N60201.AR.000288
NS MAYPORT
5090.3a

CORRECTIVE MEASURES STUDY GROUP II SOLID WASTE MANAGEMENT UNITS NS MAYPORT FL
1/1/1996
ABB ENVIRONMENTAL SERVICES

# CORRECTIVE MEASURES STUDY
# GROUP II SOLID WASTE MANAGEMENT UNITS

## U.S. NAVAL STATION
## MAYPORT, FLORIDA

**Unit Identification Code: N60201**

**Contract No. N62467-89-D-0317/028**

**Prepared by:**

**ABB Environmental Services, Inc.**
**2590 Executive Center Circle, East**
**Tallahassee, Florida 32301**

**Prepared for:**

**Department of the Navy, Southern Division**
**Naval Facilities Engineering Command**
**2155 Eagle Drive**
**North Charleston, South Carolina 29419-9010**

**David Driggers, Code 1852, Engineer-in-Charge**

**January 1996**

This document, Corrective Measures Study, Group II Solid Waste Management Units, U.S. Naval Station, Mayport, Florida has been prepared under the direction of a Florida Registered Professional Engineer. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. If conditions are determined to exist that differ from those described, the undersigned engineer should be notified to evaluate the effects of any additional information on the assessment and recommendations in this document. This document was prepared for U.S. Naval Station, Mayport, Florida, and should not be construed to apply to any other site.

Margaret E. Layne

Margaret E. Layne, P.E.
State of Florida License No. 42425
ABB Environmental Services, Inc.
2590 Executive Center Circle
Tallahassee, Florida 32301

DATE: January 9, 1996

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, ABB Environmental Services, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/028 are complete and accurate and comply with all requirements of this contract.

DATE: January 9, 1996

NAME AND TITLE OF CERTIFYING OFFICIAL: Terry Hansen, P.G.
Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Francis K. Lesesne, P.G.
Project Technical Lead

(DFAR 252.227-7036)

# FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at their facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). The acts, passed by Congress in 1980 and 1986, respectively, established the means to assess and clean up hazardous waste sites for both private-sector and Federal facilities. These acts are the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Navy Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adapted the program structure and terminology of the standard IR program.

The IR program is conducted in several stages.

- The preliminary assessment (PA) identifies potential sites through record searches and interviews.

- A site inspection (SI) then confirms which areas contain contamination, constituting actual "sites." (Together, the PA and SI steps were called the initial assessment study [IAS] under the NACIP program.)

- Next, the remedial investigation and the feasibility study (RI/FS) together determine the type and extent of contamination, establish criteria for cleanup, and identify and evaluate any necessary remedial action alternatives and their costs.

As part of the RI/FS, a risk assessment identifies potential effects on human health or the environment to help evaluate remedial action alternatives.

- The selected alternative is planned and conducted in the remedial design and remedial action stages. Monitoring then ensures the effectiveness of the effort.

A second program to address present hazardous material management is the Resource Conservation and Recovery Act (RCRA) Corrective Action program. This program is designed to identify and clean up releases of hazardous substances at RCRA-permitted facilities. RCRA is the law that ensures that solid and hazardous wastes are managed in an environmentally sound manner. The law applies primarily to facilities that generate or handle hazardous waste.

This program is conducted in three stages.

- The RCRA facility assessment (RFA) identifies solid waste management units (SWMUs), evaluates the potential for releases of contaminants, and determines the need for future investigations.

- The RCRA facility investigation (RFI) then determines the nature, extent, and fate of contaminant releases.

- The corrective measures study (CMS) identifies and recommends measures to correct the release.

The hazardous waste investigations at Naval Station Mayport are presently being conducted under the RCRA Corrective Action program. Earlier preliminary investigations had been conducted at Naval Station Mayport under the NACIP program and IR program following Superfund guidelines. In 1988, in coordination with the U.S. Environmental Protection Agency (USEPA) and the Florida Department of Environmental Regulation (FDER; now known as the Florida Department of Environmental Protection [FDEP]), the hazardous waste investigations were formalized under the RCRA program.

Mayport is conducting the cleanup at their facility by working through the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM). The USEPA and the FDEP oversee the Navy environmental program. All aspects of the program are conducted in compliance with State and Federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the RCRA program at Naval Station Mayport should be addressed to Mr. David Driggers, Code 1852, at (803) 820-5501.

## EXECUTIVE SUMMARY

ABB Environmental Services, Inc. (ABB-ES), has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to perform a corrective measures study (CMS) for Group II solid waste management units (SWMUs) at the U.S. Naval Station (NAVSTA), Mayport, Florida. This CMS is being conducted in accordance with the Hazardous and Solid Waste Amendment (HSWA) permit No. FL9 170 024 260, issued by the United States Environmental Protection Agency (USEPA) on March 25, 1988, and revised and reissued on June 15, 1993.

The purpose of this CMS is to identify corrective action objectives (CAOs) for each Group II SWMU (if necessary), identify and screen technologies for subsequent corrective action alternative development, evaluate each alternative based on specified criteria, compare all alternatives, and recommend a corrective action for implementation.

This CMS contains information relevant to the Group II SWMUs listed below.

| | |
|---|---|
| SWMU 6: | Former Waste Oil Pit and Sludge Drying Bed |
| SWMU 7: | Oily Waste Treatment Plant (OWTP) Sludge Drying Beds |
| SWMU 8: | OWTP Percolation Pond |
| SWMU 9: | OWTP |
| SWMU 10: | Hazardous Waste Storage Area |
| SWMU 11: | Fuel Spill Area |
| SWMU 12: | Neutralization Basin |
| SWMU 15: | Old Pesticide Handling Area |
| SWMU 16: | Old Transformer Storage Yard |

A Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) was conducted for Group II SWMUs to assess the impact of releases of potentially hazardous substances on the environment. As part of the RFI, risk assessments were conducted for human health and the environment. Based on the results of the RFI and risk assessments, no CAOs were developed for SWMUs 8, 9, 10, 11, 12, and 16. The CAOs developed for SWMUs 6, 7, and 15 are as follows:

SWMUs 6 and 7: Remove light nonaqueous-phase liquid (LNAPL) present on the water table in excess of 0.1 inch in the vicinity of the OWTP Area in accordance with State regulatory requirements (Florida Administrative Code 62-770). Eliminate petroleum-contaminated sludge and soil at SWMUs 6 and 7 that contribute to the presence of LNAPL and contamination of soil and groundwater.

SWMU 15: Eliminate the potential for human and ecological receptor contact with pesticide-contaminated soil at SWMU 15.

In addition to the RFI, two other programs relevant to this CMS are being conducted at NAVSTA Mayport. First, an interim measure is being implemented at SWMUs 6 and 7 to remove LNAPL. Second, NAVSTA Mayport has been selected for the Navy Environmental Leadership program (NELP), which includes innovative technology demonstrations at the station. Thermal desorption of sludge and soil at SWMUs 6 and 7 and *in situ* biodegradation of soil at SWMU 15 will be implemented under NELP.

Corrective action alternatives were developed to address CAOs, as follows:

**SWMUs 6 and 7, Sludge and Soil**

Alternatives 6 and 7-1 Onsite Thermal Desorption

Alternatives 6 and 7-2 Onsite *Ex Situ* Biotreatment

Alternatives 6 and 7-3 Offsite Soil Recycling

**SWMUs 6 and 7, LNAPL**

Alternatives 6 and 7-4 Sumps with Total Fluids Pumping

Alternatives 6 and 7-5 Trenches with LNAPL Skimming

Alternatives 6 and 7-6 Sumps with Groundwater Drawdown and LNAPL Skimming

**SWMU 15, Soil and Groundwater**

Alternative 15-1 Offsite Incineration (includes groundwater monitoring)

Alternative 15-2 Semipermeable Cover (includes groundwater monitoring)

Alternative 15-3 Onsite Biotreatment (includes groundwater monitoring)

Each corrective action alternative was evaluated based on four criteria: technical (which includes performance, reliability, implementability, and safety), environmental, human health, and safety. In addition, cost estimates were completed for each alternative which include direct, indirect, and operation and maintenance costs.

The alternatives were then compared with one another based on three criteria (technical, environmental, and human health). Based on this comparison, one corrective action for each medium is recommended for implementation.

**SWMUs 6 and 7, Sludge and Soil:** Alternatives 6 and 7-1, Onsite Thermal Desorption, is the recommended corrective action for sludge and soil. Thermal desorption will remove the source of LNAPL and is currently being implemented under NELP.

**SWMUs 6 and 7, LNAPL:** Alternatives 6 and 7-4, Sumps with Total Fluids Pumping, is the recommended corrective action for LNAPL. This technology is currently being implemented as an interim measure. If this alternative is found to be ineffective, either Alternatives 6 and 7-5 or Alternatives 6 and 7-6 could be implemented in the future.

**SWMU 15, Soil and Groundwater:** Presently, an innovative *in situ* biodegradation technology is being implemented via NELP to reduce the concentrations of pesticides in soils. Alternative 15-2, Semipermeable Cover, is recommended if this *in situ* biodegradation technology is found to be ineffective. Also, this alternative will evaluate the extent of benzene hexachloride contamination in groundwater at the SWMU.

## TABLE OF CONTENTS

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida


| Chapter | Title | Page No. |
|---|---|---|
| 1.0 | INTRODUCTION | 1-1 |
| 1.1 | FACILITY CORRECTIVE ACTION MANAGEMENT PLAN | 1-1 |
| 1.2 | PURPOSE OF THE CORRECTIVE MEASURES STUDY (CMS) REPORT | 1-4 |
| 1.3 | IMPLEMENTATION OF THE CMS FOR GROUP II SWMUs | 1-5 |
| 2.0 | DESCRIPTION OF CURRENT SITUATION AT FACILITY | 2-1 |
| 3.0 | SUMMARY OF ADDITIONAL CORRECTIVE ACTION ACTIVITIES FOR GROUP II SWMUs | 3-1 |
| 3.1 | IM FOR SWMUs 6 AND 7 | 3-1 |
| 3.1.1 | IM Process Under RCRA | 3-1 |
| 3.1.2 | Description of IM for SWMUs 6 and 7: LNAPL Recovery Sumps | 3-1 |
| 3.2 | TECHNOLOGY DEMONSTRATIONS FOR SWMUs 6, 7, AND 15 | 3-3 |
| 3.2.1 | Description of Technology Demonstration for SWMUs 6 and 7: Thermal Desorption | 3-5 |
| 3.2.2 | Description of Technology Demonstration for SWMU 15: Bioremediation | 3-5 |
| 3.3 | CLOSURE CERTIFICATION FOR SWMU 12 | 3-7 |
| 4.0 | IDENTIFICATION OF CORRECTIVE ACTION OBJECTIVES | 4-1 |
| 4.1 | REGULATORY REQUIREMENTS FOR CORRECTIVE ACTION | 4-1 |
| 4.2 | CORRECTIVE ACTION OBJECTIVES AND CRITERIA | 4-1 |
| 4.2.1 | Corrective Action Objectives | 4-1 |
| 4.2.1.1 | SWMUs 6, 7, 8, 9, 10, and 11, OWTP Area | 4-1 |
| 4.2.1.2 | SWMU 12, Neutralization Basin | 4-3 |
| 4.2.1.3 | SWMU 15, Old Pesticide Handling Area | 4-3 |
| 4.2.1.4 | SWMU 16, Old Transformer Yard | 4-5 |
| 4.2.2 | Chemicals of Concern, Media Protection Standards, and Treatment Levels | 4-5 |
| 4.2.2.1 | Sludge and Soil at SWMUs 6 and 7 | 4-6 |
| 4.2.2.2 | LNAPL at SWMUs 6 and 7 | 4-6 |
| 4.2.2.3 | Soil at SWMU 15 | 4-6 |
| 4.2.3 | Volumes of Contaminated Media | 4-7 |
| 4.2.3.1 | Sludge and Soil at SWMUs 6 and 7 | 4-7 |
| 4.2.3.2 | LNAPL at SWMUs 6 and 7 | 4-8 |
| 4.2.3.3 | Soil at SWMU 15 | 4-8 |
| 5.0 | IDENTIFICATION OF CORRECTIVE ACTION ALTERNATIVES | 5-1 |
| 5.1 | IDENTIFICATION AND SCREENING OF TECHNOLOGIES | 5-1 |
| 5.1.1 | Technology Identification and Screening for SWMUs 6 and 7 | 5-2 |
| 5.1.2 | Technology Identification and Screening for SWMU 15 | 5-2 |
| 5.2 | DEVELOPMENT OF CORRECTIVE ACTION ALTERNATIVES | 5-2 |

## TABLE OF CONTENTS (Continued)

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida


| Chapter | Title | Page No. |
|---|---|---|
| 6.0 | DESCRIPTION AND EVALUATION OF CORRECTIVE ACTION ALTERNATIVES | 6-1 |
| 6.1 | APPROACH TO EVALUATION OF ALTERNATIVES | 6-1 |
| 6.2 | CORRECTIVE ACTION ALTERNATIVES FOR SWMUS 6 AND 7 | 6-1 |
| 6.2.1 | Alternatives 6 and 7-1: Onsite Thermal Desorption | 6-1 |
| 6.2.1.1 | Description | 6-1 |
| 6.2.1.2 | Technical Criteria Evaluation | 6-9 |
| 6.2.1.3 | Environmental Criteria Evaluation | 6-10 |
| 6.2.1.4 | Human Health Criteria Evaluation | 6-10 |
| 6.2.1.5 | Institutional Criteria Evaluation | 6-11 |
| 6.2.1.6 | Cost | 6-11 |
| 6.2.2 | Alternatives 6 and 7-2: Onsite, *Ex Situ* Biotreatment | 6-11 |
| 6.2.2.1 | Description | 6-11 |
| 6.2.2.2 | Technical Criteria Evaluation | 6-17 |
| 6.2.2.3 | Environmental Criteria Evaluation | 6-18 |
| 6.2.2.4 | Human Health Criteria Evaluation | 6-18 |
| 6.2.2.5 | Institutional Criteria Evaluation | 6-18 |
| 6.2.2.6 | Cost | 6-18 |
| 6.2.3 | Alternatives 6 and 7-3: Offsite Soil Recycling | 6-20 |
| 6.2.3.1 | Description | 6-20 |
| 6.2.3.2 | Technical Criteria Evaluation | 6-22 |
| 6.2.3.3 | Environmental Criteria Evaluation | 6-24 |
| 6.2.3.4 | Human Health Criteria Evaluation | 6-24 |
| 6.2.3.5 | Institutional Criteria Evaluation | 6-24 |
| 6.2.3.6 | Cost | 6-24 |
| 6.2.4 | Alternatives 6 and 7-4: Sumps with Total Fluids Pumping | 6-24 |
| 6.2.5 | Alternatives 6 and 7-5: Trenches with LNAPL Skimming | 6-26 |
| 6.2.5.1 | Description | 6-27 |
| 6.2.5.2 | Technical Criteria Evaluation | 6-30 |
| 6.2.5.3 | Environmental Criteria Evaluation | 6-31 |
| 6.2.5.4 | Human Health Criteria Evaluation | 6-31 |
| 6.2.5.5 | Institutional Criteria Evaluation | 6-31 |
| 6.2.5.6 | Cost | 6-32 |
| 6.2.6 | Alternatives 6 and 7-6: Sumps with Groundwater Drawdown and LNAPL Skimming | 6-32 |
| 6.2.6.1 | Description | 6-32 |
| 6.2.6.2 | Technical Criteria Evaluation | 6-34 |
| 6.2.6.3 | Environmental Criteria Evaluation | 6-36 |
| 6.2.6.4 | Human Health Criteria Evaluation | 6-36 |
| 6.2.6.5 | Institutional Criteria Evaluation | 6-36 |
| 6.2.6.6 | Cost | 6-36 |
| 6.3 | CORRECTIVE ACTION ALTERNATIVES FOR SWMU 15 | 6-38 |
| 6.3.1 | Alternative 15-1: Offsite Incineration | 6-38 |
| 6.3.1.1 | Description | 6-38 |
| 6.3.1.2 | Technical Criteria Evaluation | 6-42 |

# TABLE OF CONTENTS (Continued)

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida


| Chapter | Title | Page No. |
|---|---|---|
| 6.3.1.3 | Environmental Criteria Evaluation | 6-43 |
| 6.3.1.4 | Human Health Criteria Evaluation | 6-44 |
| 6.3.1.5 | Institutional Criteria Evaluation | 6-44 |
| 6.3.1.6 | Cost | 6-44 |
| 6.3.2 | Alternative 15-2: Semipermeable Cover | 6-44 |
| 6.3.2.1 | Description | 6-44 |
| 6.3.2.2 | Technical Criteria Evaluation | 6-46 |
| 6.3.2.3 | Environmental Criteria Evaluation | 6-49 |
| 6.3.2.4 | Human Health Criteria Evaluation | 6-49 |
| 6.3.2.5 | Institutional Criteria Evaluation | 6-49 |
| 6.3.2.6 | Cost | 6-49 |
| 6.3.3 | Alternative 15-3: Onsite, *Ex Situ* Biotreatment | 6-51 |
| 6.3.3.1 | Description | 6-51 |
| 6.3.3.2 | Technical Criteria Evaluation | 6-57 |
| 6.3.3.3 | Environmental Criteria Evaluation | 6-59 |
| 6.3.3.4 | Human Health Criteria Evaluation | 6-59 |
| 6.3.3.5 | Institutional Criteria Evaluation | 6-59 |
| 6.3.3.6 | Cost | 6-59 |
| 7.0 | JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION | 7-1 |
| 7.1 | OVERALL APPROACH TO JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION | 7-1 |
| 7.2 | JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION FOR SWMUS 6 AND 7 | 7-1 |
| 7.2.1 | Sludge and Soil at SWMUs 6 and 7 | 7-1 |
| 7.2.1.1 | Justification for Recommended Corrective Action | 7-1 |
| 7.2.1.2 | Recommended Corrective Action | 7-1 |
| 7.2.2 | LNAPL at SWMUs 6 and 7 | 7-6 |
| 7.2.2.1 | Justification for Recommended Corrective Action | 7-6 |
| 7.2.2.2 | Recommended Corrective Action | 7-6 |
| 7.3 | JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION FOR SWMU 15 | 7-10 |
| 7.3.1 | Justification for Recommended Corrective Action | 7-10 |
| 7.3.2 | Recommended Corrective Action | 7-10 |

REFERENCES

APPENDICES

Appendix A: Regulatory Requirements
Appendix B: Volume Estimates
Appendix C: Cost Backup Information
Appendix D: Groundwater Monitoring Program
Appendix E: Response to Regulatory Comments

## LIST OF FIGURES

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida


| Figure | Title | Page No. |
|---|---|---|
| 1-1 | Facility Location Map | 1-2 |
| 1-2 | Group II Solid Waste Management Units (SWMUs) Locations | 1-3 |
| 3-1 | Solid Waste Management Units 6 and 7 LNAPL Recovery Sump Locations | 3-2 |
| 3-2 | SWMU 15 Proposed Application Gallery Location for *in situ* Biotreatment | 3-6 |
| 6-1 | Site Layout Plan for Alternatives 6 & 7-1, Onsite Thermal Desorption | 6-6 |
| 6-2 | Typical Process Flow Diagram for Thermal Desorption | 6-8 |
| 6-3 | Site Layout Plan for Alternatives 6 and 7-2, Onsite *Ex Situ* Biotreatment | 6-14 |
| 6-4 | Process Flow Diagram Alternative 6 and 7-3 *Ex Situ* Biodegradation | 6-15 |
| 6-5 | Site layout Plan for Alternatives 6 and 7-3, Offsite Soil Recycling | 6-21 |
| 6-6 | Alternatives 6 and 7-5, Location Map | 6-28 |
| 6-7 | Collection Trench and Recovery Sump Conceptual Model | 6-29 |
| 6-8 | Conceptual Model for Alternatives 6 and 7-6, Groundwater Depression and LNAPL Skimming | 6-35 |
| 6-9 | Site Layout Alternative 15-1: Offsite Transport and Incineration | 6-40 |
| 6-10 | Site Layout Alternative 15-2: Capping | 6-47 |
| 6-11 | Site Layout Alternatives 15-3: *Ex Situ* Biotreatment | 6-52 |
| 6-12 | Process Flow Diagram for Alternative 15-3: *Ex Situ* Biotreatment | 6-53 |
| 6-13 | Cross Section of Lined Treatment Cell Alternative 15-3: *Ex Situ* Biotreatment | 6-55 |

