N61165.AR.004237
CNC CHARLESTON
5090.3a

INTERIM MEASURE WORK PLAN SOLID WASTE MANAGEMENT UNIT 42 (SWMU 42) AREA OF CONCERN 505 (AOC 505) ZONE A WITH TRANSMITTAL CNC CHARLESTON SC
6/28/2001
NAVFAC SOUTHERN

# INTERIM MEASURE WORK PLAN

# SWMU 42, AOC 505, Zone A

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

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

PREPARED BY
***CH2M-Jones***

*June 2001*

*Revision 1*
*Contract N62467-99-C-0960*
*158814.ZA.PR.04*

# INTERIM MEASURE WORK PLAN

# SWMU 42, AOC 505, Zone A

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

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

PREPARED BY
***CH2M-Jones***

*June 2001*

*Revision 1*
*Contract N62467-99-C-0960*
*158814.ZA.PR.04*

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

5090/11
Code 18713
28 Jun 01

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

Subj: SUBMITTAL OF SOLID WASTE MANAGEMENT UNIT 42 AND AREA OF CONCERN 505 INTERIM MEASURE WORK PLAN

Dear Mr. Litton:

The purpose of this letter is to submit an Interim Measure Work Plan, Revision 1, for Solid Waste Management Unit (SWMU) 42 and Area of Concern (AOC) 505, Zone A, located at the Charleston Naval Complex. The work plan is submitted to fulfill the requirements of condition IV.E.2 of the RCRA Part B permit issued to the Navy by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency (EPA).

CH2M-Jones distributed the document under separate cover letter, and appropriate certification is provided under that correspondence. We request that the Department and the EPA review this document and provide comments or approval whichever is appropriate.

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

Sincerely,

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

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

CH2M HILL
3011 S.W. Williston Road
Gainesville, FL
32608-3928
Mailing address:
P.O. Box 147009
Gainesville, FL
32614-7009
Tel 352.335.7991
Fax 352.335.2959

CH2MHILL

June 27, 2001

Mr. David Scaturo
Division of Hazardous and Infectious Wastes
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: Interim Measure Work Plan (Revision 1), SWMU 42 – Former Asphalt Tanks/Boiler Plant, and AOC 505 – Creosote Cross-Tie/Railroad Ballast Storage Area and Golf Course Maintenance Building, Zone A

Dear Mr. Scaturo:

Enclosed please find four copies of the Interim Measure Work Plan (Revision 1), SWMU 42 Former Asphalt Tanks/Boiler Plant, and AOC 505 – Creosote Cross-Tie/Railroad Ballast Storage Area and Golf Course Maintenance Building in Zone A, at the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

Please contact me if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

# Certification Page for the Interim Measure Work Plan (Revision 1), SWMU 42 – Former Asphalt Plant Tanks/Boiler Plant, and AOC 505 – Creosote Cross-Tie/Railroad Ballast Storage Area and Golf Course Maintenance Building, Zone A

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

South Carolina

Temporary Permit No. T2000342

Dean Williamson, P.E.

6/19/2001

Date

SOUTH CAROLINA
CH2M
HILL, INC.
No. C00201
CERTIFICATE OF AUTHORIZATION

# Contents

# Contents, Continued

# Acronyms and Abbreviations

| | |
|---|---|
| AOC | area of concern |
| AST | aboveground storage tank |
| BCT | BRAC Cleanup Team |
| BEQ | benzo(a)pyrene equivalent |
| BRAC | Base Realignment and Closure Act |
| CA | corrective action |
| CNC | Charleston Naval Complex |
| COC | chemical of concern |
| COPC | chemical of potential concern |
| CSAP | Comprehensive Sampling and Analysis Plan |
| 1,1-DCE | 1,1-dichloroethene |
| EnSafe | EnSafe Inc. |
| EPA | U.S. Environmental Protection Agency |
| $ft^2$ | square feet |
| ft bgs | feet below ground surface |
| HI | hazard index |
| IM | interim measure |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| MCL | maximum contaminant level |
| MCS | media cleanup standard |
| mg/kg | milligrams per kilogram |
| NAVBASE | Naval Base |
| PAH | polynuclear aromatic hydrocarbon |
| PCA | 1,1,2,2-tetrachloroethane |
| PCB | polychlorinated biphenyl |
| PCE | tetrachloroethene |

| | | |
|---|---|---|
| PPE | personal protective equipment |
| RBC | risk-based concentration |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessment |
| RFI | RCRA Facility Investigation |
| RGO | remedial goal option |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| SSL | soil screening level |
| SVOC | semivolatile organic compound |
| SWMU | solid waste management unit |
| UCL | upper confidence level |
| UST | underground storage tank |
| VOC | volatile organic compound |
| $y^3$ | cubic yards |

SECTION 1.0

# Introduction

# 1.0 Introduction

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

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

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to document the basis for an Interim Measure (IM) Work Plan (WP) at Solid Waste Management Unit (SWMU) 42/Area of Concern (AOC) 505 in Zone A of the CNC.

This IM WP (Revision 1) is a revised submittal of the IM WP (Revision 0) of January 2001. Responses to SCDHEC comments pertaining to the Revision 0 submittal are provided in Appendix A.

## 1.1 Background and Summary for the IM WP

As part of RCRA CA activities, a RCRA Facility Investigation (RFI) report was finalized for Zone A (EnSafe Inc. [EnSafe], 1998). Zone A is located in the northern-most portion of CNC on the western side of the Cooper River. It is bounded by the base boundary to the north and west, the Cooper River to the east, and Noisette Creek to the south.

Figure 1-1 presents the location of Zone A with respect to the CNC. Detailed figures depicting SWMU 42/AOC 505 are presented in Section 2.0 of this IM WP.

The RFIs for SWMU 42 and AOC 505 were conducted concurrently. The data and conclusions from the RFI are detailed in Section 2.0 of this IM WP.

All data for SWMU 42/AOC 505 were evaluated during the preparation of this IM WP. Results of the evaluation show that concentrations of arsenic and benzo(a)pyrene equivalents (BEQs) exceed levels that would allow the site to be used for unrestricted land

use. This IM WP supports a recommendation to remove soils with elevated concentrations of arsenic and BEQs. This IM is expected to be the final remedial activity at the site, and it is anticipated that the site will be suitable for unrestricted land use. However, in the event that other soil or groundwater require further removal or treatment, the proposed remedy in this IM WP is expected to be compatible with the overall restoration objectives for SWMU 42/AOC 505.

## 1.2 Document Organization

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

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

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

**3.0 Interim Measure Work Plan** – Presents proposed cleanup levels and details associated with the proposed site cleanup plan.

**4.0 References** – Lists the references used in this document.

**Appendix A** contains responses to SCDHEC comments to the Revision 0 submittal.

**Appendix B** contains excerpts from the Zone A Final RFI Report.

**Appendix C** contains the Interim Measure Completion Report for an IM previously completed at SWMU 42.

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

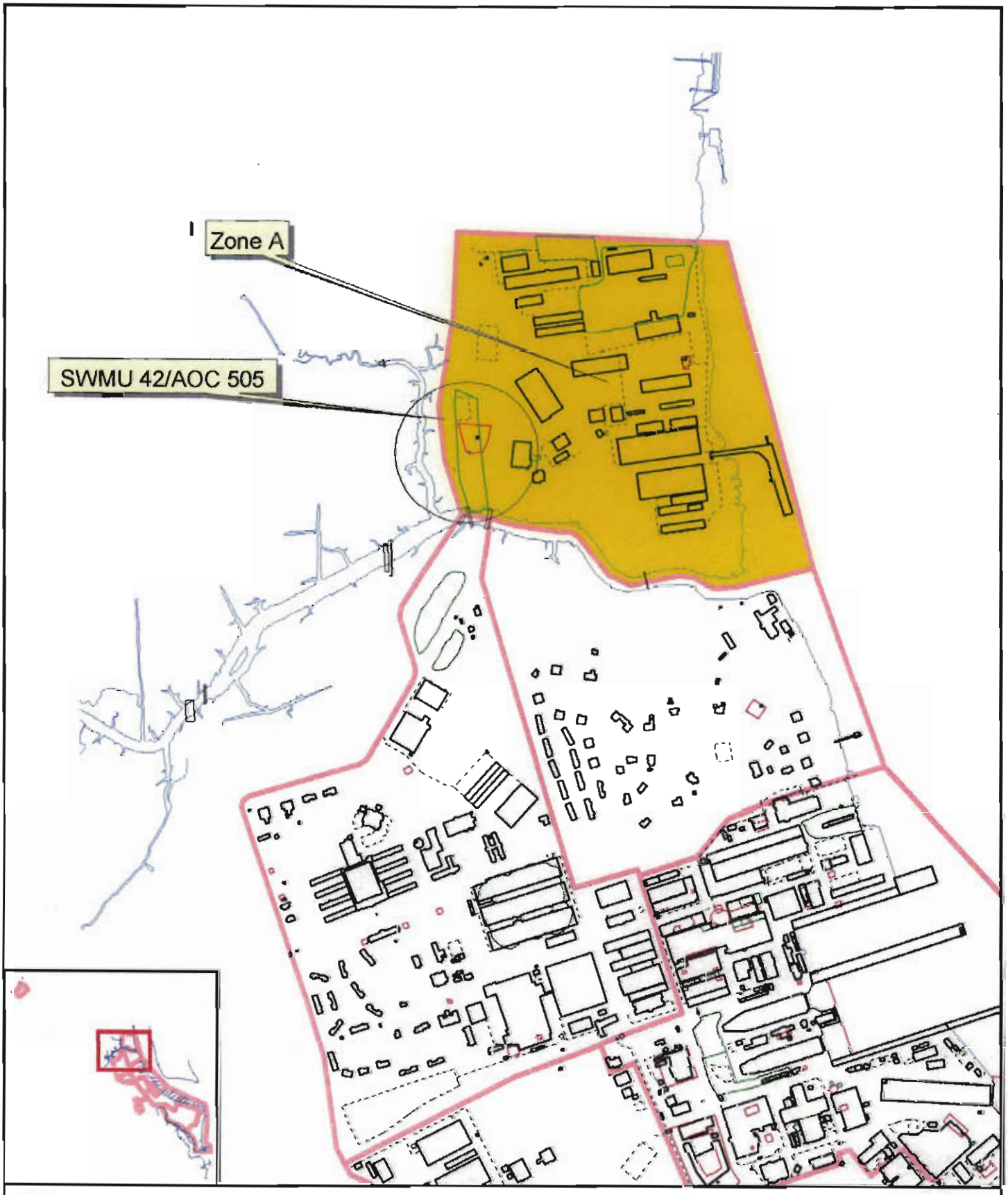



**Figure 1-1**
Location of Zone A and
SWMU 42/AOC 505
Charleston Naval Complex

CH2MHILL

SECTION 2.0

# Technical Basis and Rationale for Interim Measure

# 2.0 Technical Basis and Rationale for Interim Measure

## 2.1 Brief Overview of Site and Previous Investigations

SWMU 42, a former asphalt plant, and AOC 505, a creosote cross-tie/railroad ballast storage area and golf course maintenance building, were identified as areas with potential contamination in the RCRA Facility Assessment (RFA) completed by EnSafe (EnSafe, 1995). An aerial photograph of SWMU 42/AOC 505 is provided as Figure 2-1.

### 2.1.1 SWMU 42

SWMU 42 is located in the southwest corner of Zone A. The asphalt plant operated from 1947 until 1962, and has since been demolished. Because the facility was taken out of service in the early 1960s, minimal information is available regarding the dimensions, design features, operating practices, or waste disposal methods. The site currently contains a concrete rack used to support asphalt-related aboveground storage tanks (ASTs). The surrounding unpaved area contains rock and asphalt debris. The RFA did not find evidence of a release at SWMU 42.

The materials associated with SWMU 42 activities were identified in the RFI as waste asphalt products, solvents, and degreasers. The chemicals of concern (COCs) included volatile organic compounds (VOCs), heavy metals, phenolic compounds, polynuclear aromatic hydrocarbons (PAHs), and petroleum hydrocarbons.

### 2.1.2 AOC 505

AOC 505, located in the southwest corner of Zone A, overlaps a portion of SWMU 42. The area was used to store creosote cross-tie/railroad ballasts during the 1960s and 1970s. AOC 505 consists of Building 1803, a former golf maintenance shop, in which pesticides used at the golf course were handled. Since operations at this unit were discontinued in the 1970s, minimal information was found concerning the unit's design features, dates of operation, or operating practices. The RFA did not find evidence of a release at AOC 505.

The materials associated with AOC 505 activities were identified in the RFI as creosote, pesticides, and asphalt degradation products. The COCs included phenolic compounds, PAHs, chlorinated pesticides, and petroleum hydrocarbons.

### 2.1.3 RFI Status and Conclusions

The status of the *Zone A RCRA Facility Investigation Report* is final (EnSafe, 1998). Results of the RFI for SWMU 42/AOC 505 are discussed in Section 10.5 of the Zone A Final RFI Report. Excerpts from the RFI report are presented in Appendix B.

BEQs, arsenic, and beryllium were identified as COCs in soil during the SWMU 42/AOC 505 RFI. These chemicals were identified as COCs because they exceeded at least one RFI screening criterion, including regulatory, risk-based, or background values. Remedial goal options (RGOs) were established during the RFI for BEQs, arsenic, and beryllium based on risk calculations for each constituent. In addition to the RGOs, the remedial objectives also included reducing contaminant concentrations to background levels.

Other constituents were identified as chemicals of potential concern (COPCs) in the RFI; however, their contribution to risk and hazard index (HI) was not considered significant. Therefore, they are not considered COCs. Beryllium was identified as a COC before the U.S. Environmental Protection Agency (EPA) released the revised risk-based concentration (RBC) of 160 milligrams per kilogram (mg/kg). This revised RBC was not exceeded. Therefore, beryllium will not be further addressed in this IM WP. Several COPCs were identified in groundwater; however, PCE was the only COC selected for the site.

#### Brief Summary of Soil Samples from the Zone A RFI

Three soil sampling events were conducted during a Geoprobe investigation at SWMU 42/AOC 505 locations. Generally, a surface (0-1 foot below ground surface [ft bgs]) and subsurface (3-5 ft bgs) sample were planned for each sampling location. However, saturated samples were not submitted for analysis; if the saturated zone was encountered within the subsurface interval, the sample was not collected. This resulted in fewer subsurface samples collected. The Geoprobe samples were collected at 2- to 4-foot intervals.

The first sampling event involved collecting 21 surface samples and 17 subsurface samples. These samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), metals, cyanide, pesticides, herbicides, and polychlorinated biphenyls (PCBs).

During the second sampling event, 11 surface soil samples were collected from SWMU 42 and six surface soil samples were collected from AOC 505. One subsurface sample was not collected during the second sampling event due to auger refusal. Samples collected from SWMU 42 were analyzed for SVOCs and metals; AOC 505 samples were analyzed for SVOCs, pesticides, and PCBs. Three Geoprobe samples were collected from SWMU 42 and analyzed for VOCs. The eight surface soil samples and two subsurface soil samples were

collected to delineate the extent of BEQs exceeding the RBC of 88 micrograms per kilogram ($\mu$g/kg). Consequently, these samples were analyzed for SVOCs.

The cancer risks and non-cancer HIs estimated in the RFI for industrial land use (workers), and future residential land use (residential adult and child) are summarized in Table 2-1. These tables include chemicals from the RFI report that contributed to risks above one in a million level, or HI contribution above 0.1 to the total HI. Further details on the risk assessment from Section 10.5.6 of RFI Report are provided in Appendix B (Ensafe, 1998).

**Surface Soil**

Results of surface soil analyses were compared in the RFI to applicable screening criteria (EPA Region III residential RBCs or background values). Analytes that exceeded the screening criteria were further evaluated in the risk assessment to determine which of these parameters were considered COCs at SWMU 42/AOC 505 (Section 10.5.6 of the Zone A RFI; page 10.5.77 from the RFI is included in Appendix B). This analysis resulted in the identification of arsenic and BEQs as COCs for the combined SWMU 42/AOC 505 for future residential land use.

Aroclor-1260, beryllium, 4,4-DDE, 4,4-DDT, and manganese, although COPCs, were minor contributors to cumulative risk and HI and therefore are not considered COCs in this IM WP. Additionally, with respect to beryllium, review of site data (56 sample results) and comparison to the most recent EPA RBC (EPA Region III RBC Table, April 13, 2000) value for beryllium (160 mg/kg) indicates that beryllium does not exceed the recent RBC value at any location within SWMU 42/AOC 505. The highest concentration of beryllium reported was 0.57 mg/kg.

Lead was detected at two locations (A505SB005: 491 mg/kg and A042SB009: 1,180 mg/kg) at concentrations above the generally accepted residential soil cleanup level of 400 mg/kg. However, lead was not identified as a COC in the RFI Report. As will be presented in the Corrective Measures Study (CMS), soils with elevated lead levels were removed as part of an IM conducted upon completion of the RFI.

Arsenic and BEQ data in surface soils are discussed in the text that follows. The data presented include all data, including that which were collected after completion of the RFI.

### Arsenic

A total of 62 samples were analyzed for arsenic (refer to Table 2-2 and Figure 2-2). Seventeen samples exceeded the Zone A RFI reference concentration of 9.44 mg/kg. The soil screening level (SSL) of 15 mg/kg was adopted in the RFI. A total of eleven surface soil samples were reported with concentrations greater than the SSL in Table 2-2.

One site groundwater sample (505GW001 – 9.0 ug/L "J") was reported to exceed the Zone A RFI reference value of 7.4 ug/L. However, this value was qualified with a "J" flag. The three other results from this well, as well as from other well samples (42GW001, 42GW002, and 42GW003) were reported with arsenic levels less than the reference concentration. Therefore, arsenic in surface soil is not expected to be a significant source of soil-to-groundwater contamination (page 10.5.41, Fate and Transport Summary of the Zone A RFI Report, is provided in Appendix B). Arsenic in groundwater is discussed in further detail in the subsurface soil section below.

### BEQs

PAHs, expressed as BEQs, were identified as a COC in SWMU 42/AOC 505 based on exceedances of the RBC of 88 $\mu$g/kg (Section 10.5.6.5 of the Zone A RFI Report, and page 10.5.77 and Table 10.5.23 from the RFI Report are included in Appendix B). PAHs are routinely detected in non-impacted as well as impacted areas of the CNC.

After the RFI was finalized, the BRAC Cleanup Team (BCT) agreed on the sitewide BEQ reference values of 1,304 and 1,400 $\mu$g/kg for surface and subsurface soil, respectively. This approach has been documented in a memorandum dated May 3, 2001, to the BCT. A total of 71 surface soils were analyzed for BEQs; nine exceeded the background level of 1,304 $\mu$g/kg. Figure 2-3 and Table 2-3 present BEQ data.

