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CNC CHARLESTON  
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U S NAVY RESPONSE TO REGULATOR COMMENTS TO IM COMPLETION REPORT AREA  
OF CONCERN 700 (AOC 700) ZONE C WITH TRANSMITTAL CNC CHARLESTON SC  
4/23/2002  
CH2M HILL

AOC 700 Zone C

RESPONSE TO COMMENTS I/M COMPLETION REPORT (RO)

**CH2MHILL**

## TRANSMITTAL

**To:** Mr. Jerry Stamps and  
Mr. Paul Bergstrand  
Bureau of Land and Waste  
Management  
South Carolina Department of Health  
and Environmental Control

**From:** Jim Edens  
(352) 335-5877, ext. 2491

**Date:** April 23, 2002

**Re:** CH2M-Jones' Responses to Comments by SCDHEC on the AOC 700, Zone C, Interim Measure Completion Report, Revision 0

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Quantity	Description
2	Two (2) copies of CH2M-Jones' Responses to Comments SCDHEC on the AOC 700, Zone C, Interim Measure Completion Report, Revision 0 (originally submitted October 2001)

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The attached material includes:

- CH2M-Jones' Responses to Comments Prepared by Jerry Stamps on the AOC 700, Zone C, Interim Measure Completion Report, Revision 0 (originally submitted October 2001)

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

## Comments Prepared by Jerry Stamps

### General Comments

#### **SCDHEC Comment 1:**

Sample ID LC037SB025, located north of the excavated area, had arsenic concentrations of 39J mg/kg and 70J mg/kg in the surface and subsurface soils, respectively. The surface soil concentration is on the upper limit of the Zone C background range of 0.40 – 39 mg/kg, and the subsurface soil concentration significantly exceeds the background range of 0.36 – 32 mg/kg. It should be noted that this area is within the vicinity of the railroad. Though the surface soil concentration is within the range of arsenic concentration presented in the technical memorandum entitled Results from Additional Background Sampling of the CNC Railroad Lines and Naval Annex (Zone K), it does exceed the average arsenic concentration calculated in this technical memorandum. Furthermore, this technical memorandum address surface soils only; therefore, the issue of the elevated subsurface soil concentrations remains to be resolved. Consequently, additional delineation (surface and subsurface soils) adjacent to sample location LC037SB025 is necessary to determine if additional excavation is warranted.

It should be noted that similar concentrations of arsenic as those found in LC037SB025 were detected in LC037SB001, which prompted further investigation and subsequent soil excavation at AOC 700.

#### **CH2M-Jones Response 1:**

*CH2M-Jones evaluated the data from the Interim Measure, and determined that while one soil boring (LC037SB025) remained where the analytical results were above the media cleanup standards (MCSs), the site soil was adequately remediated by the IM. The conclusion is based on the proximity of soil boring LC037025 to the railroad lines (limiting the practicality of excavation) and the fact that reported arsenic concentrations at that location appear to be consistent with the range of arsenic concentrations near railroad lines.*

*To address SCDHEC's concern regarding arsenic concentrations at LC037SB025, CH2M-Jones developed a Sampling and Analysis (SAP) to: 1) verify the presence of arsenic at LC037SB025 and 2) to determine the areal extent of arsenic-impacted soil. These samples have been collected and the findings and conclusions are presented below.*

*The SAP for AOC 700 called for collecting five samples from three soil borings. Surface and subsurface samples were proposed from two boring locations and a subsurface sample was proposed from a location adjacent to soil boring LC037SB025. Surface and subsurface samples were collected from each of the three soil boring locations, resulting in six samples being collected. Each sample was analyzed for arsenic.*

*Soil borings LC037SB035 and LC037SB036 were located approximately 20 feet from soil boring LC037SB025. The locations of the soil borings are presented on the attached Figure 1.*

