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CORRECTIVE MEASURES STUDY REPORT SOLID WASTE MANAGEMENT UNIT 67 (SWMU 67) ZONE E CNC CHARLESTON SC

8/3/2004

CH2M HILL

CORRECTIVE MEASURES STUDY REPORT

SWMU 67, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

CH2M Jones

July 2004

Contract N62467-99-C-0960

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August 3, 2004

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

Re: CMS Report (Revision 0) – SWMU 67, Zone E

Dear Mr. Scaturo:

Enclosed please find two copies of the CMS Report (Revision 0) for SWMU 67 in Zone E 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 contact me at 352/335-5877, ext. 2280, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

CORRECTIVE MEASURES STUDY REPORT

SWMU 67, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

PREPARED BY
CH2M-Jones

July 2004

Revision 0
Contract N62467-99-C-0960
158814.ZE.PR.01

Certification Page for Corrective Measures Study Report (Revision 0) — SWMU 67, Zone E

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.

7/29/2004

Date

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Acronyms and Abbreviations

AOC	area of concern
BCT	BRAC Cleanup Team
BEQ	benzo(a)pyrene equivalent
BRAC	Base Realignment and Closure Act
CA	corrective action
CMS	corrective measures study
CNC	Charleston Naval Complex
COC	chemical of concern
CSI	confirmatory sampling investigation
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
µg/kg	micrograms per kilogram
LUC	land use control
LUCIP	Land Use Control Implementation Plan
LUCMP	Land Use Control Management Plan
MCL	maximum contaminant level
MCS	media cleanup standard
NAVBASE	Naval Base
OP	organo-phosphorus
PAH	polycyclic aromatic hydrocarbon
PPE	personal protective equipment
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RDA	Redevelopment Authority

Acronyms and Abbreviations, Continued

RFA	RCRA facility assessment
RFI	RCRA facility investigation
RGO	remedial goal option
SCDHEC	South Carolina Department of Health and Environmental Control
SWMU	solid waste management unit
yd^3	cubic yard

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 Addendum and Corrective Measures Study (CMS) Work Plan were prepared for Solid Waste Management Unit (SWMU) 67 in Zone E of the CNC (CH2M-Jones, 2003). The RFI Report Addendum and CMS Work Plan presented the remedial action objectives (RAOs) and media cleanup standards (MCSs) proposed for SWMU 67. This CMS Report has been prepared by CH2M-Jones to complete the next stage of the CA process for SWMU 67.

1.1 Corrective Measures Study Report Purpose and Scope

This CMS report evaluates corrective measure (remedial) alternatives for addressing the presence of polycyclic aromatic hydrocarbon (PAHs) in surface soil at SWMU 67. PAHs in surface soil are the only chemicals of concern (COCs) identified at SWMU 67 under the unrestricted and industrial land use scenarios. No COCs were identified for subsurface soil or groundwater. Figure 1-1 illustrates the location of SWMU 67 within Zone E. Figure 1-2 is an aerial photograph showing the layout of SWMU 67.

This CMS report consists of the following: 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 focused CMS evaluates the options for meeting the RAOs, which are described in Section 2.0 of this CMS report. The two remedies considered for achieving the RAOs are: 1) soil excavation, offsite disposal, and land use controls (LUCs), and 2) LUCs. The remedial activities associated with soil removal include excavation, backfilling, (replacing) pavement, and offsite disposal. The remedial activities that are associated with 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 to the understanding of the remedial goal options (RGOs), MCSs, and ultimately the evaluation of corrective measure alternatives for SWMU 67. Additional information on the site and hydrogeology in the Zone E area of the CNC is provided in the *Zone E RFI Report, Revision 0* (EnSafe Inc. [EnSafe], 1997).

1.2.1 Facility Description

SWMU 67 consists of a former mercury gauge room and a mercury storage area, each in separate locations within Building 3. Building 3 was constructed in 1905, with additions constructed in 1939 and 1943. The mercury gauge room was used to calibrate and test gauges for leaks. A room near the middle of the northwest wall of the ground floor was originally intended to serve as the gauge room, but it is not known whether mercury gauges were ever handled in this room. Mercury gauge operations are known to have been conducted for 25 years in this building. Currently the building is being used as a machine shop by CMMC Machine, Inc.

The only material of concern at SWMU 67 indicated in the *Final Zone E RFI Work Plan, Revision 1* (EnSafe/Allen & Hoshall, 1995) was mercury. The Final RCRA Facility Assessment (RFA) recommended a confirmatory sampling investigation (CSI) for this site. This area of Zone E is zoned M2 (industrial).

The RFI was initially conducted by the Navy/EnSafe team. RFI activities were documented in the *Zone E RFI Report, Revision 0* (EnSafe, 1997) submitted during 1997. Regulatory review was conducted on this document and a response to the comments from SCDHEC were prepared by the Navy/EnSafe team. An RFI report addendum and CMS work plan were

subsequently prepared by CH2M-Jones. This subsequent report described the results of additional sampling and analysis of soil samples by CH2M-Jones and an evaluation of results for environmental samples collected at other sites located adjacent to SWMU 67.

