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CORRECTIVE MEASURES STUDY REPORT SOLID WASTE MANAGEMENT UNIT 36 (SWMU 36) AND AREA OF CONCERN 620 (AOC 620) ZONE F CNC CHARLESTON SC

8/26/2003

CH2M HILL

CORRECTIVE MEASURES STUDY REPORT

SWMU 36 and AOC 620, Zone F

Charleston Naval Complex
North Charleston, South Carolina

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

CH2M-Jones

August 2003

Contract N62467-99-C-0960

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CH2MHILL

August 26, 2003

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: Corrective Measures Study Report (Revision 0) – SWMU 36 and AOC 620, Zone F

Dear Mr. Scaturo:

Enclosed please find four copies of the Corrective Measures Study Report (Revision 0) for SWMU 36 and AOC 620 in Zone F of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

Please do not hesitate to contact me at 352/335-5877, extension 2280, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

CORRECTIVE MEASURES STUDY REPORT

SWMU 36 and AOC 620, Zone F

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
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PREPARED BY
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Revision 0
Contract N62467-99-C-0960
158814.ZF.EX.07

Certification Page for Corrective Measures Study Report (Revision 0) — SWMU 36 and AOC 620, Zone F

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

South Carolina

P.E. No. 21428

Dean Williamson, P.E.

8/26/2003

Date

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Acronyms and Abbreviations

AOC	area of concern
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure Act
CA	corrective action
CFR	Code of Federal Regulations
CMS	Corrective Measures Study
CNC	Charleston Naval Complex
COC	chemical of concern
COPC	chemical of potential concern
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
ft^2	square feet
ft bls	feet below land surface
HI	Hazard Index
ILCR	incremental lifetime cancer risk
LUC	land use control
LUCIP	land use control Implementation Plan
LUCMP	land use control Management Plan
MCL	maximum contaminant level
MCS	media cleanup standard
mg/kg	milligram per kilogram
NAVBASE	Naval Base
NFA	no further action
PCB	polychlorinated biphenyl

Acronyms and Abbreviations, Continued

PPE	personal protective equipment
RAO	remedial action objective
RBC	risk-based concentration
RCRA	resource Conservation and Recovery Act
RDA	Redevelopment Authority
RFI	RCRA Facility Investigation
RGO	remedial goal option
SCDHEC	South Carolina Department of Health and Environmental Control
SVOC	semivolatile organic compound
SWMU	solid waste management unit
UST	underground storage tank
VOC	volatile organic compound
yd^3	cubic yards

Section 1.0

1.0 Introduction

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

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA), with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. All RCRA CA activities are performed in accordance with the Final Permit (Permit No. SC0 170 022 560). In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC.

A RCRA Facility Investigation (RFI) Report for Solid Waste Management Unit (SWMU) 36 and Area of Concern (AOC) 620 in Zone F of the CNC was prepared during 1997 (EnSafe Inc. [EnSafe], 1997). An RFI Report Addendum and Interim Measure Completion Report (CH2M-Jones, 2003) was also prepared for these sites to document the additional investigations conducted to complete the RFI and present details of an interim measure soil excavation conducted by the Navy/CH2M-Jones team during 2003. This Corrective Measures Study (CMS) report has been prepared by CH2M-Jones to complete the next stage of the CA process for SWMU 36 and AOC 620.

1.1 Corrective Measures Study Report Purpose and Scope

This CMS report evaluates corrective measure (remedial) alternatives for preventing unacceptable exposure to arsenic contamination found in surface soils and near-surface soils at SWMU 36 and AOC 620. Arsenic in surface soil is the chemical of concern (COC) identified at SWMU 36 and AOC 620 under the unrestricted (i.e., residential) use. Figure 1-1 illustrates the original location of SWMU 36 and AOC 620 within Zone F. Figure 1-2 is an aerial photograph showing the layout of SWMU 36 and AOC 620.

This CMS report consists of: 1) the identification of a set of corrective measure alternatives that are considered to be technically appropriate for addressing COC-contaminated soil; 2) an evaluation of the alternatives using standard criteria from U.S. Environmental

Protection Agency (EPA) RCRA guidance; and 3) the selection of a recommended (preferred) corrective measure alternative for the site.

This CMS evaluates the options for meeting the remedial action objectives (RAOs), which are described in Section 2.0 of this report. The two remedies considered for achieving the RAOs are: 1) soil removal and offsite disposal, and 2) land use controls (LUCs). The remedial activities associated with soil removal include excavation, backfilling, (replacing) pavement, and offsite disposal. The remedial activities that are associated with the LUCs include maintaining the existing site use (commercial/industrial) and site controls (pavement/building); a LUC Management Plan (LUCMP) agreement between the Navy and the State of South Carolina; and long-term monitoring and review.

1.2 Background Information

This section of the CMS report presents background information on the facility, site history, and a summary of the nature and extent of the COCs at the site. This information is important for the understanding of the remedial goal options (RGOs), media cleanup standards (MCSs), and ultimately the evaluation of corrective measure alternatives for SWMU 36 and AOC 620. Additional information on the site and hydrogeology in the Zone F area of the CNC is provided in the *Zone F RFI Report, Revision 0* (EnSafe, 1997).

1.2.1 Facility Description and Site History

SWMU 36/AOC 620 includes Building 68, which is the former Battery Shop, as well as the property immediately surrounding the building. Building 68 was composed of 58,000 square feet (ft^2) of elevated concrete floor space, supported by piles and underlain by unpaved earth. The interior of Building 68 included a room with generators and transformers near the center of the building, an acid storage tank room near the south-central wall, and a wash basin area near the northeast corner. A loading dock surrounded the eastern, western, and half of the northern sides of the building.

Building 68 was located in the industrial area of Zone F, east of Hobson Avenue. The Zone E borderline is approximately 65 feet east of the building site, and the Zone G borderline is 20 to 40 feet south of the building. AOC 628, the Sand Blasting Area, is located directly southeast of Kilo Street (Thirteenth Street) across from AOC 620. AOC 619, the Former Oil Storage Yard, is located directly west of AOC 620. Both of these adjacent AOCs are considered for No Further Action (NFA) status. The area surrounding Building 68 is

expected to remain in industrial use in the future. This area is zoned M-2 (heavy marine industrial land use).