#### **Analytical Results for Additional Samples**

*Table 1, provided below, presents the analytical results for the collected samples. The complete data table and the data validation summary are included in Attachment A. Arsenic*

*was detected in the surface soil sample (037SB03401, 102 milligrams per kilogram [mg/kg]) collected adjacent to soil boring LC037SB025. The detected concentration is above the range of Zone C surface soil background concentrations (0.4 to 39 mg/kg) and above the range of background concentrations for samples collected near railroad lines (CH2M-Jones, 2001; 2 to 92 mg/kg).*

*The surface soil samples collected at soil borings LC037SB035 (7.62 mg/kg) and LC037SB036 (5.93 mg/kg) were reported at concentrations within the range of Zone C surface background concentrations.*

*Arsenic was detected in the subsurface soil sample (037SB03402), collected adjacent to soil boring LC037SB025, at a concentration of 167 mg/kg. The detected concentration is above the range of Zone C subsurface background concentrations (0.36 to 32 mg/kg) and above the generic soil screening level (SSL) of 29 mg/kg (dilution attenuation factor [DAF]=20). This sample was collected within approximately 10 feet of the railroad lines. Surface soil arsenic background concentrations have been shown to be higher near railroad lines (CH2M-Jones, 2001), however subsurface soil was not included in the evaluation. Therefore appropriate comparison criterion may not be available.*

*The subsurface soil samples collected at soil borings LC037SB035 (9.51 mg/kg) and LC037SB036 (6.58 mg/kg) were reported at concentrations within the range of Zone C subsurface background concentrations.*

**TABLE 1**  
 Arsenic Concentrations  
 AOC 700, Zone C, Charleston Naval Complex

Station ID	Surface Concentration (mg/kg)	Subsurface Concentration (mg/kg)
<b>MCS</b>	<b>14.7</b>	<b>29</b>
LC037SB034	102	167
LC037SB035	7.62	9.51
LC037SB036	5.93	6.58

*These results verify that the previously detected concentrations of arsenic at soil boring LC037SB025 were not anomalous. Arsenic concentrations near the railroad are generally higher than those found elsewhere on the base.*

*The detected concentration of arsenic in surface soil at soil boring E037SB025 is above the concentrations found at other locations along the railroad, but is likely a result of railroad activities. The results from the surface delineation samples were all below 8 mg/kg, indicating that the extent of arsenic in surface soil above the MCS is small.*

## **Evaluation of Residual Site Risk**

*To evaluate the residual site risk based on current site conditions, including the new sample results, an exposure concentration was calculated. Sample locations that were removed during the IM were replaced by the analytical results of the fill material. Fill material collected at the source was analyzed in May 2001. The results for arsenic were 0.94 U mg/kg and 0.95 J mg/kg. The 0.95 J mg/kg result was used in the calculation.*

*The exposure concentration is based on an one-half acre exposure area as recommended by the EPA. The exposure area is shown on the attached Figure 2. Because of the small size of the site, the exposure area included the entire site. The exposure concentration was calculated as the upper limit of the mean with a 95-percent confidence level (UCL<sub>95</sub>). According to the distribution test statistic, W, the data best fit a non-parametric distribution. The non-parametric UCL<sub>95</sub> was calculated as 0.95 mg/kg. However, review of the Q-Q plots indicate that the data are well represented by a lognormal distribution ( $R^2 = 0.902$ ). The lognormal UCL<sub>95</sub> was calculated as 8.6 mg/kg. The UCL<sub>95</sub> calculations for both the normal distribution (12.3 mg/kg) and the bootstrap method (12.5 mg/kg) resulted in UCL<sub>95</sub> as above 12 mg/kg, but below the MCS of 14.7 mg/kg. The UCL<sub>95</sub> calculations included the greater analytical results for the surface soil samples collected at soil boring LC037SB025 (037SB02501 and 037SB03401, 102 mg/kg). Using the higher of the two results will provide a conservative UCL<sub>95</sub> value. None of the calculated UCL<sub>95</sub> values were above the MCS. A summary of the UCL<sub>95</sub> calculations is provided in Attachment B.*