1.2.2 Soil COC Summary

Several soil sampling events were completed at SWMU 67 during the RFI phase of the project. During the initial soil sampling event, seven surface (0 to 1 foot below land surface [ft bls]) soil samples and seven co-located subsurface (3 to 5 ft bls) soil samples were collected at SWMU 67. All areas at SWMU 67 are under asphalt or concrete pavement. These boring locations were identified as E067SB001 through E067SB007. All samples were analyzed for mercury. Two subsurface soil samples were selected as duplicates. One duplicate sample was analyzed for mercury only. The other duplicate sample was analyzed for an extended list of parameters that includes herbicides, hexavalent chromium, organo-phosphorus (OP) pesticides, and dioxins.

Additional soil samples were collected and analyzed by CH2M-Jones to further assess the presence of COCs in soil at SWMU 67. Figure 1-3 shows the locations of soil samples collected during the various RFI sampling events at SWMU 67 and Area of Concerns (AOCs) 538, 541, 542, and 546, which are adjacent to or partially overlap SWMU 67.

The locations of soil samples collected as part of the SWMU 37 sanitary sewer investigation in the vicinity of SWMU 67 are also shown in Figure 1-3. These data were included in the remedial planning for SWMU 67. SWMU 37, which consisted of certain portions of the sanitary sewer system, was originally investigated in 1998, in conjunction with certain portions of the storm sewer and sections of the railroad lines. These sections of the investigated utilities were collectively referred to as Zone L. Per agreements reached in the BRAC Cleanup Team (BCT), Zone L was granted No Further Action status and the team agreed to consider and evaluate the Zone L data at sites in close proximity to areas investigated under the Zone L effort and where the data were useful in decision making. Thus, the SWMU 37 soil and groundwater data were considered in the RFI Report Addendum and CMS Work Plan for SWMU 67.

The analytical results of the samples shown in Figure 1-3 were presented in the *Zone E RFI Report, Revision 0* (EnSafe, 1997) and the *SWMU 67 RFI Report Addendum/Corrective Measures Study Work Plan* (CH2M-Jones, 2003). Based on the evaluation of data and risk assessment presented in these reports, PAHs in surface soil were identified as COCs for SWMU 67. No other COCs in surface soil or other media were identified for the site. PAHs in surface soil

(calculated as benzo(a)pyrene equivalents [BEQs]) exceeded the sitewide reference concentration for surface soil BEQs of 1,304 micrograms per kilogram ($\mu g/kg$) as previously determined for the CNC.

Surface soil sampling locations in the SWMU 67 vicinity that exceeded the BEQ sitewide reference concentration are shown in Figure 1-4. Only three surface soil samples in reasonably close proximity to each other exceeded the BEQ sitewide reference concentration. This BEQ-impacted surface soil is the focus of this CMS.

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 67, 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 67 — 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 PAHs 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 PAHs 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.

