Tonnage:** 16.88
Received by: [Signature] **Date:** 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

6-5-01 0803
Truck # 35
4th load

**SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002**

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE Truck # 35

Date: 6-5-01 Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 951122 Tonnage: 15.24
Received by: [Signature] Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2697 Fax 843-563-3375

6-5-01 0817
TRUCK # 30
5th load

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 **Contact:** JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE **Truck #** 30

Date: 6-5-01 **Driver Signature:** [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL

Ticket Number: 257176 **Tonnage:** 12.37

Received by: [Signature] **Date:** 6/5/01

AOC 700

Received by
BRC 0115



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

6-5-01 0933
Truck # 16
6th load

**SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002**

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE Truck # 16

Date: 6, 5, 201 Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL

Ticket Number: 951188 Tonnage: 23.48

Received by: [Signature] Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

6-5-01 1013

Truck #31

7th load

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

Generator: CHARLESTON NAVAL COMPLEX

Account Number: 490-439

Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)

Tele Number: 843-740-2780

Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE

Truck # 31

Date: 6-5-01

Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130

Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL

Ticket Number: 451197

Tonnage: 22.77

Received by: [Signature]

Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2607 Fax 843-563-3375

6-5-01 1035
Truck # 14
8th load

**SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002**

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE Truck # 14

Date: 6-5-01 Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 051199 Tonnage: 18.92
Received by: [Signature] Date: 6-5-01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

TRUCK # 35
6-5-01
1045
LOAD # 9

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE Truck # 35

Date: 6-5-01 Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL

Ticket Number: 05206 Tonnage: 1566

Received by: [Signature] Date: 6/5/01

FAXED

AOC 700



OAKRIDGE LANDFILL

2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

6-5-01
1100
Truck No: 30
10th load

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE Truck # 30

Date: 6-5-01 Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 00019 Tonnage: 12.76
Received by: nc Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2697 Fax 843-663-3375

TRUCK # 16

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

6-5-01

1215

Load # ^{Rec} to
11

Generator: CHARLESTON NAVAL COMPLEX

Account Number: 490-439

Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)

Tele Number: 843-740-2780

Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE

Truck # 16

Date: 6, 5, 2001

Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130

Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL

Ticket Number: 831228

Tonnage: 20.64

Received by: [Signature]

Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

Truck # 14
6-5-01
1245
BRC
HM load
12

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: BRC

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

Transporter of Waste: BUTLER WARE Truck # 14
Date: 6-5-01 Driver Signature: Anthony Brown

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 201235 Tonnage: 19.14
Received by: undated Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

Truck # 31
6-5-01
1300
Load # 13
R

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 **Contact:** JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE **Truck #** 31
Date: 6-5-01 **Driver Signature:** Thomas Bennett

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 051241 **Tonnage:** 21.50
Received by: nc **Date:** 6/5/01

AOC 700



OAKRIDGE LANDFILL
2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

TRUCK # 35
6-5-01
1305
Load # 13 14th
1 Q

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE Truck # 35

Date: 6-5-01 Driver Signature: [Signature] Hamilton

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 951244 Tonnage: 17.40
Received by: [Signature] Date: 6/5/01

AOC 700



OAKRIDGE LANDFILL

2183 Highway 78, Durham, NC 27437
Tel 919-863-2607 Fax 919-863-3378

1340

6-5-01

~~1235~~

Truck # ~~35~~ 30

~~14th~~

15th

**SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002**

Generator: CHARLESTON NAVAL COMPLEX
Account Number: 490-439
Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)
Tele Number: 843-740-2780 **Contact:** JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE **Truck #** 30

Date: 6-5-01 **Driver Signature:** [Signature]

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

Disposal Site: Oakridge Landfill DWP 130
Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL
Ticket Number: 051246 **Tonnage:** 1934
Received by: RC **Date:** 6/5/01

AOC 700



OAKRIDGE LANDFILL

2183 Highway 78, Dorchester, SC 29437
Tel 843-563-2687 Fax 843-563-3375

6-5-01 1450

Truck 16

15th @
16th land

SPECIAL WASTE MANIFEST
APPROVAL # OR 0105040
EXPIRATION 05/31/2002

Generator: CHARLESTON NAVAL COMPLEX

Account Number: 490-439

Location / Address: CHARLESTON NAVAL YARD CHARLESTON (10)

Tele Number: 843-740-2780

Contact: JED HEAMES

Generator Signature: [Signature]

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

Transporter of Waste: BUTLER WARE

Truck # 16

Date: 6/5/01

Driver Signature: [Signature]

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

Disposal Site: Oakridge Landfill DWP 130

Description of Waste: SOL / ARSENIC & PESTICIDE CONTAMINATED SOIL

Ticket Number: 05053

Tonnage: 80.72

Received by: nc

Date: 6/5/01

1 2 3 4 5 6 7 8 9 10 11

AOC 700 15073

BUTLER WARE TRUCKING CO.

Customer Hill Date 6-5-01

Job: NAVAL YARD

Location Dorchester Pit Butler Material fill

Time Start: _____ Time Stop: _____ Hours Rental: _____

Truck # 35 Truck Type TIT C.Y. 20

Driver X Ms. Jean Hamilton Load Count 3

Signature X [Signature]

12
13
14
15
16
17

18 19 20 21 22 23 24 25 26 27

1 2 3 4 5 6 7 8 9 10 11

AOC 700 14162

BUTLER WARE TRUCKING CO.