## **Evaluation of Leaching Potential**

*Subsurface soil at soil boring LC037SB025 contained arsenic above the subsurface MCS (29 mg/kg) established for the IM. The results from the subsurface delineation samples were all below 10 mg/kg, indicating that the extent of arsenic in subsurface soil above the MCS is small.*

*Individual exceedances of SSLs do not necessarily represent a leaching hazard. Site average concentrations provide a more realistic measure of a constituent's potential for leaching. The average concentration of arsenic in the area west of Building 1646, including the new subsurface soil results, was calculated to be 7.55 mg/kg. Table 2 presents the data for the samples used to calculate the average subsurface arsenic concentration. The calculation again used the greater of the two samples collected at soil boring LC037SB025 (037SB02502 and 037SB03402, 167 mg/kg). Analytical results for samples that were removed as part of the IM were replaced with the arsenic concentration reported for the fill material (0.95 J mg/kg). The average residual arsenic concentration in the area is below the SSL, indicating that existing concentrations do not pose a significant threat to local groundwater.*

## **Summary**

*Based on the fact that the locations of the residual soil borings found to contain arsenic above the appropriate MCS are within approximately 10 feet of the railroad, excavation is not considered practical. Additionally, the surface soil exposure concentration and average subsurface arsenic concentration are below conservative screening criteria. Therefore, the analytical results of the samples collected as part of the IM and SAP indicate that arsenic-impacted soil has been removed to the extent practical and necessary at AOC 700. Based on this information, it is recommended that the status of the site be modified to NEA.*

**TABLE 2**  
Subsurface Arsenic Concentrations  
AOC 700, Zone C, Charleston Naval Complex

Station ID	Sample ID	Date Collected	Arsenic (mg/kg)	Qualifier	Adjusted Concentration <sup>a</sup>	Adjusted Qualifier <sup>a</sup>
LC037SB003R	037SB00302	01/31/01	7.8	J	0.95	J
LC037SB004R	037SB00402	01/31/01	81.1	J	0.95	J
LC037SB005R	037SB00502	01/31/01	14.1	J	0.95	J
LC037SB007R	037SB00702	01/31/01	540	J	0.95	J
LC037SB008R	037SB00802	05/02/01	13.9	=	0.95	J
LC037SB009R	037SB00902	03/01/01	4.35	=	0.95	J
LC037SB010R	037SB01002	03/01/01	152	=	0.95	J
LC037SB011R	037SB01102	03/01/01	20.7	=	0.95	J
LC037SB012R	037SB01202	03/01/01	60.6	=	0.95	J
LC037SB013R	037SB01302	03/01/01	15.9	=	0.95	J
LC037SB014R	037SB01402	03/01/01	201	=	0.95	J
LC037SB015R	037SB01502	03/01/01	37.7	=	0.95	J
LC037SB016R	037SB01602	03/01/01	3.99	=	0.95	J
LC037SB017R	037SB01702	03/01/01	5.76	=	0.95	J
LC037SB019R	037SB01902	03/09/01	2.15	=	0.95	J
LC037SB020R	037SB02002	03/09/01	10.1	=	0.95	J
LC037SB021R	037SB02102	03/09/01	10.7	=	0.95	J
LC037SB022R	037SB02202	03/09/01	101	=	0.95	J
LC037SB023R	037SB02302	03/09/01	31.8	=	0.95	J
LC037SB024R	037SB02402	03/09/01	3.2	=	0.95	J
LC037SB026	037SB02602	05/02/01	4.28	=	4.28	=
LC037SB027	037SB02702	05/02/01	5.98	=	5.98	=
LC037SB028R	037SB02802	05/02/01	19.5	=	0.95	J
LC037SB029R	037SB02902	05/02/01	64.3	=	0.95	J
LC037SB032R	037SB03202	08/30/01	0.54	U	0.95	J
LC037SB033	037SB03302	08/30/01	13	=	13	=
LC037SB034	037SB03401	03/14/02	167	=	167	=
LC037SB035	037SB03501	03/14/02	9.51	=	9.51	=
LC037SB036	037SB03601	03/14/02	6.58	=	6.58	=