From 1942 to 1952, Building 68 was used as a paint and oil storage facility. Beginning in 1952, it was used for the destruction, assembly, and rebuilding of large submarine batteries. Most recently, Building 68 was used for storage and charging of arsenic acid batteries for various equipment. In 1995 the building was decommissioned and operations ceased. The materials historically released, stored, or disposed of at AOC 620 include sulfuric acid, arsenic, paint, solvents, and petroleum products.

SWMU 36 is the site of two historical sulfuric acid releases, where acid was discharged within the acid tank room to floor drains in which the piping had separated. The separated piping reportedly allowed approximately 1,025 gallons of acid to leak onto the underlying unpaved ground surface. Following each spill, a sodium carbonate solution was used to neutralize the soil below the building.

The northeast portion of the building contained two shallow wash basins along the eastern wall. The basins drained to a former 6-inch drain line hung beneath the loading dock; the drain line led south to a sewer at the southeast corner of Building 68, and later to an underground storage tank (UST) located south of the building outside of the acid tank room. The acid UST was cleaned and decommissioned in 1995.

Until the demolition of Building 68 in late 2002, approximately 95 percent of SWMU 36/AOC 620 was paved or under a roof. A grass-covered strip located at the south side of Building 68 and a railroad line area west of the west loading dock were not paved. The building was demolished in November and December 2002, and the site is to be used for future commercial or industrial purposes.

Regulatory review was conducted on the *Zone F RFI Report, Revision 0* (EnSafe, 1997), and a draft responses to comments from SCDHEC was prepared by the Navy/EnSafe team. Additional investigations and an interim measure for soil removal were conducted by CH2M-Jones during 2002. The interim measure was conducted to remove surface soil (0-1 foot below land surface (ft bls)) and near-surface soil (1-2 ft bls), with lead concentrations exceeding industrial land use screening criteria. The subsequent *RFI Report Addendum and IM Completion Report for SWMU 36 and AOC 620, Revision 0* (CH2M-Jones, 2003) identified arsenic as a soil COC, due to its exceedance of the Zones F and G maximum background arsenic concentration of 31.5 milligram per kilogram (mg/kg) at one soil sampling location, and recommended LUCs for the site due to exceedances of the unrestricted land use criteria

for metals at a few soil sampling locations. Detailed information on the analytical results and the screening of those results to determine the COCs can be found in the *Zone F RFI Report, Revision 0* (EnSafe, 1997), and the *RFI Report Addendum and IM Completion Report for SWMU 36 and AOC 620, Revision 0* (CH2M-Jones, 2003).

1.2.2 Soil COC Summary

Two soil sampling events were conducted at SWMU 36 and AOC 620 during the initial RFI. Soil samples were analyzed during these sampling events for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and metals. Two additional soil sampling events were conducted during 1999 and 2001 to complete the RFI. Soil samples from these sampling events were analyzed for SVOCs, metals, polychlorinated biphenyls (PCBs), and pesticides.

Additional soil sampling for lead was conducted before and after demolition of Building 68 to verify the presence of lead in soils at the site. Some of these samples were also analyzed for pH.

The sampling locations from the various sampling events are shown in Figure 1-3, and discussed in detail in the *RFI Report Addendum and IM Completion Report for SWMU 36 and AOC 620, Revision 0* (CH2M-Jones, 2003).

The RFI report identified the following COCs for surface and near-surface soil:

- Unrestricted (i.e., residential) – arsenic, and
- Commercial/Industrial – no COCs identified.

No COCs were identified in subsurface soils (3-5 ft bls) at the conclusion of the IM.

1.2.3 Groundwater COC Summary

The RFI report identified barium, arsenic, and antimony as chemicals of potential concern (COPCs) in shallow groundwater at SWMU 36 and AOC 620. No COCs were identified in shallow or deep groundwater during the COPC screening process, as described in Section 5.3 of the *RFI Report Addendum and IM Completion Report for SWMU 36 and AOC 620, Revision 0* (CH2M-Jones, 2003).

This CMS focuses on arsenic in surface soil at SWMU 36 and AOC 620.

1.3 Report Organization

This CMS report consists of the following sections, including this introductory section:

1.0 Introduction — Presents the purpose of, and background information relating to, this CMS report.

2.0 Remedial Goal Options and Proposed Media Cleanup Standards — Defines the RGOs and proposed MCSs for SWMU 36 and AOC 620, in addition to the criteria used in evaluating the corrective measure alternatives for the site.

3.0 Overall Approach for Evaluating Focused Alternatives for SWMU 36 and AOC 620 — Describes the alternative development process and presents the detailed evaluation criteria.

4.0 Description of Candidate Corrective Measure Alternatives — Describes each of the candidate corrective measure alternatives for addressing arsenic in soil.

5.0 Evaluation and Comparison of Corrective Measure Alternatives — Evaluates each alternative relative to standard criteria, then compares the alternatives and the degree to which they meet or achieve the evaluation criteria.

6.0 Recommended Corrective Measure Alternative — Describes the preferred corrective measure alternative to achieve the MCS and RGOs for arsenic in soil based on a comparison of the alternatives.

7.0 References — Lists the references used in this document.

Appendix A contains cost estimates developed for the proposed corrective measure alternatives.