## LIST OF TABLES

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida


| Table | Title | Page No. |
|---|---|---|
| 3-1 | Estimated LNAPL Recovery Performance Criteria for SWMUs 6 and 7 | 3-4 |
| 4-1 | Corrective Action Objectives for OWTP Area | 4-4 |
| 4-2 | Corrective Action Objective for SWMU 15 | 4-5 |
| 5-1 | Corrective Action Technologies, Sludge and Soil at SWMUs 6 and 7 | 5-3 |
| 5-2 | Corrective Action Technologies, LNAPL at SWMU 6 and 7 | 5-5 |
| 5-3 | Corrective Action Technologies, Soil at SWMU 15 | 5-7 |
| 5-4 | Corrective Action Alternatives, Sludge and Soil at SWMUs 6 and 7 | 5-9 |
| 5-5 | Corrective Action Alternatives, LNAPL at SWMU 6 and 7 | 5-11 |
| 5-6 | Corrective Action Alternatives, Soil at SWMU 15 | 5-12 |
| 6-1 | Evaluation Criteria for Corrective Action Alternatives | 6-2 |
| 6-2 | Components of Cost Estimate for Each Corrective Action Alternative | 6-4 |
| 6-3 | Cost Summary Table for Alternatives 6 and 7-1: Onsite Thermal Desorption | 6-12 |
| 6-4 | Cost Summary Table for Alternatives 6 and 7-2: Onsite, *Ex Situ* Biotreatment | 6-19 |
| 6-5 | Cost Summary Table for Alternatives 6 and 7-3: Offsite Soil Recycling | 6-25 |
| 6-6 | Cost Summary Table for Alternatives 6 and 7-5: Trenches with LNAPL Skimming | 6-33 |
| 6-7 | Cost Summary Table for Alternatives 6 and 7-6: Sumps with Groundwater Drawdown and LNAPL-Skimming | 6-37 |
| 6-8 | Cost Summary Table for Alternative 15-1: Offsite Incineration | 6-45 |
| 6-9 | Cost Summary Table for Alternative 15-2: Semipermeable Cover | 6-50 |
| 6-10 | Cost Summary Table for Alternative 15-3: Onsite, *Ex Situ* Biotreatment | 6-60 |
| 7-1 | Criteria for Justification and Recommendation of Corrective Action | 7-2 |
| 7-2 | Justification of Corrective Action SWMUs 6 and 7, Sludge and Soil | 7-3 |
| 7-3 | Justification of Corrective Action SWMUs 6 and 7, LNAPL | 7-7 |
| 7-4 | Justification of Corrective Action SWMU 15 | 7-11 |

## GLOSSARY

| | |
|---|---|
| ABB-ES | ABB Environmental Services, Inc. |
| AOC | Area of Concern |
| ASP | aerated soil pile |
| BHC | benzene hexachloride |
| bls | below land surface |
| BTEX | benzene, toluene, ethylbenzene, and xylenes |
| CAMP | Corrective Action Management Plan |
| CAO | corrective action objective |
| CAP | Contamination Assessment Plan (Florida) |
| CCED | Clean Closure Equivalency Demonstration |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CMS | Corrective Measures Study |
| CO | Corporate Officer |
| cy | cubic yards |
| DDA | dichlorodiphenylacetate |
| DDD | dichlorodiphenyldichloroethane |
| DDE | dichlorodiphenyldichloroethene |
| DDT | dichlorodiphenyltrichloroethane |
| DOD | Department of Defense |
| DPT | direct push technology |
| °F | degrees Fahrenheit |
| FAC | Florida Administrative Code |
| FDEP | Florida Department of Environmental Protection |
| FDER | Florida Department of Environmental Regulation (before 7/93) |
| FOTW | federally owned treatment works |
| $ft^2$ | square feet per day |
| GIR | General Information Report |
| gpm | gallons per minute |
| GPR | ground-penetrating radar |
| HDPE | high-density polypropylene |
| HSWA | Hazardous and Solid Waste Amendment |
| IAS | initial assessment study |
| IM | interim measure |
| IR | Installation Restoration |
| LDR | land disposal restriction |
| LNAPL | light nonaqueous-phase liquid |
| MCL | maximum contaminant level |
| MPS | Media Protection Standard |

## GLOSSARY (Continued)

| | |
|---|---|
| NA | not applicable |
| NACIP | Navy Assessment and Control of Installation Pollutants |
| NAS | Naval Air Station |
| NAVSTA | Naval Station |
| NELP | Navy Environmental Leadership program |
| O&M | operations and maintenance |
| OWTP | oily waste treatment plant |
| PA | Preliminary Assessment |
| PAH | polynuclear aromatic hydrocarbons |
| PCB | polychlorinated biphenyl |
| PPE | personal protection equipment |
| ppm | part per million |
| PVC | polyvinyl chloride |
| QA/QC | quality assurance and quality control |
| RA | remedial action |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA facility assessment |
| RFI | RCRA facility investigation |
| RGO | remedial goal option |
| RI/FS | remedial investigation and feasibility study |
| SARA | Superfund Amendments and Reauthorization Act |
| SI | site inspection |
| SOUTHNAV-FACENGCOM | Southern Division, Naval Facilities Engineering Command |
| SV | sampling visit |
| SVOC | semivolatile organic compound |
| SWMU | solid waste management unit |
| TCL | target compound list |
| TPH | total petroleum hydrocarbons |
| TRPH | total recoverable petroleum hydrocarbons |
| USEPA | U.S. Environmental Protection Agency |
| UTS | Universal Treatment Standards |
| VOA | volatile organic aromatic |
| VOC | volatile organic compound |
| VOH | volatile organic halocarbon |
| VSI | visual site inspection |

## 1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to complete a corrective measures study (CMS) for Group II solid waste management units (SWMUs) at the U.S. Naval Station (NAVSTA), Mayport, Florida (Figure 1-1). The CMS is being conducted under contract number N62467-89-D-0317-028. This report presents the results of the CMS, including the development, screening, evaluation, and recommendation of corrective action to address contaminated media at Group II SWMUs.

The remainder of this chapter provides an overview of NAVSTA Mayport's corrective action management strategy, a brief summary of the CMS process according to Resource Conservation and Recovery Act (RCRA), and a description of how the CMS process is being implemented for Group II SWMUs at NAVSTA Mayport.

**1.1 FACILITY CORRECTIVE ACTION MANAGEMENT PLAN**. NAVSTA Mayport SWMUs are being investigated in a phased approach.

An RCRA facility assessment and visual site inspection (RFA/VSI) for NAVSTA Mayport was conducted for U.S. Environmental Protection Agency (USEPA) Region IV in 1989 (A.T. Kearny, 1989). The RFA/VSI identified 56 SWMUs and 2 areas of concern (AOC) at NAVSTA Mayport. These SWMUs and AOCs were included in the Hazardous and Solid Waste Amendments (HSWA) permit. Fifteen of these SWMUs were determined to require no further action. Twenty-three of the remaining SWMUs were determined to require further investigation by conducting RCRA facility assessment/sampling visits (RFA/SVs), referred to in the current Hazardous and Solid Waste Amendment (HSWA) permit as confirmatory sampling. The remaining 18 SWMUs were determined to require an RCRA facility investigation (RFI).

Because of the number of SWMUs, the diversity of their past and present operations, and the magnitude of the permit requirements, the USEPA recommended that a phased approach be used to implement the RFI and other corrective action activities at NAVSTA Mayport. A Corrective Action Management Plan (CAMP) was prepared in response to the USEPA recommendation and describes the strategy to implement the RCRA corrective action program at NAVSTA Mayport (ABB-ES, 1995a).

The corrective action program at NAVSTA Mayport described in the CAMP uses a phased approach to assure collection of adequate site characterization data to support the selection of effective corrective measures. The structure of the corrective action program at NAVSTA Mayport is based on the establishment of four SWMU groups: Group I, II, III, and IV. The corrective action activities at each group of SWMUs are being implemented in phases.

This CMS report focuses on Group II SWMUs at NAVSTA Mayport (Figure 1-2). Group II SWMUs are located along the northern part of NAVSTA Mayport contiguous with the St. Johns River. Group II includes former hazardous and solid waste storage areas, petroleum waste treatment and disposal, and pesticide handling facilities. The SWMUs were incorporated into Group II because of their proximity to each other and the St. Johns River. Group II SWMUs that were identified as requiring an RFI include:

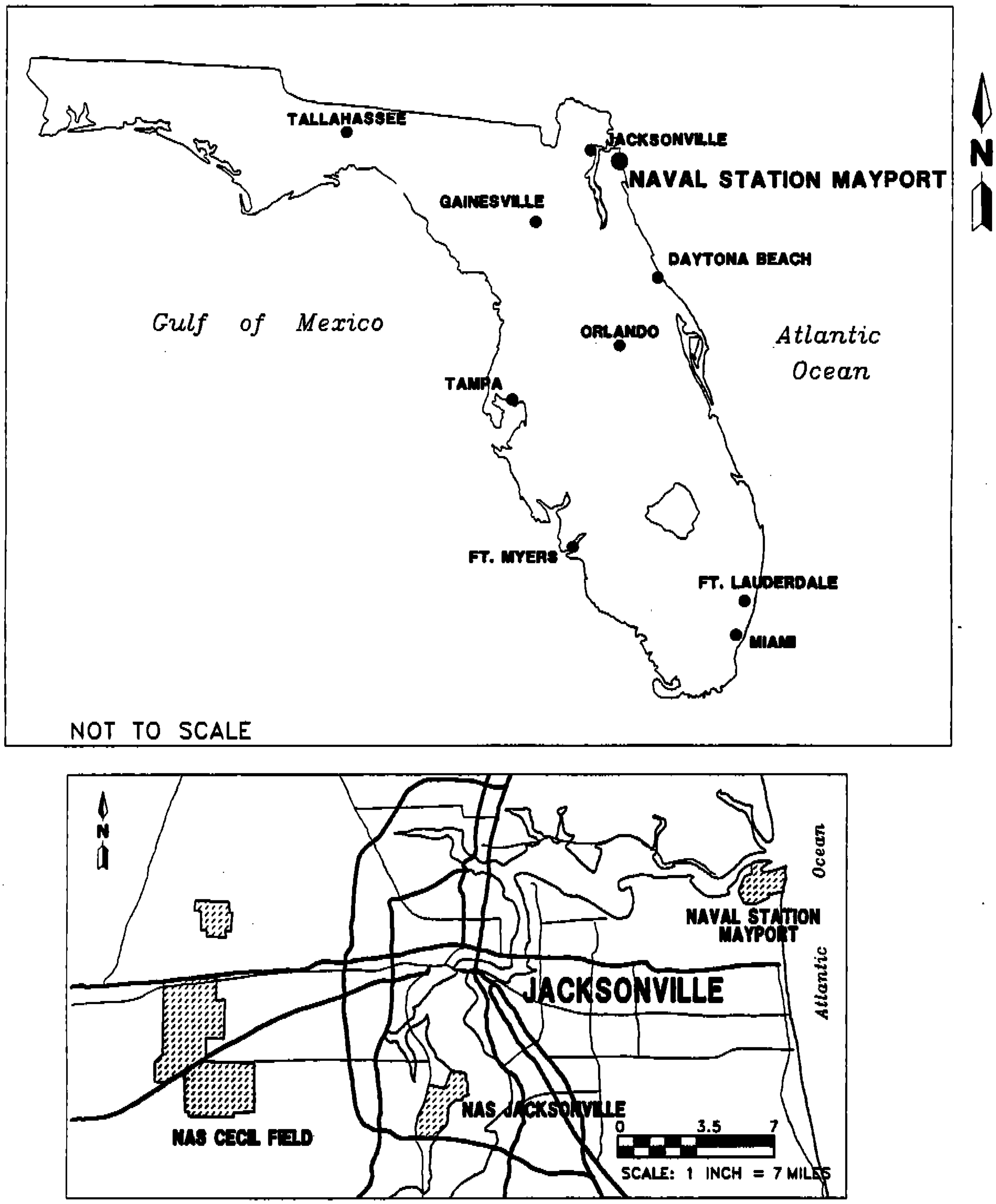



**FIGURE 1-1**
**FACILITY LOCATION MAP**

H:\9500\002200\JMK-JC-NP\01-02-96

**BUILDING 191**
**SAMPLING REPORT**

**U.S. NAVAL STATION**
**MAYPORT, FLORIDA**

SWMU 6 Former Waste Oil Pit and Sludge Drying Bed
SWMU 7 Oily Waste Treatment Plant (OWTP) Sludge Drying Beds
SWMU 8 OWTP Percolation Pond
SWMU 9 OWTP
SWMU 10 RCRA Hazardous Waste Storage Area
SWMU 11 Fuel Spill Area
SWMU 12 Neutralization Basin
SWMU 15 Old Pesticide Handling Area
SWMU 16 Old Transformer Storage Yard

Two reports provide additional information on Group II SWMUs which will not be repeated in this CMS: the RCRA Corrective Action Program General Information Report for NAVSTA Mayport (GIR) (ABB-ES, 1995b) and the RCRA Facility Investigation (RFI) for Group II SWMUs for NAVSTA Mayport (ABB-ES, 1995c).

The NAVSTA Mayport GIR provides information common to all SWMUs and AOCs being investigated such as:

- facility information,
- geography,
- physiography,
- demographics,
- background sampling information and analytical methodology,
- risk assessment approach, and
- ecological characterization of the station.

The RFI for Group II SWMUs provides the following information:

- procedures for analytical data management and evaluation,
- physical characteristics of the SWMUs such as geology and hydrogeology,
- an assessment of the extent, magnitude, and impact of contamination at the SWMUs,
- a qualitative and quantitative assessment of risks to human health and the environment, and
- a recommendation of whether or not corrective action is necessary at the SWMUs.

The RFI included a study of four areas within Group II SWMUs. SWMUs 6, 7, 8, 9, 10, and 11 were studied and evaluated as one area (referred to as the OWTP Area) because the SWMUs are located in the same vicinity of the station and the potential for similar or related corrective measures exists. SWMUs 12, 15, and 16 were each studied and evaluated separately.

1.2 PURPOSE OF THE CORRECTIVE MEASURES STUDY (CMS) REPORT. The purpose of the CMS is to identify, evaluate, and recommend corrective action for SWMUs that warrant such action based on the results of the RFI. The following components are considered in identifying appropriate corrective action:

- Corrective Action Objectives (CAOs). CAOs are developed to specify the contaminants, media of interest, exposure pathways, and corrective action goals for an SWMU.

- Media Protection Standards (MPS). MPS are developed based on regulatory requirements, when available, site-specific risk-based factors, or other available information (e.g., leachability of contaminants from soil to groundwater).

- Volumes of Media of Concern. The volumes or areas of media of concern at each SWMU are determined by considering the requirements for protectiveness as identified in the CAOs and the chemical and physical characterization of the site (i.e., the results and conclusions of the RFI).

- Applicable Technologies. Technologies applicable to contaminated media at each SWMU are identified and screened. Technologies that cannot be implemented technically are eliminated.

- Corrective Action Alternatives. Technologies that pass the screening phase are assembled into corrective action alternatives.

- Description and Evaluation of Corrective Action Alternatives. Selected corrective action alternatives are described and evaluated using four criteria: technical, environmental, human health, and institutional factors.

- Justification and Recommendation of Corrective Action. The results of the evaluation of alternatives are summarized and a corrective action is recommended for each SWMU.

These components are described further in the CMS workplan for NAVSTA Mayport (ABB-ES, 1995d).

<u>1.3 IMPLEMENTATION OF THE CMS FOR GROUP II SWMUs</u>. This CMS for Group II SWMUs uses the CMS process described in the CMS workplan (ABB-ES, 1995e) for NAVSTA Mayport.

An interim measure (IM) for light, nonaqueous-phase liquid (LNAPL, or floating, free-phase hydrocarbons) at SWMUs 6 and 7, two technology demonstrations for contaminated soil at SWMUs 6, 7, and 15, and closure certification for SWMU 12 are currently planned (see Chapter 3.0). This CMS is based on site conditions prior to completion of the IM and technology demonstrations. Consequently, this CMS cannot incorporate treatability information that could be gained by these activities. Chapter 5, 6, and 7 discuss corrective action alternatives for the SWMUs, including those proposed for the IM and technology demonstrations.

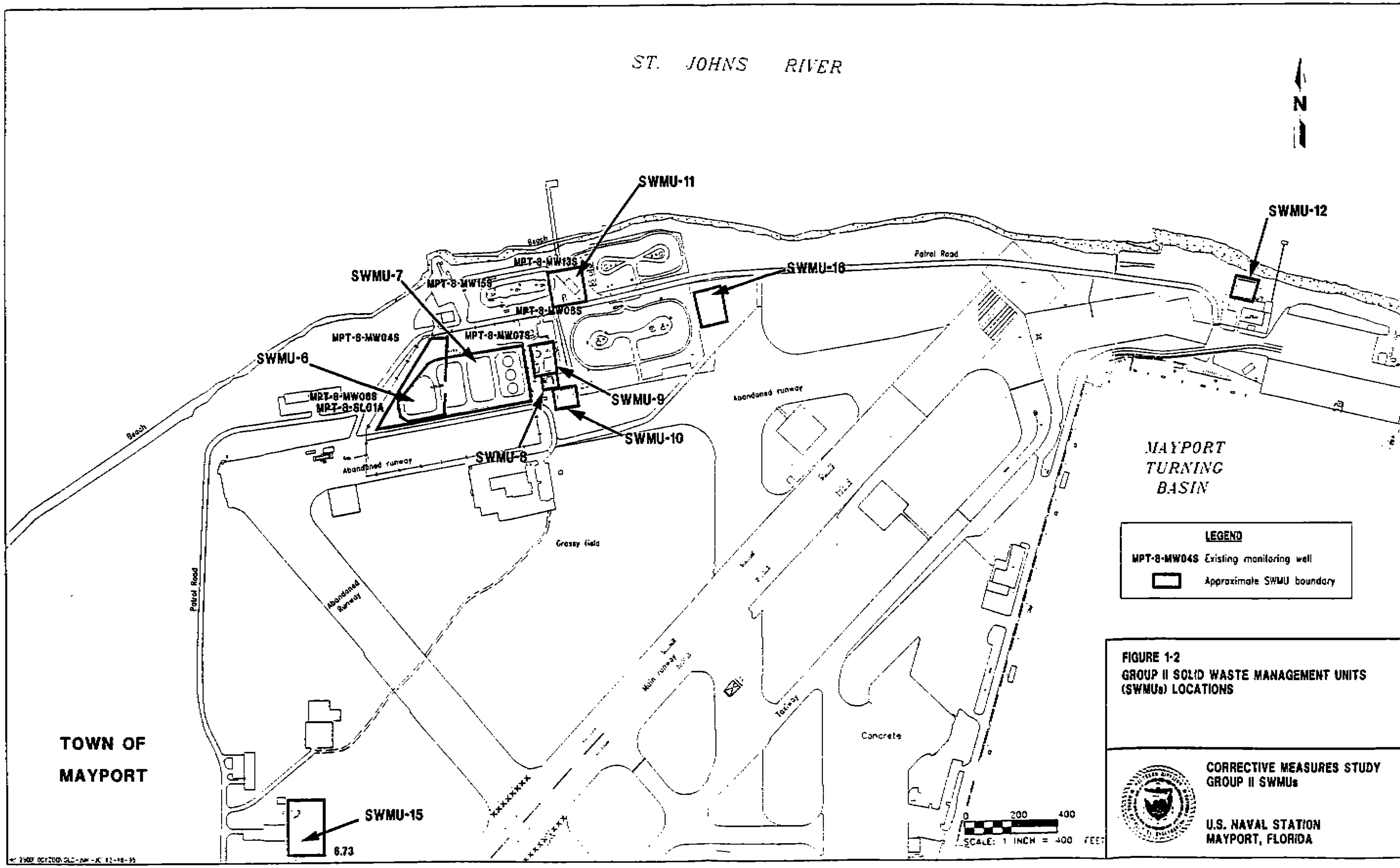



FIGURE 1-2
GROUP II SOLID WASTE MANAGEMENT UNITS (SWMUs) LOCATIONS

CORRECTIVE MEASURES STUDY
GROUP II SWMUs

U.S. NAVAL STATION
MAYPORT, FLORIDA

## 2.0 DESCRIPTION OF CURRENT SITUATION AT FACILITY

The HSWA permit number FL9-170-024-260, issued March 25, 1988, and revised and renewed June 15, 1993, for SWMUs at NAVSTA Mayport (Groups I through IV) requires that changes at the station since the time of the issuance of the RFI report (June 1995) be documented in the CMS report. At the time of this writing (July 1995), the RFI report accurately reflects the current situation at the station. Thus, no updated information is available. As discussed in Chapter 1.0, general station information can be obtained from the NAVSTA Mayport GIR and RFI reports (ABB-ES, 1995b and 1995c).