**TABLE 2**  
Subsurface Arsenic Concentrations  
AOC 700, Zone C, Charleston Naval Complex

Station ID	Sample ID	Date Collected	Arsenic (mg/kg)	Qualifier	Adjusted Concentration <sup>a</sup>	Adjusted Qualifier <sup>a</sup>
C700SB003	700SB00302	06/05/96	3.8	=	3.8	=
C700SB004	700SB00402	06/06/96	2.3	=	2.3	=
C700SB005	700SB00502	06/06/96	7.3	=	7.3	=
<b>Mean</b>					<b>7.55</b>	<b>mg/kg</b>

R indicates that the station location was removed during the IM.

U indicates that the compound was not detected. The reported value is the detection limit.

J indicates that the compound was detected. The reported value is an estimated concentration.

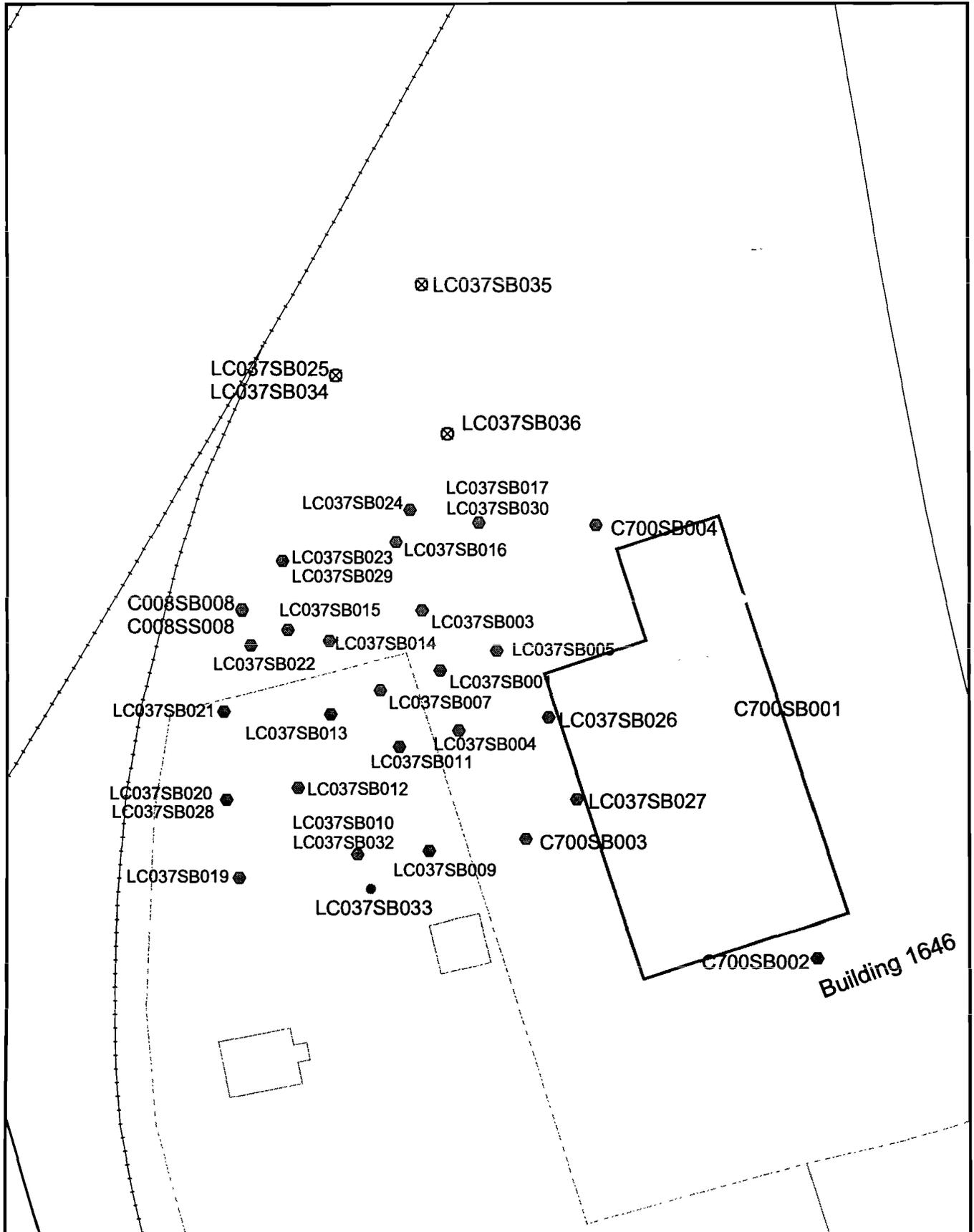
= indicates that the compound was detected. The reported value is the measured concentration.