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

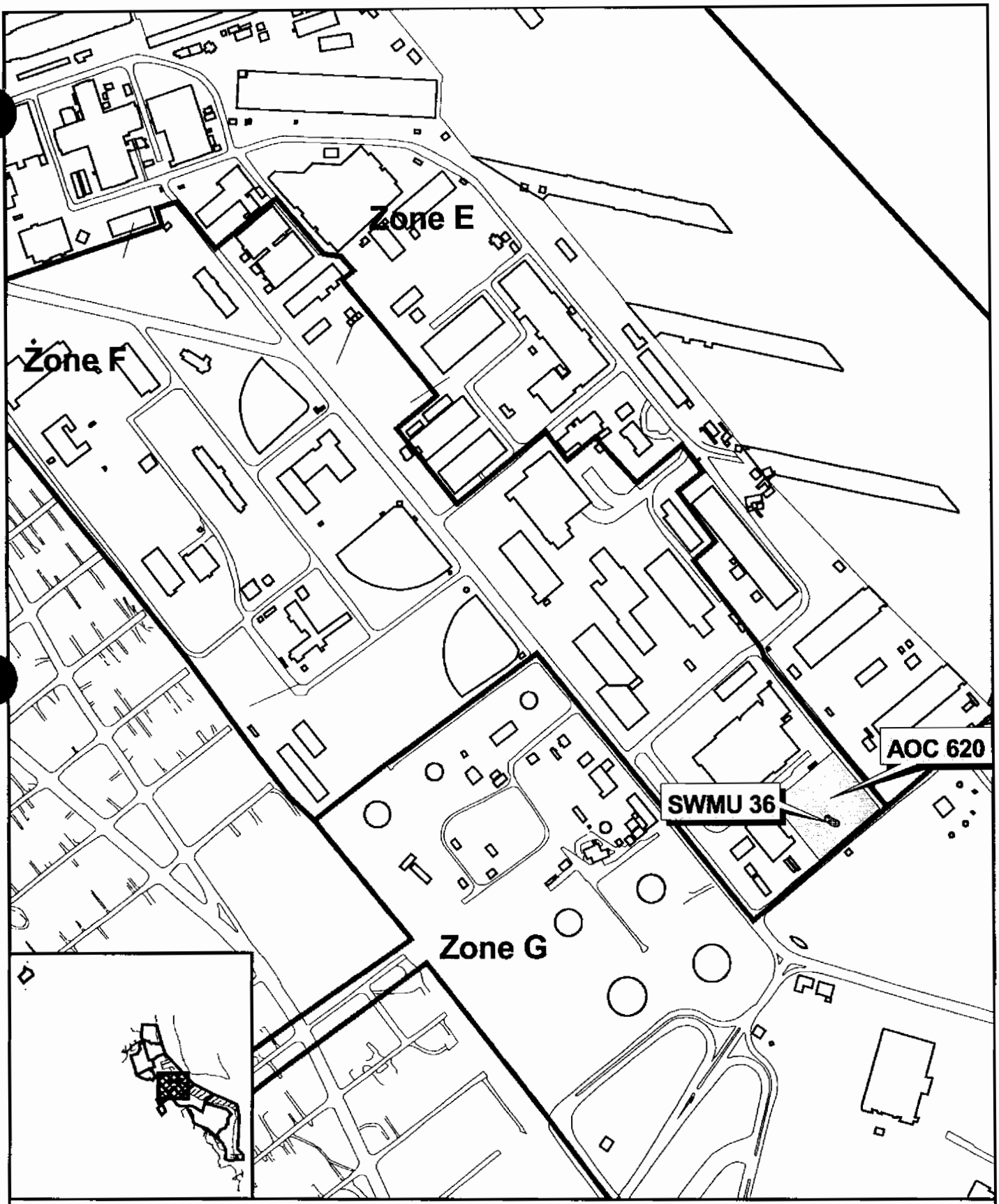
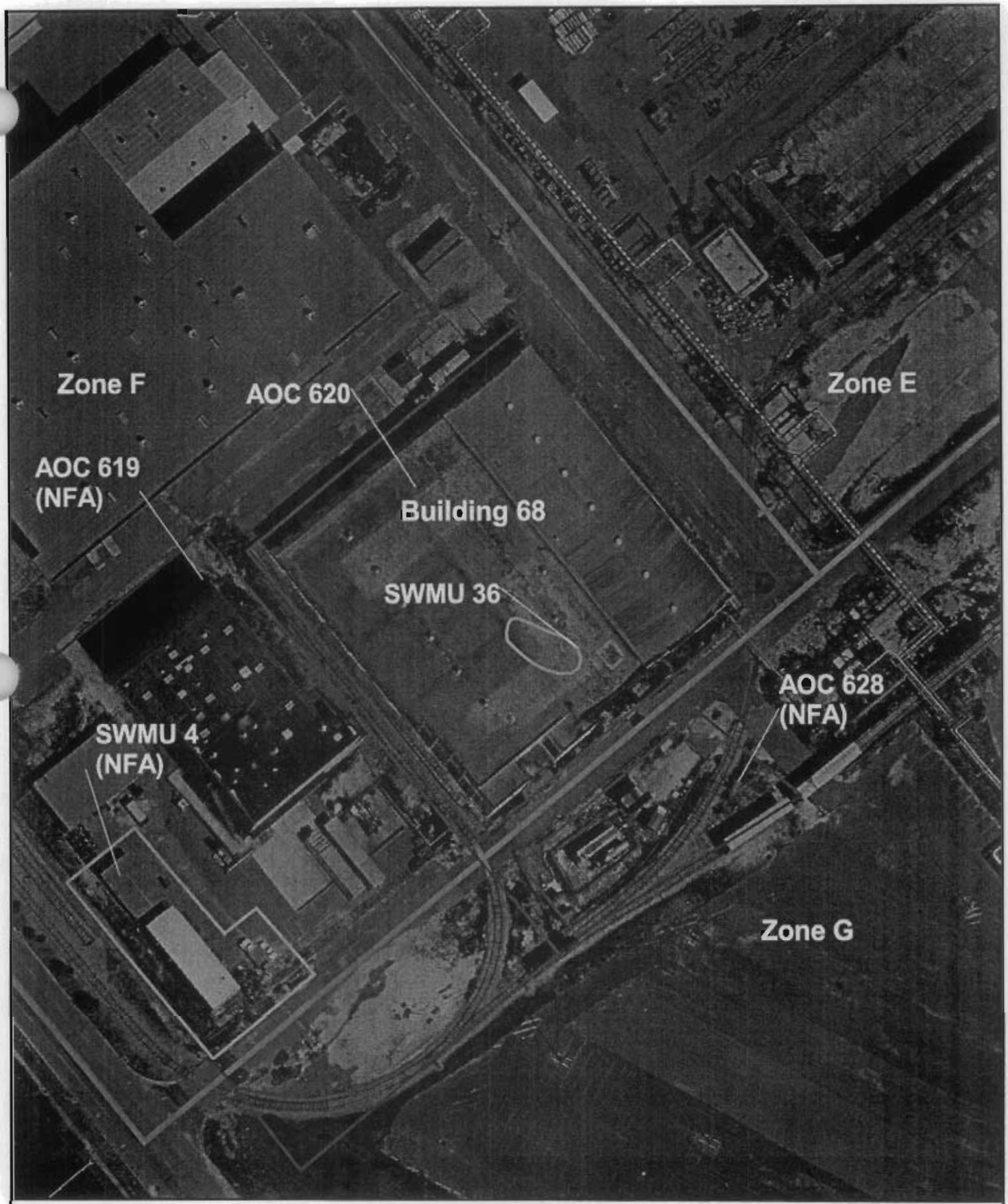