### Subsurface Soil

Subsurface soil samples were collected as part of the RFI at the same locations as the surface soil boring locations. Due to high water table or auger refusal, not all borings produced both a surface and subsurface sample. Results of subsurface soil analyses in the RFI Report were compared to applicable screening criteria (EPA SSLs or background values).

Generally, analytes detected in subsurface soils were either not detected above their respective SSLs or not reliably identified in shallow groundwater above their reference concentrations or MCLs, indicating that existing soil concentrations are protective of surficial groundwater (pages 10.5.34 and 10.5.38-39; Section 10.5.5.1 of the Zone A RFI Report is included in Appendix B). Arsenic is a possible exception.

Arsenic was detected in two subsurface soils (see Table 2-4) above the SSL of 15 mg/kg. The reported concentrations were 21.4 and 16.5 mg/kg. These two samples only slightly exceeded the SSL. Monitor wells in and near AOC 505 were sampled for arsenic, which was detected only once above its RBC and background reference value in one groundwater sample (A505GW001: 9.0 J μg/L); however, it was not detected above the MCL of 50 μg/L (the "J" qualifier indicates an estimated concentration). Arsenic had not been detected during two previous sampling events conducted at the location. Arsenic was detected in a subsequent sample collected from the same well four months later, but at a reduced concentration (6.4 J μg/L). This monitor well is also immediately adjacent and downgradient of an area with elevated arsenic levels.

Based on these data, the risk assessment did not identify any COCs for subsurface soil at SWMU 42/AOC 505. Also, considering that the data in Table 2-4 do not suggest widespread subsurface arsenic contamination, remediation of subsurface soils is not warranted.

### Groundwater

Four groundwater wells were installed at SWMU 42/AOC 505 at the time the RFI was completed. The location of these monitor wells is presented in Figure 2-4. Groundwater sample results were compared in the RFI to appropriate screening criteria. Analytes that exceeded the screening criteria were further evaluated in the risk assessment to determine which of these parameters were considered COCs at SWMU 42/AOC 505 (Section 10.5.6 of the Zone A RFI; pages 10.5.77 - 78 from the RFI Report is included in Appendix B). This analysis resulted in the identification of the following COPCs for the combined SWMU 42/AOC 505 for future residential use:

- Aluminum
- Arsenic
- Manganese
- Silver
- 1,1-dichloroethene (1,1-DCE)
- 1,1,2,2-tetrachloroethane (PCA)
- Tetrachloroethene (PCE)

Chloromethane, 1,1-DCE, 1,4-dichlorobenzene, and trichloroethene, although COPCs, are considered minor contributors to cumulative risk and HI and therefore do not warrant further consideration in this IM WP.

As stated in Section 1.1, this IM WP focuses on arsenic and BEQs. Therefore, arsenic will be the only groundwater COPC further discussed in this section (BEQs are not a groundwater COPC). The remaining groundwater COPCs will be addressed in the CMS for SWMU 42/AOC 505.

**Arsenic**

Arsenic was detected in 3 of 16 samples collected at SWMU 42/AOC 505 as part of the RFI. It exceeded its reference concentration (7.4 µg/L) in the third sampling event collected from A505GW001 (9.0 µg/L). However, the arsenic concentration did not exceed the reference concentration (11.1 µg/L) for the deep portion of the surficial aquifer or its MCL (50 µg/L).

Arsenic was detected in one of the 4 samples collected upon completion of the RFI (A505GW001C1a: 4.0 J µg/L). The detected concentration was below the reference concentration for arsenic. No groundwater samples exceeded the MCL of 50 µg/L for arsenic. Based on this information, arsenic in groundwater should not be considered a COC at this site. Further consideration of this constituent in remedial planning is not warranted.

### 2.1.5 Previously Conducted Interim Measure

Following the completion of the RFI, the Southern Division Naval Facilities Engineering Command determined that an IM would be performed by the Supervisor of Shipbuilding, Conversion and Repair, United States Navy, Portsmouth, Virginia, Environmental Detachment Charleston. The objective of the IM was to remove and dispose of lead-contaminated soil with concentrations above 400 mg/kg.

The IM removed approximately 5.4 cubic yards of lead-contaminated soil. The removal areas were around soil boring locations A505SB005 and A042SB009 (see figures in Appendix C for locations), both of which measured 6 x 6 x 2 feet deep. Following the removal of the contaminated soil, confirmatory samples were collected along the sidewalls and the bottom of the excavation. No samples reported lead concentrations above 400 mg/kg. The final *Completion Report –Interim Measure for SWMU 42, Former Asphalt Plant Tanks, Naval Base Charleston, Charleston, SC*, which presents excavation areas and sample locations, is presented in Appendix C (SUPSHIP, 1997).

# 2.2 Summary

## 2.2.1 Soil COCs and Remedial Objectives

As arsenic and BEQs were determined to be the only COCs in soil, MCSs were developed for these two constituents.

The MCS for BEQ will be the CNC base-wide reference concentration of 1,304 ug/kg.

The statistically estimated Zone A reference concentration for arsenic, as presented in the Final Zone A RFI, was 9.44 mg/kg. Table 2-5 (note this table presents the original grid sample population for the RFI as well as new samples collected in March 2001) presents the full data set for arsenic in surface soil grid samples in Zone A, sorted from the highest to lowest value. The Zone A reference concentration was a UTL 95%value, after the highest grid data point (30.1 mg/kg) was removed from the sample population.

The highest concentration data point was removed from the reference sample population because it was considered an "outlier." However, since this sample is representative of anthropogenic background conditions at the base, it should be included in the background evaluation. Therefore, the full range of arsenic results from grid locations was evaluated. The resulting UTL95% from the full data set was calculated as 29.0 mg/kg.

Additional soil samples were collected in March 2001 to characterize BEQ concentrations at railroad tracks; arsenic was also targeted for analysis in these samples. The railroad samples included samples from near/under railroad ties, and adjacent runoff areas. The results of this dataset are highlighted in Table 2-5. Two of the railroad track samples were collected from areas in Zone A.

The arsenic concentrations in the two railroad track samples were 2.04 and 41.0 mg/kg. Since SWMU 42/AOC 505 has extensive railroad tracks traversing the site, and some of the highest observed arsenic concentrations were near the railroad tracks, these railroad sample concentrations were included in a UTL95% calculation for Zone A. When all "non-SWMU" samples (i.e., original grid samples as well as railroad samples collected in March 2001) are included in the UTL95% calculation, the new UTL95% was calculated as 41 mg/kg.

In addition to the above site-specific information, another factor to consider in developing an MCS is a recent position EPA Region IV has taken on arsenic. This position was outlined in a letter prepared by Dann Spariosu, EPA Region IV, and submitted to Mihir Mehta, SCDHEC. The letter recommends a remediation goal of 20 mg/kg for arsenic in soil and cites a general range of arsenic background of 10 to 30 mg/kg within EPA Region IV.

Given the above information, CH2M-Jones recommends setting an MCS for arsenic at 29.0 mg/kg. The basis of this recommendation is:

- The proposed MCS represents the UTL95% for the original reference sample population
- The value is less than the upper end of the background range of arsenic with in Region IV (i.e., 30 mg/kg)

Though inclusion of the new (March 2001) railroad samples is applicable in the development of an MCS for SWMU 42/AOC 505, as a conservative measure, the new data have not been included.

It should be noted that developing an SSL-based MCS was considered. Using EPA default assumptions, and a DAF of 10, the SSL for arsenic in soil is 14.5 mg/kg. As this value is lower than the proposed reference value of 29.0 mg/kg, the proposed reference value would be the more relevant than the SSL in defining the MCS.

### 2.2.2 Groundwater COCs and Remedial Objectives

This IM WP focuses on arsenic and BEQs in soils. Groundwater COCs and remedial objectives will be addressed in the CMS.

## 2.3 Determination of Soil Excavation Limits

As discussed in the subsurface soil portion of Section 2.1.3, only surface soil removal is recommended.

As presented in Section 2.2.1, the recommended MCS for arsenic and BEQs is 29.0 mg/kg and 1,304 ug/kg, respectively. The objective of the IM is to ensure that, upon IM completion, the half-acre parcel exposure concentration is equal to or less than the MCS. Note that it is possible for individual soil samples within SWMU 42/AOC 505 to exceed the statistically based MCS, provided that the UCL95 concentration is lower than the MCS. A half-acre box will be used as an exposure area for future assumed residential land use, where statistical upper-bound averages (i.e., UCL 95%) are at or below reference levels for arsenic.

The phased process was used to determine excavation extents:

1. A half-acre box was moved over the site with the purpose to "box in" as many of the highest arsenic and BEQ levels on the site. Several half-acre box calculations were performed, as required, to address all the highest levels of arsenic and BEQs in soil. Once a box was drawn around the samples, a UCL95 was calculated for data within that

box. If the UCL95 concentration is below the MCS, no excavation is required within that box. If the UCL95 is greater than the MCS, then some soil requires removal.

2. Two-dimensional kriging was used to estimate the extent of excavation within boxes that are determined to require soil removal, based on results of Phase 2 above. (Kriging is a mathematical process recognized by the EPA as the best and standard means for the interpolation and extrapolation of measured data.) Where excavation is required in a half-acre box, it was assumed that the sample locations where soil is being removed were replaced with "clean" soil. Proposed excavation limits are further discussed in Section 3.1 of this IM WP.

**TABLE 2-1**
Risk Assessment Results Summary from RFI Report
*IM Work Plan, SWMU 42, AOC 505, Zone A, CNC*

| COPC | Maximum Concentration (mg/kg) | EPC (mg/kg) | Industrial Worker | | Residential | | |
|---|---|---|---|---|---|---|---|
| | | | ILCR | HQ/HI | ILCR | HQ/HI | |
| **Surface Soils** | | | | | | **Adult** | **Child** |
| Aroclor-1260 | 1.8 | 0.16 | 1.5E-07 | NC | 7.4E-07 | NC | NC |
| Arsenic | 62 | 23 | 8.3E-06 | 0.052 | 5.90E-05 | 0.121 | 1.0 |
| BEQ | 7.4 | 7.4 | 1.5E-05 | NC | 7.40E-05 | NC | NC |
| Beryllium | 0.38 | 0.18 | 2.0E-07 | 0.00002 | 1.34E-06 | 0.00006 | 0.0005 |
| 4,4-DDE | 2.5 | 0.27 | 4.3E-08 | NC | 2.15E-07 | NC | NC |
| 4,4-DDT | 2.3 | 0.3 | 4.7E-08 | 0.00077 | 2.31E-07 | 0.00148 | 0.0098 |
| Manganese | 79 | 311 | NC | 0.00117 | 0 | 0.00277 | 0.0236 |
| **Total Risk/HI for Soils (ingestion+dermal)** | | | **2E-05** | **0.05** | **1E-04** | **0.13** | **1.06** |

* Risk summary is adapted from Final RFI.
EPC Exposure point concentration from RFI report, Tables 10.5.13 and 10.5.14.
HQ/HI hazard quotient/hazard index
ILCR Incremental lifetime cancer risk
NC not calculated

**TABLE 2-2**
Arsenic Results from Surface Soil Samples Collected at SWMU 42/AOC 505
*IM Work Plan, SWMU 42, AOC 505, Zone A, CNC*

| Sample | Result | Unit | Qualifier | Date Collected |
|---|---|---|---|---|
| 505SB00801 | 12.90000 | mg/kg | = | 10/07/1995 |
| 505SB00201 | 62.00000 | mg/kg | = | 10/07/1995 |
| 505SB00301 | 3.30000 | mg/kg | = | 10/07/1995 |
| 505SB00401 | 6.60000 | mg/kg | = | 10/06/1995 |
| 505SB00501 | 8.60000 | mg/kg | = | 10/07/1995 |
| 505SB00601 | 7.00000 | mg/kg | = | 10/07/1995 |
| 505SB00901 | 3.60000 | mg/kg | = | 10/07/1995 |
| 505SB01001 | 33.10000 | mg/kg | = | 10/07/1995 |
| 505SB01101 | 10.30000 | mg/kg | = | 10/07/1995 |
| 505SB00701 | 18.20000 | mg/kg | = | 10/07/1995 |
| 042SB04701 | 14.30000 | mg/kg | = | 02/22/1999 |
| 042SB04801 | 2.10000 | mg/kg | = | 02/22/1999 |
| 505SB00101 | 2.90000 | mg/kg | = | 10/06/1995 |
| 042SB04401 | 28.00000 | mg/kg | = | 02/22/1999 |
| 042SB00801 | 1.10000 | mg/kg | J | 10/06/1995 |
| 042SB00101 | 1.50000 | mg/kg | J | 10/05/1995 |
| 042SB00201 | 2.30000 | mg/kg | = | 10/06/1995 |
| 042SB00301 | 2.00000 | mg/kg | J | 10/06/1995 |
| 042SB00401 | 1.80000 | mg/kg | J | 10/06/1995 |
| 042SB00501 | 2.10000 | mg/kg | J | 10/06/1995 |
| 042SB00601 | 0.93000 | mg/kg | U | 10/06/1995 |
| 042SB00701 | 5.50000 | mg/kg | = | 10/06/1995 |
| 042SB04601 | 36.90000 | mg/kg | = | 02/22/1999 |
| 042SB03401 | 4.40000 | mg/kg | = | 10/13/1998 |
| 042SB02601 | 0.90000 | mg/kg | J | 10/13/1998 |
| 042SB02701 | 1.40000 | mg/kg | = | 10/13/1998 |
| 042SB02801 | 1.10000 | mg/kg | = | 10/13/1998 |
| 042SB02901 | 3.50000 | mg/kg | = | 10/13/1998 |
| 042SB03001 | 3.80000 | mg/kg | = | 10/13/1998 |
| 042SB03101 | 5.30000 | mg/kg | = | 10/13/1998 |
| 042SB03301 | 0.65000 | mg/kg | J | 10/13/1998 |
| 042SB02101 | 25.40000 | mg/kg | = | 03/29/1996 |
| 042SB03501 | 2.80000 | mg/kg | = | 10/13/1998 |
| 042SB03601 | 1.40000 | mg/kg | = | 10/13/1998 |
| 042SB03701 | 3.30000 | mg/kg | = | 10/13/1998 |
| 042SB03801 | 2.90000 | mg/kg | = | 10/13/1998 |
| 042SB03901 | 1.80000 | mg/kg | = | 10/13/1998 |
| 042SB04001 | 4.80000 | mg/kg | J | 10/13/1998 |
| 042SB04101 | 2.40000 | mg/kg | = | 10/14/1998 |

**TABLE 2-2**
Arsenic Results from Surface Soil Samples Collected at SWMU 42/AOC 505
*IM Work Plan, SWMU 42, AOC 505, Zone A, CNC*

| Sample | Result | Unit | Qualifier | Date Collected |
|---|---|---|---|---|
| 042SB04201 | 8.60000 | mg/kg | = | 10/14/1998 |
| 042SB04301 | 3.00000 | mg/kg | = | 10/14/1998 |
| 042SB03201 | 0.62000 | mg/kg | J | 10/13/1998 |
| 042SB00901 | 6.10000 | mg/kg | = | 10/06/1995 |
| 042SB01001 | 12.30000 | mg/kg | = | 10/07/1995 |
| 042SB01101 | 3.20000 | mg/kg | = | 03/29/1996 |
| 042SB01201 | 4.80000 | mg/kg | = | 03/29/1996 |
| 042SB01301 | 9.50000 | mg/kg | = | 03/29/1996 |
| 042SB01401 | 30.30000 | mg/kg | = | 03/29/1996 |
| 042SB01501 | 4.90000 | mg/kg | = | 03/29/1996 |
| 042SB04501 | 4.50000 | mg/kg | = | 02/22/1999 |
| 042SB01601 | 28.20000 | mg/kg | = | 03/29/1996 |
| 042SB01701 | 38.60000 | mg/kg | = | 03/29/1996 |
| 042SB01801 | 2.60000 | mg/kg | = | 03/29/1996 |
| 042SB01901 | 6.30000 | mg/kg | = | 03/29/1996 |
| 042SB02001 | 31.60000 | mg/kg | = | 03/29/1996 |
| 037SB001A1 | 3.40000 | mg/kg | = | 05/16/1997 |
| 504SB006A1 | 10.90000 | mg/kg | = | 07/17/1997 |
| 504SB007A1 | 7.20000 | mg/kg | = | 07/17/1997 |
| 504SB008A1 | 4.60000 | mg/kg | = | 07/17/1997 |
| 504SB005A1 | 16.40000 | mg/kg | = | 07/17/1997 |
| 504SB001A1 | 2.10000 | mg/kg | = | 07/17/1997 |
| 504SB002A1 | 7.80000 | mg/kg | = | 07/17/1997 |

= Result is equal to reported value.
J Result is estimated and below quantitation limit.
U Result is not detected below reported level.