<sup>a</sup> Arsenic results for removed samples were replaced by fill concentration (0.95 J mg/kg).

## References

CH2M-Jones. *Results from Additional Background Sampling of the CNC Railroad Lines and Naval Annex (Zone K)*. Technical Memorandum. August 2001.

CH2M-Jones. *Interim Measure Completion Report, Area of Concern 700, Zone C*. Revision 0. October 2001.



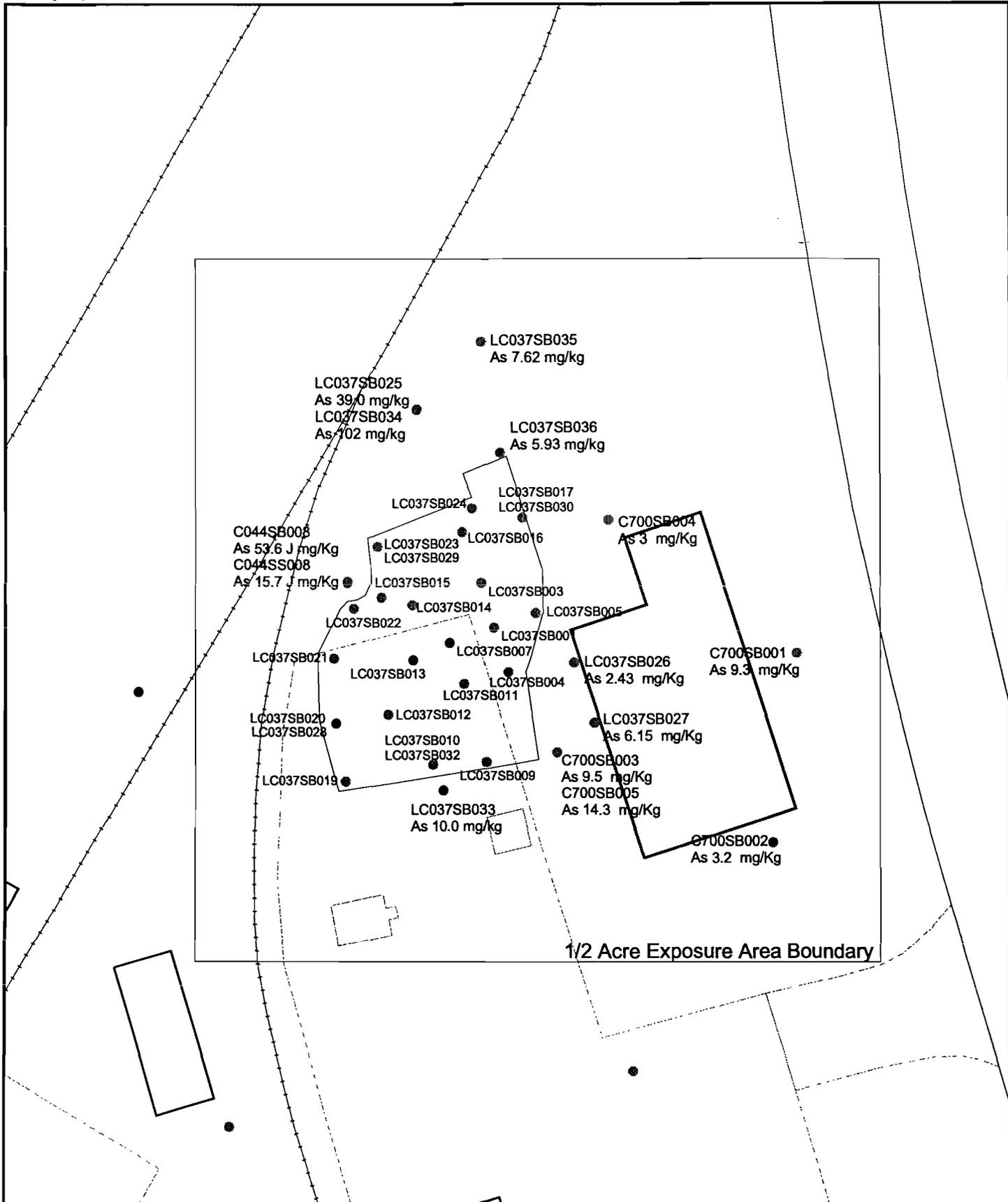
- ⊗ Additional Soil Sample Locations
- Interim Measures Sample Locations
- ~ Railroads
- - - Pavement
- ▭ AOC Boundary
- - - SWMU Boundary
- ▭ Buildings
- ▨ Concrete Slab