Figure 1-1
Location of SWMU 36/AOC 620
Zone F
Charleston Naval Complex

CH2MHILL

File Path: D:\18gis\Projects\Zone_F\AOC_620\Aprs\aoc620_Figure1-1_debra.apr, Date: 28 Jan 2003 11:55, User: DSANTOS, EGIS: Charleston Naval Complex - Figure 1-1 Basemap

NOTE: Aerial Photo Date is 1997



AOC Boundary
SWMU Boundary
Zone Boundary

N

0 80 160 Feet

1 inch = 100 feet

Figure 1-2
Aerial Photo
SWMU 36/AOC 620
Charleston Naval Complex

CH2MHILL

File Path: c:\18gis\projects\zone_f\aoc_620\aprs\aoc620_figure1-2.apr, Date: 20 May 2002 14:06, User: JOVERSTR, EGIS: Charleston Naval Complex - Figure 1-2 Aerial Photo

NOTE: Original figure created in color

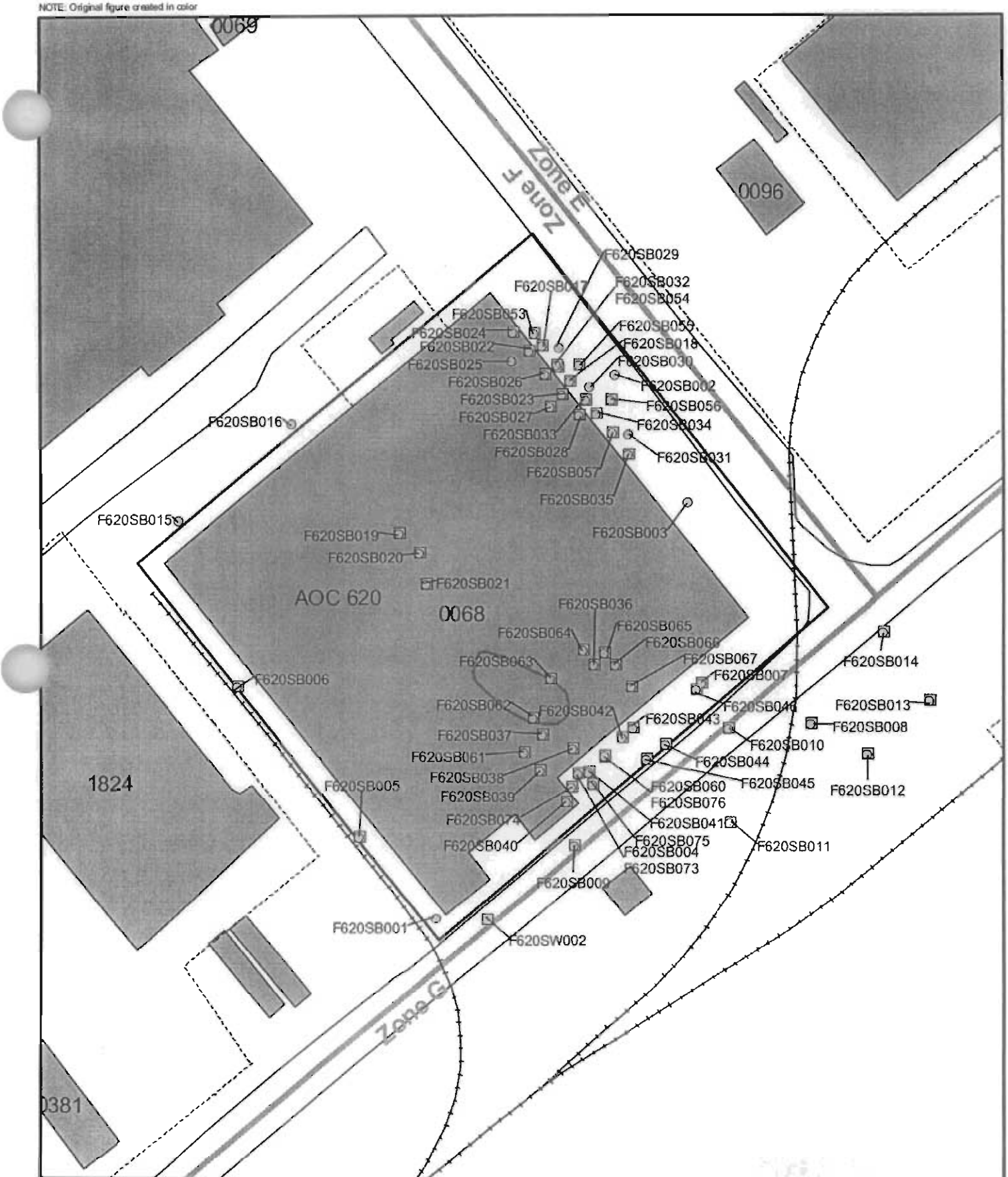


Figure 1-3
RFI and Post-RFI Soil Sampling Locations
AOC 620, Zone F
Charleston Naval Complex

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File Path: c:\18gis\projects\zone_f\aoc620\aoc620.apr, Date: 20 Aug 2003 10:37, User: NMOUDRY, Figure 1-3 RFI and Post-RFI Soil Sampling Locations

Section 2.0

2.0 Remedial Goal Options and Proposed Media Cleanup Standards

RGOs and MCSs are typically developed at the end of the risk assessment in the RFI. RGOs can be based on a variety of criteria, such as drinking water maximum contaminant levels (MCLs), specific incremental lifetime cancer risk (ILCR) target levels (e.g., 1E-04, 1E-05, or 1E-06), target Hazard Index (HI) levels (e.g., 0.1, 1.0, 3.0), or site background concentrations. When site background concentrations are higher than the health protection-based concentrations, the background levels are the target MCSs. Achieving these goals should protect human health and the environment, while achieving compliance with applicable state and federal standards.