## 3.0 SUMMARY OF ADDITIONAL CORRECTIVE ACTION ACTIVITIES FOR GROUP II SWMUs

This chapter describes the IM planned for SWMUs 6 and 7, technology demonstrations for SWMUs 6, 7, and 15, and closure certification for SWMU 12. These activities are summarized in this chapter because they are considered in selecting an appropriate corrective action for these SWMUs.

**3.1 IM FOR SWMUs 6 AND 7.** The purpose of conducting an IM is to address contamination or site conditions that pose an immediate threat to human health and the environment or where response is appropriate prior to completion of the RFI and CMS (USEPA, 1988a).

To determine whether an IM is appropriate for an AOC or SWMU, decision criteria are evaluated using both engineering judgement and an evaluation of the potential threat to human health. The decision to complete an IM may be based on the following factors:

- immediacy or magnitude of potential threat to human health and the environment,
- an easily identifiable appropriate corrective action for the site, and
- adverse effects to human health and the environment that may occur if action is deferred until completion of the RFI and CMS.

To the extent practicable, IMs should be consistent with any anticipated longer-term corrective actions for a site. IMs should not complicate or interfere with management of wastes.

**3.1.1 IM Process Under RCRA** IM planning and implementation are conducted as follows:

- preparation and approval of IM workplans;
- preparation and approval of final design documents;
- construction bidding, award, and implementation;
- monthly progress reports during IM construction;
- preparation and review of draft IM reports; and
- preparation and review of final IM reports.

**3.1.2 Description of IM for SWMUs 6 and 7: LNAPL Recovery Sumps** The IM being implemented for SWMUs 6 and 7 is LNAPL recovery. Recovery of LNAPL is presently occurring using five 1-meter-diameter, gravity-flow collection sumps, installed to a depth of approximately 20 feet below land surface (bls). Figure 3-1 depicts the location of these sumps. The sumps are equipped with total-fluids pumps, which are currently being pumped at a low rate (up to 1 gallon per minute [gpm]). The liquid generated during total-fluids pumping is being piped to two 20,000-

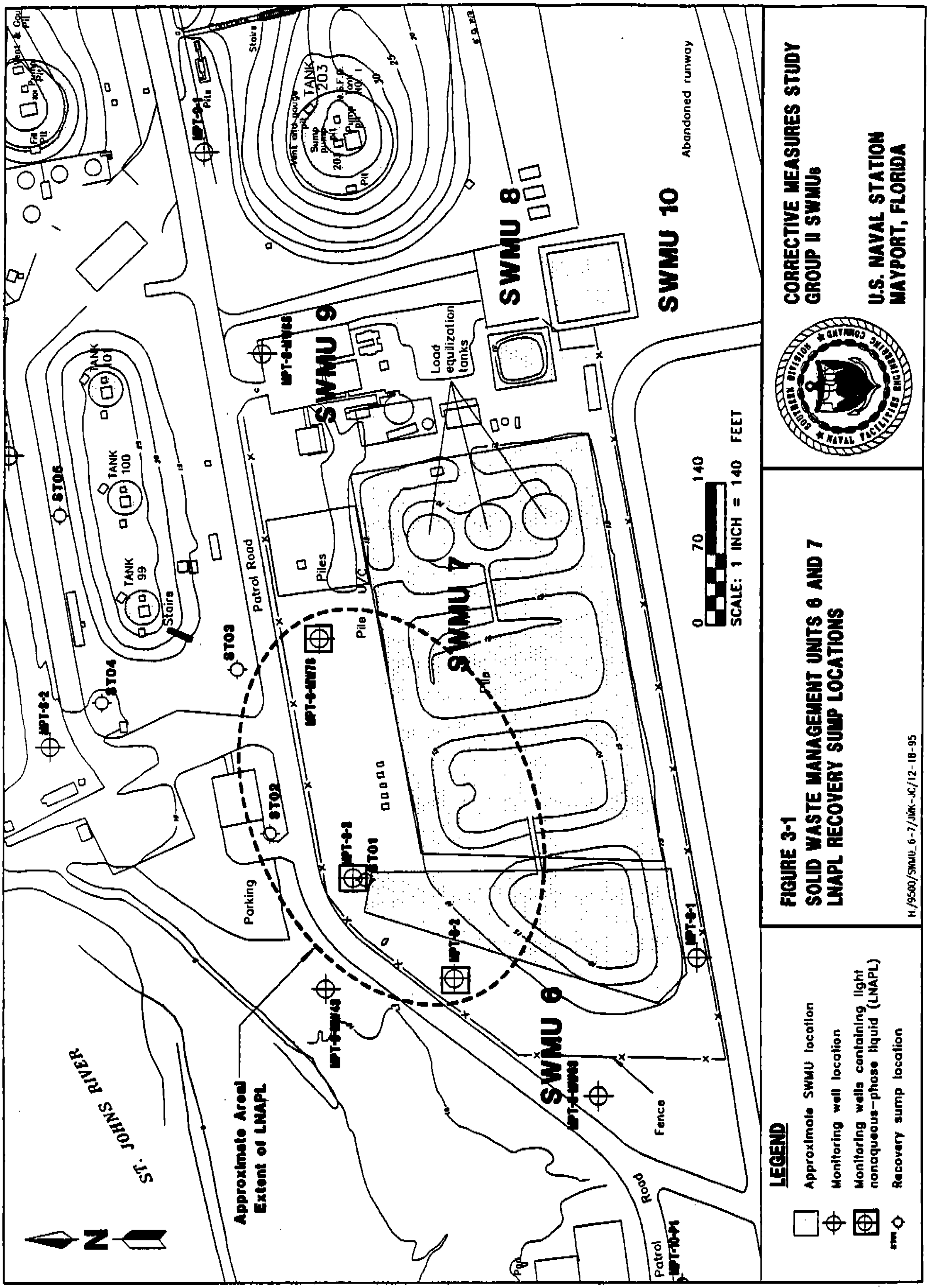



FIGURE 3-1
SOLID WASTE MANAGEMENT UNITS 6 AND 7
LNAPL RECOVERY SUMP LOCATIONS

gallon tanks. The fluid collected in each tank is being tested and after testing is being discharged to the OWTP (SWMU 9) for pretreatment prior to treatment at NAVSTA Mayport's wastewater treatment plant.

The IM workplan (ABB-ES, 1994) contains estimates of performance criteria, volume estimates, and recovery rates for the LNAPL recovery system. Table 3-1 summarizes these criteria. The IM workplan also includes a description of field and administrative activities for the recovery system.

Preliminary data have been generated on the effectiveness of the recovery sumps. As of December 1995, LNAPL is potentially being recovered from four of five sumps. LNAPL has been measured in sumps ST01 and ST02 at a thickness ranging from 0.02 to 0.09 foot and 0.04 to 0.06 foot, respectively. A sheen is observed at the location of sumps ST03 and ST04. LNAPL has not been observed or measured in sump ST05.

Approximately 75,400 gallons of total fluid (groundwater and LNAPL) has been recovered to date. Currently, LNAPL has not been observed as a sheen or noted to be present at measurable quantities in either of the 20,000-gallon collection tanks.

Samples of the liquid collected in the two 20,000-gallon tanks have been analyzed for Appendix IX constituents including volatile and semivolatile organics, pesticides, polychlorinated biphenyls, metals and cyanide. The analytical results suggest that volatile organics and semivolatile organics are present at concentrations that support the presence of petroleum hydrocarbons.

The presence of LNAPL in the recovery sumps (four out of five) and detection of petroleum-related organic compounds provide supporting evidence that the IM as currently being implemented is successful in recovering LNAPL. Additional data need to be collected over a longer period to evaluate the overall effectiveness of the IM.

To recover the estimated volume of LNAPL at SWMUs 6 and 7, it is anticipated that the system must be operated in the manner described in the IM workplan for approximately 5 to 10 years. Most recovery is expected to occur during the initial phase of operation of the recovery system. The system will continue to operate and will be continually monitored to ensure effectiveness.

At the time of publication of the draft CMS (July 1995), the sumps were installed, but were not fully operational.

**3.2 TECHNOLOGY DEMONSTRATIONS FOR SWMUs 6, 7, AND 15.** Two technology demonstrations are being conducted at NAVSTA Mayport, one for sludge and soil at SWMUs 6 and 7 containing petroleum chemicals and the other for surface soil containing pesticide chemicals at SWMU 15. These demonstrations are being conducted under the Navy Environmental Leadership program (NELP).

The goal of NELP is to promote innovation and new technologies in the areas of compliance, conservation, cleanup, and pollution prevention within the Navy. NAVSTA Mayport was selected as one of two Navy bases nationwide to participate in NELP. Sites were selected for IMs under the NELP based on their suitability for using an innovative technology for cleanup.

**Table 3-1**
**Estimated LNAPL Recovery Performance Criteria for SWMUs 6 and 7**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Parameter | Estimate |
|---|---|
| Volume of recoverable LNAPL (gallons) | 62,668 |
| Water flow rate to sumps (gallons per day) | 546 to 747 |
| Recoverable LNAPL flow rate to sumps (gallons per day) | 81 to 111 |
| Time period required for LNAPL recovery (years) | 5 to 10 |

Notes: LNAPL = light nonaqueous-phase liquid
SWMU = solid waste management unit

3.2.1 Description of Technology Demonstration for SWMUs 6 and 7: Thermal Desorption A portion of sludge and soil from SWMUs 6 and 7 that contains petroleum-related organic compounds will be treated onsite using a mobile, thermal desorption unit. The sludge and soil at SWMUs 6 and 7 contain waste oil from bilge water that was disposed of at the SWMUs.

It is estimated that approximately 29,800 cubic yards (cy) of sludge and soil require treatment. However, under NELP, a fixed fund has been allotted to NAVSTA Mayport for thermal desorption. Based on the available funds, it is estimated that approximately 2,076 cy of sludge and soil (out of approximately 29,800 cy) would be treated during the technology demonstration. Remaining sludge and soil (approximately 27,724 cy) would be addressed under the corrective measures implementation (CMI) by one of the alternatives presented in this CMS.

According to a workplan submitted by Southeast Soil Remediation, Inc. (SSR), the NELP technology demonstration contractor, sludge and soil will be sampled and analyzed prior to treatment to characterize the petroleum-related constituents as required by Florida Administrative Code (FAC) 62-775.410. During the technology demonstration, sludge and soil will be thermally treated through the use of a low temperature thermal desorber (LTTD). Treated soil exiting the LTTD will be sampled and compared to criteria in FAC 62-775.400 to ensure that "clean soil" requirements are met (SSR, 1995)

3.2.2 Description of Technology Demonstration for SWMU 15: Bioremediation Pesticide-contaminated soil at SWMU 15 will be treated using *in situ* bioremediation. Field and administrative activities for this technology are described in the *Bioaugmentation Corrective Action Submittal Package* (Environmental and Geotechnical Engineering Network, Inc. [EnGen], 1995), which provides the following information:

- The treatment proposed by ENGEN consists of applying a proprietary liquid containing microorganisms, Bac-Terr™ (also known as BR-650), along with nutrients, onto the surface soil. The microorganisms and nutrients will be mixed in separate tanks and applied by gravity through a common distribution system placed on the land surface (Figure 3-2). Reportedly, BR-650 contains microorganisms capable of degrading petroleum hydrocarbons, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). The ability of BR-650 to degrade pesticides present in the surface soil at SWMU 15 (i.e., chlordane and 4,4'-DDT) is not addressed in the submittal package.

- BR-650 and the nutrient mixture will be prepared onsite in separate holding tanks and introduced into the surface soil via an infiltration system.

- The nutrient mixture will be metered to the infiltration system prior to application. BR-650 will be combined with nutrients and then applied to the soil. The application rate recommended by the vendor is 1.5 gallons of nutrient mixture and 1.5 gallons of BR-650 mixture per cy of surface soil to be treated.

- Soil samples will be collected and analyzed prior to implementing bioremediation at SWMU 15; samples will then be collected and analyzed at specified intervals during the treatment process. Collection of final

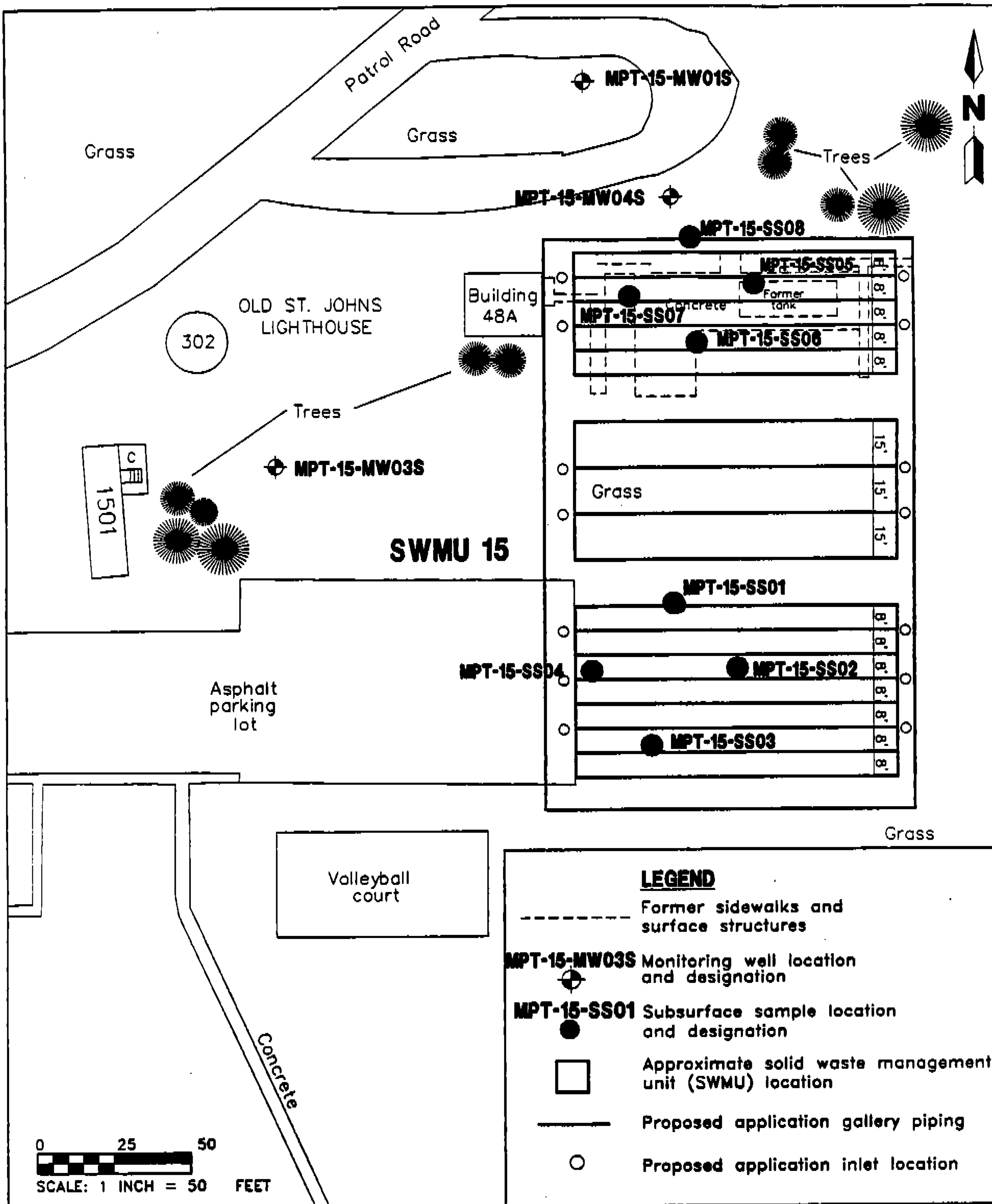



**FIGURE 3-2**
**SWMU 15**
**PROPOSED APPLICATION GALLERY LOCATION FOR *IN SITU* BIOTREATMENT**

**CORRECTIVE MEASURES STUDY REPORT, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

H:\9500\MAYFIGS\JMK-JC-NAB\12-28-95

soil samples is scheduled for 60 days following the initiation of treatment at the site. The analytical parameters specified for soil samples are VOCs, SVOCs, pesticides, metals, and cyanide.

Based on the time specified for the final collection of soil samples, it is implied that the vendor estimates a treatment duration of 60 days.

3.3 CLOSURE CERTIFICATION FOR SWMU 12. In accordance with a Consent Order (CO No. 87-1128) negotiated between NAVSTA Mayport and the Florida Department of Environmental Protection (FDEP) for closure of SWMU 12 (Neutralization Basin), a Closure Plan and Groundwater Monitoring Plan, pursuant to 40 Code of Federal Regulations (CFR) 264 and 265, was prepared. The FDEP Consent Order included a waiver for the groundwater monitoring requirements if NAVSTA Mayport could demonstrate that no migration of hazardous waste or hazardous waste constituents from the neutralization basin had occurred.

Implementation of a Groundwater Monitoring Plan, Closure Plan, and Addendum (E.C. Jordan, 1988a; 1988b; 1989) was initiated in early 1989. The results were submitted to the FDEP in September 1990, and the final closure certificate was submitted to the FDEP on November 26, 1990. The FDEP accepted the closure certificate and terminated the Consent Order on March 8, 1991.

However, USEPA promulgated new regulations after the effective date of the Consent Order in September 1987, requiring a Clean Closure Equivalency Demonstration (CCED) to show that units closed pursuant to 40 CFR 265 also meet the requirements of 40 CFR 264. This regulation requires the permittee to submit an equivalency demonstration of "closure-by-removal" under 40 CFR 270. To comply with the new regulations, an additional monitoring well was installed at the neutralization basin during the RFI activities and a CCED Petition was prepared and submitted to USEPA and FDEP (ABB-ES, 1994a). Currently, NAVSTA Mayport is awaiting approval of the CCED Petition.

## 4.0 IDENTIFICATION OF CORRECTIVE ACTION OBJECTIVES

This section presents the CAOs for Group II SWMUs at NAVSTA Mayport. The CAOs provide the basis for selecting an appropriate corrective action for each SWMU that warrants such action based on the results of the RFI.

**4.1 REGULATORY REQUIREMENTS FOR CORRECTIVE ACTION.** Applicable Federal and State regulatory requirements are identified for developing and evaluating corrective action alternatives. For SWMUs undergoing a CMS, Federal and State regulatory requirements are used to:

- evaluate the appropriate extent of corrective action required,
- develop and evaluate corrective action alternatives, and
- govern the implementation and operation of the selected corrective action.