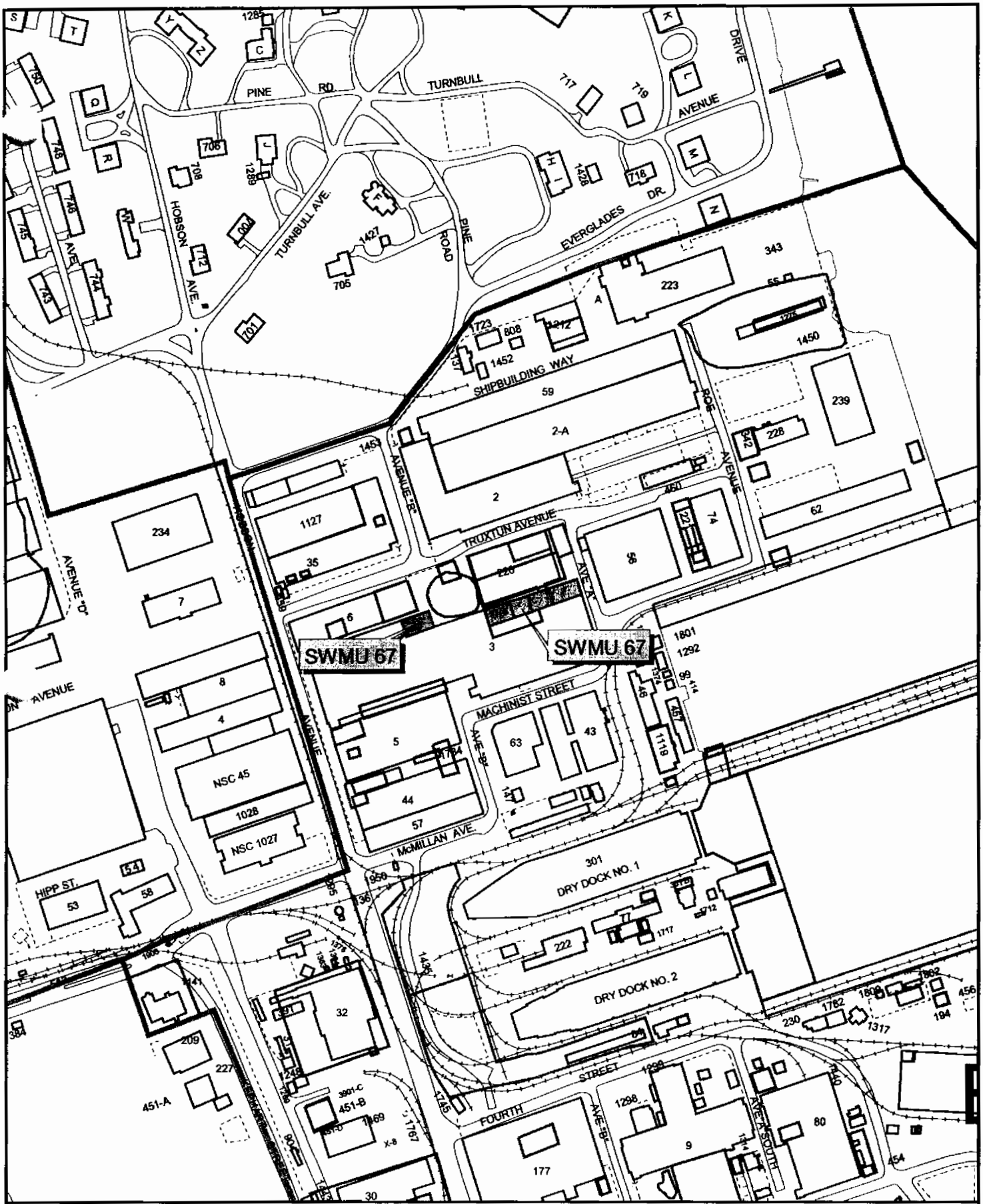
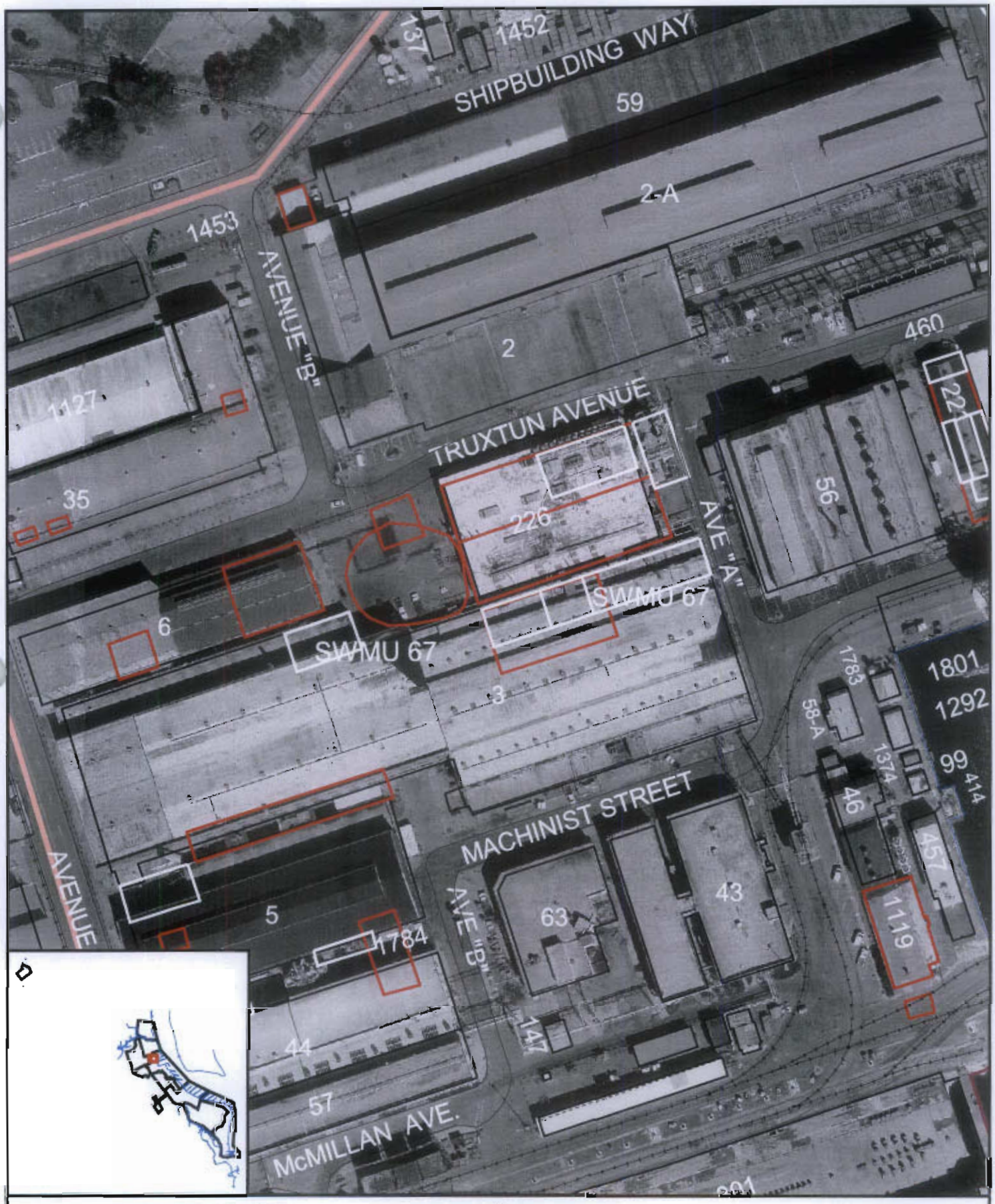