**TABLE 2-3**
BEQ Results from Surface Soil Samples Collected at SWMU 42/AOC 505
*IM Work Plan, SWMU 42, AOC 505, Zone A, CNC*

| Station ID | BEQ (mg/kg) | Qualifier | Unit | Station ID | BEQ (mg/kg) | Qualifier |
|---|---|---|---|---|---|---|
| A042SB024 | 7389.10000 | = | mg/kg | A505SB021 | 820.17000 | = |
| LA504SB006 | 3219.60000 | = | mg/kg | A505SB018 | 808.62000 | = |
| A505SB008 | 2348.80000 | = | mg/kg | AGDASB009 | 804.17000 | = |
| LA504SB008 | 2195.45000 | U | mg/kg | A042SB009 | 784.30000 | = |
| A042SB010 | 1892.40000 | = | mg/kg | A042SB023 | 738.83000 | = |
| A042SB017 | 1882.95000 | = | mg/kg | A505SB002 | 698.42000 | = |
| AGDASB006 | 1384.98000 | = | mg/kg | A042SB013 | 626.81000 | = |
| A042SB022 | 1374.84000 | = | mg/kg | A042SB021 | 542.05100 | = |
| A505SB007 | 1365.90000 | = | mg/kg | A042SB011 | 537.20000 | = |
| A042SB007 | 1228.51000 | = | mg/kg | A042SB042 | 507.09000 | = |
| A042SB014 | 1227.20000 | = | mg/kg | A042SB028 | 462.20000 | U |
| A042SB016 | 1067.08000 | = | mg/kg | A042SB036 | 462.20000 | U |
| A505SB001 | 1063.06000 | U | mg/kg | A042SB027 | 450.64500 | U |
| A505SB004 | 995.87000 | = | mg/kg | A042SB029 | 439.09000 | U |
| A505SB020 | 924.40000 | U | mg/kg | A042SB030 | 439.09000 | U |
| A042SB006 | 889.73500 | U | mg/kg | A042SB032 | 439.09000 | U |
| A505SB003 | 889.73500 | U | mg/kg | A042SB034 | 439.09000 | U |
| A505SB005 | 883.62000 | = | mg/kg | A042SB035 | 439.09000 | U |
| A042SB018 | 878.18000 | U | mg/kg | A042SB037 | 439.09000 | U |
| A505SB009 | 878.18000 | U | mg/kg | A042SB026 | 427.53500 | U |
| A505SB010 | 877.95000 | = | mg/kg | A042SB031 | 427.53500 | U |
| A042SB001 | 866.62500 | U | mg/kg | A042SB038 | 427.53500 | U |
| A042SB005 | 866.62500 | U | mg/kg | A042SB039 | 427.53500 | U |
| A042SB008 | 866.62500 | U | mg/kg | A042SB041 | 427.53500 | U |
| A505SB013 | 866.62500 | U | mg/kg | A042SB043 | 427.53500 | U |
| AGDASB008 | 866.62500 | U | mg/kg | LA504SB001 | 427.53500 | U |
| A042SB012 | 865.93600 | = | mg/kg | A042SB019 | 374.74000 | = |
| A505SB006 | 863.35000 | = | mg/kg | A505SB017 | 369.35000 | = |
| A042SB004 | 855.07000 | U | mg/kg | LA504SB002 | 330.77000 | = |
| A042SB015 | 855.07000 | U | mg/kg | LA504SB005 | 298.45000 | = |
| A042SB003 | 843.51500 | U | mg/kg | A505SB016 | 293.09600 | = |
| A042SB025 | 843.51500 | U | mg/kg | A042SB033 | 291.60000 | = |
| A505SB019 | 843.51500 | U | mg/kg | A505SB014 | 287.97000 | = |
| AGDASB010 | 843.51500 | U | mg/kg | A505SB012 | 270.81000 | = |
| A042SB020 | 831.96000 | U | mg/kg | LA037SB001 | 267.47300 | = |
| A505SB011 | 831.96000 | U | mg/kg | A505SB015 | 259.63500 | = |
| AGDASB007 | 831.81000 | = | mg/kg | LA504SB007 | 223.66000 | = |
| A042SB002 | 820.40500 | U | mg/kg | A042SB040 | 199.25000 | = |

= Result is equal to reported value.
U Result is not detected below reported level.

**TABLE 2-4**
Arsenic Results from Subsurface Soil Samples Collected at SWMU 42/AOC 505
*IM Work Plan, SWMU 42, AOC 505, Zone A*

| Sample | Result | Unit | Qualifier | Date Collected |
|---|---|---|---|---|
| 042SB01702 | 21.40000 | mg/kg | = | 03/29/1996 |
| 504SB008A2 | 16.50000 | mg/kg | = | 07/17/1997 |
| 042SB00102 | 12.10000 | mg/kg | = | 10/05/1995 |
| 042SB02002 | 12.00000 | mg/kg | = | 03/29/1996 |
| 042SB00202 | 11.30000 | mg/kg | J | 10/06/1995 |
| 042SB00802 | 9.50000 | mg/kg | = | 10/06/1995 |
| 042SB01102 | 6.30000 | mg/kg | = | 03/29/1996 |
| 042SB00302 | 6.20000 | mg/kg | = | 10/06/1995 |
| 505SB00802 | 6.00000 | mg/kg | = | 10/07/1995 |
| 042SB00502 | 5.90000 | mg/kg | = | 10/06/1995 |
| 505SB00702 | 5.40000 | mg/kg | = | 10/07/1995 |
| 042SB01802 | 5.30000 | mg/kg | = | 03/29/1996 |
| 504SB002A2 | 5.10000 | mg/kg | = | 07/17/1997 |
| 042SB00402 | 5.00000 | mg/kg | = | 10/06/1995 |
| 042SB01202 | 4.90000 | mg/kg | = | 03/29/1996 |
| 042SB01502 | 4.70000 | mg/kg | = | 03/29/1996 |
| 042SB00602 | 4.30000 | mg/kg | = | 10/06/1995 |
| 042SB02102 | 4.20000 | mg/kg | = | 03/29/1996 |
| 042SB01402 | 4.20000 | mg/kg | = | 03/29/1996 |
| 042SB00702 | 3.80000 | mg/kg | = | 10/06/1995 |
| 037SB001A2 | 3.70000 | mg/kg | = | 05/16/1997 |
| 042SB00902 | 3.40000 | mg/kg | = | 10/06/1995 |
| 042SB01902 | 3.40000 | mg/kg | = | 03/29/1996 |
| 504SB005A2 | 3.10000 | mg/kg | = | 07/17/1997 |
| 042SB01302 | 3.00000 | mg/kg | = | 03/29/1996 |
| 505SB00402 | 2.70000 | mg/kg | = | 10/06/1995 |
| 505SB01002 | 2.10000 | mg/kg | J | 10/07/1995 |
| 504SB007A2 | 1.90000 | mg/kg | = | 07/17/1997 |
| 042SB01602 | 1.20000 | mg/kg | J | 03/29/1996 |
| 505SB00502 | 0.93000 | mg/kg | U | 10/07/1995 |
| 505SB00102 | 0.92000 | mg/kg | U | 10/06/1995 |
| 505SB01102 | 0.92000 | mg/kg | U | 10/07/1995 |
| 505SB00302 | 0.90000 | mg/kg | U | 10/07/1995 |
| 504SB001A2 | 0.87000 | mg/kg | J | 07/17/1997 |
| 504SB006A2 | 0.69000 | mg/kg | J | 07/17/1997 |

= Result is equal to reported value.
J Result is estimated and below quantitation limit.
U Result is not detected below reported

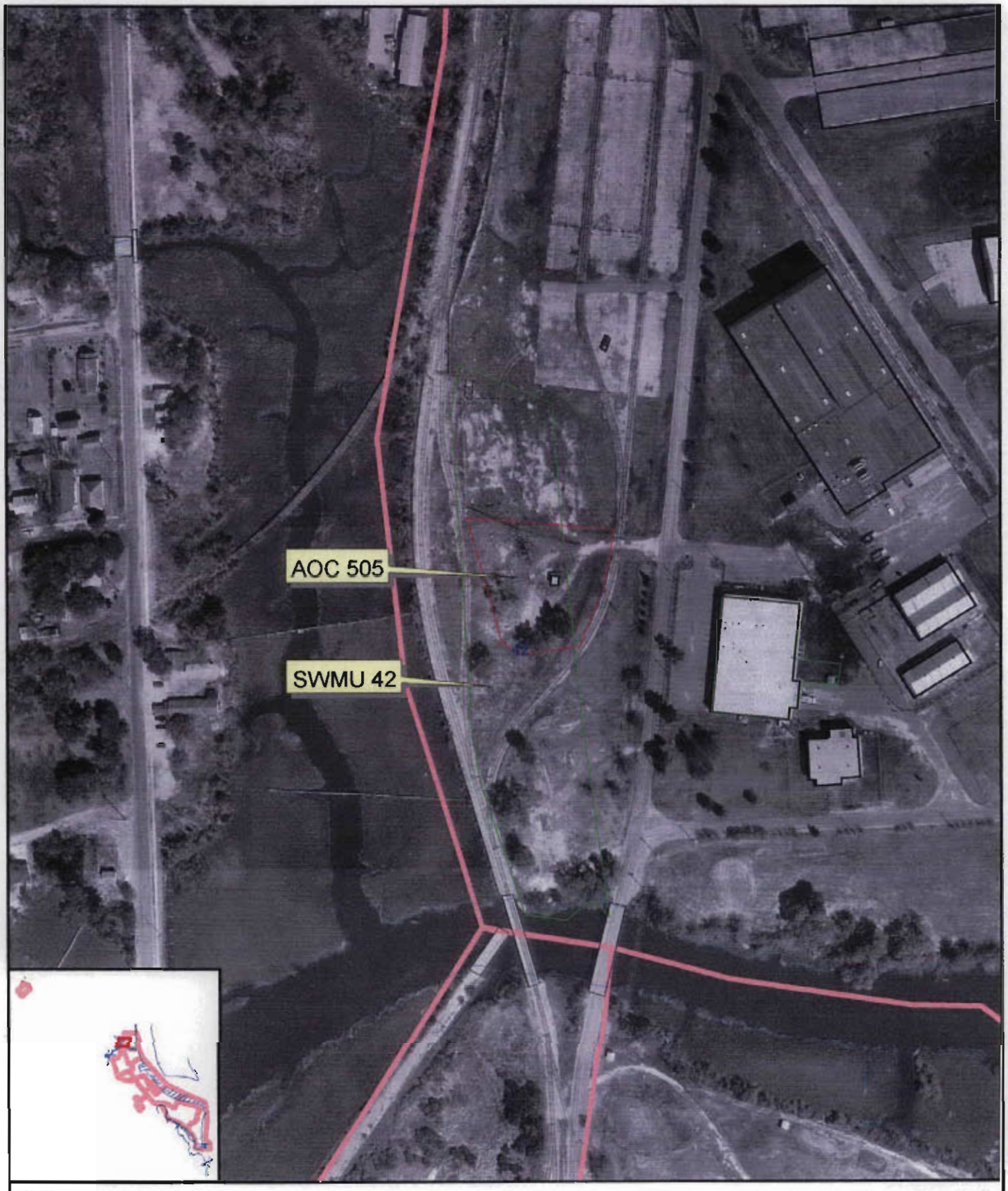



**Figure 2-1**
Aerial View
SWMU 42/AOC 505
Charleston Naval Complex

CH2MHILL

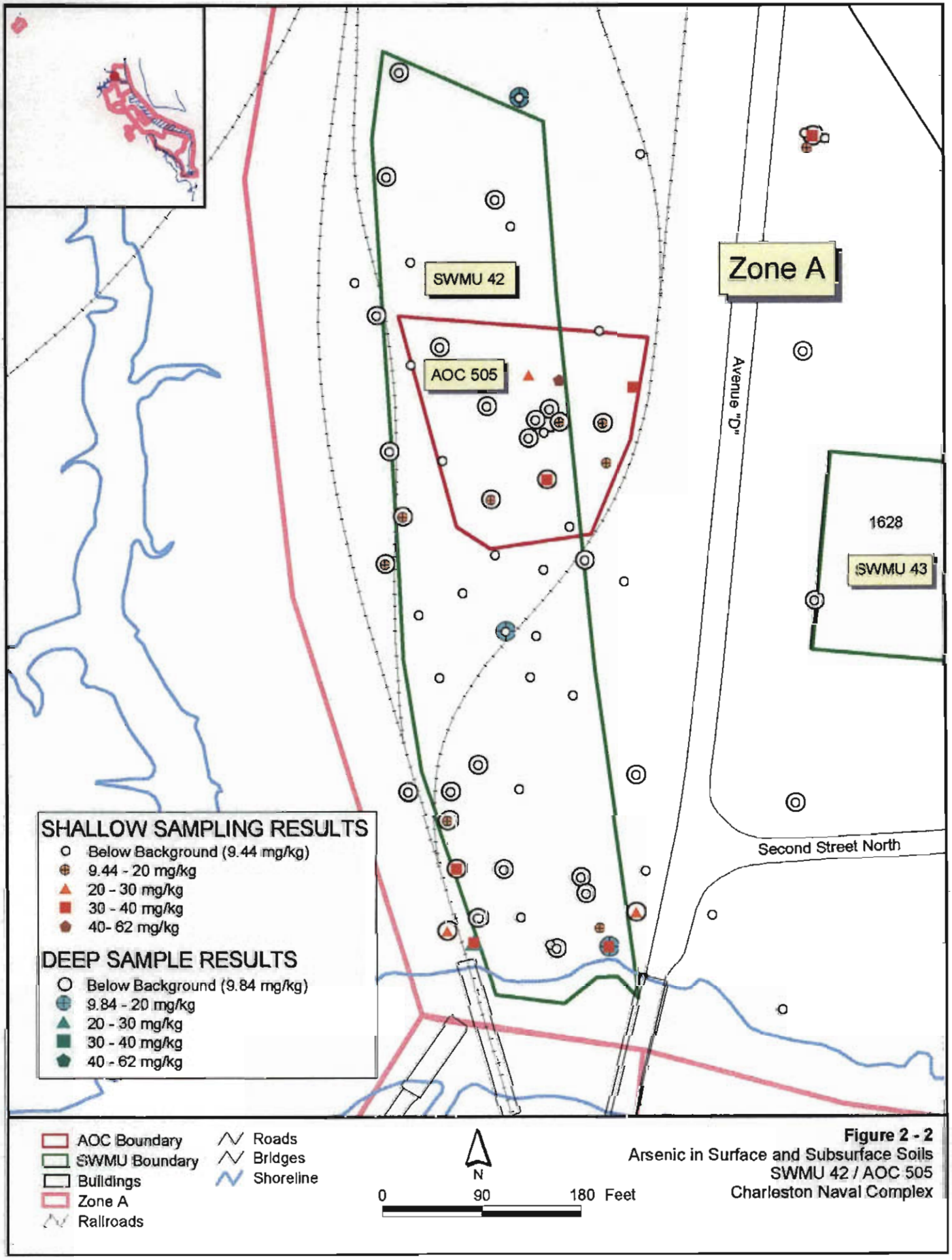



**Figure 2 - 2**
Arsenic in Surface and Subsurface Soils
SWMU 42 / AOC 505
Charleston Naval Complex

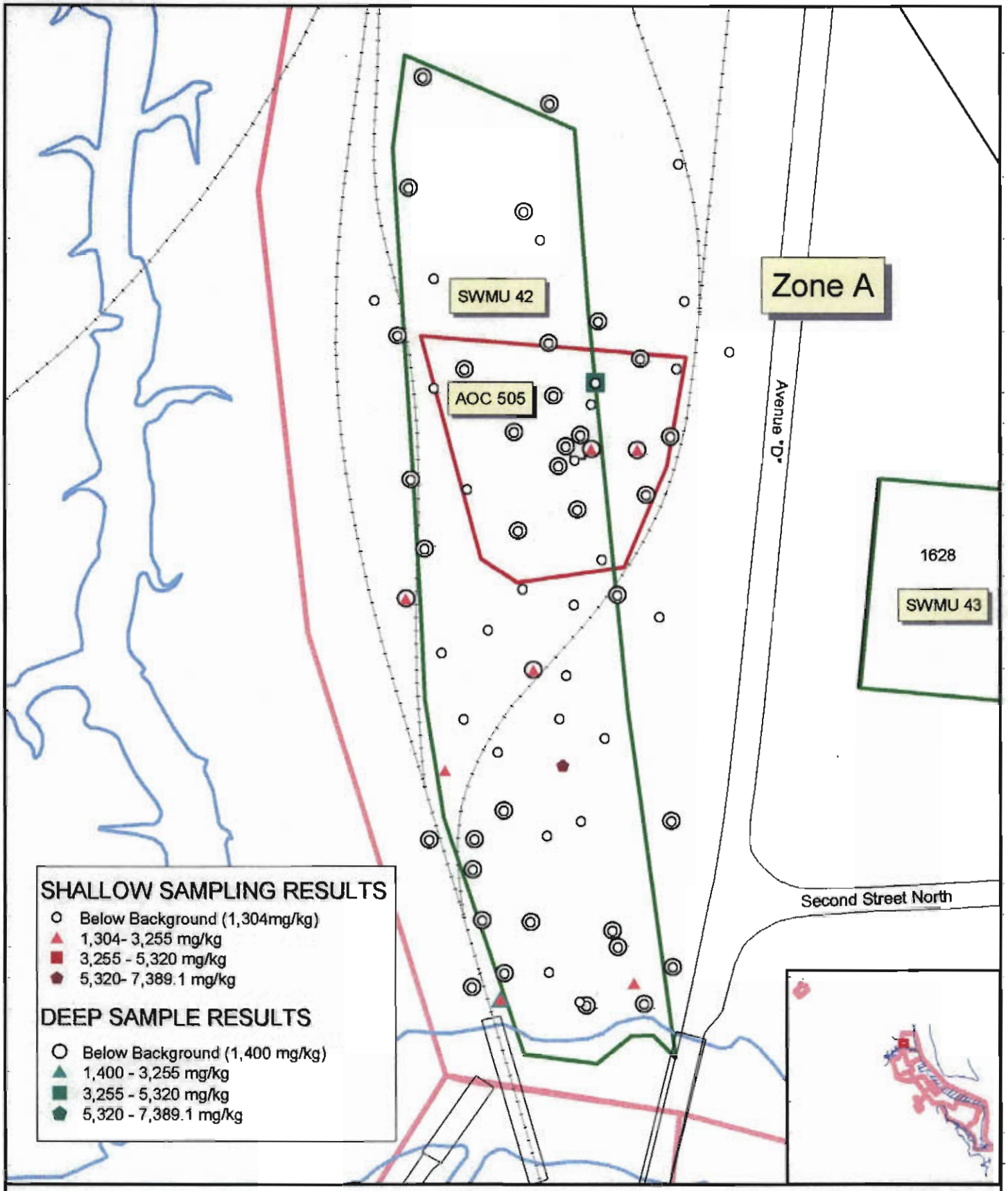



**Figure 2 - 3**
BEQ's in Surface and Subsurface Soils
SWMU 42 / AOC 505
Charleston Naval Complex

File Path: c:\ifiles\swmu42\aoc-eqissswmu42a.apr Date: 08 Jan 2001 21:42 User: RPFELST

