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CORRECTIVE MEASURES STUDY REPORT AREA OF CONCERN 525 (AOC 525) ZONE E
CNC CHARLESTON SC
12/31/2003
CH2M HILL

CORRECTIVE MEASURES STUDY REPORT

AOC 525, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

CH2M-Jones

December 2003

Contract N62467-99-C-0960

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CH2MHILL

December 31, 2003

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) – AOC 525, Zone E

Dear Mr. Scaturo:

Enclosed please find two copies of the CMS Report (Revision 0) for AOC 525 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.

The principal author of this document is Sam Naik. Please do not hesitate to contact him at 770/604-9182, extension 255, should 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

CORRECTIVE MEASURES STUDY REPORT

AOC 525, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

PREPARED BY
CH2M-Jones

December 2003

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

Certification Page for Corrective Measures Study Report (Revision 0) — AOC 525, 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

Dean Williamson, P.E.

12/19/2003

Date

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Acronyms and Abbreviations

AOC	area of concern
BRAC	Base Realignment and Closure Act
CA	corrective action
CMS	corrective measures study
CNC	Charleston Naval Complex
COC	chemical of 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
µg/kg	micrograms per kilogram
mg/kg	milligrams 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
PCB	polychlorinated biphenyl
PPE	personal protective equipment
RAO	remedial action objective
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

Acronyms and Abbreviations, Continued

SSL	soil screening level
SVOC	semivolatile organic compound
VOC	volatile organic compound
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 Area of Concern (AOC) 525 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 AOC 525. This CMS Report has been prepared by CH2M-Jones to complete the next stage of the CA process for AOC 525.

1.1 Corrective Measures Study Report Purpose and Scope

This CMS report evaluates corrective measure (remedial) alternatives for addressing the presence of acetone in soil at AOC 525. Acetone in soil is the only chemical of concern (COC) identified at AOC 525 under the unrestricted (i.e., unpaved) land use scenario. No COCs were identified for the paved or industrial future land use scenarios. No COCs were identified based on unacceptable risk to human receptors. Acetone was identified as a COC in soil due to its potential to leach under the unpaved land use scenario. Figure 1-1 illustrates the original location of AOC 525 within Zone E. Figure 1-2 is an aerial photograph showing the layout of AOC 525.

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 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 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 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 AOC 525. 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

AOC 525 consists of Paint Booth No. 35 in Building 223. Building 223 is located at the intersection of First Street and Roe Avenue in Zone E of the CNC. Paint Booth No. 35 was used to paint miscellaneous parts and was the oldest of five dry-filter type paint booths located inside Building 223. Building 223 is currently used as a paint shop by Metal Trades, Inc. Paint Booth No. 35 is reportedly no longer active.

This area of Zone E is zoned M-2 (industrial). The CNC RCRA Permit identified AOC 525 as requiring an RFI.

1.2.2 Soil COC Summary

A single soil sampling event was conducted at AOC 525 during the RFI at the locations shown in Figure 1-3. Soil samples at AOC 525 were analyzed for organotins, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs) (acetone), metals, and cyanide.

For surface soil, no COCs were identified for human health risks. Additionally, no COCs were identified for groundwater.

For protection of groundwater quality, acetone was identified as a COC for soil in the unpaved scenario only. No soil COCs were identified for a paved scenario.

Acetone was identified as a soil COC for the unpaved future land use scenario due to exceedances of its unpaved soil screening level (SSL). Table 1-1 presents the results of acetone analyses for surface and subsurface soil at AOC 525. It can be seen in Table 1-1 that both detections of acetone above its unpaved SSL occurred in boring E525SB004. The average acetone concentration for all soil samples was below the unpaved site-specific SSL. Acetone was not detected in site groundwater. Because the site is currently occupied by a building and is expected to remain paved, there is no migration route of concern for acetone.

The isopropanol that was used to decontaminate field equipment during the RFI is known to have acetone as a trace contaminant (see excerpt from Memorandum from Charlie Vernoy/EnSafe to BCT, dated February 12, 1998). Acetone was detected in grid samples collected in Zone E at concentrations ranging from 9 to 5,800 micrograms per kilogram ($\mu g/kg$). The acetone detected in soil at AOC 525 is within this range, suggesting that it may be a sampling artifact and thus should not be considered a COC. However, as a conservative measure, acetone was retained as a soil COC for the unpaved scenario.

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 AOC 525, in addition to the criteria used in evaluating the corrective measure alternatives for the site.