Figure 1-1
Location of SWMU 67 in Zone E
Charleston Naval Complex

File Path: C:\18gis\GNC\cpc-egis.apr, Date: 03-Jun-2002 11:01, User: MKARAFA, EGIS:

NOTE: Aerial Photo Date is 1997



Fence
Railroads
Roads - Lines
Shoreline
AOC Boundary
SWMU Boundary
Buildings
Zone Boundary

N

0 100 200 Feet

1 inch = 139 feet

Figure 1-2
Aerial Photograph
SWMU 67, Zone E
Charleston Naval Complex

File Path: C:\1fleis\CNC\cnc-eois.apr Date: 22 Jul 2002 13:52 User: MKARLSEN

NOTE: Aerial Photo Date is 1997
NOTE: Original figure created in color

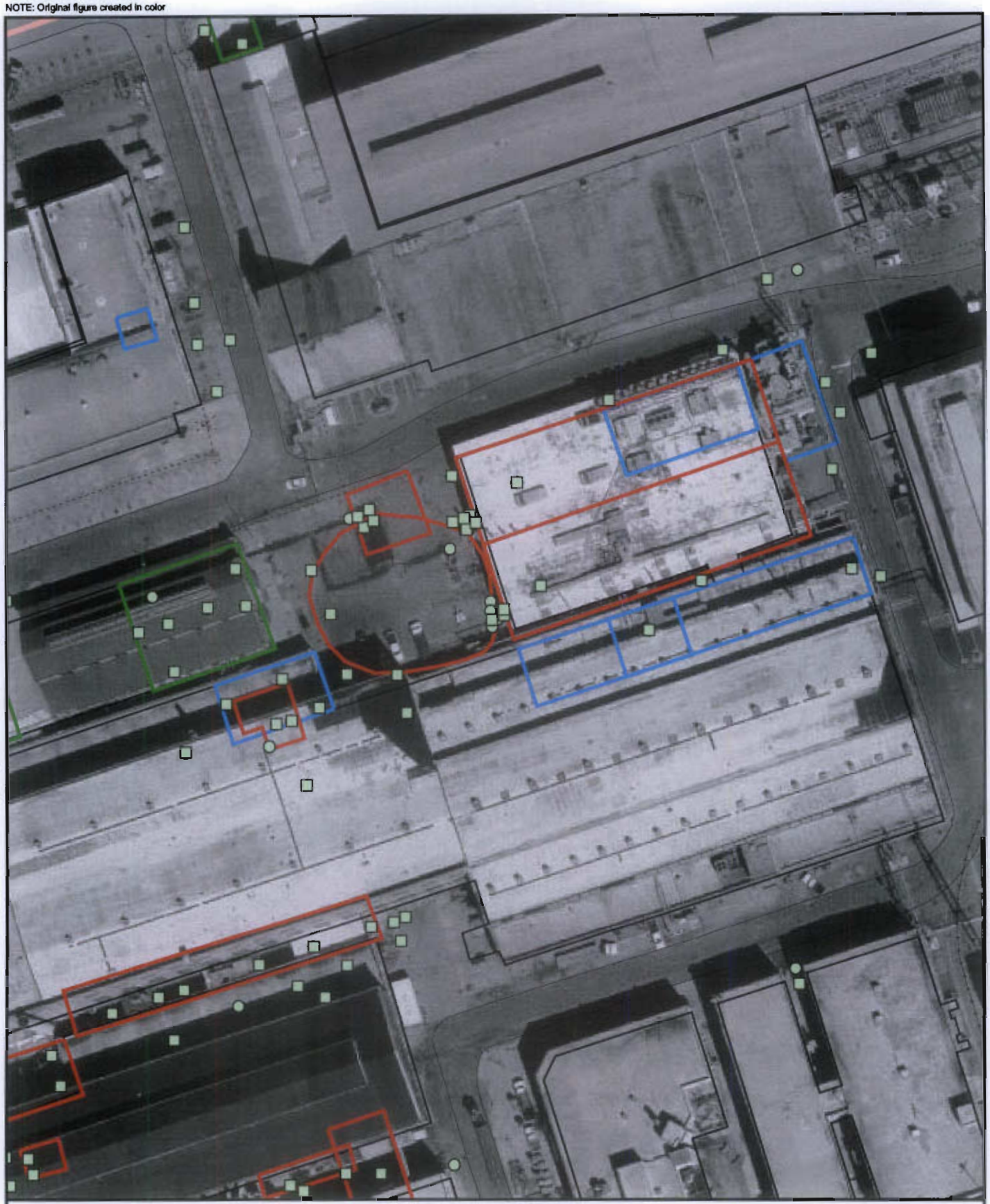


Figure 1-3
Soil Sampling Locations
SWMU 67 and Surrounding Area; Zone E
Charleston Naval Complex

File Path: c:\18gis\cnc\cnc-egis.apr, Date: 23 Jul 2004 15:42, User: DWILLIAM, EGIS: Charleston Naval Complex - Figure 1-3 Soil Sampling Locations