NOTE: Original figure created in color

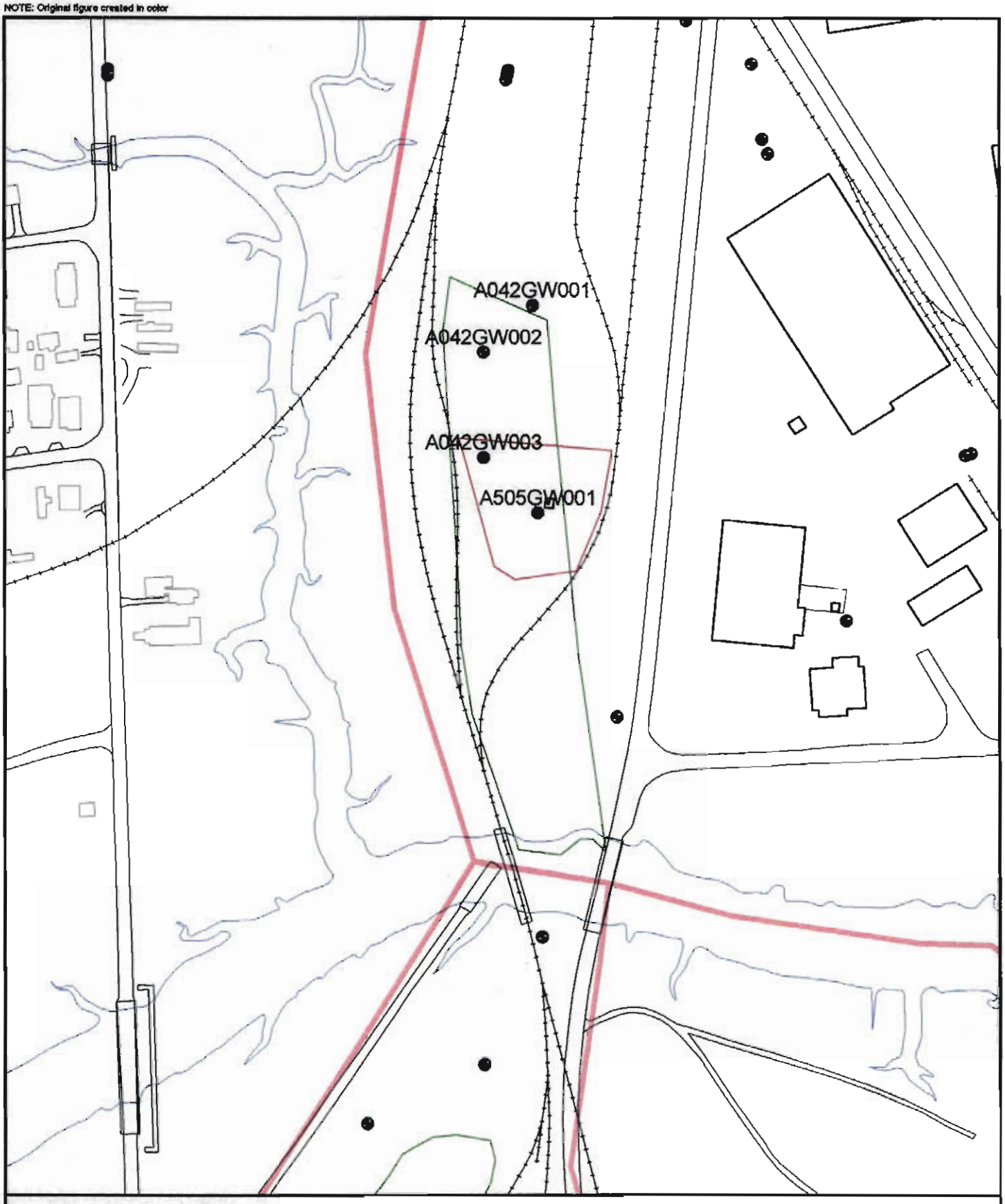



**Figure 2-4**
Monitoring Well Locations
SWMU 42/AOC 505
Charleston Naval Complex

CH2MHILL

SECTION 3.0

# Interim Measure Work Plan

# 3.0 Interim Measure Work Plan

This section presents the details associated with the proposed site cleanup plan. The objective of the IM is to remove arsenic and BEQs in surface soils to a level that reduces the overall site exposure concentration to the previously referenced MCSs. Following removal of the contaminated soils, the site will be backfilled with clean fill.

## 3.1 Soil Removal

As presented in the subsurface soil portion of Section 2.1.3, only surface soil removal is required to achieve the remedial action objectives at SWMU 42/AOC 505.

The data were evaluated to determine whether the exposure concentration for the default exposure area (half-acre) was below the MCS for arsenic and BEQs. The data evaluation indicated that soil with elevated arsenic and BEQs required removal to achieve the respective exposure concentration below the MCS for a half-acre exposure area.

Two-dimensional kriging was performed to estimate the area of soil requiring cleanup. The EVS-PRO software package was used to complete the two-dimensional kriging. EVS-PRO utilizes expert systems to analyze the input data, construct a multidimensional variogram that best fits the data set being analyzed, and then perform kriging in the domain to be considered in the visualization. One of the fundamental criteria used in EVS-PRO's variogram and kriging algorithms was to produce kriged distributions that honor the measured distributions as closely as possible. Engineering judgement was also used to estimate appropriate excavation limits.

### 3.1.1 Arsenic Removal

Figure 3-1 shows the surface soil exposure concentration and proposed excavation areas. To evaluate the UCL 95% on a half-acre area basis, half-acre boxes were drawn around sample points with concentrations greater than the MCS. A total of three boxes were drawn, as illustrated on Figure 3-1. All three boxes were calculated to have an exposure concentration in excess of the arsenic MCS. However, the exposure concentration in Box 2 of Figure 3-1 shows that the MCS exceedance is driven by elevated arsenic concentrations found very close to the railroad tracks (30.3 and 38.6 $\mu$g/kg). Additionally, an elevated arsenic value is also reported near the railroad track in Exposure Box 1 ( 36.9 mg/kg).

As presented in a memorandum to the BCT dated May 3, 2001, the range of arsenic in railroad track soil samples collected in areas not influenced by a SWMU or AOC is 2 to 92 mg/kg.The two-times the mean value of arsenic reported for railroad track samples is 53 mg/kg The elevated railroad track samples reported for Box 1 and Box 2 in Figure 3-1 are consistent with those typically found near railraod track. Therefore, removal of soils at the locations is not warranted (i.e., soil removal is not required in Exposure Box 2). Therefore, soil removal is only necessary at two of the three boxes represented in Figure 3-1.

To allow for a UCL 95% concentration reduction to a level below the MCS in Boxes 1 and 3, soil removal is required. Proposed excavation shapes are represented on Figure 3-1. To evaluate a UCL 95% concentration for an exposure box where excavation was performed, it was assumed that the backfilled soil would have an arsenic concentration of 10 mg/kg. With this approach, the soil sample points in an excavation shape were assumed to be 10 mg/kg arsenic. This value is consistent with the arsenic reported in the fill that CH2M-Jones will use for backfill.

Two areas, as illustrated on Figure 3-1, are proposed for excavation. A total excavation area of approximately 3,200 square feet ($ft^2$) is required to a depth of one foot. This area corresponds to approximately 118 cubic yards ($y^3$) of soil, not accounting for a swell factor. The weight of soil removed from the site is estimated as 177 tons (assuming 1.50 tons of soil per $y^3$ of soil in place).

### 3.1.2 BEQ Removal

Figure 3-2 shows the surface soil exposure concentration and proposed excavation area. To evaluate the UCL 95% on a half-acre area basis, half-acre boxes were drawn around sample points with concentrations greater than the MCS. A total of three boxes were drawn, as illustrated on Figure 3-2. One box was calculated to have an exposure concentration in excess of the BEQ MCS. Figure 3-2 shows exposure concentrations in Box 2 as a function of different removal and calculation scenarios. The UCL 95% is still greater than the MCS when the highest sample is removed, and less than the MCS when the two highest samples are removed. However, the second highest BEQ value on Figure 3-2 is located near a railroad track.

As presented in a memorandum to the BCT dated May 3, 2001, the range of BEQ in railroad track soil samples collected in areas not influenced by a SWMU or AOC is 87 to 5,133 $\mu g/kg$. The two-times the mean value of BEQ reported for railroad track samples is 3,397 $\mu g/kg$. The elevated railroad track samples reported for Box 2 on Figure 3-2 are consistent with

those typically found near railroad tracks. Therefore, removal of soils is not warranted at the locations where BEQ exceeds the MCS in Box 2 of Figure 3-2. An acceptable exposure concentration in Box 2 is calculated assuming removal of the highest soil sample concentration, and not considering the railroad track samples, the exposure concentration in Exposure Box 2 is below the MCS.

To allow for a UCL 95% concentration reduction to a level below the MCS in Box 2, soil removal is required. To evaluate a UCL 95% concentration for an exposure box where excavation was performed, it was assumed that the backfilled soil would have a BEQ concentration of 1,000 $\mu g/kg$. This value is consistent with the BEQ reported in the fill CH2M-Jones plans to use for backfill.

One area, as illustrated on Figure 3-2, is proposed for excavation. A total excavation area of approximately 3,100 square feet ($ft^2$) is required to a depth of one foot. This area corresponds to approximately 114 cubic yards ($y^3$) of soil, not accounting for a swell factor. The weight of soil removed from the site is estimated as 172 tons (assuming 1.50 tons of soil per $y^3$ of soil in place).

## 3.2 Excavation Summary

A total of 6,300 $ft^2$ of soil (350 tons), excavated to a depth of one foot, will be removed from three different excavation areas. The soil excavation areas are presented on Figure 3-3.

## 3.3 Health and Safety

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

## 3.4 Sampling and Analysis Plan

All investigative work will be performed in accordance with the Comprehensive Sampling and Analysis Plan (CSAP) portion of the RFI Work Plan (EnSafe, 1997).

## 3.5 Pre-Excavation Activities

Prior to excavation, soil samples will be collected and analyzed for arsenic and BEQs to determine the proper extent of the excavation required for exposure concentrations to be below the MCS. Initially, four surface soil samples will be collected from the limits of each of the three excavations presented on Figure 3-3 (note the target constituent in the analysis will

be limited to either arsenic or BEQ). Results of these analyses will be evaluated to determine whether removal of the area between the four samples is adequate to allow the exposure concentration to be below the MCS. If this evaluation indicates that additional soil should be removed, additional pre-excavation sampling will be conducted. The pre-excavation sampling will be completed when it can be demonstrated that the exposure concentration for the exposure area is below the arsenic or BEQ MCS. The limits of the excavation limits will then be staked to provide a boundary for the actual limits of soil to be removed.

To prepare for the start of onsite operations, CH2M-Jones will notify the necessary agencies, departments, and utilities regarding planned activities at the project site. No permits are necessary for completing the removal of soils at SWMU 42/AOC 505.

CH2M-Jones will assess the site for existing water, electricity, natural gas, telephone, or other utility lines that may pose a potential hazard at the site. Utilities will be clearly marked and identified.

CH2M-Jones requires and places significant emphasis on project health and safety for our own personnel, our subcontractors, and the local community. Once all mobilized site personnel have arrived on site, a project briefing and health and safety orientation meeting will be conducted for all site personnel. Work areas will be designated. Site control procedures, including work area barricades, daily site security, and site cleanliness and maintenance procedures, will be reviewed and implemented. Vehicle access areas will be identified and site traffic monitored.

### 3.5.1 Site Security Zones

The contaminant levels reported at SWMU 42/AOC 505 are within a range considered protective of industrial workers. Therefore, personnel working at the site will be required to comply with wearing Level D personal protective equipment (PPE). The excavation area will be clearly marked with warning tape to warn of possible tripping or falling hazards.

### 3.5.2 Site Clearing

Site preparation, clearing, and grubbing of onsite vegetation will begin in areas where excavation and site preparation activities will take place. In areas not disturbed by site activities, reasonable attempts will be made to limit the disturbance of ground cover. No activities in or under existing site structures are planned as part of this IM.

# 3.6 Support Activities

## 3.6.1 Waste Management

The following three waste streams will be generated as part of this IM: 1) excavated soils, 2) decontamination wastes, and 3) PPE. No hazardous wastes are expected to be generated as a result of this IM. Excavated soils will be characterized in accordance with South Carolina Hazardous Waste Management Regulations (Section SCDHEC R.61-79.261) and disposed of in accordance with all applicable regulations and permits. Assuming soils will be characterized as non-hazardous, they will be sent to a subtitle D landfill. Decontamination wastes and PPE also will be disposed of in accordance with applicable regulations.

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

## 3.6.2 Equipment Decontamination

Decontamination of personnel, sampling and removal equipment, and materials will comply with the CH2M-Jones Site Specific Project Health and Safety Plan.

# 3.7 Excavation of Soils

## 3.7.1 Excavation

Figure 3-3 presents the estimated limits of the excavation for arsenic and BEQ contaminated soils. These limits may be revised after the pre-excavation are collected and evaluated, as discussed in Section 3.6 of this IM WP. Surface soil will be excavated to a depth of one foot. Post-excavation confirmation sampling will not be performed as the pre-excavation sampling effort described in Section 3.6 will be adequate to ensure the proper amount of soil has been removed to comply with the remedial action objectives of this IM WP.

Excavated soils will be transferred immediately to a disposal container (e.g., a roll-off box or similar container) and subsequently transported to an appropriately permitted offsite disposal facility for landfilling. The transported waste will be covered with a tarp to minimize airborne transfer of soil particulates.

### 3.7.2 Site Restoration

The excavation area will be backfilled with appropriate fill material to an elevation that approximates pre-excavation topography. The site will then be seeded to promote growth of grass.

## 3.8 Interim Measure Completion Report

Upon IM WP approval, the IM will be implemented. A final report will be submitted within 60 days of completion of the IM. The final report will summarize actions performed and will provide the following information:

- Excavated volumes
- Nature and volume of waste generated
- Waste disposal
- Sampling results
- Site photographs
- Problems encountered
- Other information that could be helpful in evaluating the IM

NOTE: Original figure created in color

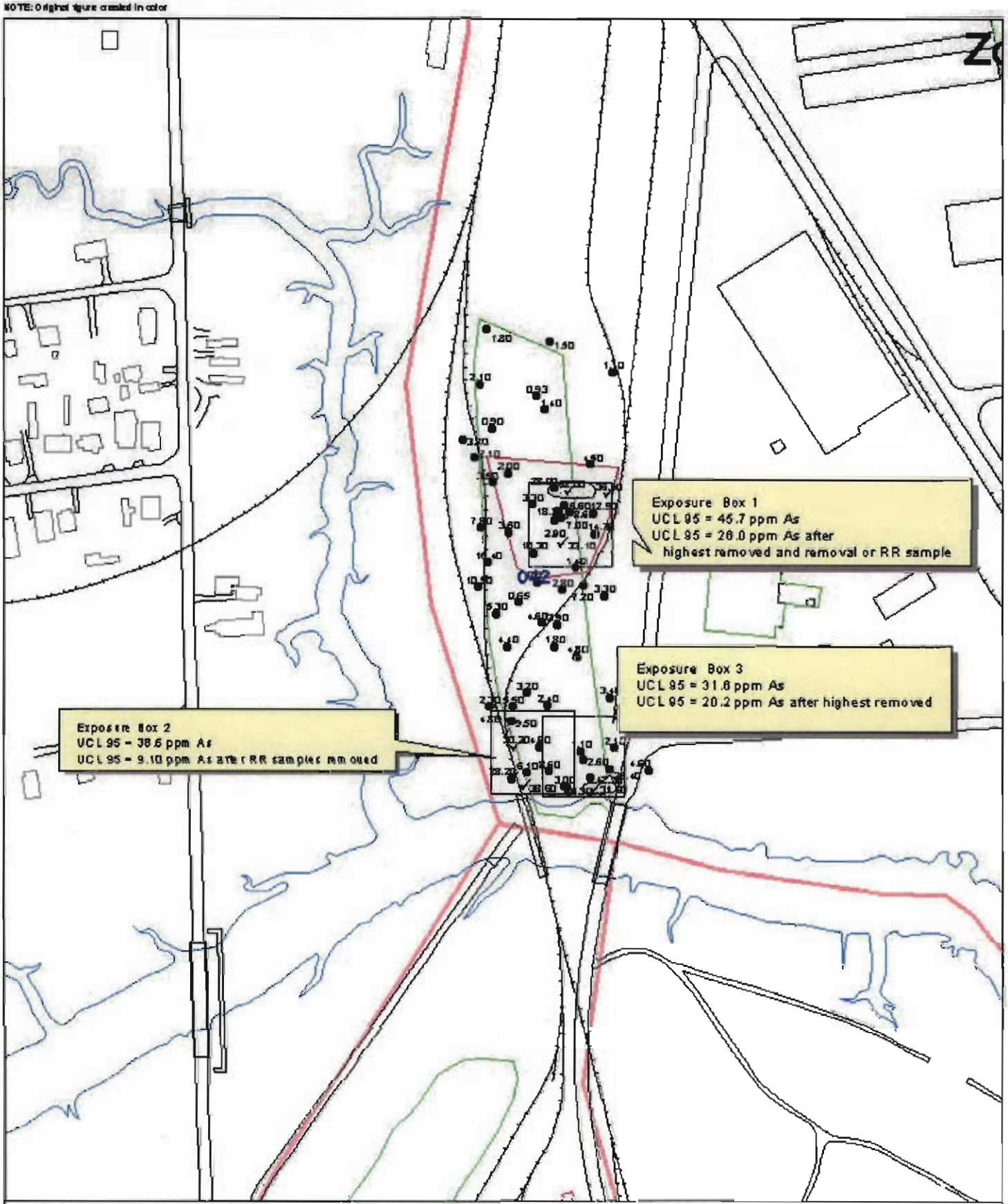



**Figure 3-1**
As Exposure Concentrations and Excavation Area
SWMU 42/AOC 505
Charleston Naval Complex

CH2MHILL

NOTE: Original figure created in color

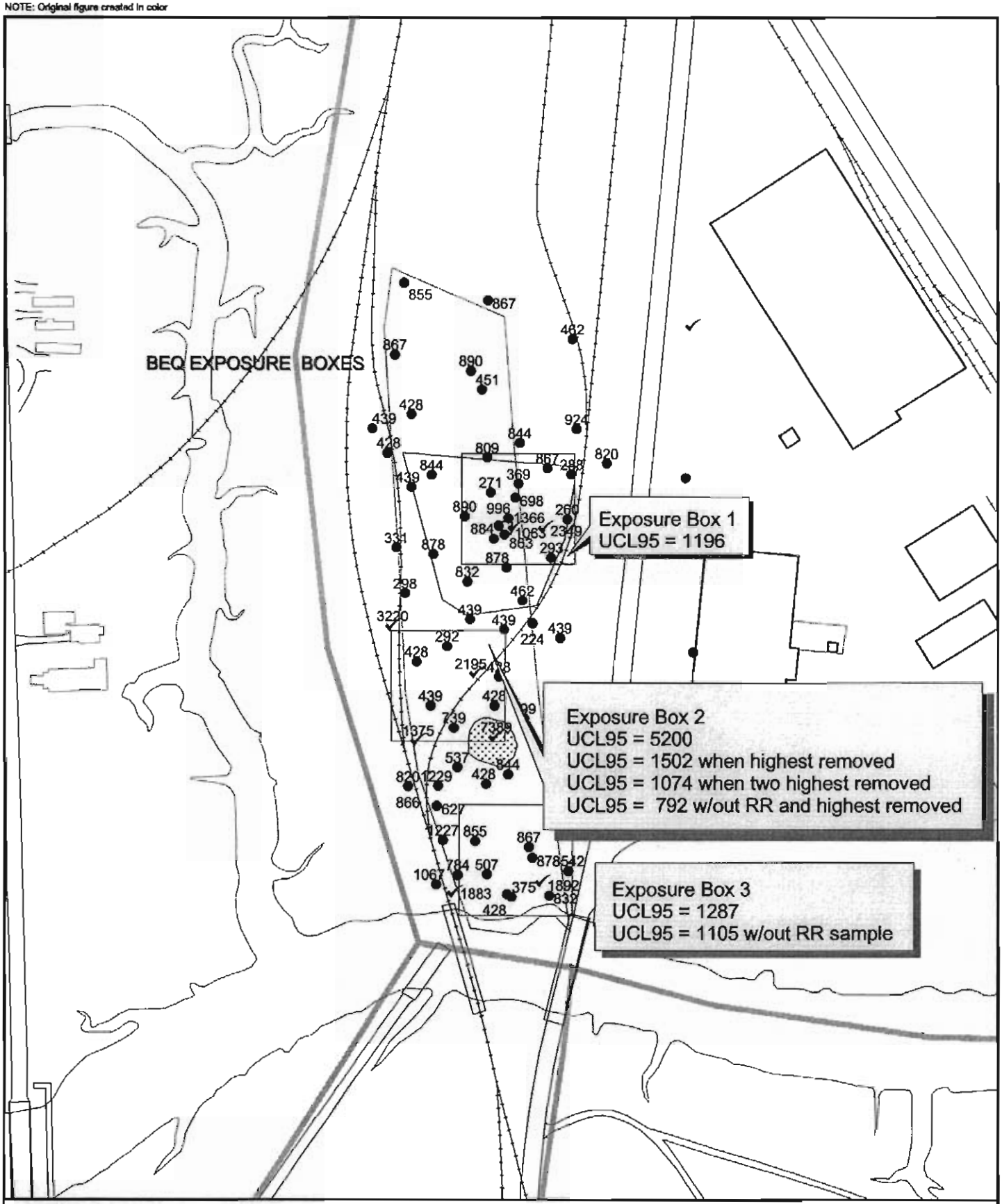



**Figure 3-2**
BEQ Exposure Concentrations and Excavation Area
SWMU 42/AOC 505
Charleston Naval Complex

CH2MHILL

File Path: c:\paulsarc\view\aprs\swmu 42.apr, Date: 15 Jun 2001 13:38, User: PFAVARA