Customer CHAZM JONES Date 6-5-01

Job: Naval Yard

Location Dorchester Pit Butler Material fill

Time Start: _____ Time Stop: _____ Hours Rental: _____

Truck # 31 Truck Type TT C.Y. 20 yds

Driver X Thomas Bennett Load Count 3

Signature X [Signature]

12
13
14
15
16
17

3 4 5 6 7 8 9 10 11

AOC 700

14208

BUTLER WARE TRUCKING CO.

Customer Charleston Naval Complex Date 6-5-01

Job: Charleston Waste Yard

Location Charleston Pit Dockside Material Fill

Time Start: _____ Time Stop: _____ Hours Rental: _____

Truck # 14 Truck Type TIT C.Y. 20 yd

Driver X A Brown Load Count 3 Loads

Signature X [Signature]

26 25 24 23 22 21 20 19 18

3 4 5 6 7 8 9 10 11

AOC 700

13149

BUTLER WARE TRUCKING CO.

Customer CHZM Hill Date 6-9-201

Job: _____

Location DORCHESTER Pit BW Material Fill

Time Start: _____ Time Stop: _____ Hours Rental: _____

Truck # 16 Truck Type TT C.Y. 20

Driver X Benny Load Count 3

Signature X [Signature]

12 13 14 15 16 17

Appendix D



MEMORANDUM

TO: Mihir Mehta
Corrective Action Engineering Section
Bureau of Land and Waste Management

FROM: Elizabeth Frady
Corrective Action Engineering Section
Bureau of Land and Waste Management

DATE: December 7, 2000

RE: Charleston Naval Complex
AOC 700, Building 1646, Zone C
Interim Measure Work Plan, Revision 0
Dated October 2000

The above referenced document has been reviewed with regard to the requirements of the SRS Hazardous Waste Permit and the South Carolina Hazardous Waste Management Regulations. As a result of this review, the following comments have been generated and should be addressed in the Interim Measures Report. Remediation work may proceed as described in the above-referenced Plan.

1. Section 2.1.1, Line 18 states, "SCDHEC approval of the *Zone C Final RFI Report* indicates SCDHEC concurrence with NFA for this site (Ensafe 1997)." That approval was based on information in the Zone C report, with the understanding that full characterization of the area would be completed with the Zone J and Zone L investigations. Obviously the additional sampling associated with SWMU 37 (Zone L) indicates that characterization for AOC 700 was not complete. Despite the Department's initial approval, any additional sampling and analysis for this or any other SWMU or AOC that reveals previously undetected contamination will supersede any prior conclusions. Please include a follow-up statement to the above-noted language that expresses this policy.

Response: CH2M-Jones believes that the additional samples collected as part of the IM at AOC 700 has fully characterized the site. The IM excavation has removed arsenic- and pesticide-impacted soil to the extent practical. CH2M-Jones is now

recommending that the site's status be changed to NFA.

2. Section 2.1.1 notes that Arsenic and PAHs represent the largest risks to human health for AOC 700. By the time the IM Report is issued, the BCT should hopefully have an agreed-upon value for BEQs which will allow for a conclusive discussion of allowable remaining levels in soils. Please include any such information as part of the IM Report discussion.

Response: Section 2.1.1 reported that arsenic accounted for 85 and 92 percent of the ICLR for residential and industrial exposure scenarios respectively. It also reported that BEQs were carried forward to the risk assessment and the cumulative ICLR was calculated to be within the range of 1E-04 to 1E-06. EPA has defined an acceptable risk range of 1E-4 - 1E-6 for risk managers to make risk management decisions for various land uses. Arsenic-impacted soil was targeted for removal because the maximum reduction of risk would be accomplished by reducing the arsenic contribution to the ICLR. Removal of arsenic-impacted soil was expected to result in adequate reduction of the ICLR to allow a decision of NFA for AOC 700.

The additional sampling and data analysis has been completed by CH2M-Jones for the evaluation of BEQs at the CNC. The results were presented in the Background PAHs Study Report – Technical Information for Development of Background BEQ Values (CH2M-Jones, February 2001). The surface and subsurface soil background concentrations were determined to be 1,304 and 1,400 ug/kg respectively. As reported in the IM WP, the maximum BEQ value reported in the Zone C RFI was 235 ug/kg, which is below the screening levels.

3. Figure 2-3 should more clearly show the extent of the IM performed for SWMU 44. As it is currently drawn, there is only one line which does not clearly define the limits of removal.

Response: Figure 2-3 illustrates only the portion of the SWMU 44 investigation/IM that relates to the AOC 700 investigation/IM. Illustrating the entire area of the SWMU 44 IM would make evaluation of AOC 700 more difficult for DHEC due to the resulting change in the scale of the figure.

4. Please confirm in the Interim Measures Report that a visual survey of the entire AOC showed absolutely no presence of an Oil/Water Separator.

Response: The issue of OWSs was addressed in Section 4.6 of the IM WP for AOC 700. The IM WP reported that neither the RFA nor the RFI refers to the presence or possible presence of an OWS at AOC 700 and that as part of a site-wide evaluation of the presence of OWSs, the Navy completed (during year 2000) a comprehensive review of its records and facilities to identify the presence of OWSs. A list of 27 known OWSs was provided to the BCT members, including DHEC staff, at the BCT meeting in September 2000 and a copy of this list was included in the appendix of the AOC 700

IM WP. Additionally, the IM field team did not observe evidence of an OWS during their fieldwork.