3.0 Overall Approach for Evaluating Focused Alternatives for AOC 525 — 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 acetone 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 acetone 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.

TABLE 1-1
Acetone Results for Soil Samples at AOC 525
CMS Report, AOC 525, Zone E, Charleston Naval Complex

Station	Sample	Result	Unit	Qualifier	SSL (Unpaved) mg/kg	SSL (paved) mg/kg
E525SB001	525SB00101	0.01100	mg/kg	UJ	2.9	17
E525SB003	525SB00301	0.05200	mg/kg	J	2.9	17
E525SB002	525SB00201	0.01100	mg/kg	UJ	2.9	17
E525SB004	525SB00401	**4.50000**	mg/kg	=	2.9	17
E525SB003	525SB00302	0.06300	mg/kg	J	2.9	17
E525SB001	525SB00102	0.04900	mg/kg	J	2.9	17
E525SB002	525SB00202	0.06500	mg/kg	J	2.9	17
E525SB004	525SB00402	**3.90000**	mg/kg	=	2.9	17
	Mean (all samples)	1.08000				

Note: Bold text means value exceeds the screening levels.
mg/kg milligrams per kilogram

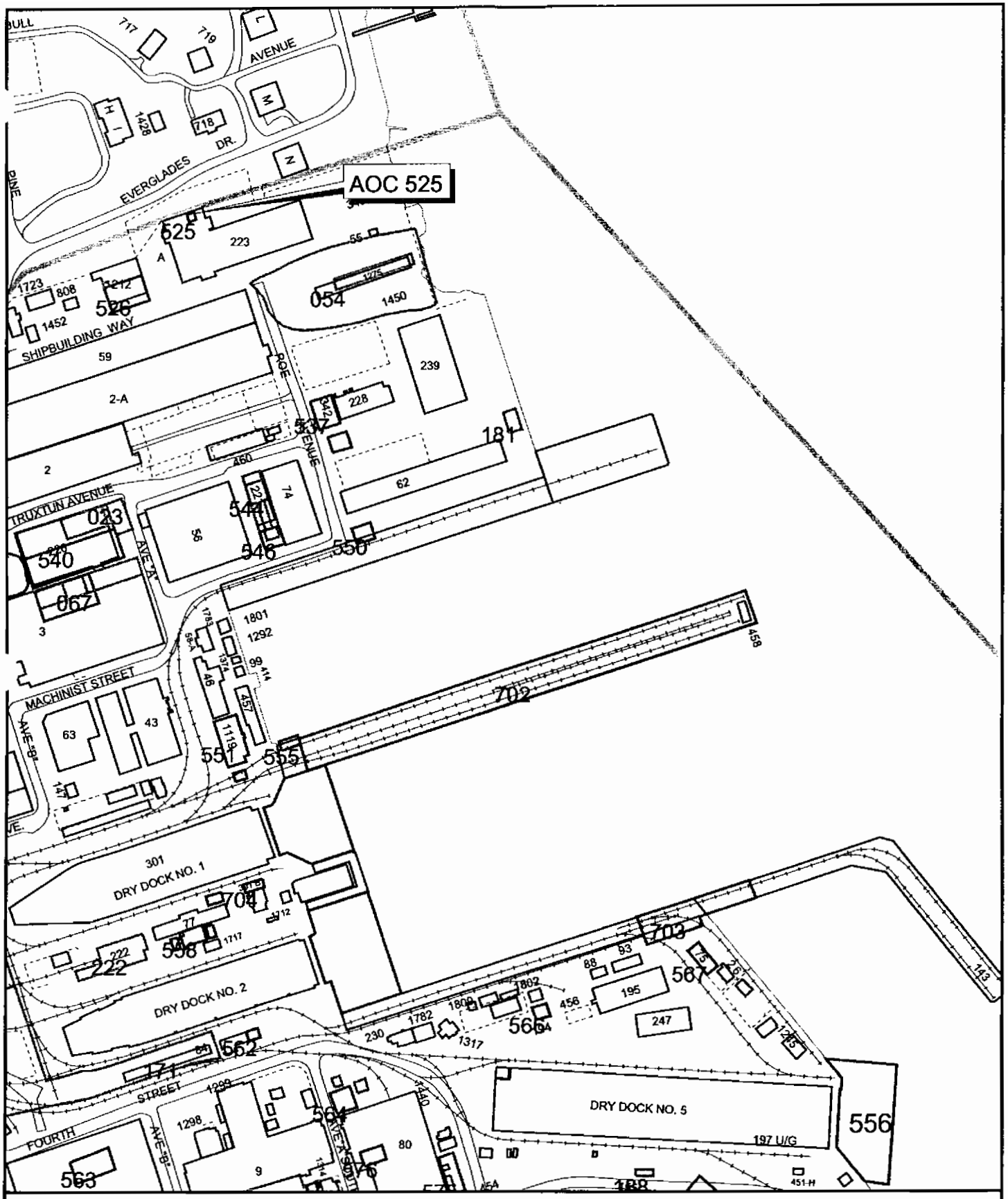

Figure 1-1
Location of AOC 525 in Zone E
Charleston Naval Complex

CH2MHILL

File Path: C:\18gis\CNC\cnc-egis.apr, Date: 25 Jun 2002 11:16, User: NMOUDRY, Figure 1-1 Location of AOC 525 in Zone E

NOTE: Aerial Photo Date is 1997

Fence
Railroads
Roads
Shoreline
AOC/SWMU Boundary
Buildings
Zone Boundary

N

0 40 80 Feet

1 inch = 50 feet

Figure 1-2
Site Map
AOC 525, Zone E
Charleston Naval Complex

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File Path: c:\18gis\projects\zone_e\non_priority\non_pro_fig2.apr, Date: 25 Jun 2002 11:29, User: NMOUDRY, AOC 525