0 10 20 Feet

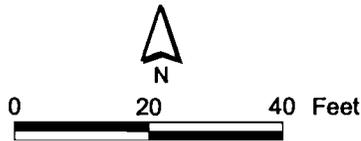
**Figure 1**  
 Sample Locations  
 AOC 700, Zone C  
 Charleston Naval Complex





1/2 Acre Exposure Area Boundary

- Soil Boring Locations
- IM Excavation Area
- Buildings
- AOC Boundary
- SWMU Boundary
- Railroads
- Roads



**Figure 2**  
 Exposure Area Samples and Results  
 AOC 700, Zone C  
 Charleston Naval Complex

**Attachment A: DST and DQE Summary**

Analytical Data Summary

04/22/2002 3:06 PM

		A037SB034	A037SB034	A037SB035	A037SB035	A037SB036
Stati nID						
SampleID		037SB03401 (0-1ft)	037SB03402 (3-5ft)	037SB03501 (0-1ft)	037SB03502 (3-5ft)	037SB03601 (0-1ft)
DateCollected		3/14/2002	3/14/2002	3/14/2002	3/14/2002	3/14/2002
DateExtracted		3/25/2002	3/25/2002	3/25/2002	3/25/2002	3/25/2002
DateAnalyzed		3/26/2002	3/26/2002	3/26/2002	3/26/2002	3/26/2002
SDGNumber		57553	57553	57553	57553	57553
Parameter	Units					
Arsenic	mg/kg	102 =	167 =	7.62 =	9.51 =	5.93 =

Analytical Data Summary

04/22/2002 3:06 PM

<b>StationID</b>	A037SB036		
<b>SampleID</b>	037SB03602 (3-5ft)		
<b>DateCollected</b>	3/14/2002		
<b>DateExtracted</b>	3/25/2002		
<b>DateAnalyzed</b>	3/26/2002		
<b>SDGNumber</b>	57553		
<b>Parameter</b>	<b>Units</b>		
Arsenic	mg/kg	6.58	=

## Data Validation Summary - Charleston Naval Complex - Zone C, AOC 700

TO: Jim Edens/CH2M Hill/GNA

FROM: Amy Juchem/CH2M Hill/GNA  
Herb Kelly/CH2M HILL/GNA

DATE: April 16, 2002

The purpose of this memorandum is to present the results of the data validation process for the samples collected at the following sites in Zone C, AOC 700. The samples were collected on March 14, 2002.