NOTE: Original figure created in color

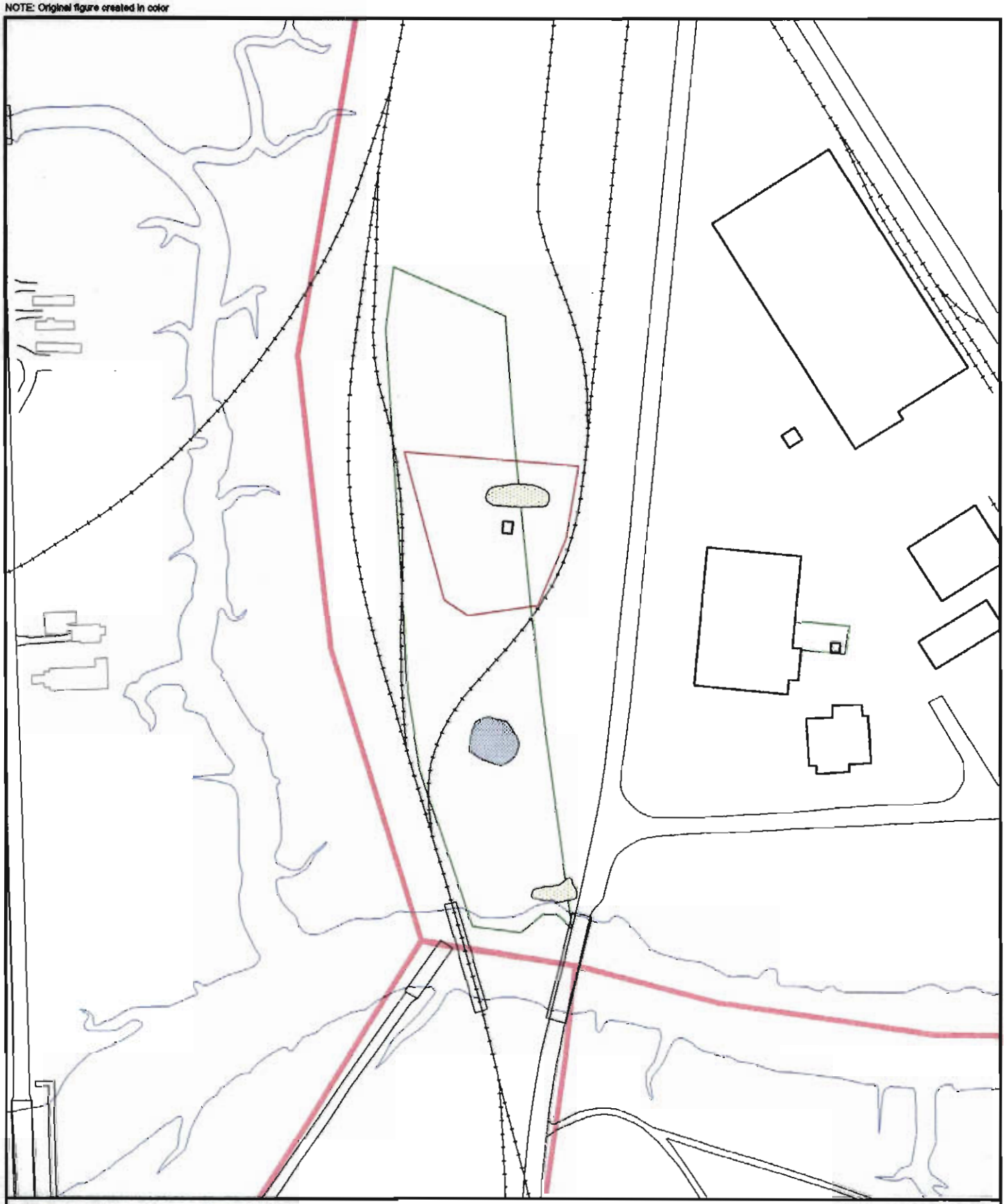



**Figure 3-3**
Arsenic and BEQ Excavation Areas
SWMU 42/AOC 505
Charleston Naval Complex

CH2MHILL

SECTION 4.0

# References

# 4.0 References

CH2M-Jones. *Background PAHs Study Report – Technical Information for Development of Background BEQ Values.* February, 2001.

EnSafe Inc. *Final Zone A RCRA Facility Investigation Report, NAVBASE Charleston.* Revision 0. August 7, 1998.

Supervisor of Shipbuilding, Conversion and Repair, USN (SUPSHIP). *Completion Report – Interim Measure for SWMU 42, Former Asphalt Plant Tanks, Naval Base Charleston, Charleston, SC.* July 17, 1997.

# Appendix A

**South Carolina Department of Health and Environmental Control comments on: Interim Measures Work Plan for SWMU 42 and AOC 505 located in Zone A of the Charleston Naval Complex, SCO 170 022 560, Revision 0, dated January 2001, received January 26, 2001.**

**Comments by Mihir Mehta:**

1. **The stated comments were briefly discussed, via phone call, between Paul Favara (CH2MHILL) and Mihir Mehta (SCDHEC) on March 8, 2001. This was beneficial in clarifying minor issues and also gave a head start for resolving the comments. In general, the referenced document was suitably written in meeting the goals and expectations of the contents of interim measures work plan.**

   Response: Comment noted.

2. **Section 2.1.3. Surface Soil. Page 2-3.**
   **Line 26 indicates soil sample locations indicating elevated levels for Lead. It would be beneficial if these locations can be identified on one of the figures in this section. There are other sub-sections that reference the locations but are not shown on the figures. Indicating the sample locations on the figures would facilitate the review and would enable the Department to understand the rational presented in the document.**

   Response: A reference to the IM Completion Report, which is included as an appendix, has been added to the text to clarify sample locations.

3. **Section 2.1.3. Subsurface Soil. Page 2-5.**
   **Lines 11-24 discuss the rational for why Arsenic above SSLs should not be considered for further action. Please elaborate this portion of the text to address the following concerns:**

   - **The SSL were calculated using generic DAF. What would be the difference between the SSL values if site-specific DAF were used instead of generic DAF. Will the difference affect the proposed recommendation?**

     Response: Subsequent to SCDHEC issuance of these comments, the BCT has agreed it is appropriate to screen using a default DAF.

   - **Specify which locations had hits above the SSL in the text and on the Figure 2-2.**

     Response: Subsequent to SCDHEC issuance of these comments, the BCT has agreed upon an approach to define Media Cleanup Standards (MCS) for constituents that are naturally occurring in the site soils at CNC. As presented in BCT meetings (April, May, June 2001)

and correspondence with SCDHEC (April 22, 2001 and June 2, 2001), the MCS is a soil concentration within the background range. When an MCS is based on a concentration within the background range, and that MCS is greater than the SSL, the SSL is not a factor in defining soil cleanup levels. Therefore, identification of which soil samples had hits above the SSL would not add value to the document.

- **Indicate the groundwater well used in supporting the no further action recommendation.**

  Response: The requested information has been included in the Revision 1 IM WP.

4. **Section 2.1.3. Groundwater. Page 2-5.**
**Lines 26-29 discuss the screening of surface soils data against Region III RBCs. It appears that this was an oversight and the discussion should be focused on groundwater screening and not on surface soil screening. Please revise accordingly.**

   Response: Comment noted. This error was corrected in the Revision 1 IM WP.

5. **Section 2.1.3. Groundwater. Page 2-5.**
**It might be beneficial to provide a figure that indicates the groundwater wells, groundwater flow direction, and other relevant information to support the no further corrective action recommendation for groundwater. Recognizing that the RFI Report recommends CMS for groundwater contamination and the referenced document provides the rational why this recommendation is not appropriate. Please revise the document accordingly.**

   Response: Comment noted. The focus of the Revision 0 IM Work Plan was to present all relevant RFI data and recommend remediation only where soil or groundwater requires treatment or removal. This process led to the recommendation that only arsenic and BEQs in soils at levels in excess of MCS's be removed. This conclusion was the basis of the statement *"the site can be used for unrestricted land use following the completion of the IM"*. It is recognized that SCDHEC has not been provided with the data collected to support the CMS.

   In order to streamline the implementation of the IM Work Plan, the Revision 1 IM Work Plan will focuses on the arsenic and BEQ issues in soil. Although other relevant RFI data will be included in the IM Work

Plan, that data will provide perspective on the decision to remove only arsenic and BEQ contaminated soils to a level that would comply with MCS's. The Department's concerns outlined in this comment will all be addressed in the Revision 0 CMSWork Plan; the new field data collected to support the CMS will also be clearly presented. This report will be submitted after the IM is completed at SWMU 42/AOC 505. As arsenic and BEQ data was not a focus of the supplemental sampling effort to support the CMS, and the data are not remarkable (all non-detect in groundwater monitoring wells), their inclusion IM Work Plan does not change the recommendations for soil removal.

6. **Section 3.6.1. Excavation. Page 3-4.**
**Lines 19-27, discusses the confirmation sampling strategy for the proposed excavation. It states that the samples will be taken approximately every 50 linear feet of the excavation perimeter. Figure 3-4 indicated that excavation area 5 and 6 has perimeter of approximately 84.98 and 70.06 ft respectively. Based on the confirmation sampling strategy it appears for these two areas only one confirmation sample will be obtained. This may not be sufficient to show that the extent of contamination (and interim measure goal) has been excavated in all directions. Please revise the confirmation sampling strategy to address this concern.**

Response: The volume of soil recommended for removal in the Revision 1 IM WP is substantially less than that originally presented in the Revision 0 IM WP. This reduction is due to the BCT adopting a risk-based cleanup criteria. The basis for confirmation sampling has been revised to fully delineate the soils to be removed prior to excavation, thus eliminating the need for post-removal confirmation soil samples.

7. **Figure 3-3 and Figure 3-4.**
**Figure 3-3 illustrates the proposed excavation area with respect to BEQ data. Figure 3-4 illustrates the excavation areas for these interim measures work plan. The Department has question with the delineation of proposed excavation area 4, 6, and 9. Figure 3-3 shows that these areas have been surrounded by sample locations with BEQ levels below the background levels, but the proposed area on excavation does not encompass the entire area above background. The text on page 3-1 indicates that two-dimensional Kriging was performed to estimate the area of surface soils requiring cleanup. The proposed goal is to cleanup this site to established background values. Please provide an explanation of how these areas were estimated.**

**The discussion with Dean Williamson (CH2MHILL) during the CNC team meeting on March 13, 2001 helped understand the process for developing excavation areas. Based on the discussion additional information within the referenced document would be helpful in understanding the development of proposed excavation areas. Please revise the document accordingly.**

Response: The document was revised to incorporate the risk-based cleanup approach the BCT has agreed upon. This approach has been discussed in BCT meetings held in April, May, and June 2001 as well as being documented in correspondence dated April 22, 2001 and June 1, 2001. The risk-based cleanup approach allows for localized soil concentrations in excess of MCS's to remain at a site, provided that the exposure concentration with in a defined area is less than the MCS.

8. **Throughout the referenced document the MCL for arsenic is noted as 10 ppb. Please note that the current promulgated MCL for arsenic is 50ppb and not 10 ppb. Please make necessary revisions.**

Response: Comment noted. The Revision 1 IM WP will reflect the above recommended change.

# COMMENTS

RCRA IM Workplan

Paul M. Bergstrand
3 April 2001

GENERAL COMMENTS

1. **The Department provided the Navy a reply to the Response to Comments on 29 January 1999 for the Zone A RFI Report. Those comments were made relying on data to be collected during the Zone A CMS workplan and state, in part, "*Because SWMU 39 and SWMU42/505 is being addressed in the CMS, further efforts to evaluate soil and monitoring well data in the RFI will not be pursued.*" The Department also provided comments on the Draft Zone A CMS workplan on 13 July 1998 and replied to the Response to Comments on 15 March 1999. This new CMS data was intended to refine the nature and extent of contamination at this and other Zone A AOCs and SWMUs. That CMS Workplan has reportedly been implemented, however it is not clear if the results have ever been submitted to the Department or included in this document. Not having those results or resolution of the Department's CMS comments makes the conclusion of this IM that *"the site can be used for unrestricted land use following the completion of the IM"* highly questionable. New or unsubmitted data used to develop this workplan should be provided to the Department as soon as possible.**

   Response: Comment noted. The focus of the Revision 0 IM Work Plan was to present all relevant RFI data and recommend remediation only where soil or groundwater requires treatment or removal. This process led to the recommendation that only arsenic and BEQs in soils at levels in excess of MCS's be removed. This conclusion was the basis of the statement *"the site can be used for unrestricted land use following the completion of the IM"*. It is recognized that SCDHEC has not been provided with the data collected to support the CMS.

   In order to streamline the implementation of the IM Work Plan, the Revision 1 IM Work Plan focuses on the remediation of arsenic and BEQ in soil. Although other relevant RFI data has been included in the IM Work Plan, that data will provide perspective on the decision to remove only arsenic and BEQ contaminated soils to a level that would comply with MCS's. The

Department's concerns outlined in this comment will be addressed in a Revision 0 CMSWork Plan; any field data collected by EnSafe to support the CMS, as well as analytical results from this IM for soil, will also be clearly presented. This report will be submitted after the IM is completed at SWMU 42/AOC 505. As arsenic and BEQ data was not a focus of the supplemental sampling effort to support the CMS performed by EnSafe, and the data are not remarkable (all non-detect in groundwater monitoring wells), their inclusion in the IM Work Plan does not change the recommendations for soil removal.

2. The Department recently received new information which may improve our understanding of SWMU 42 and AOC 505 and in turn may impact the current interpretation of data. Primarily, the concern is that the groundwater sample locations at SWMU 42/505 were not adequate to assess the actual SWMU location. This concern is based upon the following points:

- **The 6 June 1995 RFA states in part "*Since the unit (SWMU 42) was taken out of service in the early 1960s, little information was obtained about the dimensions, design features, operating practices, or waste disposal methods.*" And "*Primary materials associated with this unit are waste asphalt products, solvents, and degreasers.*" RFI workplan SWMU boundaries and soil and groundwater sample locations were based on limited information provided in the RFA.**

  Response: Comment noted.

- **The Department replied to the Response to Comments on 29 January 1999 for the Zone A RFI Report. Those comments were made relying on data to be collected during the Zone A CMS workplan and state, in part, "*Because SWMU 39 and SWMU42/505 is being addressed in the CMS, further efforts to evaluate soil and monitoring well data in the RFI will not be pursued.*"**

  Response: Comment noted.

- **It is not clear if the Ensafe CMS workplan has been implemented, nor is it clear that the results of that CMS workplan have ever been submitted to the Department or included in this document.**

Response: The CMS Work Plan has been implemented. The results of this field effort will be reported in the CMSWork Plan, which will be submitted after the IM field work is completed. These data have not been previously submitted to the Department.

- **The Department recently received maps of the Charleston Naval Base dated January 1962 and June 1947. These maps indicate that the SWMU 42 Asphalt Plant may be in a location different from the site that is depicted in the RFA or RFI. This information, when coupled with site groundwater elevation contour maps, indicates that the shallow RFI monitoring wells may be up gradient or side gradient of the site they were intended to assess. Copies of the relevant maps with the current monitoring wells drawn in and Figures of groundwater elevations are provided with these comments.**

Response: Comment noted. This information will be evaluated in the CMS Work Plan phase of work.

- **The Naval Detachment provided a set of air photos taken before 1980. These air photos indicate that AOC 505 may encompass a much larger area than previously thought. The air photos also indicate that items other than railroad ties and ballast may have been stored in this area. The Navy needs to evaluate and discuss the adequacy of sample locations and the type of analysis performed in light of this information. A copy of one of the air photos of 42/505 has been provided with these comments.**

Response: Additional soil sampling will be conducted if necessary prior to submission of the Revision 0 CMS Work Plan to address this comment. The need for additional groundwater sample locations will be evaluated after the IM field work is completed.

- **Lithologic cross sections of Zone A provided in the Ensafe CMS portray the area of 42/505 as primarily a sandy aquifer. The Section reportedly has five feet of surface Fill (a variable mixture of clays, silt, sand, gravel and ROC), nine feet of Qc; Quaternary Clayey Sand and Silty Sand (Aquifer) and an estimated thirty or more feet of Qs; Quaternary Sand (Aquifer). Chlorinated solvents,**

**being denser than groundwater, have the ability to migrate downwards through the sandy aquifer. All wells in the 42/505 area are shallow and could miss a rapidly sinking contaminant. A copy of the relevant cross section has been provided with these comments.**

Response: As part of the CMS field work, a deep well was installed next to 042GW002. This well was sampled for VOCs. None were detected. This information will be presented in the CMSWork Plan.

- **The shallow monitoring wells 042001 and 505001 reported low ppb detections of chlorinated solvents in excess of RBCs and/or MCLs. It is not clear whether these shallow groundwater detections are the edge of a larger and deeper downgradient contaminant plume. Copies of the Groundwater Elevation Contours from the Ensafe CMS Workplan are provided with these comments.**

Response: Please see response to Comment No. 1 and 2.