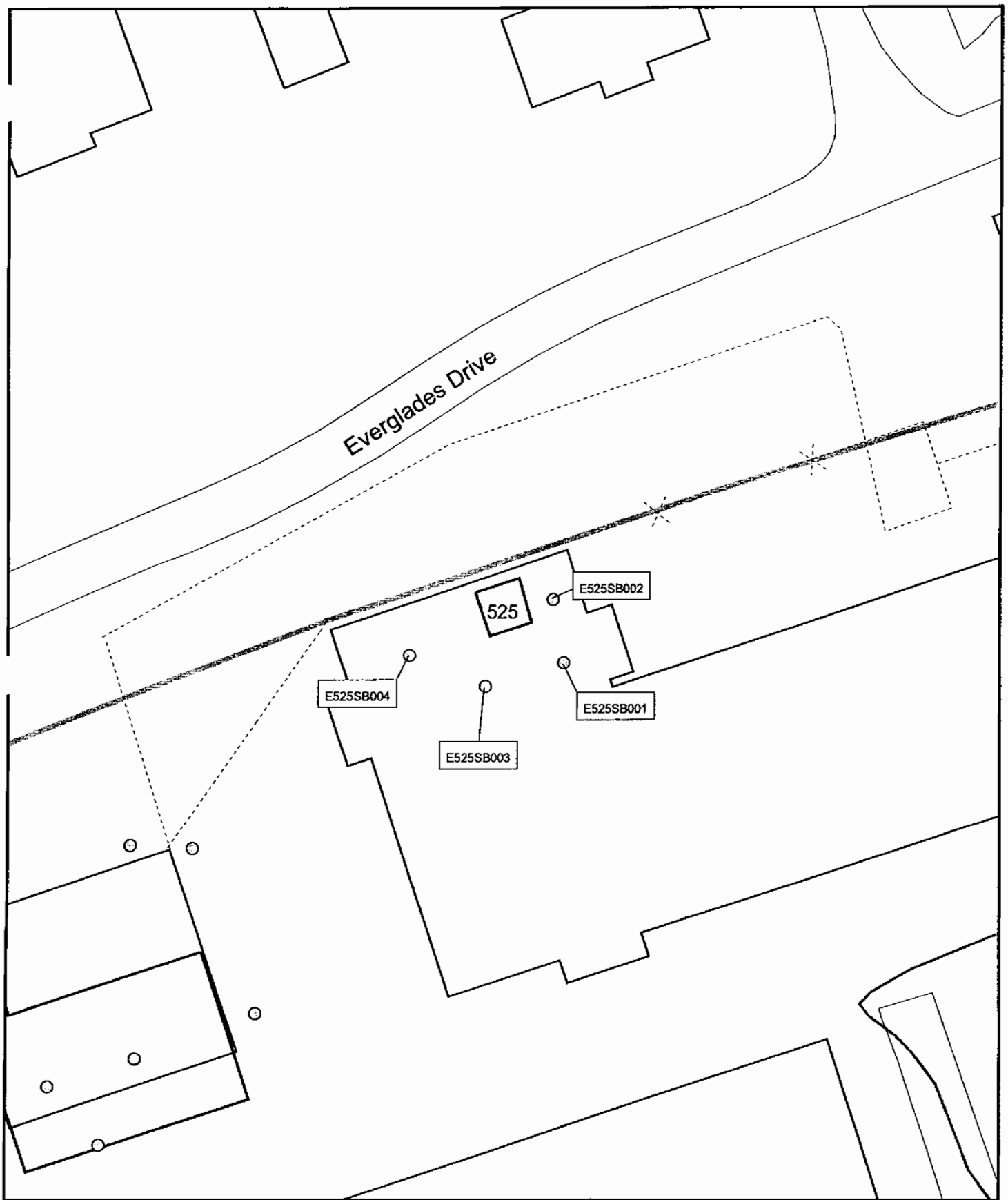

Figure 1-3
Soil Sample Locations
AOC 525, Zone E
Charleston Naval Complex

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File Path: C:\18gis\Projects\Zone_E\AOC525\aoc525.apr, Date: 18 Jul 2002 6:03, User: NMOUDRY, Figure 2-1 Soil Samples

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 acetone to groundwater such that unacceptable impacts to groundwater occur.

2.2 Media Cleanup Standards

For acetone, the target MCS for soil is the unpaved site-specific SSL of 2.9 mg/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 AOC 525

3.1 Preferred Remedies

A variety of corrective measure approaches are conceptually feasible for addressing acetone in soil at AOC 525. 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
- Alternative 2: LUCs

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

- Sample location E525SB004. This location is beneath Building 223, which has a concrete floor. Removal and replacement of the floor 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 10 ft by 10 ft and 5 ft deep. A 20-percent scope contingency is also assumed and included in the cost for this alternative.

Additionally, because AOC 525 is located within Zone E of the CNC, LUCs will be applied to this site even after excavation and removal of the acetone-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

This alternative will remove contaminated soil in areas that exceed the MCS established in Section 2.0. It is assumed that the concrete floor would be removed to access soil exceeding the MCS and then be 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, with no unpaved land use restrictions. 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 restrictions of the property to non-residential activities.

The proposed excavation area is approximately 10 feet by 10 feet for a total excavated area of 100 square feet (ft^2). For an assumed average depth of soil excavation of 5 feet below land surface (ft bls), the total in-place volume of soil to be removed from the area is about 18.5 cubic yards (yd^3) plus a 1-foot thick pavement structure with an approximate volume of 3.7 yd^3. Confirmation sampling would involve five samples (four sidewall samples and one bottom sample in the excavation). An equal amount of clean backfill will be required to fill in the excavated areas and of concrete to replace the floor.

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

This alternative 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 controls are maintained; periodic site inspections would be required to assure the institutional controls are complied with. 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.