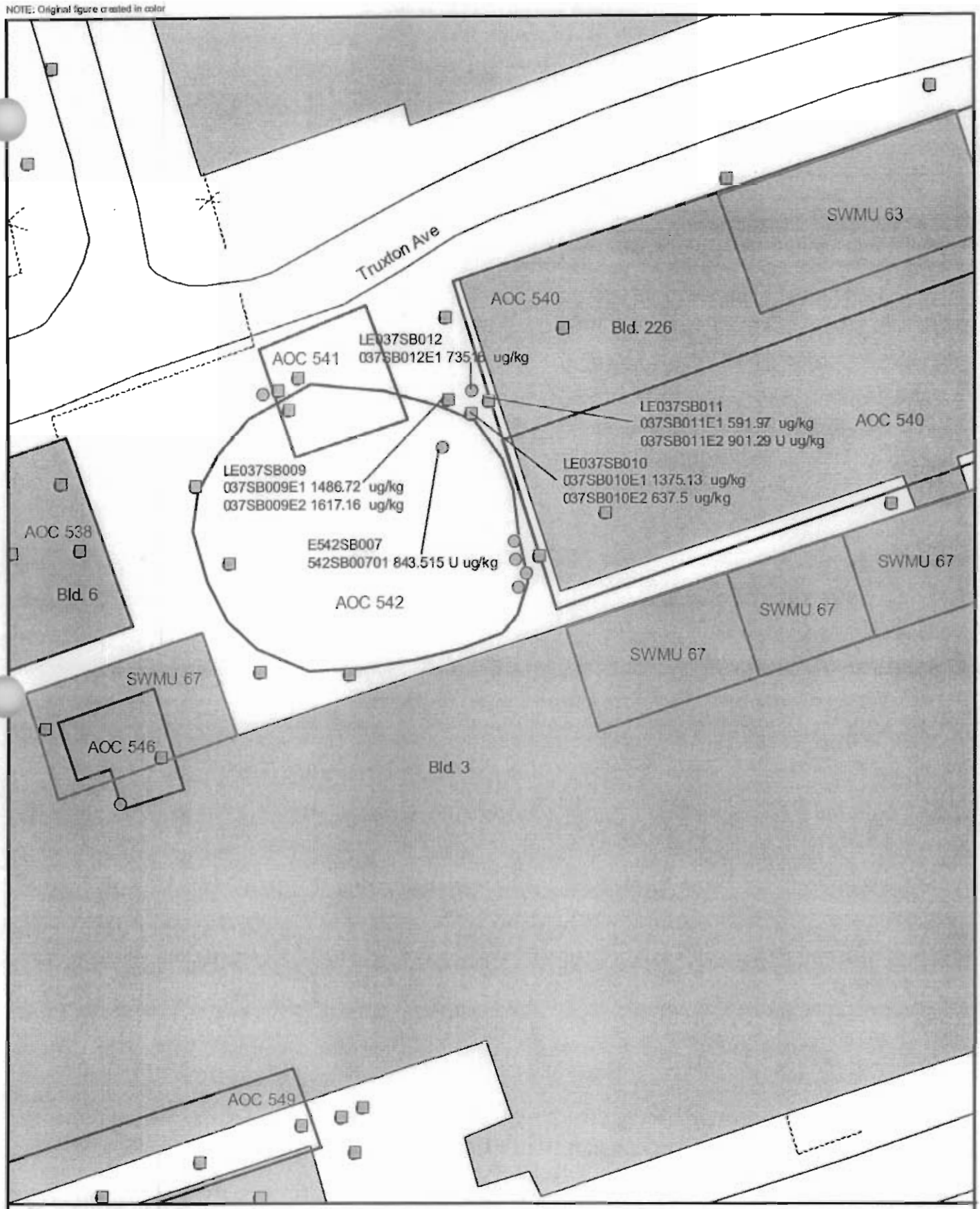


Figure 1-4
Soil BEQs at SWMU 67
Near Sample LE037SB12
Charleston Naval Complex

CH2MHILL

File Path: c:\18gis\projects\zone_e\swmu_67\apr\swmu67_beq.apr, Date: 23 Jan 2004 8:52, User: NMQUDRY, Figure 1-4 Soil BEQs at SWMU 67

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 area 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. The proposed RAO for surface soil is to prevent leaching of PAH to groundwater such that unacceptable impacts to groundwater occur.

2.2 Media Cleanup Standards

For PAHS, the target MCS for soil is the CNC sitewide reference concentration for BEQs in surface soil of 1,304 $\mu g/kg$.

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

1) Soil Excavation, Offsite Disposal, and LUCs; and
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 67

3.1 Preferred Remedies

A variety of corrective measure approaches are conceptually feasible for addressing PAHs in surface soil at SWMU 67. 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 excavation, offsite disposal, and LUCs; and 2) LUCs. Generally, at sites 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:

1. **Protection of human health and the environment.** The alternatives will be evaluated on the basis of their ability to protect human health and the environment. The ability of an alternative to achieve this criterion may or may not be independent of its ability to achieve the other criteria. For example, an alternative may be protective of human health, but may not be able to attain the MCSs if the MCSs were not developed based on human health protection factors.

2. **Attainment of MCSs.** The alternatives will be evaluated on the basis of their ability to achieve the MCS defined in this CMS. Another aspect of this criterion is the time frame required to achieve the MCS. Estimates of the time frame for the alternatives to achieve RGOs will be provided.