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 Arsenic following SW-846 6010 methodology.

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.

There were no qualifiers applied to any of the data received for this site.

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

SDG	Lab Sample ID	Sample ID	Matrix	Sample Type	Station ID	Upper Depth	Lower Depth	Date Collected	Arsenic SW6010B
57553	57553001	037SB03401	SO	N	A037SB034	0	1	03/14/02	X
57553	57553002	037SB03402	SO	N	A037SB034	3	5	03/14/02	X
57553	57553003	037SB03501	SO	N	A037SB035	0	1	03/14/02	X
57553	57553004	037SB03502	SO	N	A037SB035	3	5	03/14/02	X
57553	57553005	037SB03601	SO	N	A037SB036	0	1	03/14/02	X
57553	57553006	037SB03602	SO	N	A037SB036	3	5	03/14/02	X
57553W (57607)	57607001	037EB034M1	WQ	EB	FIELDQC			03/14/02	X
<b>MATRIX CODE</b>									
SO - Soil									
WQ - Water QC Samples									
<b>SAMPLE TYPE CODE</b>									
EB - Equipment Blank									
N - Native Sample									

## Inorganic Parameters

### Quality Control Review

The following list represents the QA/QC measures that are typically 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.
- **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. No data was qualified.

## **Rejected Data**

No data was rejected for this sampling event.

## **Conclusion**

A review of the analytical data submitted regarding the investigation of selected sites in Zone C, AOC 700 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.

The analytical data had no QC concerns affecting data usability. The validation review demonstrated that the analytical systems were in control and the data results can be used in the decision making process.



## **Attachment B: UCL<sub>95</sub> Calculations**

Site:	AOC 700
Media:	Surface Soil
Chemical:	Arsenic
CASRN:	
Units:	mg/kg

Data	Qualifier	Adjusted Data	Detected		
0.95	J	0.95	YES	LC037SB001	R
0.95	J	0.95	YES	LC037SB001	R
0.95	J	0.95	YES	LC037SB003	R
0.95	J	0.95	YES	LC037SB004	R
0.95	J	0.95	YES	LC037SB005	R
0.95	J	0.95	YES	LC037SB007	R
0.95	J	0.95	YES	LC037SB009	R
0.95	J	0.95	YES	LC037SB010	R
0.95	J	0.95	YES	LC037SB011	R
0.95	J	0.95	YES	LC037SB012	R
0.95	J	0.95	YES	LC037SB013	R
0.95	J	0.95	YES	LC037SB014	R
0.95	J	0.95	YES	LC037SB015	R
0.95	J	0.95	YES	LC037SB016	R
0.95	J	0.95	YES	LC037SB017	R
0.95	J	0.95	YES	LC037SB019	R
0.95	J	0.95	YES	LC037SB020	R
0.95	J	0.95	YES	LC037SB021	R
0.95	J	0.95	YES	LC037SB022	R
0.95	J	0.95	YES	LC037SB023	R
0.95	J	0.95	YES	LC037SB024	R
2.43	=	2.43	YES	LC037SB026	
6.15	=	6.15	YES	LC037SB027	
0.95	J	0.95	YES	LC037SB028	R
0.95	J	0.95	YES	LC037SB029	R
0.95	J	0.95	YES	LC037SB032	R
10	=	10	YES	LC037SB033	
102	=	102	YES	LC037SB034	
7.62	=	7.62	YES	LC037SB035	
5.93	=	5.93	YES	LC037SB036	
53.6	J	53.6	YES	C044SB008	
15.7	J	15.7	YES	C044SS008	
9.5	=	9.5	YES	C700SB003	
3	=	3	YES	C700SB004	
14.3	=	14.3	YES	C700SB005	
9.3	=	9.3	YES	C700SB001	
3.2	=	3.2	YES	C700SB002	