MONITORING WELL 042001

| ORGANICS in Groundwater | 12-95 | 4-96 | 6-96 | 10-96 | *RBC* | *MCL* |
|---|---|---|---|---|---|---|
| **Chloromethane** | **7.8** | ND | ND | ND | *2.10* | *NL* |
| **Trichloroethene** | ND | 1.4 | **1.6** | ND | *1.6* | *5.0* |
| **Tetrachloroethene** | **5.9** | 1.5 | 1.4 | ND | *1.10* | *5.0* |

MONITORING WELL 505001

| ORGANICS in Groundwater | 12-95 | 4-96 | 6-96 | 10-96 | *RBC* | *MCL* |
|---|---|---|---|---|---|---|
| Chlorobenzene | 1.3 | ND | ND | ND | *3.90* | *100* |
| **1,1-Dichloroethene** | **1.00** | ND | ND | ND | *0.04* | *7.0* |
| Ethylbenzene | 1.2 | ND | ND | ND | *130.0* | *700* |
| **1,1,2,2-Tetrachloroethane** | **1.5** | ND | ND | ND | *0.05* | *NL* |
| M+P Xylene | 3.5 | ND | ND | NS | *NA* | *NL* |
| O Xylene | 1.4 | ND | ND | NS | *140* | *10,000* |
| 1,3 Dichlorobenzene | 1.8 | ND | ND | NS | *54* | *600* |
| 1,2 Dichlorobenzene | 1.8 | ND | ND | NS | *27* | |
| **1,4 Dichlorobenzene** | **2.0** | ND | ND | NS | *0.44* | *75* |

2. **The Department's concern is that RFI sample locations were not adequate to asses the SWMU and AOC in question. Additional groundwater assessment, including monitoring wells appear to be necessary to complete the assessment of groundwater at**

**this site. Please note, the Department is not suggesting that groundwater corrective action is warranted at this time. However, the Department cannot concur with eliminating groundwater as a medium of concern based on the documentation at hand. The Department will be available to review and discuss this information with the Navy.**

Response: For the purpose of the Revision 1 IM WP, adequate data is available to support the decision to remove arsenic and BEQ contaminated soils, as well as determining the amount of soils that should be removed. The issue of additional groundwater assessment will be evaluated in the CMS phase of work, after the IM has been completed.

# Appendix B

### 10.5.5.1 SWMU 42 — Soil to Groundwater Cross-Media Transport

Tables 10.5.8 and 10.5.9 compare the maximum detected concentrations of organic and inorganic chemicals reported in soil to risk-based soil screening levels considered protective of groundwater. As shown on Table 10.5.8, six organics — benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, carbazole, and Aroclor-1260 — were identified for further evaluation of soil to groundwater migration based on the screening process presented in Section 6. None of these organic constituents were reported in combined SWMU 42 groundwater. As shown in Table 10.5.9, five inorganics — antimony, arsenic, chromium (total), lead, and thallium — were identified for further evaluation of soil to groundwater migration. Antimony and thallium were not reported in groundwater samples collected from combined SWMU 42.

One organic, PCE, exceeded its MCL in well NBCA-042-001, but was not further evaluated for soil to groundwater migration because only two soil samples (505SB00501 and 505SB00702) detected PCE. The detections did not exceed the SSL and are near Building 1803, approximately 300 feet south of NBCA-042-001. Furthermore, PCE was not detected in groundwater samples from well NBCA-505-001 which is downgradient and near soil borings SB005 and SB007.

Of the six organics retained for further evaluation of soil to groundwater migration, only benzo(a)anthracene and dibenzo(a,h)anthracene were reported in subsurface soil at concentrations exceeding their corresponding soil to groundwater SSL. Benzo(a)anthracene exceeded its soil to groundwater SSL in five surface soil samples (042SB010, 042SB017, 042SB024, 505SB007, and 505SB008) and in two subsurface soil samples (042SB017 and 505SB017). Dibenzo(a,h)anthracene exceeded its soil to groundwater SSL in one subsurface soil sample only (505SB017). Benzo(a)pyrene exceeded its soil to groundwater SSL in one surface soil sample (042SB024). Benzo(b)fluoranthene and carbazole exceeded their respective soil to groundwater SSLs in the same two surface soil samples (042SB010 and 042SB024). Aroclor-1260 exceeded its soil to groundwater SSL in one surface soil sample (505SB008). With the exceptions of dibenzo(a,h)anthracene and Aroclor-1260, the maximum concentrations of each chemical exceeding its soil to groundwater SSL were detected in the same surface soil sample (042SB024).

Table 10.5.8
Organic Compounds Detected in Surface Soil, Subsurface Soil, Shallow Groundwater, and Deep Groundwater
Comparison to Cross-media SSLs, Tap Water RBCs, and Saltwater Surface Water Chronic Screening Levels
NAVBASE-Charleston, Zone A: SWMU 42 and AOC 505
Charleston, South Carolina

| Parameter | Maximum Concentration | | | | Screening Concentration * | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Shallow GW | Deep GW | Soil to GW | Soil to Air | Tap Water RBC | Saltwater Surf. Wtr. Chronic | Soil Units | Water Units | Leaching Potential | Volatil-ization Potential | Ground-Water Migration Concern | Surface Water Migration Concern |
| **Volatile Organic Compounds** | | | | | | | | | | | | | | |
| Acetone | 10 | 55 | ND | NA | 8000 | 100000000 | 3700 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| 2-Butanone | ND | 16 | ND | NA | 3900 c | NA | 1900 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Carbon disulfide | 88 | 2.3 | 1.6 | NA | 16000 | 720000 | 1000 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Chlorobenzene | ND | ND | 1.3 | NA | 700 | 130000 | 39 | 105 | ug/kg | ug/L | NO | NO | NO | NO |
| Chloromethane | ND | ND | 7.8 | NA | 3.4 c | 63 | 1.4 | NA | ug/kg | ug/L | NO | NO | YES | NO |
| 1,1-Dichloroethene | ND | ND | 1 | NA | 30 | 70 | 0.044 | NA | ug/kg | ug/L | NO | NO | YES | NO |
| Ethylbenzene | ND | ND | 1.2 | NA | 6500 | 400000 | 1300 | 4.3 | ug/kg | ug/L | NO | NO | NO | NO |
| 2-Hexanone | ND | 1.2 | ND | NA | 3700 c | NA | 1500 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Methylene chloride | ND | 2.9 | ND | NA | 10 | 13000 | 4.1 | 2600 | ug/kg | ug/L | NO | NO | NO | NO |
| 1,1,2,2-Tetrachloroethane | ND | ND | 1.5 | NA | 1.5 | 600 | 0.052 | 90 | ug/kg | ug/L | NO | NO | YES | NO |
| Tetrachloroethene | 1.3 | 2.3 | 5.9 | NA | 30 | 11000 | 1.1 | 45 | ug/kg | ug/L | NO | NO | YES | NO |
| Trichloroethene | ND | ND | 1.6 | NA | 30 | 5000 | 1.6 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Xylene | ND | ND | 3.5 | NA | 70000 c | 320000 | 12000 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| o-Xylene | ND | ND | 1.4 | NA | 95000 | 410000 | 12000 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| **Semivolatile Organic Compounds** | | | | | | | | | | | | | | |
| Acenaphthene | 720 | 120 | ND | NA | 290000 | NA | 2200 | 9.7 | ug/kg | ug/L | NO | NO | NO | NO |
| Acenaphthylene | 200 | 485 | ND | NA | 96000 c | NA | 1500 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Anthracene | 490 | 470 | ND | NA | 5900000 | NA | 11000 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Benzo(g,h,i)perylene | 1800 | 1850 | ND | NA | 1.2E+08 c | NA | 1500 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Benzo(a)pyrene equivalents | | | | | | | | | | | | | | |
| Benzo(a)anthracene | 5000 | 1350 | ND | NA | 800 | NA | 0.092 | NA | ug/kg | ug/L | YES | NO | NO | NO |
| Benzo(a)pyrene | 5500 | 1900 | ND | NA | 4000 | NA | 0.0092 | NA | ug/kg | ug/L | YES | NO | NO | NO |
| Benzo(b)fluoranthene | 5800 | 1750 | ND | NA | 2500 | NA | 0.092 | NA | ug/kg | ug/L | YES | NO | NO | NO |
| Benzo(k)fluoranthene | 5400 | 1600 | ND | NA | 25000 | NA | 0.92 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Chrysene | 5100 | 1700 | ND | NA | 80000 | NA | 9.2 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Dibenzo(a,h)anthracene | 560 | 805 | ND | NA | 800 | NA | 0.0092 | NA | ug/kg | ug/L | YES | NO | NO | NO |
| Indeno(1,2,3-cd)pyrene | 1900 | 1750 | ND | NA | 7000 | NA | 0.092 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Butylbenzylphthalate | 390 | ND | ND | NA | 8100000 | 930000 | 7300 | 29 | ug/kg | ug/L | NO | NO | NO | NO |
| Carbazole | 1100 | 290 | ND | NA | 300 | NA | 3.4 | NA | ug/kg | ug/L | YES | NO | NO | NO |
| 4-Chloro-3-methylphenol | 78 | 86 | ND | NA | 4300 c | NA | NA | NA | ug/kg | ug/L | NO | NO | NO | NO |
| 2-Chlorophenol | ND | 110 | ND | NA | 2000 | 53000000 | 180 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Dibenzofuran | 460 | 130 | ND | NA | 42000 c | 120000 | 150 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Di-n-butylphthlate | 200 | ND | ND | NA | 2700000 | 2300000 | 3700 | 3.4 | ug/kg | ug/L | NO | NO | NO | NO |
| 1,2-Dichlorobenzene | ND | ND | 1.8 | NA | 8500 | 560000 | 64 | 20 | ug/kg | ug/L | NO | NO | NO | NO |
| 1,3-Dichlorobenzene | ND | ND | 1.8 | NA | 8700 c | NA | 540 | 29 | ug/kg | ug/L | NO | NO | NO | NO |
| 1,4-Dichlorobenzene | ND | ND | 2 | NA | 1000 | 1E+09 | 0.44 | 20 | ug/kg | ug/L | NO | NO | YES | NO |
| Di-n-octylphthalate | 49 | ND | ND | NA | 1.2E+09 | 10000000 | 730 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| bis(2-Ethylhexyl)phthalate | 99 | 220 | ND | NA | 1800000 | 31000000 | 4.8 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| Fluoranthene | 9400 | 2500 | ND | NA | 2100000 | NA | 1500 | 1.6 | ug/kg | ug/L | NO | NO | NO | NO |
| Fluorene | 780 | 245 | ND | NA | 280000 | NA | 1500 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| 2-Methylnaphthalene | 43 | 390 | ND | NA | 230000 c | NA | 1500 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| 3-Methylphenol | ND | 71 | ND | NA | 6700 c | NA | 1800 | NA | ug/kg | ug/L | NO | NO | NO | NO |
| 4-Methylphenol (p-cresol) | ND | 53 | ND | NA | 670 c | NA | 180 | NA | ug/kg | ug/L | NO | NO | NO | NO |

**Table 10.5.8**
**Organic Compounds Detected in Surface Soil, Subsurface Soil, Shallow Groundwater, and Deep Groundwater**
**Comparison to Cross-media SSLs, Tap Water RBCs, and Saltwater Surface Water Chronic Screening Levels**
**NAVBASE-Charleston, Zone A: SWMU 42 and AOC 505**
**Charleston, South Carolina**

| Parameter | Maximum Concentration | | | | Screening Concentration * | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Shallow GW | Deep GW | Soil to GW | Soil to Air | Tap Water RBC | Saltwater Surf. Wtr. Chronic | Soil Units | Water Units | Leaching Potential | Volatilization Potential | Ground-Water Migration Concern | Surface Water Migration Concern |
| Naphthalene | 480 | 300 | ND | NA | 42000 | NA | 1500 | 24 | UG/KG | UG/L | NO | NO | NO | NO |
| N-Nitrosodiphenylamine | 43 | ND | ND | NA | 600 | NA | 0.0096 | NA | UG/KG | UG/L | NO | NO | NO | NO |
| Phenanthrene | 5200 | 1450 | ND | NA | 900000 c | NA | 1500 | NA | UG/KG | UG/L | NO | NO | NO | NO |
| Phenol | 78 | 100 | ND | NA | 50000 | NA | 22000 | 58 | UG/KG | UG/L | NO | NO | NO | NO |
| Pyrene | 6900 | 2300 | ND | NA | 2100000 | NA | 1100 | NA | UG/KG | UG/L | NO | NO | NO | NO |
| **Pesticides/PCB Compounds** | | | | | | | | | | | | | | |
| Aldrin | ND | 2.4 | ND | NA | 250 | 3000 | 0.004 | 0.13 | UG/KG | UG/L | NO | NO | NO | NO |
| Aroclor-1260 | 1800 | 59 | ND | NA | 1000 | 1000 | 0.034 | 0.03 | UG/KG | UG/L | YES | YES | NO | NO |
| alpha-Chlordane | 17 | ND | ND | NA | 5000 | 20000 | 0.19 | 0.004 | UG/KG | UG/L | NO | NO | NO | NO |
| gamma-Chlordane | 17 | ND | ND | NA | 5000 | 20000 | 0.19 | 0.004 | UG/KG | UG/L | NO | NO | NO | NO |
| 4,4'-DDD | 700 | 3.8 | ND | NA | 8000 | NA | 0.28 | 0.025 | UG/KG | UG/L | NO | NO | NO | NO |
| 4,4'-DDE | 2500 | 1.2 | ND | NA | 27000 | NA | 0.2 | 0.14 | UG/KG | UG/L | NO | NO | NO | NO |
| 4,4'-DDT | 2300 | 19.4 | ND | NA | 16000 | 1E+09 | 0.2 | 0.001 | UG/KG | UG/L | NO | NO | NO | NO |
| Endosulfan sulfate | ND | 10 | ND | NA | 9000 | NA | 220 | 0.0087 | UG/KG | UG/L | NO | NO | NO | NO |
| Endrin | 3.8 | 4.4 | ND | NA | 500 | NA | 11 | 0.0023 | UG/KG | UG/L | NO | NO | NO | NO |
| Endrin ketone | ND | 45 | ND | NA | 500 | NA | 11 | NA | UG/KG | UG/L | NO | NO | NO | NO |
| Heptachlor epoxide | ND | 6 | ND | NA | 350 | 5000 | 0.0012 | 0.0036 | UG/KG | UG/L | NO | NO | NO | NO |
| **Dioxin Compounds** | | | | | | | | | | | | | | |
| Dioxin (TCDD TEQ) | 1.549 | 0.421 | ND | NA | 1600 c | NA | 0.45 | 10 | NG/KG | PG/L | NO | NO | NO | NO |

Explanations of screening procedures appear in Section 6.2.
Frequency and range of detections, average detected concentrations, and number of screening concentration exceedances appear in Tables 10.5.3 and 10.5.6.

* Screening Concentrations:
Soil to GW - Generic SSLs based on DAF = 10, adapted from USEPA Soil Screening Guidance: Technical Background Document, May 1996 (first preference), or calculated using values from T
Soil to Air - From USEPA Soil Screening Guidance: Technical Background Document, May 1996 (first preference), or USEPA Region III Risk-Based Concentration Table, June 1996
Tap Water RBC - From USEPA Region III Risk-Based Concentration Table, October 1997
Salt Water Surface Water Chronic - From USEPA Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment, November 1995, Table 2

c - Calculated soil to groundwater SSL value (See Table 6.2)
GW - Groundwater
NA - Not available
ND - Not detected
RBC - Risk-based concentration
SSL - Soil screening level
MG/KG - Milligrams per kilogram
NG/KG - Nanograms per kilogram
UG/KG - Micrograms per kilogram
PG/L - Picograms per liter
UG/L - Micrograms per liter

Table [illegible]
Inorganic Chemicals Detected in Surface Soil, Subsurface Soil, Shallow Groundwater, and Deep Groundwater
Comparison to Cross-media SSLs, Tap Water RBCs, Saltwater Surface Water Chronic Screening Levels, and Background Reference Values
NAVBASE-Charleston, Zone A: SWMU 42 and AOC 505
Charleston, South Carolina

| Parameter | Maximum Concentration | | | | Screening Concentration * | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Shallow GW | Deep GW | Soil to GW | Soil Background Reference | Soil to Air | Tap Water RBC | GW Background Reference | Saltwater Surf. Wtr. Chronic | Soil Units | Water Units | Leaching Potential | Fugitive Particulate Inhalation Concern | Ground-Water Migration Concern | Surface Water Migration Concern |
| **Inorganic Chemicals** | | | | | | | | | | | | | | | | |
| Aluminum | 9700 | 23900 | 27200 | NA | 560000 o | 28240 | NA | 37000 | 3210 | NA | MG/KG | UG/L | NO | NO | NO | NO |
| Antimony | 1.5 | 13.6 | ND | NA | 2.5 | ND | NA | 15 | ND | NA | MG/KG | UG/L | YES | NO | NO | NO |
| Arsenic | 62 | 21.4 | 9 | NA | 15 | 9.8 | 750 | 0.045 | 11.1 | 36 | MG/KG | UG/L | YES | NO | NO | NO |
| Barium | 160 | 108 | 53.6 | NA | 820 | 53 | 690000 | 2600 | 179 | NA | MG/KG | UG/L | NO | NO | NO | NO |
| Beryllium | 0.38 | 0.34 | ND | NA | 32 | ND | 1300 | 0.016 | ND | NA | MG/KG | UG/L | NO | NO | NO | NO |
| Cadmium | 0.032 | 0.41 | 0.29 | NA | 4 | ND | 1800 | 18 | ND | 9.3 | MG/KG | UG/L | NO | NO | NO | NO |
| Chromium (total) | 29.2 | 36.1 | 45.9 | NA | 19 | 63.4 | 270 | 180 | 8.7 | 103 | MG/KG | UG/L | YES | NO | NO | NO |
| Chromium (hexavalent) | ND | 0.12 | ND | NA | 19 | ND | 270 | 180 | ND | 50 | MG/KG | UG/L | NO | NO | NO | NO |
| Cobalt | 16.6 | 2.3 | 25 | NA | 990 o | 4.4 | NA | 2200 | 12.1 | NA | MG/KG | UG/L | NO | NO | NO | NO |
| Copper | 192 | 39.5 | 12.2 | NA | 5600 o | 165 | NA | 130000 | 15.7 | 2.9 | MG/KG | UG/L | NO | NO | NO | YES |
| Lead | 1180 | 216 | 7.6 | NA | 400 | 140 | 400 | 15 | 4.7 | 8.5 | MG/KG | UG/L | YES | YES | NO | NO |
| Manganese | 311 | 186 | 827 | NA | 550 o | 98.1 | NA | 840 | 2690 | NA | MG/KG | UG/L | NO | NO | NO | NO |
| Mercury | 0.35 | 0.23 | ND | NA | 1 | 0.3 | 10 | 11 | ND | 0.2 | MG/KG | UG/L | NO | NO | NO | NO |
| Nickel | 20 | 6.7 | 0.9 | NA | 65 | 35 | 13000 | 730 | 21.1 | 42 | MG/KG | UG/L | NO | NO | NO | NO |
| Selenium | 1.2 | 1.9 | 3.1 | NA | 2.5 | 1.7 | NA | 180 | ND | 71 | MG/KG | UG/L | NO | NO | NO | NO |
| Silver | ND | ND | 111 | NA | 17 | ND | NA | 180 | ND | 0.23 | MG/KG | UG/L | NO | NO | NO | YES |
| Thallium | 0.42 | 0.48 | ND | NA | 0.35 | ND | NA | 2.9 | 2 | 21 | MG/KG | UG/L | YES | NO | NO | NO |
| Tin | 28.5 | 10.1 | 51.4 | NA | 5500 c | ND | NA | 22000 | ND | NA | MG/KG | UG/L | NO | NO | NO | NO |
| Vanadium | 39.9 | 52.1 | 61 | NA | 3000 | 77.3 | NA | 260 | 10.9 | NA | MG/KG | UG/L | NO | NO | NO | NO |
| Zinc | 303 | 364 | 99.6 | NA | 6200 | 208 | NA | 11000 | 83.2 | 86 | MG/KG | UG/L | NO | NO | NO | YES |

Explanations of screening proocedures appear in Section 6.2.
Frequency and range of detections, average detected concentrations, and number of screening concentration exceedances appear in Tables 10.5.4 and 10.5.7.