Institutional requirements, such as State or local permits and human health and environmental protective measures, may substantially affect the selection of an appropriate corrective action.

Regulatory requirements are identified for the OWTP Area (SWMUs 6, 7, 8, 9, 10, and 11), the Neutralization Basin (SWMU 12), the Old Pesticide Handling Area (SWMU 15), and the Old Transformer Storage Yard (SWMU 16). Appendix A provides the regulatory requirements identified for these four areas.

**4.2 CORRECTIVE ACTION OBJECTIVES AND CRITERIA.** This section discusses CAOs, identifies contaminants of concern, media protection standards, and treatment levels, and provides volumes of media of concern requiring corrective action.

**4.2.1 Corrective Action Objectives** CAOs are site-specific objectives for corrective action and are based on contaminants of concern, exposure pathways, and potential receptors at the site.

CAOs are developed in this subsection for each area (i.e., grouping of Group II SWMUs) where existing data justify initiation of a CMS. CAOs for Group II SWMUs are based on consideration of the RFI, applicable State and Federal requirements, and human health and ecological risks posed by contaminants.

4.2.1.1 **SWMUs 6, 7, 8, 9, 10, and 11, OWTP Area** The RFI indicates that LNAPL is present in the vicinity of these SWMUs. The RFI further indicates that the source of the LNAPL is the sludge and soil associated with the sludge drying beds, SWMUs 6 and 7.

The State regulatory requirement, *Florida Petroleum Contaminated Site Cleanup Criteria* (Florida Administrative Code [FAC] 62-770), is applicable to LNAPL discovered in the vicinity of these SWMUs. This statute indicates that "free product," defined as petroleum or petroleum product in excess of 0.1 inch thickness floating on surface water or groundwater, must be recovered. Therefore, the following CAO was established:

CAO 1 Remove LNAPL present on the water table in excess of 0.1 inch in the vicinity of the OWTP Area as per State regulatory requirements (FAC 62-770).

Because the sludge and soil at SWMUs 6 and 7 were identified as the source of LNAPL and may also contribute to contamination of soil and groundwater in the area, the following additional CAO was developed:

CAO 2 Eliminate petroleum-contaminated sludge and soil at SWMUs 6 and 7 that contribute to the presence of LNAPL and contamination of soil and groundwater.

The cleanup of soil containing petroleum hydrocarbons and LNAPL at these SWMUs is based on the assumption that sludge and soil in the vadose zone beneath SWMUs 6 and 7 were the source of LNAPL. The soil containing petroleum hydrocarbons will be excavated and treated (FAC 62-775.400) to produce residual concentrations that are not likely to cause adverse effects to groundwater.

If, after completion of the recommended corrective measures (treatment of sludge and soil via thermal desorption and interim measures for LNAPL removal), LNAPL were still present on the water table in excess of 0.1 inch, additional corrective measures (such as examining technologies for groundwater and phreatic soil) could be taken.

The human health risk assessment completed for SWMUs in the OWTP Area evaluated risks to a future resident for exposure to groundwater as a potable water resource. The assessment indicated a potential cancer risk based on exposure to arsenic and lead and a potential noncancer risk based on exposure to manganese and iron. However, a CAO will not be established for protection of human health at these SWMUs for the following reasons:

- The human health risk assessment assumed that a future resident would install a drinking water well within the surficial aquifer and would consume unfiltered water. This assumption is very conservative and is not reflective of the projected use of the aquifer.

- Arsenic was not detected in groundwater samples above the Federal or State maximum contaminant level (MCL).

The ecological risk assessment completed for these SWMUs evaluated risks to aquatic receptors exposed to surface water. The surface water exposure was based on groundwater samples containing phenanthrene, cyanide, iron, nickel, and mercury at concentrations that exceed the lowest toxicity benchmark concentrations (i.e., concentrations at which literature indicates adverse effects could occur). A CAO will not be established for protection of ecological receptors at these SWMUs for the following reasons:

- An assumption of no risk to aquatic life resulting from potential exposure to groundwater was made because data collected during the RFI suggest that groundwater containing petroleum hydrocarbons is currently not discharging to the St. Johns River.

- Mercury was detected in groundwater samples at concentrations similar to background screening concentration and, therefore, is not likely related to the SWMUs.

Other SWMUs in the OWTP Area, SWMUs 8, 9, 10, and 11, do not warrant corrective action at this time. CAOs are not established for these SWMUs for the following reasons:

- No further action was recommended for SWMU 8, 9, and 10 in the RFI.
- SWMU 10 is the current RCRA Hazardous Waste Storage Area and, as such, is maintained under a Florida Hazardous Waste Storage Permit (Permit No. H016-220719). Upon closure of this area, any future releases of chemicals from the SWMU would be evaluated and addressed in accordance with the permit.
- Any environmental effect presented by the fuel spill at SWMU 11 (i.e., the presence of LNAPL) would be addressed through LNAPL recovery for SWMUs 6 and 7.

CAOs for SWMUs in the OWTP Area are summarized in Table 4-1, which identifies CAOs only for SWMUs 6 and 7.

4.2.1.2 **SWMU 12, Neutralization Basin** After consideration of the RFI, regulatory requirements, and potential risks, a CAO will not be developed for SWMU 12 for the following reasons.

- A CCED Petition for the neutralization basin was submitted to the USEPA and FDEP.
- Although the human health risk assessment identified a possible cancer and noncancer risk due to the presence of arsenic in groundwater, the concentrations detected are not above USEPA and FDEP MCLs.
- The ecological risk assessment did not identify any risks to aquatic receptors in the St. Johns River.
- No corrective measures were recommended for SWMU 12 in the RFI.

4.2.1.3 **SWMU 15, Old Pesticide Handling Area** The RFI identified the presence of pesticide chemicals in soil and groundwater at this SWMU. The human health and ecological assessment suggests:

- a potential risk to human receptors (both occupational workers and residents) based on dermal exposure (under current and future land use scenarios) to 4,4'-DDT and chlordane in surface soil,
- a potential risk to ecological receptors from exposure to 4,4'-DDT in surface soil, and
- a potential risk to humans (future residents) who may consume water from the surficial aquifer from exposure to benzene hexachloride (BHC) and arsenic.

**Table 4-1**
**Corrective Action Objectives for OWTP Area**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| SWMU(s) | CAO |
|---|---|
| SWMUs 6 and 7 | **CAO 1** Remove LNAPL present on the water table in excess of 0.1 inch in the vicinity of the OWTP Area as per State regulatory requirements (FAC 62-770). |
| | **CAO 2** Eliminate petroleum-contaminated sludge and soil at SWMUs 6 and 7 that contributes to the presence of LNAPL and contamination of soil and groundwater. |
| SWMU 8 | None required. |
| SWMU 9 | None required. |
| SWMU 10 | None required. |
| SWMU 11 | None required. |

Notes: OWTP = Oily Waste Treatment Plant.
SWMU = solid waste management unit.
CAO = corrective action objective.
LNAPL = light nonaqueous phase liquid.
FAC = Florida Administrative Code.

Based on these observations, the following CAO is established:

**CAO 1** Eliminate the potential for human and ecological receptor contact with pesticide-contaminated soil at SWMU 15.

The risk identified for human exposure to BHC and arsenic in groundwater was within USEPA's acceptable range ($1x10^{-4}$ to $1x10^{-6}$), but slightly exceeds FDEP's acceptable level ($1x10^{-6}$). The RFI indicated that the extent of these chemicals in groundwater at SWMU 15 was not completely defined. In addition, the use of groundwater as a potable source in nearby homes should be evaluated to determine the appropriateness of a risk assessment scenario that included the potable use of groundwater.

Additional groundwater assessment activities are proposed to follow the completion of the technology demonstration because it is not known whether the bioaugmentation of *in situ* soil at SWMU may mobilize the pesticides. The results of the additional investigation activities will be used to develop an additional CAO, if applicable, and if required, assess corrective measures to mitigate the horizontal and vertical extent of BHC and/or arsenic. The CAO established for SWMU 15 is summarized in Table 4-2.

**Table 4-2**
**Corrective Action Objective for SWMU 15**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| SWMU(s) | CAO |
|---|---|
| SWMU 15 | **CAO 1** Eliminate the potential for human and ecological receptor contact with pesticide-contaminated soil at SWMU 15. |

Notes: SWMU = Solid Waste Management Unit.
CAO = Corrective Action Objective.

4.2.1.4 **SWMU 16, Old Transformer Yard** After consideration of the RFI, regulatory requirements, and the potential risks, a CAO will not be developed for SWMU 16 for the following reasons.

- Surface soil at SWMU 16 has been excavated and stockpiled outside the boundaries of the SWMU. Therefore, the surface soil exposure pathway for human and ecological receptors at the SWMU was eliminated.
- The human health risk assessment did not identify significant risks posed by exposure to subsurface soil or groundwater.
- The ecological risk assessment did not identify significant risks posed by aquatic receptor exposure to groundwater.
- No corrective measures were recommended for SWMU 16 in the RFI.

### 4.2.2 Chemicals of Concern, Media Protection Standards, and Treatment Levels

This subsection defines the chemicals of potential concern, MPSs (the concentration of a chemical in a contaminated media above which corrective action is necessary), and treatment levels (the concentration of a chemical that a treatment technology should achieve, if implemented) for SWMUs and media for which CAOs are identified: sludge and soil at SWMUs 6 and 7, LNAPL at SWMUs 6 and 7, and soil at SWMU 15.

4.2.2.1 **Sludge and Soil at SWMUs 6 and 7** Chemicals of concern for sludge and soil at SWMUs 6 and 7 are petroleum-related constituents that contribute to the presence of LNAPL.

Chemical-specific MPSs are not identified for these media. A human health and ecological assessment was not completed for soil at the SWMU because corrective action was assumed to be warranted; thus, human health- or ecological-based remedial goal options (RGOs) were not selected for these media. Also, no chemical-specific MPSs were identified for these media because promulgated cleanup levels for petroleum-related constituents in soil do not currently exist.

Treatment levels for sludge and soil at SWMUs 6 and 7 were based on the FDEP statute, *Thermal Treatment Facilities for Petroleum Contaminated Soil* (FAC 62-775). This statute provides treatment standards for petroleum-contaminated soil if thermal treatment is utilized. According this statute, soil exiting a thermal treatment unit must achieve:

- a total petroleum hydrocarbons (TPH) concentration of no greater than 50 parts per million (ppm),
- volatile organic aromatics (benzene, toluene, ethylbenzene, and xylene [BTEX]) concentrations of no greater than 0.1 ppm,
- volatile organic halocarbon (VOH) concentrations of no greater than 0.05 ppm,
- polynuclear aromatic hydrocarbons (PAH) concentrations of no greater than 1.0 ppm, and
- certain metals no greater than treatment levels: arsenic (10 ppm), barium (4,940 ppm), cadmium (37 ppm), chromium (50 ppm), lead (108 ppm), mercury (23 ppm), selenium (389 ppm), and silver (353 ppm).

Because no other treatment levels were identified for sludge and soil at these SWMUs, the aforementioned treatment standards will be the treatment levels for any corrective action alternative evaluated for these media.

4.2.2.2 **LNAPL at SWMUs 6 and 7** As presented in Paragraph 4.2.1.1, the MPS for LNAPL at SWMUs 6 and 7 is removal to less than 0.1 inch, as per Florida regulations.

4.2.2.3 **Soil at SWMU 15** The human health and ecological risk assessment completed for SWMU 15 identified potential risks to receptors based on exposure to 4,4'-DDT (human and ecological receptors) in surface soil and chlordane (human receptors only) in surface and subsurface soil. No promulgated cleanup levels were identified. Therefore, 4,4'-DDT and chlordane are the chemicals of potential concern retained for SWMU 15 for the CMS.

RGOs were identified in the risk assessment for 4,4'-DDT (5.0 ppm for human receptors and 1.0 ppm for ecological receptors) and chlordane (2.7 ppm for human receptors). These RGOs were generated based on conservative risk estimates for either human health or ecological receptors; further, they are based on specific exposure pathways (such as dermal contact) and were designed to protect the potential receptor. No promulgated regulatory requirements were identified as being applicable for soil at this SWMU. Therefore, MPSs for soil at SWMU 15 are the RGOs.

Treatment levels for soil at SWMU 15 would be the MPSs if treatment occurs onsite. If treatment occurs offsite, RCRA Land Disposal Restrictions (LDRs) would be invoked and the appropriate treatment levels would be the Universal Treatment Standards (UTS) for chlordane (0.26 ppm) and 4,4'-DDT (0.086 ppm).

<u>4.2.3 Volumes of Contaminated Media</u> This Subsection presents the volume of petroleum-contaminated sludge and soil that contributes to the presence of LNAPL at SWMUs 6 and 7, the volume of LNAPL at SWMUs 6 and 7, and the volume of pesticide-contaminated soil at SWMU 15. Appendix B provides the calculations and supporting information used to derive these volumes.

**4.2.3.1 Sludge and Soil at SWMUs 6 and 7** The volume of sludge and soil was calculated using the following assumptions.

- Sludge and vadose soil at the sludge drying beds is contaminated with petroleum hydrocarbons.

- Soil berms surrounding the sludge drying beds are not contaminated because they were constructed with "clean" dredge spoils on the original ground surface.

- At the area where SWMU 6 does not lie beneath SWMU 7, the soil in the interval from 3 feet below land surface to the water table is likely to contain petroleum hydrocarbons and related volatile and semivolatile organic compounds.

- During the construction of foundations for the three load equalization tanks (LETs) (Figure 3-1) for the oily waste treatment plant (SWMU 9), sludge disposed of in the easternmost sludge drying bed was excavated and placed in the adjacent sludge drying bed. Therefore, soil in the easternmost sludge drying bed is not considered to contain petroleum hydrocarbons at concentrations that may contribute to the LNAPL.

- One sump, for recovery of LNAPL, has been installed in the northern section of SWMU 6. Soil excavated during the installation of this sump was placed in the westernmost sludge drying bed. Therefore, soil in this area has already been excavated.

The total volume of contaminated sludge and soil at SWMUs 6 and 7 was estimated to be 29,800 cy, based on these assumptions. However, approximately 2,076 cy of soil will be treated under NELP. Thus, this CMS will address the remaining 27,724 cy of contaminated sludge and soil at these SWMUs.

**4.2.3.2 LNAPL at SWMUs 6 and 7** The volume of LNAPL at SWMUs 6 and 7 is approximately 60,000 gallons. The basis for this calculation was presented in the IM workplan (ABB-ES, 1994).

**4.2.3.3 Soil at SWMU 15** The volume of contaminated soil was calculated using the following assumptions.

- The lateral extent of contaminated soil (i.e., surface soil) was estimated based on concentrations of chlordane and 4,4'-DDT in surface soil.
- The vertical extent of chlordane-contaminated soil (i.e., subsurface soil) was assumed to be 1 foot bls, based on concentrations of chlordane in subsurface soil.
- The vertical extent of 4,4'-DDT-contaminated soil (i.e., subsurface soil) was assumed to be 1 foot bls, based on concentrations of 4,4'-DDT in subsurface soil, except in areas where surface soil detections exceeded MPSs. In these areas, the concentrations of 4,4'-DDT in subsurface soil were estimated with a fate and transport model. The model predicts that, in some areas, 4,4'-DDT may have migrated to 2 or 3 feet bls (see Appendix B for further information).

The total volume of contaminated soil at SWMU 15 is 533 cy.

## 5.0 IDENTIFICATION OF CORRECTIVE ACTION ALTERNATIVES

The approach and rationale leading to the development of corrective action alternatives is presented in this Chapter. The development of corrective action alternatives consists of identifying applicable technologies, screening those technologies, and using the selected technologies to develop alternatives that accomplish CAOs.

In the remaining sections of this Chapter, technologies that contribute to achieving the CAOs are identified and evaluated and alternatives are developed using the selected technologies. A detailed evaluation of alternatives is presented in Chapter 6.0.

**5.1 IDENTIFICATION AND SCREENING OF TECHNOLOGIES**. Technologies were identified based on a review of current literature, vendor information, and experience in applying technologies for similar sites with similar release characteristics. Only technologies applicable to contaminants of concern were identified. Supplemental technologies may be required for residuals and emissions generated during treatment. For example, offgas generated during thermal desorption or biological treatment may require treatment prior to exhaust. The appropriate technology for treating the offgas may be different for the various technologies evaluated. Thus, the identification of required supplemental technologies will be deferred to the evaluation of corrective action alternatives (Chapter 6.0).

Containment, collection, and treatment technologies were identified for contaminated media at SWMUs 6, 7, and 15:

- *Containment* actions include technologies that involve little or no treatment, but provide protection to human and ecological receptors by preventing leaching of contaminants from soil to groundwater, dermal exposure to contaminants, or minimize contacts with contaminants in an ecological habitat. Thus, containment technologies attempt to reduce potential routes of exposure through isolation. Containment typically consists of covering contaminated areas through use of geotextiles, soil, or other less-permeable materials.

- *Collection* actions may be used for alternatives involving LNAPL removal. Collection actions include technologies that may be used in conjunction with treatment, disposal, or recycling techniques when developing corrective action alternatives. Typical collection technologies include trenches and extraction wells.

- *Treatment* actions include technologies that specifically reduce the mobility, toxicity, or volume of contaminants through biological, physical, or chemical processes. In this evaluation, *in situ* treatment, such as soil flushing or soil vapor extraction, and treatment, such as thermal treatment, are separated into their respective categories.

Once applicable technologies are identified, they are screened to eliminate those that may not perform satisfactorily or reliably or may not achieve the CAOs within a reasonable timeframe. This screening process focuses on eliminating those technologies that have limitations for waste- and site-specific conditions. This screening step may also eliminate technologies based on inherent technology limitations.

Site, waste, and technology characteristics used to screen technologies include the following.

- *Site Characteristics* Site data are reviewed to identify conditions that may limit or promote the use of certain technologies. Technologies whose use is clearly precluded by site characteristics are eliminated from further consideration.

- *Waste Characteristics* Identification of waste characteristics that limit the effectiveness or feasibility of technologies is an important part of the screening process. Technologies clearly limited by these waste characteristics are eliminated from consideration. Waste characteristics particularly affect the feasibility of *in situ* methods, direct treatment methods, and land disposal (onsite or offsite).

- *Technology Limitations* During the screening process, the level of technology development and performance as well as inherent construction, operation, and maintenance problems are identified for each technology considered. Technologies that are unreliable, perform poorly, or are not fully demonstrated may be eliminated in the screening process.

5.1.1 Technology Identification and Screening for SWMUs 6 and 7 Technologies are identified to address petroleum-contaminated sludge and soil at SWMUs 6 and 7 that is the source of LNAPL and to remove recoverable LNAPL. Table 5-1 provides the technology identification and screening for sludge and soil at SWMUs 6 and 7, and Table 5-2 provides the technology identification and screening for LNAPL.

5.1.2 Technology Identification and Screening for SWMU 15 Technologies were identified to address pesticide-contaminated soil at SWMU 15. Table 5-3 provides the technology identification and screening for soil at SWMU 15.

5.2 DEVELOPMENT OF CORRECTIVE ACTION ALTERNATIVES. Corrective action alternatives are identified in this Section. Alternatives are identified based on CAOs, using the technologies that passed the screening step in Section 5.1. Each alternative identified adequately addresses SWMU-related contamination and CAOs.

Tables 5-4 and 5-5 present the alternatives identified for sludge and soil and LNAPL at SWMUs 6 and 7. These tables also present a description of the various components of each alternative. Alternatives addressing contaminated media at SWMUs 6 and 7 are labeled "Alternatives 6 and 7-x." Alternatives 6&7-1 through 6&7-3 are applicable to contaminated sludge and soil at the SWMUs. Alternatives 6&7-4 through 6&7-6 are applicable to LNAPL recovery at the SWMUs.

Table 5-6 presents the alternatives identified for soil at SWMU 15. This table also presents a description of the various components of each alternative. Similar to the labelling of alternatives for SWMUs 6 and 7, alternatives for SWMU 15 are labeled "Alternative 15-x."