2.1 Remedial Action Objectives

RAOs are medium-specific goals that protect human health and the environment by preventing or reducing exposures under current and future land use conditions. In the *RFI Report Addendum and IM Completion Report for SWMU 36 and AOC 620, Revision 0* (CH2M-Jones, 2003), the RAO for surface soil is to prevent ingestion and direct/dermal contact with soil containing COCs at unacceptable levels.

2.2 Media Cleanup Standards

MCSs for the unrestricted and industrial land use scenarios at SWMU 36 and AOC 620 were discussed in the *RFI Report Addendum and CMS Work Plan, Revision 0* (CH2M-Jones, 2003). For sites where background arsenic levels exceed risk-based concentrations (RBCs), EPA Region IV typically considers arsenic concentrations in surface soil of up to 20 mg/kg and 270 mg/kg as acceptable for unrestricted and industrial land use, respectively (EPA, 2001). These levels are proposed as MCSs for surface soil.

The MCS will be met if the site statistical estimates of concentrations are similar to background statistical estimates. For point comparisons between site and background, the ranges of site concentrations may be compared with the ranges of Zone F and Zone G background concentrations.

The pattern of distribution of arsenic at this site indicates only one exceedance in surface soil above the unrestricted land use MCS (the EPA Region IV target cleanup goal for

unrestricted land use of 20 mg/kg). This exceedance was found in the surface soil sample from F620SB007, where arsenic was detected at 31.5 mg/kg.

The focus of this CMS is to evaluate alternatives that will achieve the RAOs described above. The corrective measure alternatives evaluated include:

- Alternative 1: Soil removal and offsite disposal with LUCs, and
- Alternative 2: LUCs.

These alternatives are discussed in Section 4.0 of this CMS report.

Section 3.0

3.0 Overall Approach for Evaluating Focused Alternatives for SWMU 36 and AOC 620

3.1 Preferred Remedies

A variety of corrective measure approaches are conceptually feasible for arsenic in soil at SWMU 36 and AOC 620. However, remedy selection at the CNC has focused on a few demonstrated technologies. For contaminants in soil that are limited in area, the preferred technologies that are expected to be effective at the CNC include: 1) soil removal and offsite disposal with LUCs, and 2) LUCs. Generally, at sites similar to SWMU 36 and AOC 620 with limited soil contamination, a preference exists for implementing one of these remedies to expedite the remedy selection and implementation processes, improve predictability of the remedy, and lower costs. These candidate alternatives are screened and evaluated using the conventional criteria presented below.

In this focused CMS, these two alternatives will be described (Section 4.0), evaluated in detail (Section 5.0), and one will be proposed as a recommended alternative (Section 6.0).

3.2 Evaluation Criteria

According to the EPA RCRA CA guidance, corrective measure alternatives should be evaluated using the following five criteria:

1. Protection of human health and the environment.
2. Attainment of MCSs.
3. The control of the source of releases to minimize future releases that may pose a threat to human health and the environment.
4. Compliance with applicable standards for the management of wastes generated by remedial activities.
5. Other factors, including (a) long-term reliability and effectiveness; (b) reduction in toxicity, mobility, or volume of wastes; (c) short-term effectiveness; (d) implementability; and (e) cost.

Each of these criteria is defined in more detail below.

4.0 Description of Candidate Corrective Measure Alternatives

4.1 General Description of Alternatives

Two candidate corrective measure alternatives were selected for SWMU 36 and AOC 620:

- Alternative 1: Soil Removal and Offsite Disposal with LUCs.
- Alternative 2: LUCs.

The implementation of Alternative 1 would involve the removal of soil at locations where arsenic concentrations exceed the MCS. Based on an evaluation of arsenic, the following surface soil at F620SB007 will require removal in order for site soils to meet the arsenic MCS of 20 mg/kg for unrestricted land use.

The approximate area of soil requiring removal to achieve the MCS for Alternative 1 is shown on Figure 4-1. A 20-percent scope contingency is assumed and included in the cost for this alternative.

For Alternative 2, it is assumed that the LUCs will include the following administrative controls:

- Restrictions limiting the property land use to non-residential uses.
- Restrictions to maintain the extent of paved area, unless a demonstration is made that changing a currently paved area to unpaved status will not cause a failure to meet one of the RAOs.

The sections below describe each alternative in detail.

4.2 Alternative 1: Soil Removal and Offsite Disposal

4.2.1 Description of Alternative

This alternative will remove contaminated soil in the area shown on Figure 4-1 that exceeds the MCS established in Section 2.0.

Excavated soil would be transported to a permitted landfill facility for long-term disposal, and the excavations would be filled with clean backfill from an offsite source. Once the contaminated soil is removed and the excavations backfilled with clean soil, the site would

be acceptable for unrestricted land use, with no long-term monitoring required. However, because the site is located in an industrial area of Zone F, LUCs will continue to be applied at this site in the same manner as the other sites within Zone E and the industrial areas of Zone F at the CNC. These LUCs are expected to include restricting the property to non-residential activities.

At F620SB007, the area of soil to be removed is approximately 10 feet by 10 feet, for a total excavated area of 100 ft^2. The depth of soil to be removed is 1 ft bls, and the in-place volume of soil to be removed is approximately 3.74 cubic yards (yd^3).

The total volume of soil to be removed is approximately 3.74 yd^3. An equal amount of clean backfill will be required to fill in the excavated areas. Confirmation sampling would involve a total of six samples (four sidewall samples and one bottom sample, plus one additional QA/QC sample).

4.2.2 Other Considerations

Coordination with the CNC Redevelopment Authority (RDA) would be required for site restrictions during excavation and traffic control for the haul trucks.

The potential for expansion of scope during confirmation testing is moderate. Based on the above factors, a 20-percent scope contingency is assumed.