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 18.5 yd^3 of soil (in-place measurement) would be excavated for offsite disposal at a Subtitle D facility and replaced with clean backfill.
- Approximately 100 ft^2 of pavement would be removed/replaced and approximately 3.7 yd^3 of concrete (in-place measurement) would be removed/replaced.
- Confirmation testing will validate 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 the 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 acetone concentrations that exceed the MCS from the site. The replacement soil will have concentrations of acetone below the MCS.

5.1.2 Attain MCS

Alternative 1 will permanently remove soil with acetone 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 AOC 525; 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. It is much less likely any significant amount of soil with acetone concentrations above the MCS will be left in place; sitewide average concentrations will be below the unpaved SSL.

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 CFR 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 sample 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:

- Remove soil in area of MCS exceedance.
- Perform confirmation tests in each area to confirm compliance with MCS.
- Apply 20 percent contingency for additional scope that may be required based on compliance tests.
- Maintain 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 $46,000.

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 AOC 525 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 leaching).

5.2.2 Attain MCS

Alternative 2 would likely achieve the MCS for acetone over time since acetone is volatile and likely to slowly attenuate due to volatilization and migration in the vadose zone.

5.2.3 Control the Source of Releases

There are no ongoing sources of releases at AOC 525; 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 AOC 525. However, natural attenuation processes are likely to decrease acetone concentrations over time.

5.2.7 Other Factors (c) Short-term Effectiveness

This alternative 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 below, 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, AOC 525, 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 eventually 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	Relies on natural processes to reduce toxicity, mobility, or volume
Short-term Effectiveness	Effective in short term	Effective in short term
Implementability	Moderately simple to implement due to need to remove/replace concrete and work in busy industrial area.	Easy to implement
Cost Ranking	Comparatively Expensive	Inexpensive
Estimated Cost	$46,000	$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 an unpaved 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.