* Screening Concentrations:
Soil to GW - Generic SSLs based on DAF = 10, adapted from USEPA Soil Screening Guidance: Technical Background Document, May 1996 (first preference), or calculated using values from Table 6.2
Soil to Air - From USEPA Soil Screening Guidance: Technical Background Document, May 1996 (first preference), or USEPA Region III Risk-Based Concentration Table, June 1996
Tap Water RBC - From USEPA Region III Risk-Based Concentration Table, October 1997
Salt Water Surface Water Chronic - From USEPA Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment, November 1995, Table 2
Background reference values for soil are shown for comparison purposes only.
Maximum groundwater concentrations are screened against the greater of tap water RBCs or corresponding background reference values to determine groundwater migration concern.

o - Calculated soil to groundwater SSL value (See Table 6.2)
GW - Groundwater
NA - Not available/Not applicable
ND - Not detected
RBC - Risk based concentration
SSL - Soil screening level
MG/KG - Milligrams per kilogram
UG/L - Micrograms per liter

Antimony exceeded its soil to groundwater SSL in one subsurface soil sample (505SB001), but was not detected in any surface soil samples. Arsenic exceeded its groundwater protection SSL in eight surface soil samples (042SB014, 042SB016, 042SB017, 042SB020, 042SB021, 505SB002, 505SB007, and 505SB010) and in one subsurface soil sample (042SB017). Lead exceeded its soil to groundwater SSL in two surface soil samples (042SB009 and 505SB005). Thallium exceeded its soil to groundwater SSL in one surface soil sample (042SB011) and one subsurface soil sample (042SB014). Chromium was detected at concentrations exceeding its soil to groundwater SSL at three surface soil sample locations (042SB010, 042SB017, and 505SB008) and at five subsurface soil sample locations (042SB001, 042SB002, 042SB004, 042SB005, and 042SB011). Chromium, however, was not reported in any soil sample at a concentration exceeding its background reference value. For screening purposes chromium was conservatively assumed to exist in its soluble hexavalent state. Hexachrome analyses at combined SWMU 42 and elsewhere in Zone A suggest that chromium in soil exists predominantly in less soluble valence states.

Antimony and thallium were not detected in groundwater through four quarters of groundwater sampling. Chromium and lead were not detected in groundwater at concentrations above their respective tap water RBCs through four quarters of groundwater sampling. Generally, combined SWMU 42 soil concentrations of antimony, chromium, and lead are consistent with background concentrations. Except for arsenic, combined SWMU 42 inorganic soil concentrations do not indicate a significant soil- to-groundwater migration concern.

Of the organic parameters identified as combined SWMU 42 soil-to-groundwater migration concerns, the PAH compounds benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene most frequently exceeded the SSLs. Subsurface soil concentrations of these PAH compounds are lower than surface soil concentrations such that only benzo(a)anthracene and dibenz(a,h)anthracene exceed the SSLs at depth. The extent of subsurface soil PAH contamination is much smaller in area than

in surface soil. Additionally, these PAH compounds were not present in the combined SWMU 42 shallow aquifer, although generally the quantitation limits for these PAHs are higher than their tap water RBCs.

Aroclor-1260 and carbazole exceeded the SSLs infrequently so that a widespread threat to the shallow aquifer is not indicated. Additionally, neither of these organic constituents were detected in shallow groundwater, although the quantitation limit for Aroclor-1260 in groundwater is generally higher than its tap water RBC. These findings indicate that, although isolated leaching from soil has the potential to occur, combined SWMU 42 soil concentrations do not present an imminent or widespread threat to the shallow aquifer.

#### 10.5.5.4 SWMU 42 — Fate and Transport Summary

PAHs and arsenic were the primary chemicals exceeding soil-to-groundwater SSLs. PAHs were reported at their highest concentrations in the surface soil sample collected from 042SB024, indicating a potential hot spot. However, PAHs were not reported in groundwater samples at combined SWMU 42, suggesting that the PAHs are not migrating to groundwater. Arsenic was reported in groundwater samples, but not at a concentration exceeding its background reference value. Therefore, arsenic in soil is not expected to be a significant source of soil-to-groundwater contamination. Inorganics exceeding saltwater surface water chronic screening values were generally consistent with background reference values, and are not expected to be significant at combined SWMU 42. Aroclor-1260 and lead were the only chemicals exceeding soil-to-air screening values, but are not expected to be significant at combined SWMU 42. Aroclor-1260 was only detected above its soil-to-air SSL once, and only marginally exceeded the SSL. Although the maximum concentration of lead was nearly 3 times the soil-to-air SSL, all other reported lead

concentrations were generally consistent with its soil-to-air SSL and soil-to-groundwater SSL of 400 mg/kg.

**COCs Identified**

Chemicals of concern were identified based on cumulative (all pathway) risk and hazard projected for this site, as shown in Table 10.5.23. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and a hazard index threshold of 1.0 (unity). In this HHRA, a COC was considered to be any chemical contributing to a cumulative risk level of 1E-6 or greater and/or a cumulative hazard index above 1.0, if its individual ILCR exceeds 1E-6 or whose hazard quotient exceeds 0.1. For carcinogens, this approach is relatively conservative, because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. The COC selection method presented was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard

Table 10.5.23
Summary of Risk and Hazard-based COCs
SWMU 42 and AOC 505
NAVBASE - Charleston, Zone A
Charleston, South Carolina

| Medium | Exposure Pathway | | Future Resident Adult Hazard Quotient | Future Resident Child Hazard Quotient | Future Resident Iwa ILCR | Site Worker Hazard Quotient | Site Worker ILCR | Identificat of COC |
|---|---|---|---|---|---|---|---|---|
| Surface Soil | Incidental | Aroclor 1260 | ND | ND | 5.1E-07 | ND | 5.7E-08 | |
| | Ingestion | Arsenic | 0.10 | 0.96 | 5.3E-05 | 0.037 | 5.9E-06 | 1 2 |
| | | Benzo(a)pyrene equivalents | ND | ND | 5.1E-05 | ND | 5.7E-06 | 2 |
| | | Beryllium | 0.000050 | 0.00047 | 1.2E-06 | 0.000016 | 1.4E-07 | 2 |
| | | 4,4'-DDE | ND | ND | 1.5E-07 | ND | 1.6E-08 | |
| | | 4,4'-DDT | 0.00081 | 0.0076 | 1.6E-07 | 0.00029 | 1.8E-08 | |
| | | Manganese | 0.0023 | 0.022 | ND | 0.00083 | ND | |
| | Dermal Contact | Aroclor 1260 | ND | ND | 2.3E-07 | ND | 9.4E-08 | |
| | | Arsenic | 0.021 | 0.070 | 6.0E-06 | 0.015 | 2.4E-06 | 2 |
| | | Benzo(a)pyrene equivalents | ND | ND | 2.3E-05 | ND | 9.3E-06 | 2 |
| | | Beryllium | 0.000010 | 0.000034 | 1.4E-07 | 0.0000073 | 5.6E-08 | |
| | | 4,4'-DDE | ND | ND | 6.5E-08 | ND | 2.7E-08 | |
| | | 4,4'-DDT | 0.00067 | 0.0022 | 7.1E-08 | 0.00048 | 2.9E-08 | |
| | | Manganese | 0.00047 | 0.0016 | ND | 0.00034 | ND | |
| Surface Soil Pathway Sum | | | 0.1 | 1 | 1E-04 | 0.05 | 2E-05 | |
| Groundwater | Ingestion | Aluminum | 0.29 | 0.68 | ND | 0.10 | ND | 1 |
| | | Arsenic | 0.46 | 1.1 | 1.1E-04 | 0.16 | 3.6E-05 | 1 2 |
| | | Chloromethane | ND | ND | 8.6E-07 | ND | 2.8E-07 | |
| | | Chromium | 0.080 | 0.19 | ND | 0.029 | ND | 1 |
| | | 1,1-Dichloroethene | 0.0030 | 0.0071 | 9.0E-06 | 0.0011 | 2.9E-06 | 2 |
| | | 1,4-Dichlorobenzene | ND | ND | 7.2E-07 | ND | 2.3E-07 | |
| | | Manganese | 0.99 | 2.3 | ND | 0.35 | ND | 1 |
| | | Silver | 0.22 | 0.51 | ND | 0.078 | ND | 1 |
| | | 1,1,2,2-Tetrachloroethane | ND | ND | 4.5E-06 | ND | 1.4E-06 | 2 |
| | | Tetrachloroethene | 0.0077 | 0.018 | 2.2E-06 | 0.0027 | 7.0E-07 | 2 |
| | | Trichloroethene | 0.0073 | 0.017 | 2.7E-07 | 0.0026 | 8.5E-08 | |
| | | Vanadium | 0.070 | 0.16 | ND | 0.025 | ND | 1 |
| | Inhalation | First Quarter | | | | | | |
| | | Chloromethane | ND | ND | 4.2E-07 | ND | 1.3E-07 | |
| | | 1,1-Dichloroethene | 0.0030 | 0.0071 | 2.6E-06 | 0.0011 | 8.4E-07 | 2 |
| | | 1,4-Dichlorobenzene | 0.00024 | 0.00056 | 7.2E-07 | 0.000085 | 2.3E-07 | |
| | | 1,1,2,2-Tetrachloroethane | ND | ND | 4.6E-06 | ND | 1.5E-06 | 2 |
| | | Tetrachloroethene | 0.0077 | 0.018 | 8.6E-08 | 0.0027 | 2.7E-08 | |
| | | Trichloroethene | 0.0073 | 0.017 | 1.4E-07 | 0.0026 | 4.6E-08 | |
| Groundwater Pathway Sum | | | 2 | 5 | 1E-04 | 0.8 | 4E-05 | |
| Sum of All Pathways | | | 2 | 6 | 3E-04 | 0.8 | 7E-05 | |

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.

during the remedial goal options development process. Table 10.5.24 presents the COCs identified on a medium-specific basis.

*Surface Soils*

**Hypothetical Site Residents (future land use)**

Arsenic, benzo(a)pyrene equivalents, and beryllium were identified as the soil pathway COCs based on their contribution to cumulative ILCR projections.

**Hypothetical Site Workers (current land use)**

Arsenic and benzo(a)pyrene equivalents were identified as the soil pathway COCs based on their contribution to cumulative ILCR projections.

The extent of the COCs identified in surface soil is briefly discussed below. To facilitate this discussion of the extent of COC concentrations, residential soil RBCs were compared to each reported concentration for each COC identified above. Arsenic was detected above the residential soil RBC (0.43 mg/kg) in 31 of 32 surface soil samples. However, the background concentration for arsenic was exceeded only 12 times and the mean concentration for combined SWMU 42 surface soil (12.5 mg/kg) was only slightly higher than the background (9 mg/kg). Beryllium was only detected above the residential soil RBC in 11 of 32 surface soil samples. Benzo(a)pyrene equivalents were detected above the residential RBC in 22 of 46 surface soil samples collected in the combined SWMU 42 area. This frequency is consistent with asphalt and tar debris scattered throughout the area.

*Groundwater*

**Hypothetical Site Residents (future land use)**

Aluminum, chromium, manganese, silver, and vanadium were identified as shallow groundwater COCs based on their contribution to cumulative hazard index. 1,1-Dichloroethene, 1,1,2,2-

Table 10.5.24
Summary of Risk and Hazard
SWMU 42 and AOC 505
Naval Base Charleston, Zone A
Charleston, South Carolina

| Medium | Exposure Pathway | HI (Adult) | HI (Child) | ILCR (LWA) | HI (Worker) | ILCR (Worker) |
|---|---|---|---|---|---|---|
| Surface Soil | Incidental Ingestion | 0.1 | 1 | 1E-04 | 0.04 | 1E-05 |
| | Dermal Contact | 0.02 | 0.07 | 3E-05 | 0.02 | 1E-05 |
| Groundwater | Ingestion | 2 | 5 | 1E-04 | 0.8 | 4E-05 |
| | Inhalation | 0.02 | 0.04 | 9E-06 | 0.007 | 3E-06 |
| Sum of All Pathways | | 2 | 6 | 3E-04 | 0.8 | 1E-04 |

Notes:
ILCR Indicates incremental excess lifetime cancer risk
HI Indicates hazard index
LWA Lifetime weighted average

tetrachloroethane, and tetrachloroethene were identified as shallow groundwater COCs based on their contribution to cumulative ILCR. Arsenic was identified as a COC based in its contribution to both HI and ILCR.

**Hypothetical Site Workers (future land use)**

Arsenic, 1,1-dichloroethene, and 1,1,2,2-tetrachloroethane were identified as shallow groundwater COCs based on their contribution to cumulative ILCR.

The extent of the COCs identified in first-quarter shallow groundwater is briefly discussed below. Each of the identified shallow groundwater COCs was detected in one well during first-quarter sampling. Arsenic was detected in monitoring well NBCA505001 during the third and fourth quarter, and was detected in monitoring well NBCA042002 during the fourth quarter. 1,1-Dichloroethene and 1,1,2,2-tetrachloroethene were detected in monitoring well NBCA505001 during the first quarter only.

# Appendix C

# COMPLETION REPORT

**INTERIM MEASURE FOR**
**SWMU 42 FORMER ASPHALT PLANT TANKS**
**NAVAL BASE CHARLESTON**
**CHARLESTON, SC**

Prepared for:

**DEPARTMENT OF THE NAVY**
**SOUTHERN DIVISION**
**NAVAL FACILITIES ENGINEERING COMMAND**
**CHARLESTON SC**

Prepared by:

**Supervisor of Shipbuilding, Conversion and Repair,**
**USN, (SUPSHIP) Portsmouth Va.,**
**Environmental Detachment Charleston, S.C.**
**1899 North Hobson Ave.**
North Charleston, SC 29405-2106

July 17, 1997

DEPARTMENT OF THE NAVY
SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, USN
PORTSMOUTH, VIRGINIA, DETACHMENT ENVIRONMENTAL CHARLESTON
1899 NORTH HOBSON AVENUE, BUILDING 3C
NORTH CHARLESTON, SOUTH CAROLINA 29405-2106

IN REPLY REFER TO:

Ser: 784

JUL 24 1997

Mr. G. Randall Thompson, Director
Division of Hazardous and Infectious Waste Management
Bureau of Solid and Hazardous Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia SC 29201

Dear Mr. Thompson:

The enclosed interim measure completion report for Solid Waste Management Unit (SWMU) 42 is submitted to fulfill the requirement of Permit Condition IV.D.6 for Permit Number SCO 170 022 560. If the Department of Health and Environmental Control should have any questions, please contact Reece Batten of Southern Division Naval Facilities Engineering Command (NAVFAC) at (803) 820-5578.

Sincerely,

for W.K. Tunstall
E.R. Dearhart
Director

Encl:
(1) SWMU 42 Completion Report

Copy to:
SCDHEC (Mr. Tapia, Mr. Bergstrand)
USEPA (Mr. Bassett)
CSO Naval Base Charleston (LCDR Rose)
NAVFAC (Mr. Batten)
EA&H (Ms. Maddux)

## TABLE OF CONTENTS

## TABLE OF CONTENTS (cont'd)



### FIGURES



### TABLES

## ACRONYMS, ABBREVIATIONS and SYMBOLS

| | |
|---|---|
| AOC | Area of Concern |
| BTEX | Benzene, Toluene, Ethylbenene, Xylenes |
| CMS | Corrective Measures Study |
| COPC | Constituents of Potential Concern |
| DERP | Defense Environmental Restoration Program |
| DET | Environmental Detachment Charleston |
| DON | Department of the Navy |
| IM | Interim Measure |
| IR | Installation Restoration |
| mg/kg (ppm) | milligrams per kilogram (equal to parts per million) |
| RBC | Risk Based Concentration |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessment |
| RFI | RCRA Facility Investigation |
| SARA | Superfund Amendments and Reauthorization Act |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| SOUTHDIV | Southern Division Naval Facilities Engineering Command |
| SUPSHIP | Supervisor of Shipbuilding, Conversion and Repair, USN |
| SWMU | Solid Waste Management Unit |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TPH | Total Petroleum Hydrocarbons |
| USN | United States Navy |
| µg/kg (ppb) | micrograms per kilogram (equal to parts per billion) |

# 1. INTRODUCTION

**1.1 INSTALLATION RESTORATION PROGRAM.** The purpose of the Department of the Navy (DON) Installation Restoration (IR) Program is to identify, assess, characterize and cleanup or control contamination from past hazardous waste disposal operations and hazardous material spills at Navy and Marine Corps activities. The Defense Environmental Restoration Program (DERP) is codified in the Superfund Amendment and Reauthorization Act (SARA) Section 211 (10 USC 2701). The IR program is a component of DERP.

**1.1.1 Naval Base Charleston Installation Restoration Program.** At Naval Base Charleston, a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was prepared which divided the Naval Base into zones and identified Solid Waste Management Units (SWMUs) and Area of Concerns (AOCs) within each zone. The RFA evaluated each SWMU and AOC and determined which sites required further investigation. Based on the RFA, a RCRA Facility Investigation (RFI) work plan has been or is being prepared for each zone containing SWMUs and AOCs requiring further investigation. On completion of the RFI for each zone, a RFI report will be prepared for that zone. The RFI report will identify SWMUs and AOCs containing wastes requiring remediation. Eventually, Corrective Measures Studies (CMSs) will be prepared to determine the best means of remediating each site.