4.3 Alternative 2: Land Use Controls

4.3.1 Description of Alternative

This alternative involves leaving the contaminated soil in place and instituting administrative/legal controls to restrict future land use. The controls would limit land use to activities that present less frequent exposure by sensitive populations to surface and near-surface soil and preclude uncontrolled disturbance to the contaminated soil, thereby minimizing the potential for human exposure to the contamination. The addition of restrictions on soil disturbance and site occupancy would minimize potential for human exposure that could occur in a residential or industrial setting. The controls may be in the form of deed restrictions and/or easements (property interests retained by the Navy during property transfer to assure protectiveness of the remedy). Periodic monitoring would be required to assure that controls are maintained; periodic site inspections would be required to assure compliance with institutional controls. Controls may be layered (multiple controls at the same time) to enhance protectiveness. The Navy is negotiating a comprehensive Land Use Control Implementation Plan (LUCIP) for the CNC.

4.3.2 Other Considerations

Currently, the Navy is the property owner and land use in Zone F of the CNC is restricted to non-residential use. Existing engineering controls include pavement and structures that prevent or limit access to contaminated soil. The location and proximity of the site to other industrial properties make residential use highly unlikely. Periodic monitoring of the deed controls and the site would be required. For the purpose of developing a representative cost estimate for this process, an annual evaluation that would include a site inspection is assumed.

5.0 Evaluation and Comparison of Corrective Measure Alternatives

The corrective measure alternatives were evaluated relative to the criteria previously described in Section 2.0 and then subjected to a comparative evaluation. A cost estimate for each alternative was also developed; the assumptions and unit costs used for these estimates are included in Appendix A.

5.1 Alternative 1: Soil Removal and Offsite Disposal

The following assumptions were made for Alternative 1:

- One area would be targeted for surface soil removal, as shown in Figure 4-1.
- A total of 3.74 yd^3 of soil (in-place measurement) would be excavated for offsite disposal at a Subtitle D facility and replaced with clean backfill.
- Excavation would include known exceedances plus extrapolated areas to account for uncertainty.
- Confirmation testing will validate that the extent of contaminated soil is limited to that shown on Figure 4-1, plus a maximum contingency of 20 percent.

5.1.1 Protection of Human Health and the Environment

Alternative 1 is effective at protecting human health and the environment because it removes soil with arsenic concentrations that exceed the MCS from the site.

5.1.2 Attain Media Cleanup Standard

Alternative 1 will permanently remove soil with arsenic concentrations that exceed the MCS. The MCS will be achieved at the completion of soil removal actions.

5.1.3 Control the Source of Releases

There are no ongoing sources of releases at SWMU 36 and AOC 620; therefore, this issue is not applicable.

5.1.4 Compliance with Applicable Standards for the Management of Generated Wastes

Excavated soil will be sampled and analyzed for waste characterization prior to disposal. Soil, decontamination waste, and personal protective equipment (PPE) will be disposed of in accordance with applicable regulations and permits. Offsite transportation and disposal will be performed by properly permitted and licensed subcontractors.

5.1.5 Other Factors (a) Long-term Reliability and Effectiveness

Alternative 1 would have long-term reliability and be effective for the site as long as all exceedances are removed. The removal of contamination from the site would be permanent. Uncertainty in the distribution of arsenic in soil is addressed by expanding the excavations beyond the RFI delineation, thus reducing the risk of failure of this alternative. Confirmation sampling would confirm that the excavations have removed soil exceedances. It is much less likely that any significant amount of soil with arsenic concentrations above the MCS will be left in place; sitewide average concentrations will be below the MCS for the unrestricted land use scenario.

5.1.6 Other Factors (b) Reduction in the Toxicity, Mobility, or Volume of Wastes

Alternative 1 reduces the mobility of the contaminated soil by transporting it to a regulated containment facility (landfill). Treatment will not be required unless the soil exhibits toxicity characteristics per 40 Code of Federal Regulations (CFR) 261.24. If required, soil will be treated at the disposal facility to further reduce the mobility of the arsenic.

5.1.7 Other Factors (c) Short-term Effectiveness

The excavation and hauling of contaminated soil in this alternative has the potential to create dust containing contaminated soil particles. However, standard engineering controls such as dust suppression during excavation, tarp covers on trucks, and worker PPE to prevent dust inhalation will be implemented. Thus, with controls, the alternative provides short-term effectiveness in preventing ingestion of, or contact with, the contaminated soil and minimizes the potential for migration of soil particles. The technologies for dust control and worker protection are well-established and robust. No unmanageable hazards would be created during implementation.

5.1.8 Other Factors (d) Implementability

Alternative 1 will be moderately difficult to implement. Most of the required activities have been routinely implemented at nearby sites using standard equipment and procedures. Utility clearance, subcontracting, waste characterization, and base approval are customary

activities. The field implementation of this remedy is estimated to require 4 to 6 weeks, and the benefits will be immediate. There is ample offsite capacity for disposal (and treatment, if required) of the contaminated soil.

5.1.9 Other Factors (e) Cost

Appendix A presents the overall cost estimate for implementing this remedy. These costs reflect soil removal based on available RFI and IM sample results, plus backfilling excavated areas with clean backfill. In summary, the costs include the following:

- Removing soil in areas at each occurrence of MCS exceedance.
- Performing confirmation tests in each area to confirm compliance with MCS.
- Applying 20 percent contingency for additional scope that may be required based on compliance tests.

Using the assumptions listed above, the total present value of Alternative 1 is $31,000.

5.2 Alternative 2: Land Use Controls

The assumptions for Alternative 2 include the following:

- A base-wide LUCIP will be developed for the CNC. The plan will allow for restrictions on land use at SWMU 36 and AOC 620 and other areas, and will be developed outside the scope of this CMS.
- Periodic monitoring will be performed for 30 years. The monitoring will consist of an annual site visit to confirm that site use(s) are consistent with the LUCIP. Although the present worth costs have been calculated for a 30-year period of monitoring, it is assumed that LUCs could be in place for as long as required. The present worth costs for a longer period of monitoring are not significantly different from those for a 30-year period of monitoring.

5.2.1 Protection of Human Health and the Environment

Alternative 2 will effectively protect human health because it restricts future uses that would be inappropriate for the MCS exceedances at the site.

5.2.2 Attain Media Cleanup Standard

Alternative 2 would not achieve the MCS for arsenic.

5.2.3 Control the Source of Releases

There are no ongoing sources of releases at SWMU 36 and AOC 620; therefore, this issue is not applicable.

5.2.4 Compliance with Applicable Standards for the Management of Generated Wastes

Alternative 2 does not generate any wastes that would require special management.