3. **The control of the source of releases.** This criterion deals with the control of releases of contamination from the source (the area in which the contamination originated) and the prevention of future migration to uncontaminated areas.

4. **Compliance with applicable standards for management of wastes.** This criterion deals with the management of wastes derived from implementing the alternatives (i.e., treatment or disposal of contaminated soil removed from excavations). Corrective measure alternatives will be designed to comply with all standards for management of wastes. Consequently, this criterion will not be explicitly included in the detailed evaluation presented in the CMS, but such compliance would be incorporated into the cost estimates for which this criterion is relevant.

5. **Other factors.** Five other factors are to be considered if an alternative is found to meet the four criteria described above. These other factors are as follows:

    a. Long-term reliability and effectiveness

    Corrective measure alternatives will be evaluated on the basis of their reliability, and the potential impact should the alternative fail. In other words, a qualitative assessment will be made as to the chance of the alternative's failing and the consequences of that failure.

    b. Reduction in the toxicity, mobility, or volume of wastes

    Alternatives with technologies that reduce the toxicity, mobility, or volume of the contamination will be generally favored over those that do not. Consequently, a qualitative assessment of this factor will be performed for each alternative.

    c. Short-term effectiveness

Alternatives will be evaluated on the basis of the risk they create during the implementation of the remedy. Factors that may be considered include fire, explosion, and exposure of workers to hazardous substances.

d. Implementability

The alternatives will be evaluated for their implementability by considering any difficulties associated with conducting the alternatives (such as the construction disturbances they may create), operation of the alternatives, and the availability of equipment and resources to implement the technologies comprising the alternatives.

e. Cost

A net present value of each alternative will be developed. These cost estimates will be used for the relative evaluation of the alternatives, not to bid or budget the work. The estimates will be based on information available at the time of the CMS and on a conceptual design of the alternative. They will be "order-of-magnitude" estimates with a generally expected accuracy of -50 percent to +100 percent for the scope of action described for each alternative. The estimates will be categorized into capital costs and operations and maintenance costs for each alternative.

Section 4.0

4.0 Description of Candidate Corrective Measure Alternatives

4.1 General Description of Alternatives

Two candidate corrective measure alternatives were selected for this site:

- Alternative 1: Soil Excavation, Offsite Disposal, and LUCs; and
- Alternative 2: LUCs.

The implementation of Alternative 1 would involve the removal of soil at locations where PAH concentrations exceed the MCS. Based on an evaluation of PAH distribution at the site, one area at the site will require surface soil removal in order for site soil to meet the PAH MCS:

- Soil in the vicinity of sample locations LE037SB009, LE037SB010, and LE037SB012. This location is adjacent to Building 226, which is paved with asphalt. Removal and replacement of the paving and removal of the top 1 foot of soil would be required to complete the soil removal.

The approximate soil area estimated to be necessary for removal to achieve the MCS for Alternative 1 is estimated as an area approximately 30 feet by 30 feet and 1 foot deep. A 20-percent scope contingency is also assumed and included in the cost for this alternative.

Additionally, because SWMU 67 is located within Zone E of the CNC, LUCs will be applied to this site, even after excavation and removal of the PAH-impacted soil. Thus, LUCs will also be an integral part of the remedy for this site even after the soil excavation.

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 one of the RAOs not to be met.

The sections below describe each alternative in detail.

4.2 Alternative 1: Soil Excavation, Offsite Disposal, and Land Use Controls

4.2.1 Description of Alternative

Alternative 1 will remove contaminated soil in areas that exceed the MCS established in Section 2.0. It is assumed that the asphalt pavement would be removed to access soil exceeding the MCS and then replaced.

Excavated soil would be transported to a permitted landfill facility for long-term disposal, and the excavation would be filled with clean fill from an offsite borrow source. Once the soil is removed, the site would be acceptable for unrestricted land use. However, because the site is located in Zone E, there will continue to be LUCs that apply to the entire zone. These LUCs are expected to include restriction of the property to non-residential activities.

The proposed excavation area is approximately 30 feet by 30 feet, for a total excavated area of 900 square feet (ft^2). For an assumed average depth of soil excavation of 1 ft bls, the total in-place volume of soil to be removed from the area is about 33 cubic yards (yd^3), plus a 1-foot thick pavement structure with an approximate volume of 11 yd^3. Confirmation sampling would involve four samples, one on each side of the excavation. An equal amount of clean backfill will be required to fill in the excavated areas and of asphalt to replace the pavement.

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. Thus, a 20-percent scope contingency is assumed.

4.3 Alternative 2: Land Use Controls

4.3.1 Description of Alternative

Alternative 2 involves leaving the contaminated soil (and co-located overlying pavement) in place and instituting administrative/legal controls to restrict future use of the land. The controls would limit land use to activities that maintain the paved condition of the site. The controls may be in the form of deed notices 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 the controls are maintained; periodic site

inspections would be required to assure compliance with the 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 E of the CNC is restricted to non-residential. Existing engineering controls include pavement and structures that prevent precipitation from leaching through the soil. 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.