Section 7.0

7.0 References

CH2M-Jones. *RFI Report Addendum and CMS Work Plan, AOC 525, Zone E*. Revision 1. November 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.

Memorandum from Charlie Vernoy/EnSafe to BCT, dated February 12, 1998.

Appendix A

COMPARISON OF TOTAL COST OF REMEDIAL SOLUTIONS

Site:	Charleston Naval Complex	**Base Year:**	2003
Location:	AOC 525	**Date:**	12/12/03
Phase:	Corrective Measures Study		

	Alternative Number 1	Alternative Number 2
Total Project Duration (Years)	<1	30
Capital Cost	$26,000	$6,000
Annual O&M Cost	$0	$1,100
Total Present Value of Solution	$46,000	$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: AOC 525
Phase: Corrective Measures Study
Base Year: 2003
Date: 12/12/03

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	$1,600	$1,600	See Confirmation Worksheet
Removal, Disposal and Backfill	1	EA	$11,000	$11,000	See Excavation 1 Worksheet
				$0	
SUBTOTAL				$12,600	
Contingency	20%		$12,600	$2,520	
SUBTOTAL				**$15,120**	
Project Management	8%		$15,120	$1,210	USEPA 2000, p. 5-13, $100K-$500K
Remedial Design	15%		$15,120	$2,268	USEPA 2000, p. 5-13, $100K-$500K
Construction Management	10%		$15,120	$1,512	USEPA 2000, p. 5-13, $100K-$500K
SUBTOTAL				**$4,990**	
Capital Cost of LUCs				**$6,000**	
TOTAL CAPITAL COST				**$26,000**	

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	$26,000	$26,000	1.000	$26,000	
	ANNUAL O&M COST	$0	$0	0.000	$0	
		$26,000			$26,000	
	PRESENT VALUE OF LAND USE CONTROLS COST				$20,000	
	TOTAL PRESENT VALUE OF ALTERNATIVE				**$46,000**	

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
Elements: Land Use Controls

COST ESTIMATE SUMMARY

Site: Charleston Naval Complex
Location: AOC 525
Phase: Corrective Measures Study
Base Year: 2003
Date: 12/12/03

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: AOC 525
Phase: Corrective Measures Study
Base Year: 2003

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	5	EA	$10	$50	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 (VOCs)	5	SAMPLE	$95	$475	GEL, PEL, STL average
Data Validation	5	HR	$100	$500	CH2M-Jones Est.
SUBTOTAL				$1,347	
Allowance for Misc. Items	20%		$1,347	$269	
SUBTOTAL				$1,616	
TOTAL COST				**$1,600**	

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: AOC 525
Phase: Corrective Measures Study
Base Year: 2003

Prepared By: tbw **Date:** 12/10/02
Checked By: **Date:**

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					
Concrete cutting	40	LF	$1.15	$46	CH2M-Jones Est.
Concrete removal	100	SF	$3.15	$315	CH2M-Jones Est.
Excavation (soil) - machine	18.5	CY	$3	$1,800	CH2M-Jones Est.
Concrete disposal - Non-Haz	8	tons	$45	$360	
Clean Fill	18.5	CY	$6	$100	CH2M-Jones Est.
Compaction	18.5	CY	$5	$100	CH2M-Jones Est.
Replace concrete	100	SF	$5	$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				$8,431	
Allowance for Misc. Items	30%		$8,431	$2,529	20% Scope + 10% Bid
SUBTOTAL				$10,960	
TOTAL UNIT 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**	

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

AOC 597 tbw 08/14/2002

Alternative 1

Location	Excavation, ft L	W	D	Surface Area, sf	In Situ Pavement Thickness, ft	Pavement Volume, cy	Soil Volume, cy	
E525SB004	10	10	5	100	1	3.7	18.5	See Note 1.
								See Note 1.
Sum				100 SF	a	3.7	18.5	CY, in situ volume (bank CY)
					b	1.3	1.15	Bulk ratio (load factor)
					c	4.8	21.3	CY, bulk volume
					d	1.6	1.3	Ton ratio
					e	8	28	Tons, bulk weight (rounded)
				CHECK:				
				Typical in situ unit weight		150	110	PCF
				Weight of in situ volume = e/a		160	112	PCF

Notes

1 Pavement (thickness assumed).