**Table 5-1**
**Corrective Action Technologies, Sludge and Soil at SWMUs 6 and 7**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Technology | Description | Applicability to SWMUs 6 and 7 |
|---|---|---|
| **Containment** | | |
| Capping | A low-permeability material (i.e., clay, soil, asphalt, or synthetic membrane) is placed over the site, providing a barrier to infiltration. In this manner, rainwater infiltration is reduced so that LNAPL is no longer leaching from petroleum-contaminated sludge and soil. | Not applicable. Capping alone would not sufficiently prevent the generation of LNAPL. Petroleum-contaminated sludge and soil must be removed or treated to eliminate the source of LNAPL. |
| **Treatment (*In situ*)** | | |
| Soil Vapor Extraction | Wells are installed at the site and a vacuum is applied to the wells. Vapor from pore spaces in the soil is collected and treated prior to release to the atmosphere. | Not applicable. Area is not conducive to soil vapor extraction because of the high water table and high daily and seasonal fluctuations in water table elevation. This limits the thickness of the unsaturated zone and the effectiveness of the technology. |
| Biodegradation | Nutrients and amendments are added to the sludge and soil in place to promote biodegradation of contaminants. Injection wells or perforated pipes can be used to perform this task. This technology can be conducted under aerobic or anaerobic conditions, depending on the contaminant and specific soil parameters. Petroleum-contaminated soil is generally more amenable to aerobic biodegradation. | Not applicable. Although *in situ* biodegradation would treat contaminated sludge and soil so that LNAPL would no longer be generated at the SWMUs, the treatment would require several years. Removal or *ex situ* treatment would be preferred. |
| **Treatment (*Ex situ*)** | | |
| Onsite Thermal Treatment | Contaminated sludge and soil is excavated, and heat is applied to vaporize or destroy organic contaminants. Thermal treatment can be conducted at varying temperatures. Off-gases and solid residuals are generated through thermal treatment and must be treated or disposed of. Examples of thermal treatment include: incineration, pyrolysis, and thermal desorption. | Applicable. Thermal desorption will be implemented at SWMUs 6 and 7 under the NELP program. Technology is viable, innovative, and relatively inexpensive to operate ($30/ton). |
| Onsite Biotreatment | Sludge and soil are excavated and mixed with nutrients and amendments to promote biodegradation of organic contaminants. The soil mixture is placed in piles, where it is periodically aerated to ensure an optimal temperature and oxygen content. The piles can be aerated either by overturning the piles or by blowing air into each pile. The soil mixture would be monitored to ensure optimum conditions are maintained. | Applicable. *Ex situ* aerobic biotreatment is a proven technology for petroleum-contaminated sludge and soil. |
| Offsite Soil Recycling | Sludge and soil are excavated and transported offsite for treatment and subsequent reuse. Standard asphalt batching equipment is similar to thermal treatment; organic contaminants are vaporized or destroyed through application of heat. Treated soil is used in asphalt production. | Applicable. Offsite soil recycling is a proven technology for petroleum-contaminated sludge and soil. This alternative also represents an option for beneficial reuse. |

See notes at end of table.

**Table 5-1 (Continued)**
**Corrective Action Technologies, Sludge and Soil at SWMUs 6 and 7**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Technology | Description | Applicability to SWMUs 6 and 7 |
|---|---|---|
| Offsite Landfilling | Sludge and soil are excavated and transported to an offsite landfill. | Not applicable. Landfilling is a viable alternative for addressing petroleum-contaminated sludge and soil at the site. However, landfilling transfers the contaminants to an offsite location, and liability is still assumed by the Navy. Soil recycling would be preferred. |

Notes: SWMU = Solid Waste Management Unit
LNAPL = light, non-aqueous phase liquid
NELP = Navy Environmental Leadership Program

## Table 5-2
## Corrective Action Technologies, LNAPL at SWMU 6 and 7

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Technology | Description | Applicability to SWMUs 6 and 7 |
|---|---|---|
| **Collection** | | |
| Sumps | Large diameter sumps (1m) are installed within the zone of recoverable LNAPL. The sump is designed so the screen is long enough to accommodate water level fluctuations. The sump screen is sized to maximize the recovery of LNAPL. Because sumps alone have a small radius of influence, a recovery system that induces the flow of LNAPL into the sumps is commonly used. | Applicable. An IM that uses sumps to collect LNAPL is currently being implemented at SWMUs 6 and 7. |
| Trenches | Trenches are used for LNAPL recovery or to act as a boundary to LNAPL migration. Trenches are installed across the migration path of the LNAPL or ahead of the LNAPL plume. The trenches are installed deep enough to accommodate water level fluctuations. LNAPL is recovered as it collects in the trenches. | Applicable. Trenches could be used to collect LNAPL and prevent migration at SWMUs 6 and 7. Although several underground utilities are present in the vicinity of the SWMUs, locations exist where trenches could be installed. A geophysical survey would be required to ascertain the location of any utilities in the area. |
| Horizontal Wells | Horizontal wells are installed in the LNAPL zone using special drilling equipment. The wells may span the entire length or width of the LNAPL plume. | Not Applicable. Horizontal wells would most likely be ineffective because of daily and seasonal fluctuations in the water table elevation. |
| Vertical Wells | Vertical wells are installed using standard drilling equipment. The wells are screened from above the LNAPL down into the groundwater. Screens are long enough to accommodate water level fluctuations. Because vertical wells alone have a small radius of influence, a recovery system that induces the flow of LNAPL into the sumps is commonly used. | Applicable. Vertical wells have been used successfully at other sites and could be used to collect LNAPL at SWMUs 6 and 7. |
| Groundwater Drawdown | Pumps are placed in wells or sumps below the LNAPL and used to pump groundwater. The cone of depression caused by the pumping induces LNAPL flow into the well or sump. | Applicable. Groundwater pumping has been used successfully at other sites and could be used to induce LNAPL flow into the collection system. |
| **Recovery** | | |
| Total Fluids Pumping | Pumps recover both LNAPL and groundwater. LNAPL is later separated from the water. This system can be used to induce flow of LNAPL into the collection system by creating a steeper hydraulic gradient. | Applicable. An IM that uses a total-fluids sump collection system is currently being implemented at SWMUs 6 and 7. |
| LNAPL Skimming | Skimming pumps float at the interface between LNAPL and groundwater. LNAPL enters the pump through a specially treated screen that repels water. These pumps may reduce the LNAPL layer to 0.1 inch. Skimming pumps are most successfully employed where LNAPL readily flows into the collection system. | Applicable. Skimming could successfully recover LNAPL at SWMUs 6 and 7. |

See notes at end of table.

## Table 5-2 (Continued)
## Corrective Action Technologies, LNAPL at SWMU 6 and 7

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Technology | Description | Applicability to SWMUs 6 and 7 |
|---|---|---|
| **Recovery** (Continued) | | |
| Vacuum Enhanced Recovery | A vacuum is applied to a well, resulting in an increase in the piezometric gradient of LNAPL and water without changing the elevation of the water table. | Applicable. Enhanced vacuum recovery may successfully augment an LNAPL recovery system at SWMUs 6 and 7. |
| **Treatment** | | |
| Existing OWTP | The OWTP consists of gravity separation, rapid-mix flocculation, clarification, neutralization, and discharge to the FOTW. | Applicable. The OWTP is currently being used to treat the total fluids recovered from SWMUs 6 and 7. |

Notes: LNAPL = light nonaqueous-phase liquids.
SWMU = Solid Waste Management Unit.
m = meter.
IM = Interim Measures.
OWTP = Oily Waste Treatment Plant.
FOTW = Federally Owned Treatment Works.

## Table 5-3
## Corrective Action Technologies, Soil at SWMU 15

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Technology | Description | Applicability to SWMU 15 |
|---|---|---|
| **Containment** | | |
| Semipermeable Cover | A semipermeable cover material (e.g., soil, asphalt, or a geotextile covered with gravel) is placed over the site to prevent exposure to contaminants through direct contact. | Applicable. Capping would prevent human and ecological receptor exposure to pesticide contaminants in soil. |
| Impermeable Cover | An impermeable cover material (e.g., geomembrane or clay) is placed over the site to prevent exposure to contaminants through direct contact and to prevent groundwater infiltration and leaching. | Not Applicable. Surface soil contamination by pesticides is not a continuing source of groundwater contamination, as indicated by leaching models. |
| Stabilization | Contaminated soil is mixed with a settling agent, such as fly ash or cement, to immobilize contaminants. The cement or fly ash binds with soil to prevent leaching and other forms of contaminant migration. This technology could be performed *in situ* or *ex situ*. Most widely used on sites containing inorganics, however it could be used on semivolatile and nonvolatile organics. | Not applicable. Stabilization has not been widely tested on pesticide-contaminated soil, and therefore the effectiveness of this technology is questionable. |
| **Treatment (*In situ*)** | | |
| Soil Flushing | An aqueous solution containing a solvent, surfactant, or water is added to or flushed through the contaminated soil. This process can be performed *in situ* or *ex situ*. Contaminants adhering to soil particles are removed through a scrubbing action. In this manner the contaminants are transferred to the fine soil particles, or the aqueous solution. The fines and solution are separated from the larger soil particles through a screening process. The contaminated fines and solution require treatment or disposal. If performed *in situ*, the scrubbing action is generated through natural movement of the solution through the soil. | Not applicable. Effectiveness of technology for treating pesticide contaminants has not been proven. Also, fines and spent solution require treatment. Soil must have specific percentage of fines for treatment to be effective. |
| Biodegradation | Nutrients and amendments are added to the soil area to promote biodegradation of contaminants. Injection wells or perforated pipes can be used to introduce the nutrients and amendments to the site. Can be conducted under aerobic or anaerobic conditions depending on the contaminant and specific soil parameters. Monitoring is necessary to ensure optimum conditions are present. | Applicable. *In situ* biodegradation is being implemented at SWMU 15 under NELP. |
| **Treatment (*Ex situ*)** | | |
| Onsite Dechlorination | During dechlorination, highly chlorinated organic contaminants such as polychlorinated biphenyls (PCBs), dioxins, and some pesticides, undergo a chemical reaction that removes chlorine atoms from the chemical structure. The chemical reagent usually consists of an alkali metal and a glycolytic substance. The end result of the process is a salt (containing the alkali metal and chlorine) and a less-chlorinated compound that is typically less hazardous to human and ecological receptors. The process still creates wastewater and treated soil which both require testing and further treatment. | Not applicable. Dechlorination has not been widely tested on pesticides. Process creates potentially hazardous residuals requiring treatment. Soil would require further treatment after the process. |

See notes at end of table.

## Table 5-3 (Continued)
## Corrective Action Technologies, Soil at SWMU 15

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Technology | Description | Applicability to SWMU 15 |
|---|---|---|
| **Treatment (*Ex Situ*)** (Continued) | | |
| Onsite Thermal Treatment | Heat is applied to contaminated soil either to vaporize or destroy organic contaminants. Thermal treatment can be conducted at varying temperatures. Off-gases and solid residuals are generated through thermal treatment and must be treated or disposed of. Examples of thermal treatment include incineration, pyrolysis, and thermal desorption. | Not applicable. Based on the small quantity of soil to be treated at SWMU 15, it would not be cost-effective to mobilize an onsite thermal treatment unit. |
| Onsite Biotreatment | Soil is excavated and combined with a nutrient source to biodegrade organic contaminants. The soil mixture can be placed in piles (biopiles) or spread evenly over a large land area (landfarming). Bioremediation can be conducted aerobically or anaerobically depending on specific contaminant requirements and microorganisms indigenous to the soil. If aerobic conditions are necessary, the soil mixture must be aerated either by overturning the soil mixture or by blowing air into the mixture. If anaerobic conditions are necessary, the soil mixture may need to be flooded. In order to ensure optimum conditions, the soil mixture must be monitored for proper temperature, food source, and oxygen content. | Applicable. *Ex situ* biotreatment is an innovative treatment technology for soil sites contaminated with pesticides. The effectiveness of bioremediation of pesticide contaminated soil has recently been proven in laboratory studies. |
| Offsite Incineration | Soil is excavated and transported to an offsite disposal facility. Depending on concentrations of contaminants in the soil, pretreatment may be required. | Applicable. Contaminants would be removed, thus reducing the risk of exposure of human and ecological receptors to pesticide-contaminated soil. |

Notes: SWMU = Solid Waste Management Unit.
NELP = Navy Environmental Leadership Program.
PCB = polychlorinated biphenyl.

## Table 5-4
## Corrective Action Alternatives, Sludge and Soil at SWMUs 6 and 7

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Alternative | Key Components | Description |
|---|---|---|
| **Alternatives 6 and 7-1**<br>**Onsite Thermal Desorption** | Excavate uncontaminated soil and stockpile.<br><br>Mobilize thermal desorption unit.<br><br>Excavate contaminated sludge and soil.<br><br>Stockpile contaminated soil at treatment unit.<br><br>Treat soil via thermal desorption.<br><br>Sample and analyze treated soil.<br><br>Backfill treated and uncontaminated soil.<br><br>Demobilize treatment unit and restore site.<br><br>Close SWMUs. | Under this alternative, a mobile thermal desorption unit would be mobilized to the site. Uncontaminated sludge and soil would be excavated and stockpiled for future use as backfill material. Contaminated soil (i.e., visually contaminated soil) would be excavated and treated via thermal desorption. Treated soil would be sampled and analyzed to ensure compliance with treatment levels, and then would be backfilled in the excavation. Once contaminated soil has been treated, the thermal desorption unit would be demobilized and the SWMUs would be closed in accordance with RCRA requirements. |
| **Alternatives 6 and 7-2**<br>**Onsite, *Ex situ* Biotreatment** | Construct engineered biotreatment cell.<br><br>Excavate uncontaminated sludge and soil and stockpile.<br><br>Excavate contaminated soil and place in biotreatment cell.<br><br>Add water, nutrients, and air to treatment cell to promote aerobic biodegradation.<br><br>Sample and analyze treated soil.<br><br>Backfill excavation with treated and uncontaminated soil.<br><br>Demobilize and restore site.<br><br>Close SWMUs. | Under this alternative, a lined biological treatment cell would be constructed. Uncontaminated soil would be excavated and stockpiled for future use as backfill material. Contaminated sludge and soil would be excavated and placed in the treatment cell to promote biological treatment of contaminants. Air, water, and nutrients would be mixed in the cell to promote aerobic biodegradation. Soil would be sampled and analyzed to ensure compliance with treatment levels, and then would be backfilled in the excavation. Once contaminated soil has been treated, the treatment cell would be demobilized and the SWMUs would be closed in accordance with RCRA requirements. |

See notes at end of table.

**Table 5-4 (Continued)**
**Corrective Action Alternatives, Sludge and Soil at SWMUs 6 and 7**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Alternative | Key Components | Description |
|---|---|---|
| **Alternatives 6 and 7-3** Offsite Soil Recycling | Excavate uncontaminated soil and stockpile.<br><br>Excavate contaminated sludge and soil.<br><br>Transport contaminated soil to permitted offsite soil recycling facility.<br><br>Backfill excavation with uncontaminated soil.<br><br>Demobilize and restore site.<br><br>Close SWMUs. | Uncontaminated soil would be excavated and stockpiled for future use as backfill material. Contaminated sludge and soil would be excavated and transported offsite to a permitted soil recycling facility for treatment. The excavation would be backfilled with uncontaminated soil. Once contaminated soil has been removed, the SWMUs would be closed in accordance with RCRA requirements. |

Notes: SWMU = Solid Waste Management Unit.
RCRA = Resource Conservation and Recovery Act.

## Table 5-5
## Corrective Action Alternatives, LNAPL at SWMU 6 and 7

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Alternative | Components | Description |
|---|---|---|
| **Alternatives 6 and 7-4** Sumps with Total Fluids Pumping | Maintain existing sumps.<br>Pump fluids (i.e., groundwater and LNAPL) from sump.<br>Treat fluids at OWTP. | Sumps are currently used to collect the LNAPL. The sump screen extends from above the LNAPL to several feet below the water table. A total fluids pump is installed near the oil-water interface, which recovers LNAPL that collects in the sump along with groundwater. The fluids are pumped to the OWTP where they are treated. |
| **Alternatives 6 and 7-5** Trenches with LNAPL Skimming | Install trenches.<br>Skim LNAPL.<br>Treat recovered LNAPL at OWTP. | Trenches are used to collect additional LNAPL. The trenches are installed across the migration path of the LNAPL and extend several feet below the water table. Skimming pumps with screens that repel water but allow the LNAPL to pass through are used to recover the LNAPL that collects in the trenches. Recovered LNAPL is then treated in the existing OWTP. |
| **Alternatives 6 and 7-6** Sumps with Groundwater Drawdown and LNAPL skimming | Install additional sumps or wells, as required.<br>Induce vacuum enhanced recovery, as required.<br>Pump water to promote drawdown in the vicinity of the sumps.<br>Skim LNAPL.<br>Treat LNAPL at OWTP<br>Treat groundwater at FOTW. | Sumps are currently used to collect the LNAPL. The sump screen extends from above the LNAPL to several feet below the water table. Groundwater is pumped to create a cone of depression. The groundwater cone of depression induces the flow of LNAPL into the well. Skimming pumps are used to recover LNAPL that collects in the well. Recovered LNAPL is treated at the OWTP. Groundwater extracted from the well is sent to the station's FOTW. |

Notes: SWMU = Solid Waste Management Unit.
LNAPL = light nonaqueous-phase liquids.
OWTP = Oily Waste Treatment Plant.
FOTW = Federally Owned Treatment Work.

## Table 5-6
## Corrective Action Alternatives, Soil at SWMU 15

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Alternative | Key Components | Applicability to SWMU 15 |
|---|---|---|
| **Alternative 15-1: Offsite Incineration** | Excavate contaminated soil.<br><br>Sample and analyze soil in open excavation.<br><br>Transport excavated soil to a permitted offsite incineration and disposal facility.<br><br>Backfill excavated area with clean borrow or native soil.<br><br>Demobilize and restore site.<br><br>Sample groundwater and perform potable water supply well survey. Review results.<br><br>Close SWMU. | Contaminated soil will be excavated and removed from the site. The excavation will be sampled to verify that soil contaminated with 4,4'-DDT and chlordane above MPSs has been removed. The excavated soil will be transported offsite and incinerated at an approved RCRA Subtitle C incineration facility. The excavated area will be backfilled with a clean fill material, either native soil (onsite source) or borrow material, and seeded and fertilized. The groundwater will be sampled to define the extent of BHC in the surficial aquifer. A potable water well survey will be conducted to ascertain if humans are consuming the water. Administrative activities will be conducted to close the SWMU. |
| **Alternative 15-2: Semipermeable Cover** | Obtain deed restriction.<br><br>Construct cover (geotextile and gravel cap).<br><br>Demobilize and restore site.<br><br>Sample groundwater and perform potable water supply well survey. Review results.<br><br>Close SWMU. | Use restrictions will be implemented to prevent excavation and other unacceptable uses of the land. A cap will be constructed consisting of gravel over geotextile to prevent dermal contact with soil. The geotextile will serve as a marker to indicate erosion of protective gravel. The gravel will prevent dermal contact by humans and ecological receptors, and will be used as a parking lot for the station. Groundwater sampling, potable water well survey, and closure of the SWMU are described in Alternative 15-1. |

See notes at end of table.