Section 5.0

5.0 Evaluation and Comparison of Corrective Measure Alternatives

The corrective measure alternatives were evaluated relative to the criteria previously described in Section 3.0 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 Excavation, Offsite Disposal, and Land Use Controls

The following assumptions were made for Alternative 1:

- One area would be targeted for soil excavation.
- A total of 33 yd^3 of soil (in-place measurement) would be excavated for offsite disposal at a Subtitle D facility and replaced with clean backfill.
- Approximately 900 ft^2 (11 yds) of pavement would be removed and replaced.
- Confirmation testing will validate that the extent of contaminated soil is limited to that estimated above, plus a maximum contingency of 20 percent.
- LUCs that apply to all of Zone E will also be applied to this site after soil removal.

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 PAH concentrations that exceed the MCS from the site. The replacement soil will have concentrations of PAHs below the MCS.

5.1.2 Attain MCS

Alternative 1 will permanently remove soil with PAH 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 67; 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. Confirmation sampling would confirm that the excavations have removed soil exceedances.

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* 261.24.

5.1.7 Other Factors (c) Short-term Effectiveness

The excavation and hauling of contaminated soil in Alternative 1 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 simple to implement. Most of the required activities have been routinely implemented at other 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 sampling results, plus removal and replacement of pavement. A scope contingency (20 percent) is added to cover minor additional excavation that may be required per results of confirmation testing. In summary, the costs include the following:

- Removing soil in area 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.
- Maintaining LUCs applied as part of the Zone E LUCs for a 30-year period.

Using the assumptions listed above, the total present value of Alternative 1 is $65,000.

Alternative 2: Land Use Controls

The following assumptions were made for Alternative 2:

- A base-wide LUCIP will be developed for the CNC. The plan will allow for restrictions on the use of land at SWMU 67 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.

5.2.1 Protection of Human Health and the Environment

Alternative 2 is effective at protecting human health because it restricts future use of the site that would be inappropriate for the MCS exceedances at the site (i.e., maintains the pavement as a cap to prevent exposure of receptors to soil).

5.2.2 Attain MCS

Alternative 2 would not likely achieve the MCS for PAH over time since PAHs are not volatile and are slow to degrade under site conditions.

5.2.3 Control the Source of Releases

There are no ongoing sources of releases at SWMU 67; 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 some 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.

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 67.

5.2.7 Other Factors (c) Short-term Effectiveness

Alternative 2 is effective in the short term because the site is paved. No short-term risks are created.

5.2.8 Other Factors (d) Implementability

Alternative 2 is relatively easy to implement since it only requires 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/review for 30 years. 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. In Table 5-1, a comparative evaluation of the degree to which each alternative meets a particular criteria is presented. Alternative 2 (LUCs) is the preferred alternative. It provides a protective and reliable remedy at a lower cost.

TABLE 5-1
Qualitative Comparison of Corrective Measure Alternatives
CMS Report, SWMU 67, Zone E, Charleston Naval Complex

Criterion	Alternative 1 Soil Excavation, Offsite Disposal, and LUCs	Alternative 2 LUCs
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	Little to no reduction of toxicity, mobility, or volume expected
Short-term Effectiveness	Effective in short term	Effective in short term
Implementability	Moderately simple to implement due to need to remove/replace asphalt and work in busy industrial area	Easy to implement
Cost Ranking	Comparatively Expensive	Inexpensive
Estimated Cost	$65,000	$20,000

Section 6.0

6.0 Recommended Corrective Measure Alternative

Two corrective measure alternatives were evaluated using the criteria described in Section 3.0 of this CMS report: Alternative 1: Soil Excavation, Offsite Disposal, and 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 unpaved land use that could allow for leaching of precipitation through soil.

Engineering controls to minimize infiltration are already in place. The impacted area is covered by a structure. Planning is already underway to develop and implement administrative controls that would limit future site activities to those that would allow a paved scenario. 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.

Land Use Controls

The LUCs will be implemented to limit the future use of the site to control or eliminate exposure pathways to COCs at the site and to ensure the integrity and effectiveness of the presumptive remedy. With regard to real property, LUC refers to any restriction or control that limits the use of, and/or exposure to, a portion of the property, including water resources, arising from the need to protect human health and the environment. The LUCs will be primarily regarded as a component of corrective action that applies technologies that reduce toxicity, mobility, volume, and mass of the source of contamination.

The term LUCs encompasses "institutional controls," which are defined as real estate restrictions, deed notifications, governmental permitting, zoning laws and other "legal"

restrictions to protect human health and the environment. Institutional controls are non-engineered mechanisms used for ensuring compliance with necessary land use limitations.

LUCs also include restrictions on access (access controls), whether achieved by means of engineered barriers (e.g., fence or concrete pad), affirmative measures to achieve the desired restrictions (e.g., night lighting of an area), and prohibitive directives (e.g., restrictions on certain types of wells for the duration of the CA).

Considered altogether, the LUCs for a facility will provide a tool for directing how the property should be used in order to maintain the level of protectiveness that one or more CAs were designed to achieve. Periodic inspections will be conducted to ensure the long-term integrity of the remedy and the effectiveness of the LUCs.

LUCs will implemented at the site for the following reasons:

- To restrict human contact with BEQ-impacted soil,
- To appropriately manage soil disturbance activities (e.g., construction activities) such that unacceptable impacts to human health and the environment do not occur, and
- To prohibit residential development of the site.