5.2.5 Other Factors (a) Long-term Reliability and Effectiveness

Alternative 2 provides a level of protection that has long-term reliability and effectiveness. The risk of failure is low, provided the LUCIP is enforced by the responsible entity. If LUCs were not enforced, unpermitted use of the site may result in human exposure to arsenic above the MCS.

5.2.6 Other Factors (b) Reduction in the Toxicity, Mobility, or Volume of Wastes

Alternative 2 involves no treatment and does not reduce the toxicity, mobility, or volume of contaminated soil at SWMU 36 and AOC 620.

5.2.7 Other Factors (c) Short-term Effectiveness

The Navy retains ownership and control of the site use until LUCs are implemented. Alternative 2 does not involve any site activities, so no short-term risks are created.

5.2.8 Other Factors (d) Implementability

Alternative 2 is relatively easy to implement since it requires only the development of LUCs and an appropriate monitoring program.

5.2.9 Other Factors (e) Cost

Alternative 2 is not costly to implement since it requires no construction of treatment facilities or disposal of wastes. The cost for this alternative is for administrative/legal services and periodic monitoring and/or review for 30 years. Although the present worth costs have been calculated for a 30-year period of monitoring, it is assumed that LUCs could be in place for as long as required. The present worth costs for a longer period of monitoring are not significantly different from those for a 30-year period of monitoring. Longer monitoring would likely be required, but its cost impact to present value of this alternative is minimal.

Using the assumptions described earlier, the total present value of Alternative 2 is $20,000.

5.3 Comparative Ranking of Corrective Measure Alternatives

The overall ability of each corrective measure alternative to meet the evaluation criteria is described above. Table 5-1 presents a comparative evaluation of the degree to which each alternative meets a particular criteria. Alternative 2: LUCs is the preferred alternative. It provides a protective and reliable remedy at a lower cost than Alternative 1.

TABLE 5-1
Qualitative Comparison of Corrective Measure Alternatives
Corrective Measures Study Report, SWMU 36 and AOC 620, Zone F, Charleston Naval Complex

Criterion	Alternative 1 Soil Removal and Offsite Disposal with Land Use Controls	Alternative 2 Land Use Controls
Overall Protection of Human Health and the Environment	Protects human health and the environment	Protects human health and the environment
Attainment of MCS	Would achieve MCS	Would not achieve MCS
Control of the Source of Releases	N/A	N/A
Compliance with Applicable Standards for the Management of Wastes	Complies with applicable standards	Complies with applicable standards
Long-term Reliability and Effectiveness	Reliable and effective long term	Reliable and effective long term, provided periodic inspections are performed
Reduction of Toxicity, Mobility, or Volume through Treatment	Reduces mobility via placement of soil in landfill	Does not reduce toxicity, mobility, or volume
Short-term Effectiveness	Effective in short term	Effective in short term
Implementability	Moderately difficult to implement due to need to remove/replace concrete and asphalt pavement and work in busy industrial area.	Easy to implement
Cost Ranking	Slightly Expensive	Inexpensive
Estimated Cost	$31,000	$20,000

Section 6.0

6.0 Recommended Corrective Measure Alternative

Two corrective measure alternatives were evaluated using the criteria described in Section 2.0 of this CMS report:

- Alternative 1: Soil Removal and Offsite Disposal with LUCs, and
- Alternative 2: LUCs.

The preferred corrective measure alternative is Alternative 2: LUCs. The remedy would be protective at a moderate cost.

Alternative 2 would provide protection of human health and the environment by maintaining the current and planned future use of the site as industrial/commercial. Limitations would prevent residential and other unrestricted land use that could expose sensitive populations.

Engineering controls to minimize future releases are already in place. Most of the area is paved or covered by a structure. Planning is already underway to develop and implement administrative controls that would limit future site activities to those that would not involve unrestricted exposures. The expected reliability of this alternative is good.

There are no community safety issues associated with implementation of this remedy, and the controls would be relatively easy to implement. This alternative provides long-term effectiveness for the planned industrial/commercial use and relies on administrative controls to prevent future residential use.

Section 7.0

7.0 References

CH2M-Jones. *RFI Report Addendum and IM Completion Report for SWMU 36 and AOC 620, Zone F, Revision 0.* February 2003.

EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, NAVBASE Charleston.* June 6, 1995.

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

Appendix A

COMPARISON OF TOTAL COST OF REMEDIAL SOLUTIONS

Site: Charleston Naval Complex
Location: SWMU 36/AOC 620
Phase: Corrective Measures Study

Base Year: 2003
Date: 08/17/03

	Alternative Number 1	Alternative Number 2
Total Project Duration (Years)	<1	30
Capital Cost	$11,000	$6,000
Annual O&M Cost	$0	$1,100
Total Present Value of Solution	$31,000	$20,000

Disclaimer: The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This is an order-of-magnitude cost estimate that is expected to be within -50 to +100 percent of the actual project costs.

Alternative: Number 1 — **COST ESTIMATE SUMMARY**

Elements: Soil Excavation and Offsite Disposal

Site: Charleston Naval Complex

Location: SWMU 36/AOC 620
Phase: Corrective Measures Study
Base Year: 2003
Date: 08/17/03

Description: Excavation of contaminated soil, disposal offsite at permitted landfill, backfill with clean soil. Extent includes RFI sample points plus 20% scope contingency.

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Confirmation Sampling	1	EA	$1,100	$1,100	See Confirmation Worksheet
Removal, Disposal and Backfill	1	EA	$6,000	$6,000	See Excavation 1 Worksheet
				$0	
SUBTOTAL				$7,100	
Contingency	20%		$7,100	$1,420	
SUBTOTAL				**$8,520**	
Project Management	8%		$8,520	$682	USEPA 2000, p. 5-13, $100K-$500K
Remedial Design	15%		$8,520	$1,278	USEPA 2000, p. 5-13, $100K-$500K
Construction Management	10%		$8,520	$852	USEPA 2000, p. 5-13, $100K-$500K
SUBTOTAL				**$2,812**	
TOTAL CAPITAL COST				**$11,000**	

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
SUBTOTAL				$0	
Allowance for Misc. Items	20%		$0	$0	
SUBTOTAL				$0	
TOTAL ANNUAL O&M COST				**$0**	

PRESENT VALUE ANALYSIS

Discount Rate = 7%

End Year	COST TYPE	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)	PRESENT VALUE	NOTES
0	CAPITAL COST	$11,000	$11,000	1.000	$11,000	
	ANNUAL O&M COST	$0	$0	0.000	$0	
		$11,000			$11,000	
	PRESENT VALUE OF LAND USE CONTROLS COST				$20,000	
	TOTAL PRESENT VALUE OF ALTERNATIVE				**$31,000**	

SOURCE INFORMATION

1. United States Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).

Alternative: **Number 2** **COST ESTIMATE SUMMARY**
Elements: **Land Use Controls**

Site: Charleston Naval Complex
Location: SWMU 36/AOC 620
Phase: Corrective Measures Study
Base Year: 2003
Date: 08/17/03

Description: Implementation of base-wide land use management plan to put instituional controls in place to restrict site use to commercial/industrial.