## Table 5-6 (Continued)
## Corrective Action Alternatives, Soil at SWMU 15

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Alternative | Key Components | Applicability to SWMU 15 |
|---|---|---|
| **Alternative 15-3: Onsite Biotreatment** | Construct lined treatment cell.<br><br>Rototill contaminated soil *in situ* and add nutrients and amendments.<br><br>Excavate contaminated soil and place in lined treatment cell.<br><br>Sample and analyze soil within the open excavation.<br><br>Add water and other nutrients to treatment cell to promote anaerobic biotreatment.<br><br>Remove water from treatment cell and add air to the system to promote aerobic biotreatment.<br><br>Sample and remove treated soil.<br><br>Backfill open excavation areas with the treated soil or clean borrow material.<br><br>Demobilize and restore site.<br><br>Sample groundwater and perform potable water supply well survey. Review results.<br><br>Close SWMU. | A lined biotreatment cell will be constructed consisting of a high-density polypropylene liner, a gravel drainage layer, and a water recirculation system. The areas of soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs will be rototilled, and nutrients and amendments will be added during construction of the treatment cell to promote biological growth and begin acclimation. The cell will be used for biodegradation under anaerobic-aerobic conditions. The soil remaining in the open excavation will be sampled to verify that soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs is removed. After the soil is placed in the treatment cell, water amended with nutrients will be added to promote anaerobic conditions for degradation of 4,4'-DDT and chlordane. When concentrations of 4,4'-DDT and chlordane are reduced to concentrations below MPSs, the water will be removed from the cell and air will be added to the soil mixture to promote aerobic conditions. This step will degrade the by-products formed during anaerobic degradation. The soil will then be tested and removed from the treatment cell to ensure that contaminants are reduced to appropriate levels. Excavated areas will be backfilled with the treated soil and borrow material, and seeded and fertilized. Groundwater sampling, potable water well survey, and closure of the SWMU are described in Alternative 15-1. |

Notes: SWMU = Solid Waste Management Unit.
DDT = dichlorodiphenyltrichloroethane.
MPS = media protection standard.
RCRA = Resource Conservation and Recovery Act.
BHC = benzene hexachloride.

## 6.0 DESCRIPTION AND EVALUATION OF CORRECTIVE ACTION ALTERNATIVES

This Chapter presents the description and evaluation of corrective action alternatives for SWMUs 6, 7, and 15 at NAVSTA Mayport. An evaluation of each alternative, based on technical, environmental, human health, and institutional criteria, is included in this Chapter to provide sufficient information to select an appropriate corrective action for SWMUs 6, 7, and 15.

**6.1 APPROACH TO EVALUATION OF ALTERNATIVES.** The CMS workplan for NAVSTA Mayport provided the methodology for the description and evaluation of corrective action alternatives.

The description of each alternative includes, where appropriate, a preliminary site layout plan, additional engineering data required, permits and regulatory requirements, access, easements, rights-of-way, health and safety requirements, general operation and maintenance (O&M) requirements, long-term monitoring requirements, community relations activities, and details on project schedule.

Each corrective action alternative is then evaluated based on four criteria. These criteria are described in Table 6-1.

A cost estimate is developed for each corrective action alternative. The cost estimate includes both capital and O&M costs (Table 6-2).

**6.2 CORRECTIVE ACTION ALTERNATIVES FOR SWMUS 6 AND 7.** This Section presents the description and evaluation of corrective action alternatives for sludge and soil (hereafter referred to as soil) at SWMUs 6 and 7 (Subsection 6.2.1) and for LNAPL at SWMUs 6 and 7 (Subsection 6.2.2).

Prior to initiating corrective action for SWMUs 6 and 7, the following pre-construction documentation would be prepared and reviewed:

- design plans and specifications, as required,
- site-specific health and safety plan,
- site-specific quality assurance/quality control (QA/QC) plan,
- confirmatory sampling and analysis plan, and
- air emissions evaluation and permit documentation (if necessary).

**6.2.1 Alternatives 6 and 7-1: Onsite Thermal Desorption** This alternative would consist of removal of contaminated soil, onsite thermal desorption of excavated contaminated soil, and backfilling of treated soil in the excavation.

6.2.1.1 **Description** Major activities associated with this alternative include:

- site preparation,
- sampling and analysis of untreated soil,
- soil-handling activities,
- mobilization of thermal desorption unit,
- thermal desorption of contaminated soil,
- sampling and analysis of treated soil, and
- site restoration and demobilization.

## Table 6-1
## Evaluation Criteria for Corrective Action Alternatives

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criteria | Component | Description |
|---|---|---|
| Technical | Performance | Each corrective action alternative will be evaluated for performance based on the effectiveness and useful life of the alternative:<br><br>Effectiveness The ability of each alternative to perform intended functions (e.g., containment, diversion, removal, destruction, or treatment) will be evaluated. This will be determined either through design specifications or by performance evaluation. Any specific waste or site characteristics that could potentially impede effectiveness will be considered. The evaluation should also consider the effectiveness of combinations of technologies.<br><br>Useful life Useful life is defined as the length of time the level of desired effectiveness can be maintained. Most alternatives, with the exception of destruction, deteriorate with time. Often, deterioration can be slowed through proper system O&M, but the alternative eventually may require replacement. Each alternative will be evaluated in terms of the projected service lives of its component technologies. Future resource availability of the alternative, as well as appropriateness of the technologies, must be considered in estimating the useful life of the project. |
| | Reliability | Each corrective action alternative will be evaluated for reliability based on their O&M requirements and their demonstrated reliability:<br><br>O&M O&M requirements will be identified for each alternative and include identifying the frequency and complexity of necessary O&M activities. Alternatives requiring frequent or complex O&M activities will be regarded as less reliable than alternatives requiring minimal O&M. The availability of labor and materials to meet these requirements will also be considered.<br><br>Demonstrated Reliability Each alternative will be evaluated based on the risk and effect of failure of the component technologies. Other items that will be considered for reliability include whether alternatives have been used effectively under similar conditions, whether the combination of technologies have been used together effectively, whether failure of any one technology has an immediate impact on receptors, and whether the technologies have the flexibility to adjust to uncontrollable changes at the site. |
| | Implementability | Each corrective action alternative will be evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve CAOs.<br><br>Constructability is determined by conditions both internal and external to the facility conditions and include such items as location of underground utilities, depth to water table, heterogeneity of subsurface materials, and location of the facility (i.e., remote location versus a congested urban area). Each alternative will be evaluated to determine measures that could be taken to facilitate construction under these conditions.<br><br>Time Each alternative will be evaluated for time for two components: the time it takes to implement an alternative and the time it takes for the benefits (reduction of contaminants to acceptable, pre-established levels) to be achieved. |
| | Safety | Each corrective action alternative will be evaluated for safety by determining the relative threats to the safety of nearby communities and environments as well as those to workers during implementation. Factors that will be considered include fire, explosion, and exposure to hazardous substances. |

See notes at end of table.

**Table 6-1 (Continued)**
**Evaluation Criteria for Corrective Action Alternatives**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criteria | Component | Description |
|---|---|---|
| Environmental | -- | The evaluation of each alternative will include an Environmental Assessment. This assessment will focus on the facility conditions and pathways of contamination addressed by each alternative and include an evaluation of the short- and long-term effects of the response alternative, adverse effects of the response alternative, adverse effects on environmentally sensitive areas, and an analysis of measures to mitigate adverse effects. |
| Human Health | -- | Each alternative will be evaluated to determine the extent to which it mitigates short- and long-term potential exposure to residual contamination and protects human health both during and after implementation. This evaluation will include a description of the concentrations and characteristics of the contaminants onsite, potential exposure routes, and potentially affected populations; a determination of the level of exposure to contaminants and the reduction over time; and, for management of migration alternatives (i.e., groundwater alternatives), the relative reduction of impact will be determined by comparing residual levels of contaminants to existing criteria, standards, or guidelines acceptable to U.S. Environmental Protection Agency (USEPA). |
| Institutional | -- | The relative institutional needs for each alternative will be evaluated. Specifically, this evaluation includes the effects of Federal, state, and local environmental and public health standards, regulations, guidance, advisories, ordinances, or community relations on the design, operation, and timing of each alternative. If the selected remedy is capping and closure in place, a notation will be made in the land deed. |

Notes: O&M = operation and maintenance.
CAO = Corrective Action Objective.
SWMU = solid waste management unit.

## Table 6-2
## Components of Cost Estimate for Each Corrective Action Alternative

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criteria | Component | | Description |
|---|---|---|---|
| Capital Costs | Direct | Construction Costs | Costs of materials, labor (including fringe benefits and worker's compensation), and equipment required to install the corrective measure. |
| | | Equipment Costs | Costs of treatment, containment, disposal and/or service equipment necessary to implement the action; these materials remain until the corrective action is complete. |
| | | Land and Site-Development Costs | Costs associated with purchase of land and development of existing property. |
| | | Buildings and Services Costs | Costs of buildings, utility connections, purchased services, and disposal. |
| | Indirect | Engineering Expenses | Costs of administration, design, construction supervision, drafting, and testing of corrective measure alternatives. |
| | | Legal Fees and License or Permit Costs | Administrative and technical costs necessary to obtain licenses and permits for installation and operation. |
| | | Start-up and Shake-down Costs | Costs incurred during corrective measure start-up. |
| | | Contingency Allowances | Funds to cover costs resulting from unforeseen circumstances, such as adverse weather conditions, strikes, and inadequate facility characterization. |
| O&M | – | Operating Labor Costs | Wages, salaries, training, overhead and fringe benefits associated with the labor for post-construction operations. |
| | | Maintenance, Materials and Labor Costs | Costs for labor, parts, and other resources required for routine maintenance of facilities and equipment. |
| | | Auxiliary Materials and Energy | Costs of such items as chemicals and electricity for treatment plant operations, water and sewer service, and fuel. |
| | | Purchased Services | Sampling costs, laboratory fees, and professional fees. |
| | | Disposal and Treatment Costs | Costs of transporting, treating, and disposing of waste materials, such as treatment plant residues generated during operations. |
| | | Administrative Costs | Costs associated with administration of corrective action O&M not included under other categories. |
| | | Insurance, Taxes, and Licensing Costs | Costs of such items as liability and sudden accident insurance; real estate taxes on purchased land or right-of-way; licensing fees for certain technologies; and permit renewal and reporting costs. |
| | | Maintenance Reserve and Contingency Funds | Annual payments into escrow funds to cover (1) costs of anticipated replacement or rebuilding of equipment and (2) any large unanticipated O&M costs. |
| | | Other Costs | Items that are not included in the above categories. |

Notes: O&M = operation and maintenance.
SWMU = Solid Waste Management Unit.

These activities are discussed in the following paragraphs. A site layout for this alternative is provided on Figure 6-1.

Site Preparation. Site preparation activities would include activities and construction prior to excavating contaminated soil at SWMUs 6 and 7.

The existing 6-foot chain-linked fence would be moved back to the perimeter of the excavation and exclusion area to limit public access during construction. Additional chain-linked fencing would be purchased and installed, as needed. Signs indicating "Contaminated Area" would be posted at 100-foot intervals.

Three monitoring wells (MPT-8-MW01S, MPT-8-MW02S, and MPT-8-MW03S) potentially require abandoning or replacing, as they are located within the excavation area (Figure 6-1). Well abandonment permits, if necessary, would be obtained prior to abandonment.

A decontamination pad would be constructed for decontamination of vehicles and equipment. This pad would be bermed and graded toward a sump for collection of decontamination fluid.

The thermal desorption unit requires water for operation. A 2-inch polyvinyl chloride (PVC) line would be connected to a fire hydrant. This line can provide up to 50 to 60 gpm of water.

Sampling and Analysis of Untreated Soil. In accordance with FAC 62-775, contaminated soil must be sampled prior to treatment. Soil samples would be collected and composited (four grab samples would be composited into one sample). The composite soil samples would be sent to an offsite laboratory for analysis of total volatile organic aromatics (VOAs), total recoverable petroleum hydrocarbons (TRPH), VOHs, and total metals. FAC 62-775 indicates that five composite soil samples must be analyzed for the first 1,000 cy of soil to be treated, and one composite soil sample must be analyzed for every 500 cy thereafter. Therefore, based on a contaminated soil volume of 25,100 cy, 54 composite soil samples would require analysis.

Soil Handling Activities. Uncontaminated soil would be excavated and stockpiled while contaminated soil is excavated and treated. A majority of uncontaminated soil would be used as backfill upon completion of treatment activities. The remaining uncontaminated soil could either be disposed of offsite or used as fill material onsite.

A decontamination pad would be constructed for decontamination of excavation equipment. Contaminated soil would be excavated and stockpiled for treatment (Figure 6-1). Soil in the open excavation that contains visible contamination (defined as obvious petroleum staining or an organic vapor reading using a flame ionizing detector (methodology described in FAC 62-770.200[2]) of 50 ppm or greater) would be excavated.

Excavation rates of contaminated soil would be controlled to match the thermal desorption unit's processing rate, resulting in a small stockpile area. Typical feed rates for a large, onsite thermal desorption unit are 30 to 40 tons per hour. Therefore, assuming operation of the thermal desorption unit for 24 hours per day, 7 days per week, it assumed that approximately 4,300 cy would be excavated weekly.

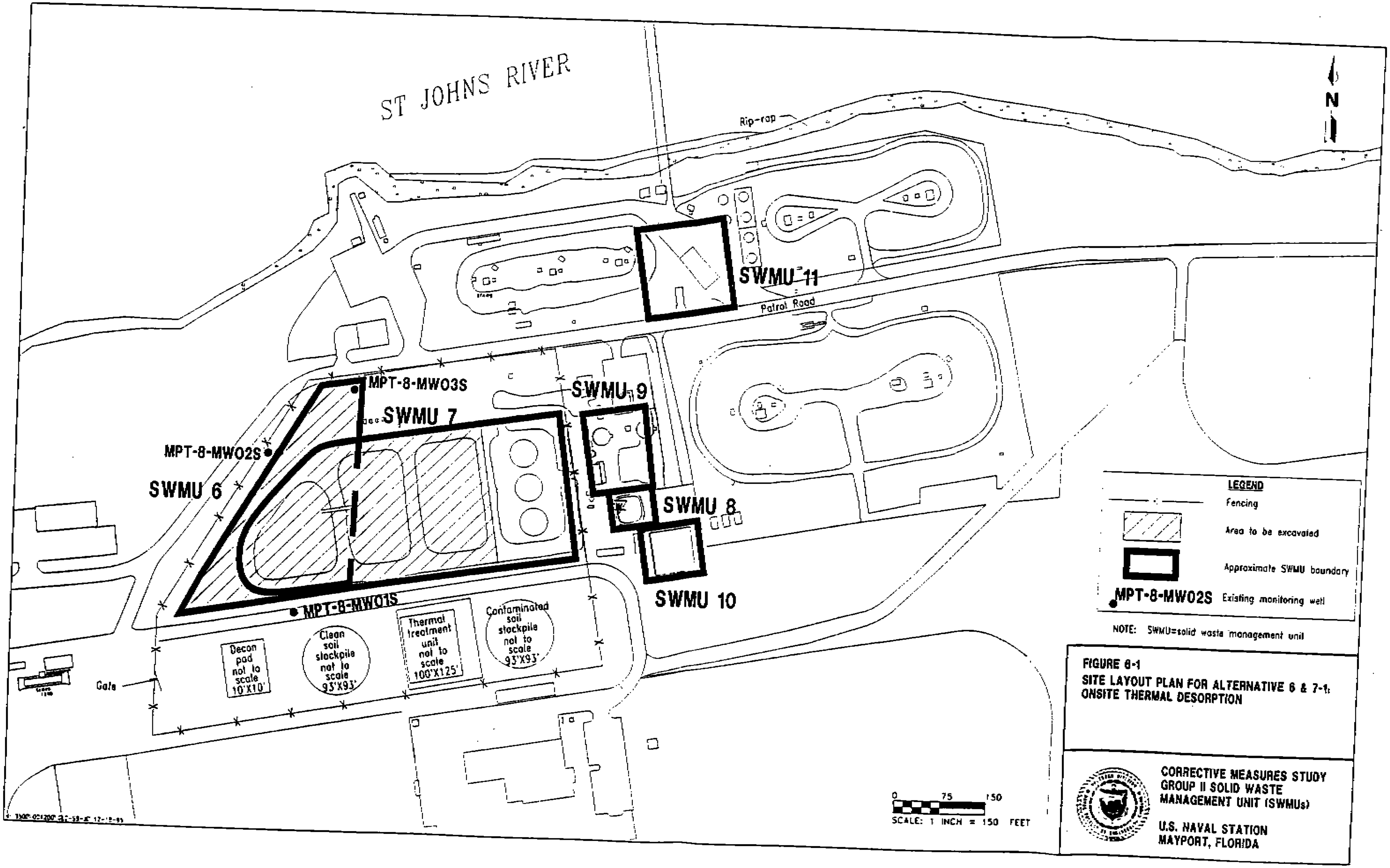



FIGURE 6-1
SITE LAYOUT PLAN FOR ALTERNATIVE 6 & 7-1: ONSITE THERMAL DESORPTION

CORRECTIVE MEASURES STUDY
GROUP II SOLID WASTE
MANAGEMENT UNIT (SWMUs)

U.S. NAVAL STATION
MAYPORT, FLORIDA

The stockpile area would be covered to prevent infiltration and percolation of rainwater through contaminated soil in compliance with FAC 62-775.

Mobilization of Thermal Desorption Unit. A thermal desorption unit would be mobilized and staged at the site. A level area approximately 100 feet long by 125 feet wide would be needed to stage the unit. A paved area, providing the surface area required, is located immediately south of the SWMUs, on the abandoned runway (see Figure 6-1). It is assumed that the thermal desorption unit could be staged at this location.

Thermal Desorption of Contaminated Soil. Thermal desorption has been applied to contaminated soil using a number of different approaches, including rotary dryers, indirect-fired dryers, modified asphalt batching equipment, and thermal screws. The basic components of these systems are similar, and the design for the thermal desorption unit for SWMUs 6 and 7 would be flexible enough to allow any of these systems to be implemented. A typical process flow diagram for thermal desorption is provided on Figure 6-2.

Contaminated soil would be fed into a hopper that meters soil through a screen (to remove particles greater than 2 inches in diameter) and into the primary treatment chamber to volatilize organic contaminants. Soil would be heated to temperatures high enough to volatilize petroleum contaminants in soil, but low enough to prevent combustion. Typical temperatures range from 250 to 1,000 degrees Fahrenheit (°F). The system would be fired with natural gas, propane, butane, or fuel oil.