The LUCs will be developed and implemented in accordance with the site-specific LUCIP agreed to by the Navy and SCDHEC. Quarterly visual inspections and reviews will be conducted for the purpose of verifying that all necessary LUCs have been implemented and are being properly maintained. An annual report will be prepared and forwarded to SCDHEC, signed by the Navy, certifying the continued retention of all LUCs implemented at SWMU 67. Additionally, the recommendation for implementing LUCs will be incorporated into the RCRA Part B Permit for the CNC.

7.0 References

CH2M-Jones. *RFI Report Addendum and CMS Work Plan, SWMU 67, Zone E.* Revision 2. December 2003.

EnSafe Inc. *Zone E RFI Report, NAVBASE Charleston.* Revision 0. November 1997.

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

Ensafe Inc. *Zone L RFI Report, NAVBASE Charleston.* Revision 0, December 1998

Section 7.0

Appendix A

COMPARISON OF TOTAL COST OF REMEDIAL SOLUTIONS

Site:	Charleston Naval Complex	**Base Year:**	2004
Location:	SWMU 67	**Date:**	01/20/04
Phase:	Corrective Measures Study		

	Alternative Number 1	Alternative Number 2
Total Project Duration (Years)	<1	30
Capital Cost	$45,000	$6,000
Annual O&M Cost	$0	$1,100
Total Present Value of Solution	$65,000	$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 67
Phase: Corrective Measures Study
Base Year: 2004
Date: 01/20/04

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	$1,200	$1,200	See Confirmation Worksheet
Removal, Disposal and Backfill	1	EA	$23,000	$23,000	See Excavation 1 Worksheet
				$0	
SUBTOTAL				$24,200	
Contingency	20%		$24,200	$4,840	
SUBTOTAL				**$29,040**	
Project Management	8%		$29,040	$2,323	USEPA 2000, p. 5-13, $100K-$500K
Remedial Design	15%		$29,040	$4,356	USEPA 2000, p. 5-13, $100K-$500K
Construction Management	10%		$29,040	$2,904	USEPA 2000, p. 5-13, $100K-$500K
SUBTOTAL				**$9,583**	
Capital Cost of LUCs				**$6,000**	
TOTAL CAPITAL COST				**$45,000**	

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	$45,000	$45,000	1.000	$45,000	
	ANNUAL O&M COST	$0	$0	0.000	$0	
		$45,000			$45,000	
	PRESENT VALUE OF LAND USE CONTROLS COST				$20,000	
	TOTAL PRESENT VALUE OF ALTERNATIVE				**$65,000**	

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 67

Phase: Corrective Measures Study

Base Year: 2004

Date: 01/20/04

Description: Implementation of base-wide land use management plan to put institutional 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 67
Phase: Corrective Measures Study
Base Year: 2004

Prepared By: DFW **Date:** 12/12/03
Checked By: **Date:**

WORK STATEMENT

Costs for soil confirmation sample collection, shipment and analysis on a per event basis.
Total of 5 samples: 1 per excavation wall plus 1 bottom

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Equipment & Labor					
Jar Kits	4	EA	$10	$40	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 (PAHs)	4	SAMPLE	$135	$540	GEL, PEL, STL average
Data Validation	1	HR	$100	$100	CH2M-Jones Est.
SUBTOTAL				$1,002	
Allowance for Misc. Items	20%		$1,002	$200	
SUBTOTAL				$1,202	
TOTAL COST				**$1,200**	

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	**Prepared By:** tbw	**Checked By:**
Location:	SWMU 67	**Date:** 12/10/02	**Date:**
Phase:	Corrective Measures Study		
Base Year:	2004		

WORK STATEMENT

Excavate soil and haul to disposal area; backfill with clean soil and restore surface to original condition.
Remove and replace pavement and loading dock.
See quantity calcs

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Mob/demob/decon	1	EA	$1,000	$1,000	CH2M-Jones Est.
Utility checks and permits	4	HR	$100	$400	CH2M-Jones Est.
Air monitoring and sampling					
Asphalt cutting	120	LF	$1.15	$138	CH2M-Jones Est.
Asphalt removal	900	SF	$3.15	$2,835	CH2M-Jones Est.
Excavation (soil) - machine	33.3	CY	$3	$1,800	CH2M-Jones Est.
Asphalt disposal - Non-Haz	70	tons	$45	$3,150	
Clean Fill	33.3	CY	$6	$100	CH2M-Jones Est.
Compaction	33.3	CY	$5	$100	CH2M-Jones Est.
Replace asphalt	900	SF	$5	$4,500	CH2M-Jones Est.
Site Operator-Oversight	24	HR	$100	$2,400	CH2M-Jones Est.
Waste characterization TCLP	1	EA	$150	$150	
Waste disposal (Soil) - Non-Haz	28	Tons	$45	$1,260	CH2M-Jones Est.
SUBTOTAL				$17,833	
Allowance for Misc. Items	30%		$17,833	$5,350	20% Scope + 10% Bid
SUBTOTAL				$23,183	
TOTAL UNIT COST				**$23,000**	

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**	

Source of Cost Data

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