R indicates that the soil boring was removed during the IM

Site: AOC 700  
 Media: Surface Soil  
 Units: mg/kg

Chemical: Arsenic  
 CASRN:

**STATISTICS**

N	37
Detects	37
FOD	100%
Mean of Detect	7.176
Min of Detect	0.9500
Max of Detect	102.00
Best Estimate of Mean (arithmetic)	12.5
Best Estimate of Mean (geometric)	2.2
Nondetects at 1/2 DL	YES

**95% UPPER CONFIDENCE LIMITS FOR MEAN**

UCL95 Normal	12.3
<i>t</i> -statistic	1.69
UCL95 Lognormal	8.6
<i>H</i> -statistic	2.63
UCL95 Nonparametric	0.95
UCL95 Bootstrap	12.5

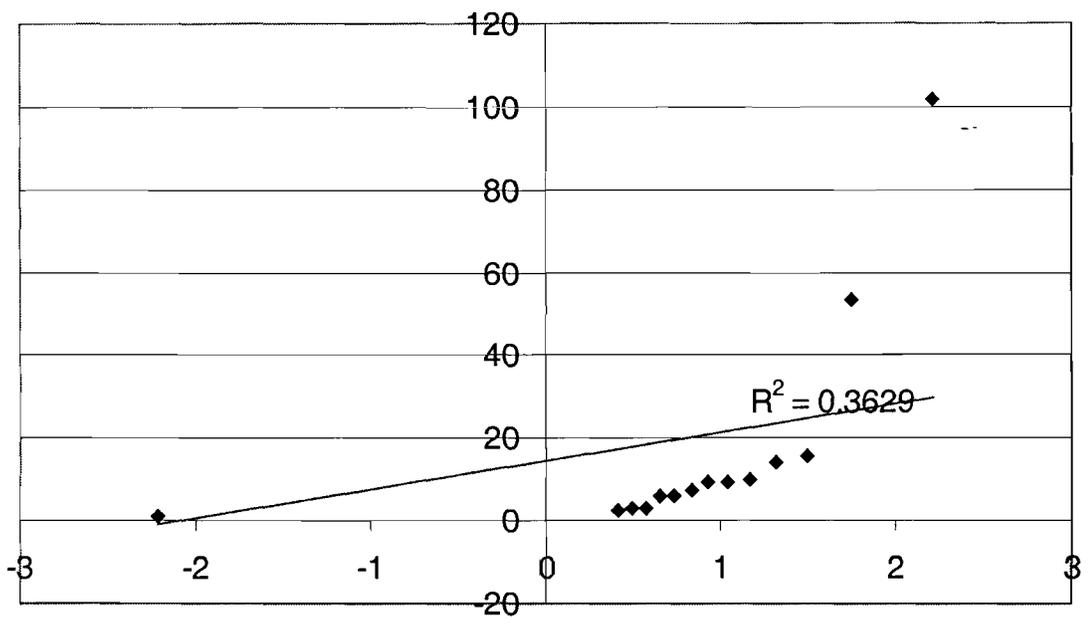
**DISTRIBUTION TESTING**

Population is best described as:	NONPARAMETRIC
$W_{normal}$	0.386
$W_{log}$	0.689
$W_{\alpha = 0.05}$	0.936

Notes:

1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL values calculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to calculate a UTL or UCL with any level of confidence.

Q-Q Plot of Untransformed Data (x)



Q-Q Plot of Log Transformed Data (y)