Assumes this site is part of a multi-site implementation, and costs are shared among all the sites.

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Deed Restrictions - Attorney	4	hour	$200	$800	
Record Deed	4	each	$500	$2,000	
LUC Implementation	24	hours	$75	$1,800	
SUBTOTAL				$4,600	
Contingency	20%		$4,600	$920	
SUBTOTAL				**$5,520**	
Project Management	10%		$5,520	$552	USEPA 2000, p. 5-13, <$100K
Remedial Design	0%		$5,520	$0	Not applicable.
Construction Management	0%		$5,520	$0	Not applicable.
SUBTOTAL				**$552**	
TOTAL CAPITAL COST				**$6,000**	

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Annual Evaluation	12	hour	$75	$900	
SUBTOTAL				$900	
Allowance for Misc. Items	20%		$900	$180	
SUBTOTAL				$1,080	
TOTAL ANNUAL O&M COST				**$1,100**	

PRESENT VALUE ANALYSIS - 20 years

Discount Rate = 7%

End Year	COST TYPE	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)	PRESENT VALUE	NOTES
0	CAPITAL COST	$6,000	$6,000	1.000	$6,000	
30	ANNUAL O&M COST	$33,000	$1,100	12.409	$13,650	
		$39,000			$19,650	
	TOTAL PRESENT VALUE OF ALTERNATIVE				**$20,000**	

SOURCE INFORMATION

1. United States Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).

Alternative: **Subtask** **COST WORKSHEET 1**

Element: **Confirmation Testing**

Site: Charleston Naval Complex
Location: SWMU 36/AOC 620
Phase: Corrective Measures Study
Base Year: 2003

Prepared By: SN **Date:** 08/17/03
Checked By: **Date:** 08/17/03

WORK STATEMENT

Costs for soil confirmation sample collection, shipment and analysis on a per event basis.
Total of 6 samples: 1 per excavation wall plus 1 bottom = 5 X 1 excavation plus 1 QA/QC Sample.

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Equipment & Labor					
Jar Kits	6	EA	$10	$60	CH2M-Jones Est.
Coolers	1	EA	$10	$10	CH2M-Jones Est.
Disposable Gloves	1	BOXES	$20	$20	CH2M-Jones Est.
Collection of samples	4	HR	$68	$272	CH2M-Jones Est.
Sample Shipment	1	EA	$20	$20	CH2M-Jones Est.
Sample Analysis (Arsenic)	6	SAMPLE	$35	$210	GEL, PEL, STL average
Data Validation	3	HR	$100	$300	CH2M-Jones Est.
SUBTOTAL				$892	
Allowance for Misc. Items	20%		$892	$178	
SUBTOTAL				$1,070	
TOTAL COST				**$1,100**	

OPERATION AND MAINTENANCE COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
SUBTOTAL				$0	
Allowance for Misc. Items	20%		$0	$0	
SUBTOTAL				$0	
TOTAL O&M COST				**$0**	

Source of Cost Data

1. Analytical Bid Form - Charleston Naval Complex - Level II

Alternative: **Subtask** **COST WORKSHEET 2**

Element: **Soil Excavation and Disposal**

Site: Charleston Naval Complex
Location: SWMU 36/AOC 620
Phase: Corrective Measures Study
Base Year: 2003

Prepared By: sn **Date:** 08/17/03
Checked By: **Date:** 08/17/03

WORK STATEMENT

Excavate soil and haul to disposal area; backfill with clean soil and restore surface to original condition.

See quantity calcs

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Mob/demob/decon	1	EA	$1,000	$1,500	CH2M-Jones Est.
Utility checks and permits	4	HR	$100	$400	CH2M-Jones Est.
Excavation (soil) - machine	1	day	$900	$900	CH2M-Jones Est.
Clean Fill	4.3	CY	$46	$200	CH2M-Jones Est.
Compaction machine	1	day	$100	$100	CH2M-Jones Est.
Site Operator-Oversight	10	HR	$100	$1,000	CH2M-Jones Est.
Waste characterization TCLP	1	EA	$150	$150	
Waste disposal (Soil) - Non-Haz	6	Tons	$45	$270	CH2M-Jones Est.
SUBTOTAL				$4,520	
Allowance for Misc. Items	30%		$4,520	$1,356	20% Scope + 10% Bid
SUBTOTAL				$5,876	
TOTAL UNIT COST				**$6,000**	

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
SUBTOTAL				$0	
Allowance for Misc. Items	0%		$0	$0	
SUBTOTAL				$0	
TOTAL ANNUAL O&M COST				**$0**	

Source of Cost Data

1. Means. 2002. Environmental Remediation Cost Data - Assemblies, 8th Edition. R.S. Means Company Kingston, MA.

COST WORKSHEET 3

Removal Areas/Volumes

SWMU 36/AOC 620 sn 08/17/2003

Alternative 1	Excavation, ft			Surface	In Situ Soil
Location	L	W	D	Area, sf	Volume, cy
F620SB007	10	10	1	100	3.70
TOTAL				**100**	**3.70**

	3.7	CY, in situ volume (bank CY)
b	1.15	Bulk ratio (load factor)
c	4.3	CY, bulk volume
d	1.3	Ton ratio
e	6	Tons, bulk weight (rounded)

CHECK:

Typical in situ unit weight	110 PCF
Weight of in situ volume = e/a	120 PCF