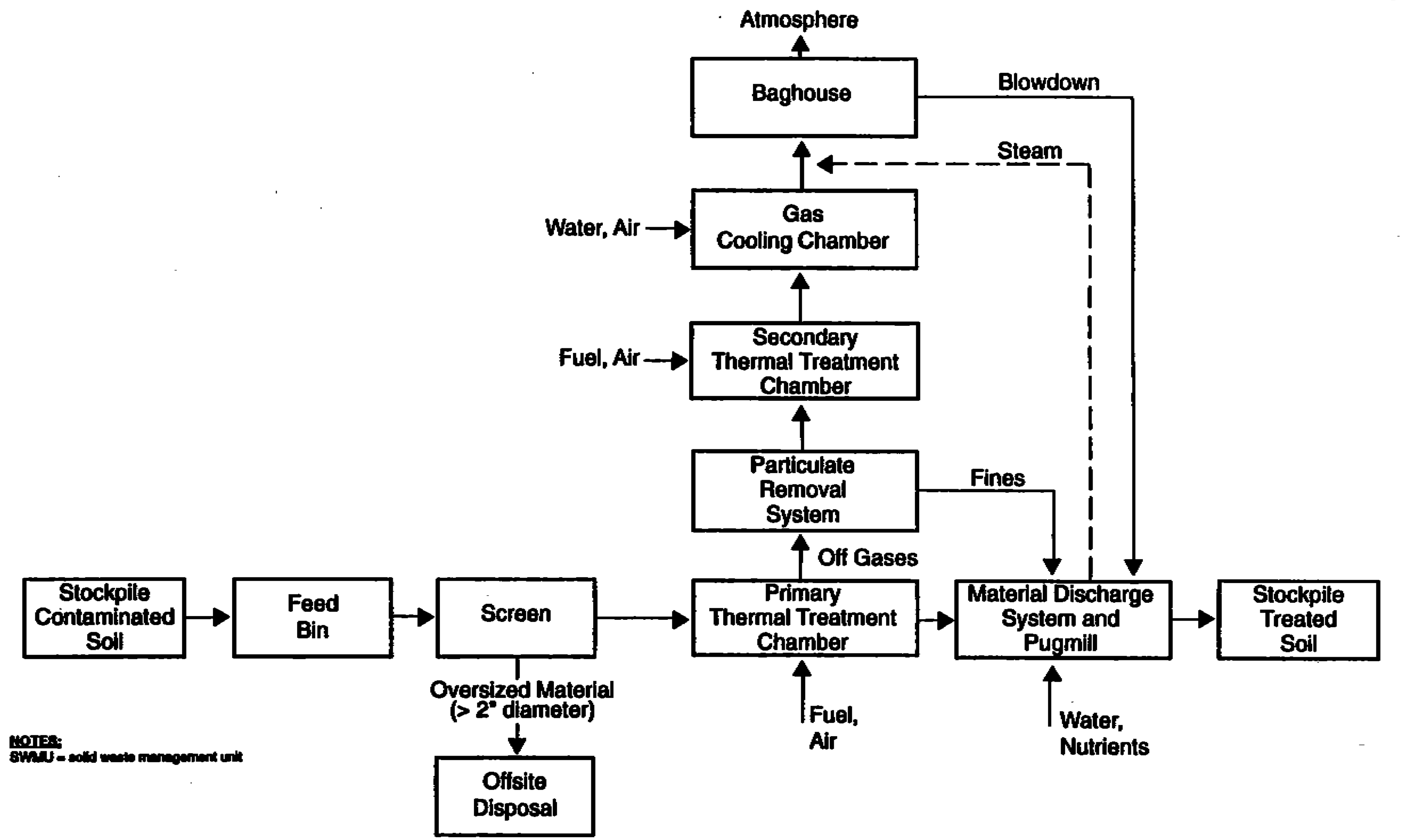
After soil passes through the primary treatment chamber, it would be discharged via a conveyor to a treated soil stockpile. A pugmill could be added prior to stockpiling for addition of water to control temperature and to reduce dust emissions.

Exhaust gases from the primary thermal treatment unit would pass through a particulate removal system (e.g., cyclone or baghouse) into a secondary treatment chamber. The secondary treatment chamber could be a thermal oxidizer. The oxidizer would be fueled with natural gas or oil and would be heated to 1,800 to 2,000 °F. Any remaining organics in the gas stream would be reduced to carbon dioxide and water in this chamber.

Gases exiting the secondary treatment chamber are cooled and filtered prior to discharge to the atmosphere. Particles removed during filtration are returned to the treated soil stockpile.

In addition to the unit itself, support equipment would include an office or change trailer. The only utility required by the thermal desorption unit would be water, at a rate of 50 to 60 gpm.

Sampling and Analysis of Treated Soil. Treated soil would be sampled prior to backfilling in accordance with FAC 62-775. This regulation states that soil samples should be collected on an hourly basis and composited over an 8-hour time period. Based on this, an estimated 1,008 grab samples would be collected and composited into 126 samples. Composite soil samples would be sent to an offsite laboratory for analysis of total VOAs, TRPH, VOHs, and total metals.




NOTES:
SWMU = solid waste management unit

FIGURE 6-2
TYPICAL PROCESS FLOW DIAGRAM
FOR THERMAL DESORPTION

CORRECTIVE MEASURES
STUDY, GROUP II SWMUs

U.S. NAVAL STATION
MAYPORT, FLORIDA

853329 MAY GROUPII CMS 121995MAW

If analytical results indicate concentrations above treatment levels (defined in Paragraph 4.2.2.1), soil exceeding treatment levels would be returned to the contaminated soil stockpile and retreated. If analytical results indicate a level below treatment levels, the soil would be stockpiled for use as backfill upon completion of excavation activities.

Site Restoration and Demobilization. After contaminated soil is treated, the excavation would be backfilled with a combination of treated soil and uncontaminated soil. The area would then be compacted, mulched, and seeded. Hay would be used to protect the seed and fertilizer during initial development. The thermal desorption unit would be demobilized from the site. Decontamination pad materials would be removed and either used elsewhere onsite or disposed of. Any decontamination water generated during this site cleanup would be drummed, sampled and analyzed, and disposed of. The water line would also be removed and reused or disposed of. Fencing at the site would be restored to its original configuration.

6.2.1.2 **Technical Criteria Evaluation** Alternatives 6 and 7-1 is evaluated in this paragraph based on performance, reliability, implementability, and safety of the alternative.

Performance. Alternatives 6 and 7-1 is evaluated for performance based on the effectiveness and useful life of the alternative.

*Effectiveness* Under this alternative, contaminated soil would be excavated and treated via thermal desorption. Removal and treatment of contaminated soil would eliminate the source of LNAPL present at the SWMUs. In this manner, this alternative would be effective in complying with COAs.

Overall performance of the alternative to achieve treatment levels would be evaluated through sampling and analysis of soil. Soil exiting the thermal desorption unit would be sampled and analyzed to ensure that treatment levels are achieved. Soil not meeting these standards would be returned to the contaminated soil stockpile and retreated.

No specific waste or site characteristics have been identified that could impede the effectiveness of this technology. A portion of contaminated soil will be treated via thermal desorption under the NELP program. Therefore, any design completed for Alternatives 6 and 7-1 could evaluate the overall effectiveness of the technology prior to implementation. Waste or site characteristics that impede progress at that time could be modified in the design of Alternatives 6 and 7-1.

*Useful Life* Destruction of contaminants in soil via thermal desorption would be permanent and irreversible. Contaminated soil would be removed and treated, and the source of LNAPL would be eliminated.

Reliability. Alternatives 6 and 7-1 is evaluated for reliability based on O&M requirements and its demonstrated reliability.

*O&M* O&M activities for this alternative include soil handling activities, treatment system monitoring, confirmatory soil sampling, and QA/QC personnel. These O&M activities are standard for corrective action; no unique O&M activities are required for this alternative.

Labor and materials to implement this alternative would be readily available. Because NELP will be conducting a technology demonstration by treating a portion of contaminated soil from SWMUs 6 and 7 via thermal desorption, a contractor would already be mobilized and prepared to treat the remainder of contaminated soil from the SWMUs. This contractor could remain onsite for continued treatment; however, this is dependant upon the success of the technology demonstration and contractual feasibility.

*Demonstrated Reliability* Thermal desorption would be a reliable technology, as it has been demonstrated to reduce contaminant concentrations at similar petroleum-contaminated soil sites. Several vendors are available that have systems that can accomplish treatment levels.

The treatment system design would be flexible to address uncontrollable changes at the site. The system would be monitored on a continuous basis to ensure that (Federal, State, and local) regulatory requirements for air emissions are met and to ensure that treated soil complies with treatment levels.

<u>Implementability</u>. Alternatives 6 and 7-1 is evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve the CAOs.

*Constructability* No assembly of the thermal desorption unit or construction of a staging area would be necessary if Alternatives 6 and 7-1 were implemented at SWMUs 6 and 7. The treatment unit would be assembled offsite, mobilized to the site, and staged on existing pavement located to the south of the SWMUs; utility hookups would be established; and the system would be operated. Therefore, this alternative would be considered easily constructed.

Excavation, transport, and storage of contaminated soil are standard tasks, and this site poses no unique technical challenge.

*Time* Site preparation activities, including construction of a decontamination pad with runoff control measures, excavation and staging of uncontaminated soil from the SWMUs, and installation of fencing are anticipated to require approximately 2 weeks. Treatment, based on a 7-day, 24-hours-per-day work week, is estimated to require approximately 6 weeks.

<u>Safety</u>. Impacts to the community or the environment during implementation of this alternative are not expected. The area would be fenced so that the community or station personnel would not have access to contaminated soil. Fugitive dust emissions would be controlled by covering and/or wetting soil.

Construction workers would conduct site work in an appropriate level of protectiveness during excavation and loading activities to minimize dermal contact and inhalation of airborne contaminants.

**6.2.1.3 Environmental Criteria Evaluation** Although an ecological risk assessment was not completed on surface or subsurface soil at SWMUs 6 and 7, implementation of this alternative would not adversely impact the environment.

**6.2.1.4 Human Health Criteria Evaluation** Although a human health risk assessment was not completed on surface or subsurface soil at SWMUs 6 and 7, implementation of this alternative would not adversely impact the community or occupational workers. The excavation and treatment area would be fenced, thereby limiting access to the site. Construction workers would implement an appropriate level of protectiveness for excavation and treatment activities.

6.2.1.5 **Institutional Criteria Evaluation** The only institutional requirement for Alternatives 6 and 7-1 would be preparing and obtaining approval for closure of SWMUs 6 and 7.

6.2.1.6 **Cost** A cost estimate for Alternatives 6 and 7-1 was developed and is summarized in Table 6-3. The estimate includes direct and indirect costs (capital costs) for construction, equipment, services, labor, purchased services, treatment of soil, analytical cost (based on requirements by FAC 62-775), engineering expenses, legal fees and permitting, administrative activities, and contingency allowances. Appendix C provides the backup information used to develop the cost estimate.

O&M costs are included in the capital cost estimate. This is because the alternative would be implemented in approximately 10 weeks, thus not invoking the necessity of a present worth analysis. Technical oversight of the thermal desorption contractor would be necessary for this alternative; however, long-term monitoring of the concentration of petroleum hydrocarbons or related organic compounds in soil and/or groundwater would not be required. It should be noted that the components for a groundwater and LNAPL monitoring program are included in each of the LNAPL recovery alternatives 6&7-4 through 6&7-6.

**6.2.2 Alternatives 6 and 7-2: Onsite, *Ex Situ* Biotreatment** This alternative would consist of excavating soil and treating the soil in an onsite biotreatment cell. If this alternative is selected for SWMUs 6 and 7, it would be recommended that additional field sampling and in-field analysis using methodology described in FAC 62-770.200(2) be performed to determine more concisely the extent of soil contamination, thereby enabling a more refined cost estimation of this alternative.

6.2.2.1 **Description** Alternatives 6 and 7-2 is an *ex situ* biotreatment process that would promote biodegradation of petroleum-related compounds in excavated soil under aerobic conditions. The primary advantage of utilizing *ex situ* biotreatment over *in situ* biodegradation is that it allows better control over soil conditions (e.g., moisture, pH adjustment, nutrient levels, and oxygen delivery).

Based on soil characteristics at the site, ease of implementation, field results, and reduced treatment system requirements, aerated soil pile (ASP) treatment would be the selected method for *ex situ* biotreatment. ASP treatment consists of creating optimal microbial conditions by providing oxygen and amendments to natural microorganisms in the excavated soil. ASP treatment typically occurs in a treatment cell that would be lined and bermed to prevent migration of contaminants.

Major activities associated with this alternative would include:

- site preparation,
- sampling and analysis of untreated soil,
- treatment pad construction,
- soil-handling activities,
- treatment system operation,

**Table 6-3**
**Cost Summary Table for Alternatives 6 and 7-1: Onsite Thermal Desorption**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $14,700 |
| Equipment | $7,000 |
| Soil Sampling and Analysis (Untreated Soil) | $104,200 |
| Thermal Treatment Unit | $1,047,200 |
| Soil Handling | $548,700 |
| Soil Sampling and Analysis (Treated Soil) | $71,000 |
| Site Restoration | $81,900 |
| Total Direct Cost (TDC) | $1,874,700 |
| | |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $37,500 |
| Administration and Permitting Fees (@ 2% of TDC) | $37,500 |
| Engineering and Design (@ 5% of TDC) | $93,700 |
| Construction Support Services (@ 10% of TDC) | $93,700 |
| Total Indirect Cost | $262,400 |
| | |
| **Total Capital Cost (Direct Cost plus Indirect Cost)** | $2,137,100 |
| Contingency on Capital Cost (@10% of Total Capital Cost) | $213,700 |
| | |
| Total Cost | $2,350,800 |

Notes: @ = at.
% = percent.

- sampling and analysis of treated soil,
- backfilling the excavation, and
- site restoration and demobilization.

These activities are discussed in the following paragraphs. A site layout for this alternative is provided on Figure 6-3.

Site Preparation. Site preparation would include activities and construction necessary prior to excavating contaminated soil.

The existing 6-foot chainlink fence would be moved back to the perimeter of the excavation and exclusion area to limit public access during construction. Additional chainlink fencing would be purchased and installed, as needed. Signs indicating "Contaminated Area" would be posted at 100-foot intervals.

Three monitoring wells (MPT-8-MW01S, MPT-8-MW02S, and MPT-8-MW03S) potentially require abandoning or replacing, as they are located within the excavation area (Figure 6-3). Well abandonment permits, if necessary, would be obtained prior to abandonment.

A decontamination pad would be constructed for decontamination of vehicles and excavation and soil-handling equipment. This pad would be bermed and graded toward a sump for collection of decontamination fluid.

Sampling and Analysis of Untreated Soil. A field sampling program would be initiated to concisely define the horizontal and vertical extent of soil contamination prior to implementing the corrective action alteration.

Treatment Pad Construction. An abandoned runway strip immediately south of SWMUs 6 and 7 could be used as the treatment area (see Figure 6-3). This runway strip would be modified into a treatment pad that would be large enough to biodegrade contaminated soil. The treatment pad would be approximately 1,000 feet long and 200 feet wide. Use of the existing runway strip would offset a portion of capital costs associated with *ex situ* biotreatment.

Treatment pad construction includes containment berm construction and water system construction (Figure 6-4). Berm construction includes installing 2- to 3-foot high concrete, Jersey barriers as retaining walls around the treatment pad. The barriers would be sealed together with concrete to create a seamless, impervious containment system. The runway surface would be sealed or lined, as required. The bermed treatment pad would be designed to control stormwater runoff or drainage from moisture addition. The height of the berm (i.e., 2 to 3 feet) would be sufficient to contain runoff from a 50-year, 24-hour storm event.

The water collection, storage, and delivery system would collect water from the treatment pad and redistribute it to the soil. A storage tank would be located onsite to collect and store excess water collected from major storm events. Water collection from the treatment pad could be accomplished through gravity drainage (slope of the pad) into one or more collection sumps. Collected water could then be transferred using sump pumps to the temporary storage tank. When required for soil irrigation, water from the storage tank could be delivered to the soil through a water distribution system composed of a pump, piping, and sprinkler heads.

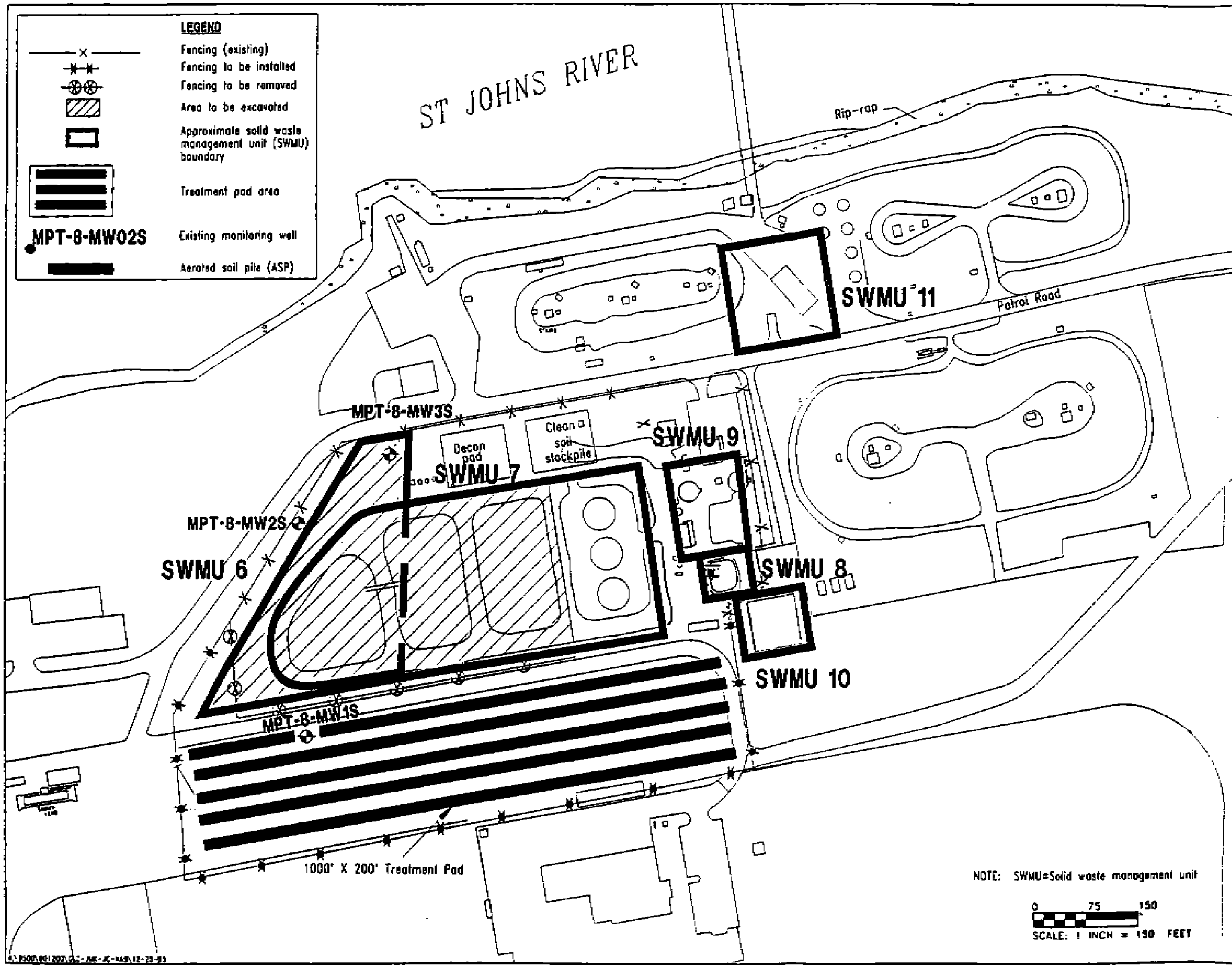
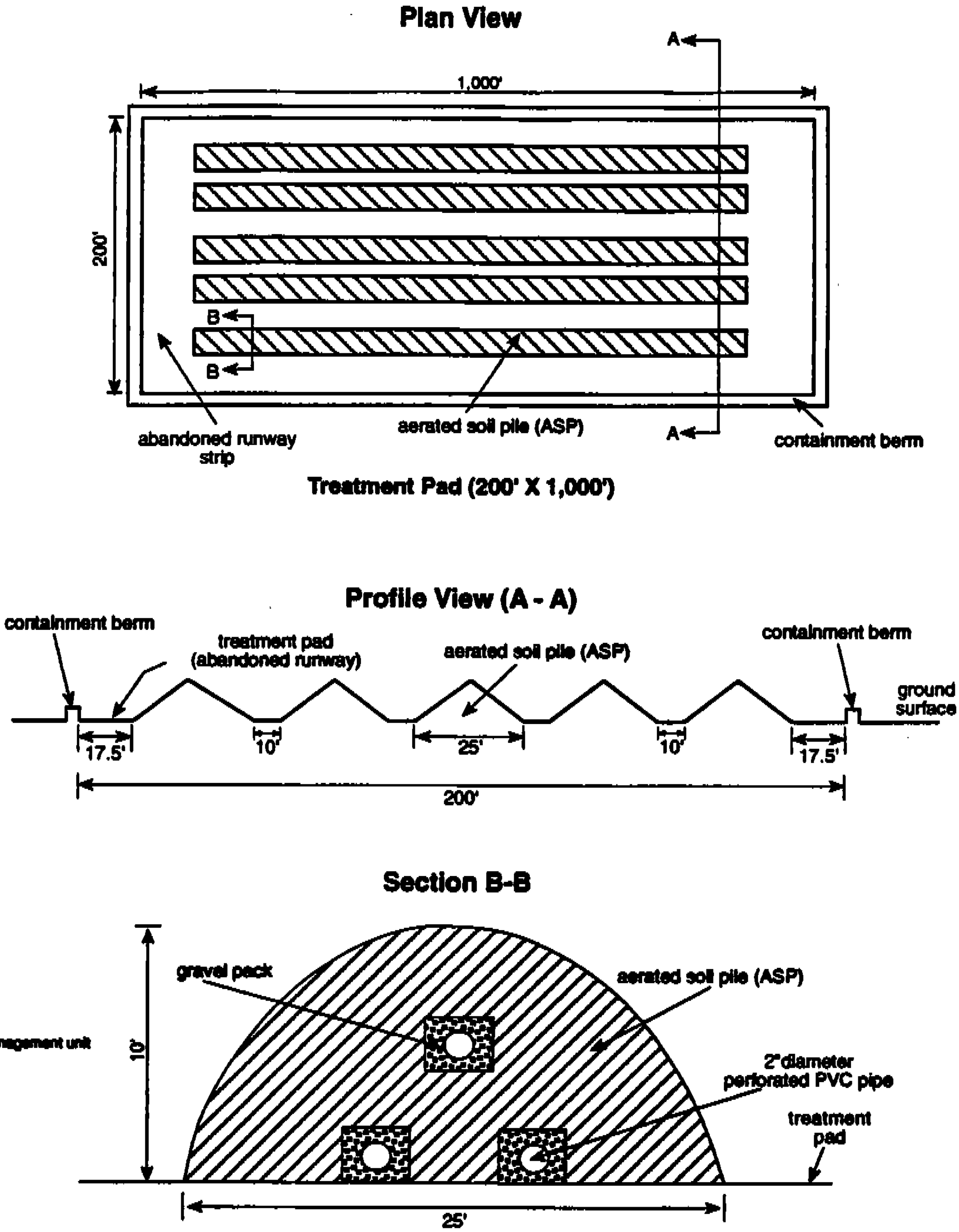



**FIGURE 6-3**
**SITE LAYOUT PLAN FOR ALTERNATIVE 6 AND 7-2: ONSITE *EX SITU* BIOTREATMENT**

CORRECTIVE MEASURES STUDY
GROUP II SWMUs

U.S. NAVAL STATION
MAYPORT, FLORIDA

# *Ex Situ* Biodegradation




NOTES:
ASP = aerated soil pile
PVC = polyvinyl chloride
SWMU = solid waste management unit

**FIGURE 6-4**
**PROCESS FLOW DIAGRAM**
**ALTERNATIVE 6 AND 7-3:**
***EX SITU* BIODEGRADATION**

**CORRECTIVE MEASURES STUDY, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

8533-09 MAY ALT 6&7 121995 MAW

Soil Handling Activities. Soil handling activities would be similar to that described for Alternatives 6 and 7-1, with the following exceptions.