**1.2 INTERIM MEASURES.** Interim Measures (IM) performed as part of the IR program are intended to eliminate sources of environmental contamination or limit the spread of environmental contaminants prior to the completion of the RFI CMSs.

**1.3 SOLID WASTE MANAGEMENT UNIT 42.** SWMU 42 is located in Zone "A", north of Noisette Creek. Figure A-1 of Appendix A illustrates the site. This SWMU consists of a former asphalt plant, associated tanks and storage area. The unit operated from 1947 until 1962 and has since been demolished. Since the unit was taken out of service in the late 1960s into the early 1970s, little information was obtain about dimensions, design features, operating practices, or waste disposal methods. The site currently contains Building 1803, a Golf Course

Maintenance Building. The unpaved surrounding area contains rock. asphalt debris and racks used to support asphalt-related above ground storage tanks. The RFI identified Lead as the Constituent of Potential Concern (COPC) at this site.

**1.4 SOLID WASTE MANAGEMENT UNIT 42 INTERIM MEASURE.** During the interval between the RFI and the completion of the CMS, it was decided by Southern Division Naval Facilities Engineering Command (SOUTHDIV) that an IM would be performed by Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP), United States Navy (USN), Portsmouth Va. Environmental Detachment Charleston (DET). The objective of this IM was to remove and dispose of the contaminated lead soil having levels greater than 400 parts per million (ppm) as the controlling guidance for cleanup.

## 2. INTERIM MEASURE EXECUTION

**2.1 ACTIONS REQUIRED BY INTERIM MEASURE WORK PLAN.** Removal was performed on an estimated 5.4 cubic yards of lead contaminated soil. This contaminated soil had lead levels greater than 400 ppm. Required action included excavation from the following areas. Excavation locations are shown on Figure A-1.

- Soil boring 505-S-B005 was excavated to an area approximately 6′ x 6′ and 2 foot in depth.
- Soil boring 042-S-B009 was excavated to an area approximately 6′ x 6′ and 2 foot in depth.

**2.2 OBSERVATIONS NOTED.** None.

**2.3 PLAN MODIFICATIONS AND JUSTIFICATION.** None.

# 3. INTERIM MEASURE OUTCOME

**3.1 SITE CONDITIONS FOLLOWING COMPLETION OF WORK.** Following completion of all site work on 21 May 1997, the excavated areas were backfilled with clean soil. All excavated waste was characterized as non-hazardous and transported to a Sub Title "D" land fill. Photos D-1 and D-2 of Appendix D reflect conditions at the site during removal of contaminated soil. Photos D-3 and D-4 reflect conditions at the site after completion of IM.

# 4. SAMPLING

## 4.1 SAMPLING EVOLUTIONS AND RESULTS.

**4.1.1 Field Sampling.** None.

**4.1.2 Confirmatory Sampling.** Following excavation, confirmatory samples (grab) were taken. These samples were collected at the bottom and sidewalls of each excavated area. These samples were analyzed for Lead. A copy of the analytical results of all confirmatory samples is included in Appendix B. Table B-1 of Appendix B summarizes the results and sample coordinates. Figure B-1 of Appendix B illustrates the sampling locations. There were no detections of Lead above 400 ppm.

**4.1.3 Waste Characterization Sampling.** One composite sample was collected from each stockpile of excavated soil and submitted for laboratory analysis for waste characterization. A Toxicity Characteristic Leaching Procedure (TCLP) was done on the waste soil and determined to be non-hazardous. A copy of the analytical results of all waste characterization samples is included in Appendix B. Table B-2 of Appendix B summarizes these samples. Figure B-2 of Appendix B illustrates the arrangement of all stockpiled soil excavated from the site with its corresponding sample identification number.

# 5. WASTE GENERATION

**5.1 HAZARDOUS/POTENTIALLY HAZARDOUS WASTE.** No hazardous waste was generated at this site.

**5.1.1 Hazardous Excavated Soil.** No hazardous soil was generated at this site.

**5.2 NON-HAZARDOUS WASTE.** Approximately 5.4 cubic yards of non-hazardous waste was generated at this site.

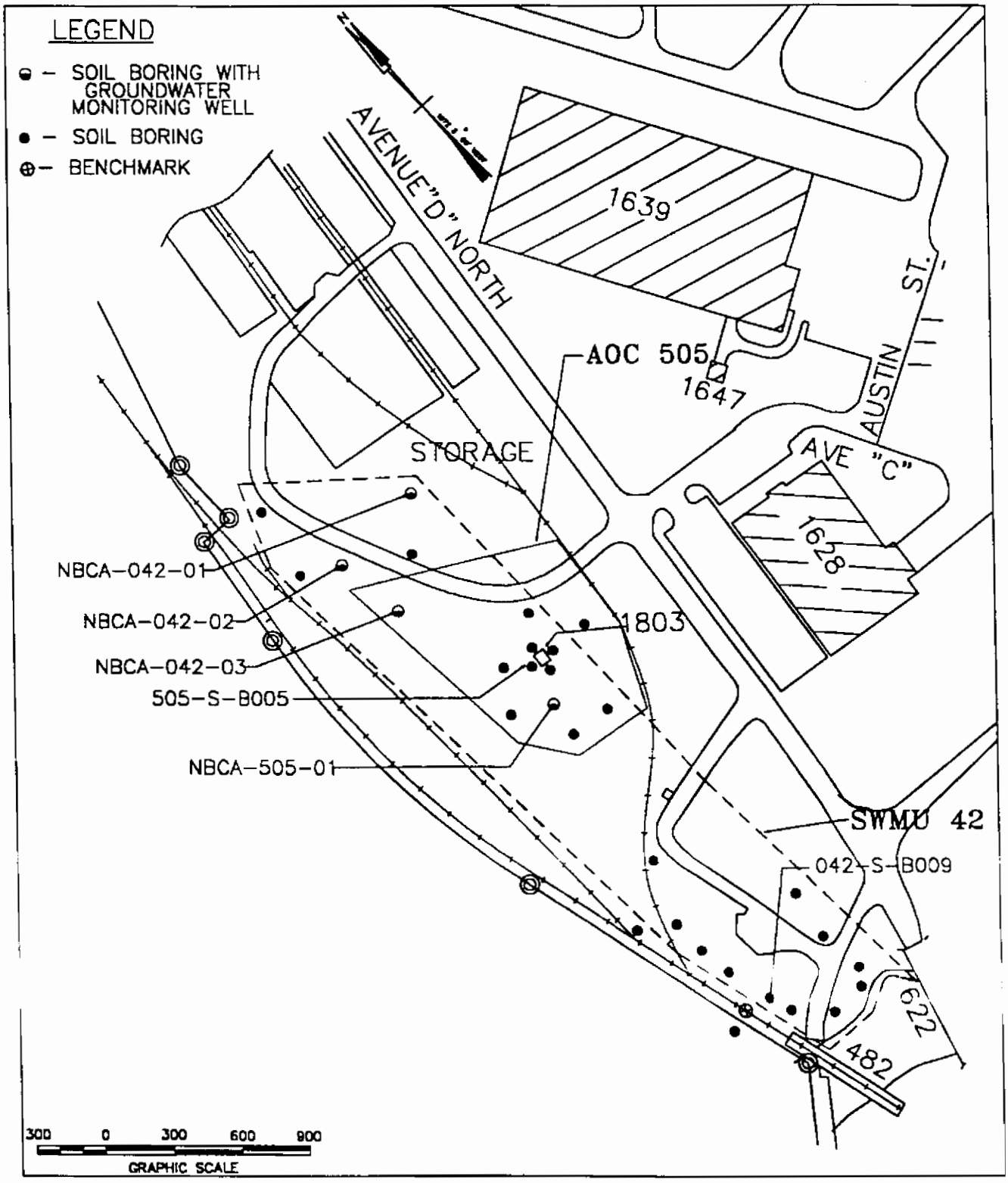
**5.2.1 Non-Hazardous Excavated Soil.** The excavated non-hazardous soil was transported from SWMU 42 to Chambers Oakridge landfill.

# APPENDIX A

# SITE MAPS

# FIGURE A-1

## SWMU 42 SITE MAP

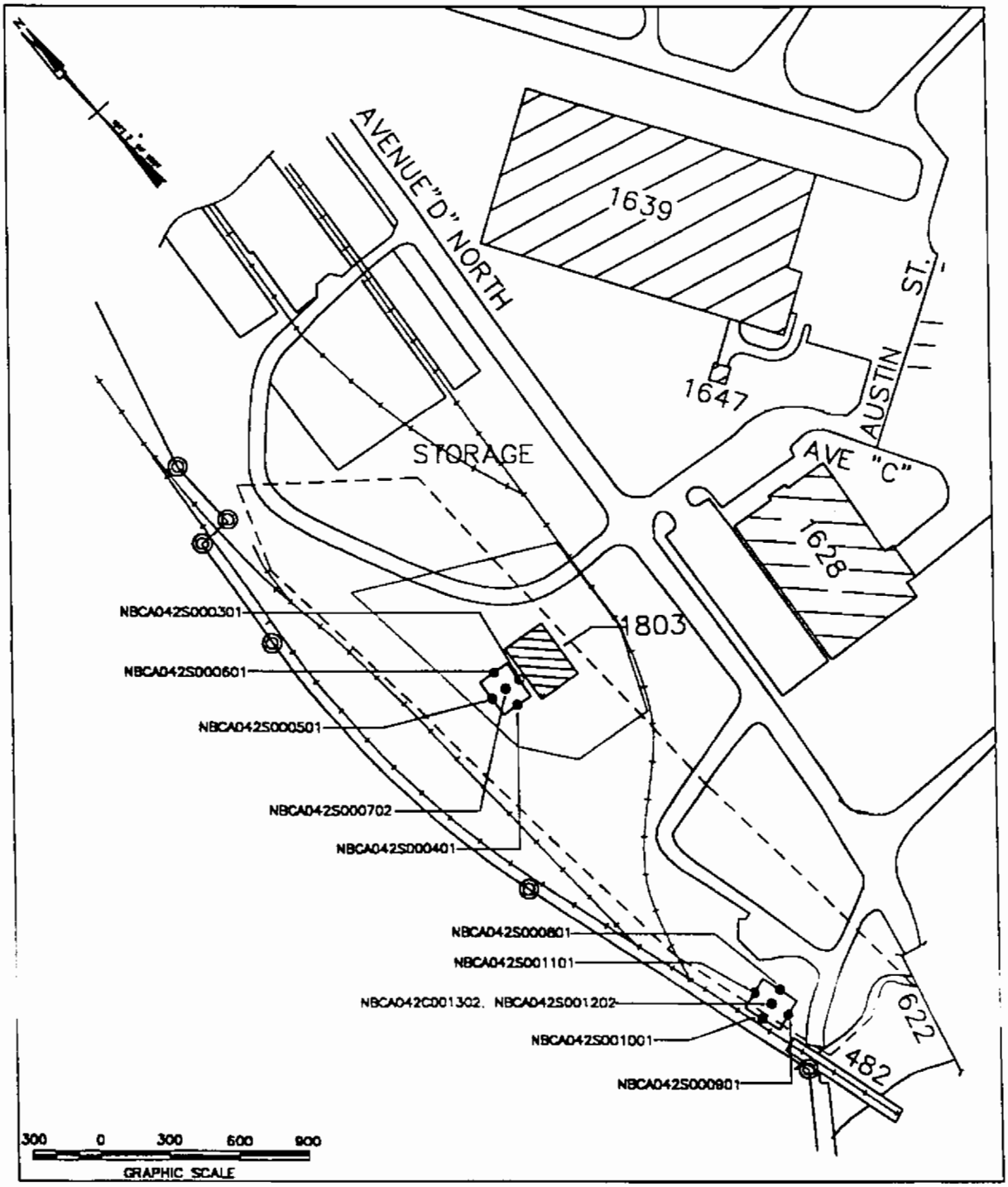


# APPENDIX B

# SAMPLING DOCUMENTATION

# FIGURE B-1

## SWMU 42 CONFIRMATORY SAMPLING GRID MAP



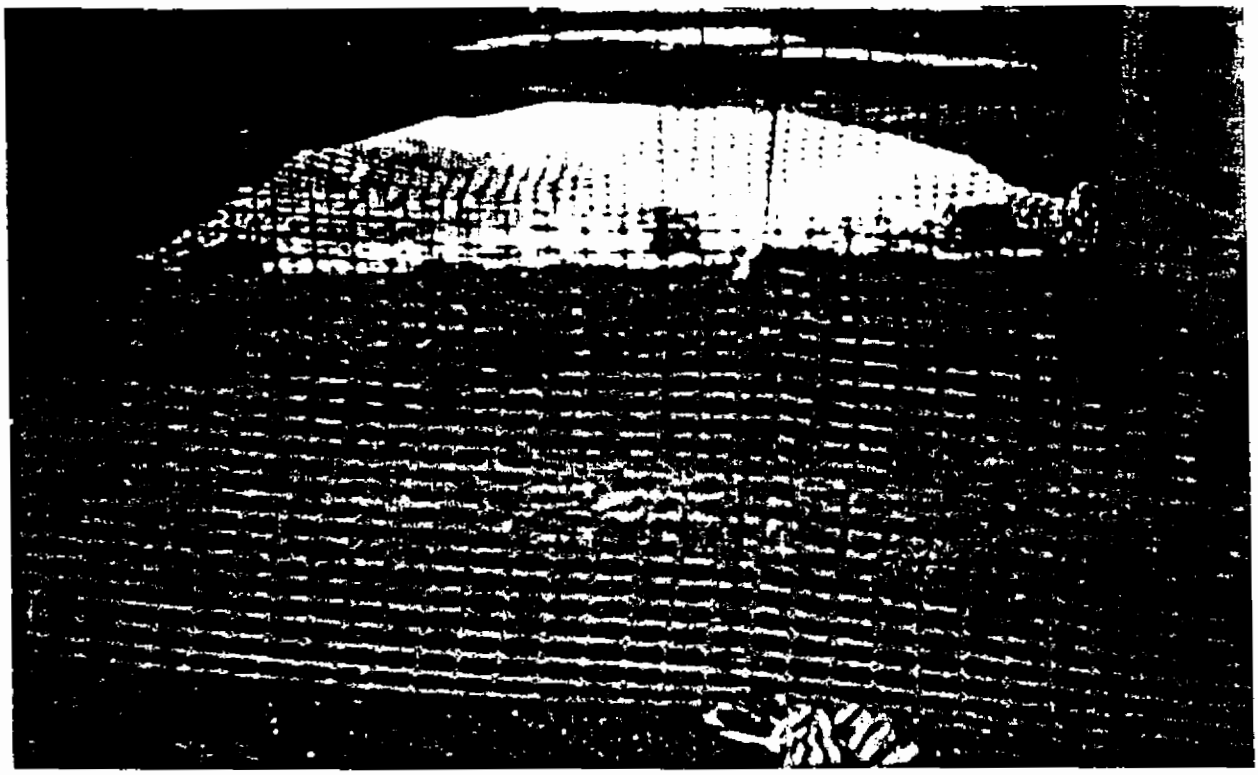


**Photo D-1** Excavation viewed from south end of site 1.

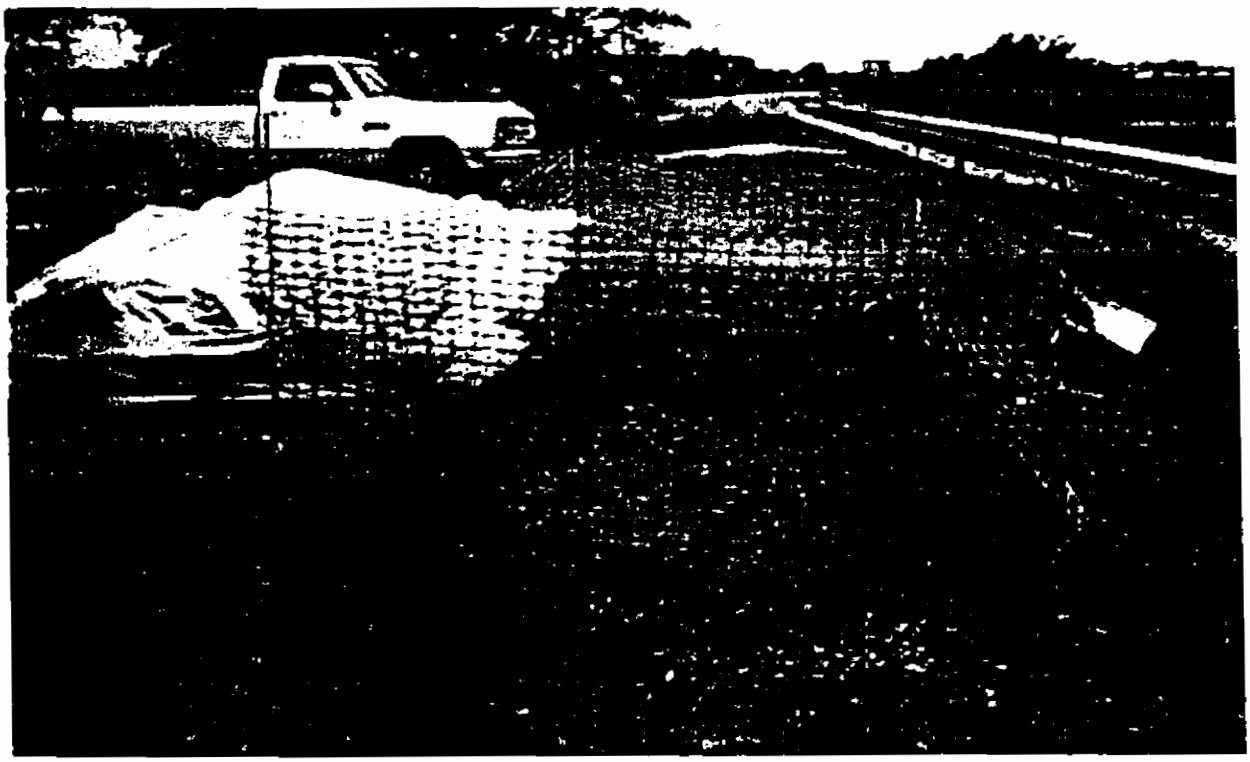


**Photo D-2** Excavation viewed from north end of site 2.

**Photo D-3** Work plan complete, waste soil and security fence removed , excavation filled in and viewed from south end of site 1.

**Photo D-4** Work plan complete, waste soil and securty fence removed, excavation filled in and viewed from north end of site 2.