Contaminated soil would be excavated and placed on the biotreatment pad. Once on the biotreatment pad, the soil would be spread into piles approximately 25 feet wide, 10 feet tall, and 950 feet long (see Figure 6-4). A total of five soil piles would be formed on the treatment pad, approximately 10 feet apart, to allow treatment of up to 26,000 cy of material.

Soil amendments such as lime and nutrients would be manually added to the soil as it is spread upon the treatment pad. Aeration of the horizontal soil piles would be accomplished by using perforated PVC piping placed throughout the soil pile as it is constructed. Gravel would be placed around each pipe to allow for even distribution of air and to prevent clogging of perforated pipe. The perforated pipe would be connected to an electrically-powered air blower system.

Treatment System Operation. System operation includes labor, addition of nutrient amendments, biological monitoring, and electric power. Based on soil characteristics, contaminant concentrations, site conditions, and treatment levels (assumed to be FAC 62-775), the system operation would be required for approximately 12 months.

To increase biodegradation of organic compounds, microbial stimulation by nutrient amendment would be used to promote bacterial growth. For cost estimating purposes, the limiting nutrients for microbial growth are assumed to be nitrogen and phosphorous. Maintaining ideal soil conditions for biodegradation would consist of watering the soil to maintain moisture levels (i.e., between 30 to 70 percent of the water holding capacity), maintaining a soil pH between 6 and 8, and maintaining nutrient levels to ensure sufficient nitrogen and phosphorus.

Watering of soil piles would consist of manually operating the water distribution system. Soil moisture level measurements would be obtained prior to water addition to determine the amount of water that should be added to the soil. It would be recommended that soil pH and nutrient concentrations be measured weekly during soil treatment. Adjustments to soil pH and nutrient levels can be made through the water distribution system.

Monitoring of soil TRPH concentrations and bacteria populations is recommended to determine the efficiency of biotreatment. Composite samples, consisting of several grab samples from various points in a soil pile, would be collected from several piles on the treatment pad for TRPH and bacterial analyses.

Sampling and Analysis of Treated Soil. Treated soil would be sampled prior to backfilling to determine if treatment levels (assumed to be FAC 62-775) have been achieved. Samples would be sent to an offsite laboratory for analysis of total VOAs, TRPH, VOHs, and metals (total).

Backfilling the Excavation. Once contaminated soil has been treated, the excavation would be backfilled with a combination of treated soil and uncontaminated soil. The backfill would be spread and compacted with heavy equipment.

Site Restoration and Demobilization. Once the area has been backfilled, it would be seeded, fertilized, and mulched to promote grass growth. Hay would be used to protect the seed and fertilizer during initial development. The decontamination pad, treatment system equipment, and utility connections would be dismantled and removed. Any decontamination water generated during this site cleanup would be drummed, sampled and analyzed, and disposed of. Fencing at the site would be restored to its original configuration.

6.2.2.2 **Technical Criteria Evaluation** Alternatives 6 and 7-2 is evaluated in this Paragraph based on performance, reliability, implementability, and safety of the alternative.

Performance. Alternatives 6 and 7-2 is evaluated for performance based on the effectiveness and useful life of the alternative.

*Effectiveness* Under this alternative, contaminated soil would be treated via *ex situ* biotreatment. This alternative involves reducing the concentrations of petroleum contaminants in soil to treatment levels (assumed to be FAC 62-775) and using the treated soil as backfill. *Ex situ* biotreatment would address the source of LNAPL. In this manner, this alternative would be effective in complying with CAO 2.

Overall performance of the alternative would be evaluated through monitoring soil conditions (i.e., nutrient consumption rates, bacterial enumerations, pH and soil moisture levels) and sampling and analyzing soil for concentration of petroleum hydrocarbons and related organic compounds before and upon completion of treatment.

*Useful Life* The useful life for biotreatment would be a function of the soil type, contaminant type and concentrations, and environment of the soil (i.e., temperature, soil moisture, and nutrient levels). *Ex situ* biotreatment technologies are designed to maintain their useful life until treatment is completed by adjusting oxygen conditions, nutrient amendment, and soil moisture as needed. It is estimated that 12 months would be necessary to treat contaminated soil to treatment levels.

Reliability. Alternatives 6 and 7-2 is evaluated for reliability based on O&M requirements and its demonstrated reliability.

*O&M* O&M of this technology would consist of aerating the soil by withdrawing or injecting air into the piles, maintaining proper soil moisture levels, ensuring nitrogen and phosphorus are available to microorganisms, and maintaining proper pH levels to ensure an ideal environment for microbial degradation. These O&M activities may be frequent over the treatment duration; however, they are not complex. The labor and materials needed to meet O&M requirements would be readily available and are only necessary for one year.

*Demonstrated Reliability* *Ex situ* biotreatment is a reliable technology and has been demonstrated to reduce contaminant concentrations to treatment levels from similar petroleum-contaminated soil sites. Several vendors are available that have demonstrated treatment on either a pilot-scale or full-scale basis.

Because the contaminated soil would be treated within a containment berm, failure of this technology would not have an immediate impact to human or ecological receptors at NAVSTA Mayport. Furthermore, this technology would have the flexibility to address various uncontrollable changes at the site by modifying aerobic conditions, nutrient amendment, or moisture level in the contaminated soil.

Implementability. Alternatives 6 and 7-2 is evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve the CAOs.

*Constructability* This alternative would require a substantial amount of construction, if implemented. Construction tasks with this alternative would include: install fencing, build decontamination pad, construct treatment pad, install containment berms, install perforated piping, connect blower and timer system, install water line and sprinkler system, install sumps and pumps, and stage water storage tank.

*Time* The total time required to implement this alternative is anticipated to be 14 weeks, based on a 5-day, 10-hours-per-day work week. This includes the time needed for site preparation, treatment pad construction, soil handling activities, and ASP construction and implementation. The time anticipated to achieve treatment levels would be approximately 12 months.

Safety. Impacts to the community or the environment during implementation of this alternative are not expected. The area would be fenced so that the community or station personnel would not have access to contaminated soil. Fugitive dust emissions would be controlled by wetting soil.

Construction workers would conduct site work in the appropriate level of protectiveness during excavation and ASP construction activities to minimize dermal contact and inhalation of airborne contaminants.

6.2.2.3 **Environmental Criteria Evaluation** Although an ecological risk assessment was not completed on surface or subsurface soil at SWMUs 6 and 7, implementation of this alternative would not adversely impact the environment.

6.2.2.4 **Human Health Criteria Evaluation** Although a human health risk assessment was not completed on surface or subsurface soil at SWMUs 6 and 7, implementation of this alternative would not adversely impact the community or occupational workers. The excavation and treatment area would be fenced, thereby limiting access to the site. Further, the stockpile area would be covered to limit dermal contact. Construction workers would be dressed in the appropriate level of protection for excavation and soil handling activities.

6.2.2.5 **Institutional Criteria Evaluation** The only institutional requirement for this alternative would be preparing and obtaining approval for closure of SWMUs 6 and 7.

6.2.2.6 **Cost** A cost estimate for Alternatives 6 and 7-2 was developed and is summarized in Table 6-4. The estimate includes direct and indirect costs (capital costs) for construction, equipment, services, labor, purchased services, biotreatment of soil, treatment system operation, engineering expenses, legal fees and permitting, administrative activities, and contingency allowances. Appendix C provides backup information used to develop the cost estimate.

O&M costs are included in the capital cost estimate because the alternative would be implemented in approximately one year, thus not invoking the necessity of a

**Table 6-4**
**Cost Summary Table for Alternatives 6 and 7-2: Onsite, *Ex Situ* Biotreatment**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $20,800 |
| Equipment | $25,100 |
| Treatment Pad Construction | $256,300 |
| Soil Handling | $351,800 |
| Soil Sampling and Analysis (Untreated Soil) | $66,200 |
| System Operation | $160,100 |
| Soil Sampling and Analysis (Treated Soil) | $68,700 |
| Site Restoration | $227,900 |
| Total Direct Cost (TDC) | $1,176,900 |
| | |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $23,500 |
| Administration and Permitting Fees (@ 2% of TDC) | $23,500 |
| Engineering and Design (@ 10% of TDC) | $117,700 |
| Construction Support Services (@ 10% of TDC) | $117,700 |
| Total Indirect Cost | $282,400 |
| | |
| **Total Capital Cost (Direct Cost plus Indirect Cost)** | $1,459,300 |
| Contingency on Capital Cost (@ 10% of Total Capital Cost) | $145,900 |
| | |
| **TOTAL COST** | **$1,605,200** |

Notes: SWMU = solid waste management unit.
@ = at.
% = percent.

present worth analysis. Technical oversight of the *ex situ* bioremediation contractor would be necessary for this alternative; however, long-term monitoring of the concentration of petroleum hydrocarbons or related organic compounds in soil and or groundwater would not be required. The components for a groundwater and LNAPL monitoring program are included in each of the LNAPL recovery alternatives 6&7-4 through 6&7-6.

<u>6.2.3 Alternatives 6 and 7-3: Offsite Soil Recycling</u> This alternative would consist of excavating contaminated soil and transporting it to an offsite soil recycling facility. If this alternative is selected, it is recommended that additional field sampling be performed to concisely define (in field analysis using methodology described in FAC 62-770.200[2]) the extent of soil contamination to refine the cost estimate prepared for this alternative.

**6.2.3.1 Description** Offsite soil recycling involves the reuse of contaminated soil for asphalt subbase or brick manufacturing. The asphalt or brick manufacturing process involves a thermal desorption or stabilization process where contaminant levels are reduced to Florida clean soil levels (pursuant to FAC 62-775). For this alternative, it is assumed that an offsite soil recycling facility that uses thermal desorption would be preferred because the FDEP has and maintains an approved list of such soil recyclers.

Major activities associated with this alternative include:

- site preparation,
- sampling and analysis of untreated soil,
- soil-handling activities,
- offsite soil recycling,
- backfilling the excavation, and
- site restoration.

These activities are discussed in the following paragraphs. A site layout for this alternative is provided on Figure 6-5.

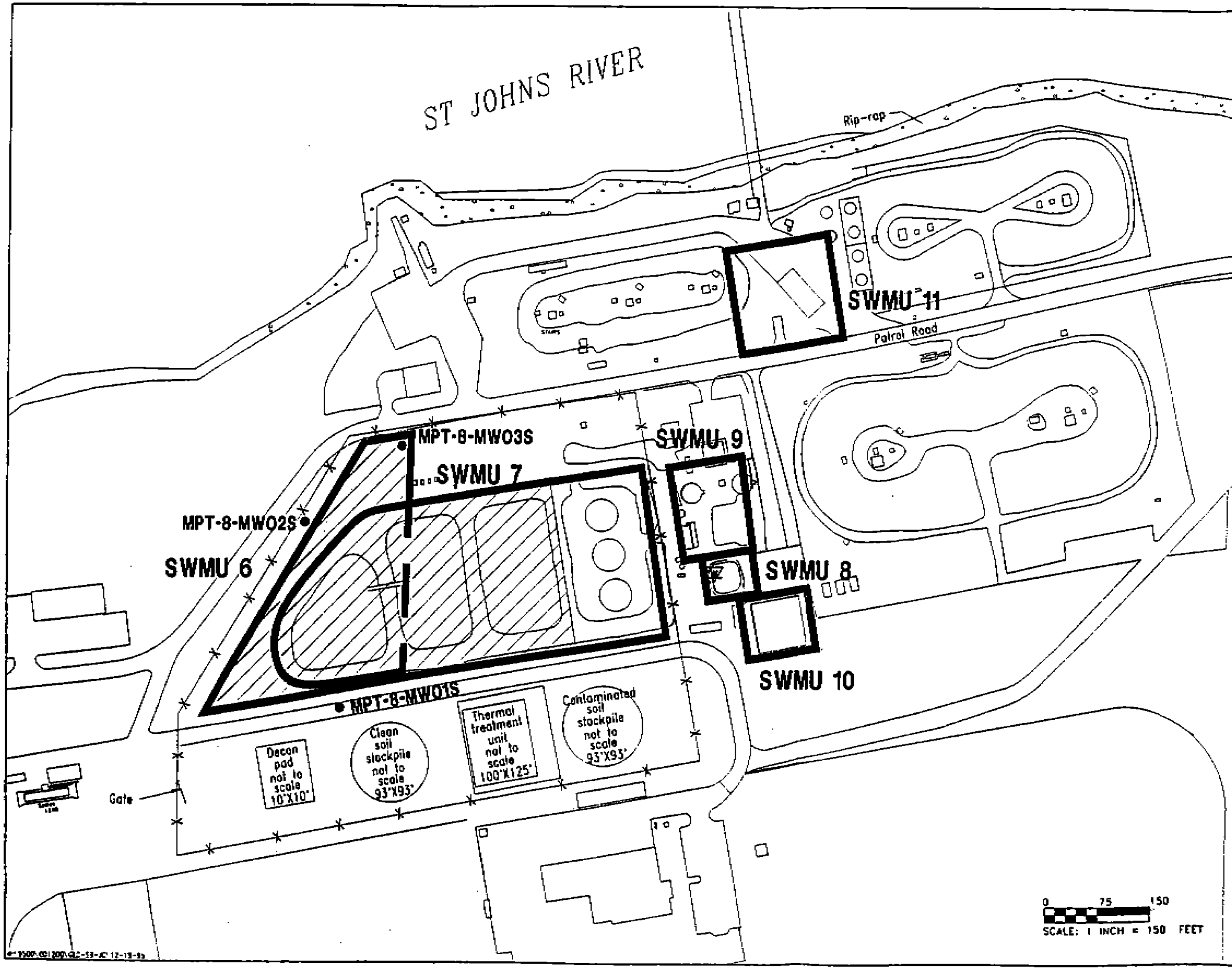
<u>Site Preparation</u>. Site preparation would include activities and construction prior to excavating of contaminated soil.

The existing 6-foot chain-linked fence would be moved back to the perimeter of the excavation and exclusion area to limit public access during construction. Additional chain-linked fencing would be purchased and installed, as needed. Signs indicating "Contaminated Area" would be posted at 100-foot intervals.

Three monitoring wells (MPT-8-MW01S, MPT-8-MW02S, and MPT-8-MW03S) potentially require abandoning or replacing, as they are located within the excavation area (Figure 6-5). Well abandonment permits, if necessary, would be obtained prior to abandonment.

A decontamination pad would be constructed for decontamination of vehicles and equipment. This pad would be bermed and graded toward a sump for collection of decontamination fluid.

<u>Sampling and Analysis of Untreated Soil</u>. Sampling and analysis of untreated soil would be similar to the analytical program discussed in Paragraph 6.2.1.1.




**LEGEND**

Fencing

Area to be excavated

Approximate SWMU boundary

MPT-8-MW02S Existing monitoring well

NOTE: SWMU=solid waste management unit

FIGURE 6-5
SITE LAYOUT PLAN FOR ALTERNATIVE 6 & 7-3:
OFFSITE SOIL RECYCLING

CORRECTIVE MEASURES STUDY
GROUP 9 SWMUs

U.S. NAVAL STATION
MAYPORT, FLORIDA

Soil-Handling Activities. Soil-handling activities would be similar to that described for Alternatives 6 and 7-1, with the following exceptions.

Contaminated soil would be excavated and loaded onto large dump trucks for transport to an offsite soil recycling facility. The rate of contaminated soil removal would be dependent on the excavation rate and distance to the offsite recycling facility. FDEP-approved soil recycling facilities exist within 75 miles of NAVSTA Mayport. Depending on the facility selected, the throughput rate for soil recycling ranges from 500 to 1,000 tons/day.

Because contaminated soil would be transported offsite for this alternative, a borrow source for backfill would be needed. An onsite borrow source has been identified at NAVSTA Mayport, thereby offsetting the cost to purchase and transport fill from an offsite location.

Offsite Soil Recycling. Offsite soil recycling involves the reuse of petroleum-contaminated soil for asphalt sub-base or brick manufacturing. Once contaminated soil is excavated and transported to the soil recycling facility, the soil would be dewatered, as appropriate, and processed. The technology used at the soil recycling facility for creating asphalt or brick is similar to the thermal desorption technology described in Alternatives 6 and 7-1. The primary difference between Alternatives 6 and 7-1 and the soil recycler would be the size of the unit; the thermal desorber used at a soil recycling facility is typically much larger than a mobile unit and could, therefore, process soil at a higher rate.

Backfilling the Excavation. Once contaminated soil has been excavated, the excavation would be backfilled with a combination of uncontaminated soil and borrow fill. The backfill would be spread and compacted with heavy equipment.

Site Restoration. Once the area has been backfilled, it would be seeded, fertilized, and mulched to promote grass growth. Hay would be used to protect the seed and fertilizer during initial development. Decontamination pad materials would be removed and either used elsewhere onsite or disposed of. Any decontamination water generated during this site cleanup would be drummed, sampled and analyzed, and disposed of. Fencing at the site would be restored to its original configuration.

6.2.3.2 **Technical Criteria Evaluation** Alternatives 6 and 7-3 is evaluated in this Paragraph based on performance, reliability, implementability, and safety of the alternative.

Performance. Alternatives 6 and 7-3 is evaluated for performance based on the effectiveness and useful life of the alternative.

*Effectiveness* Under this alternative, contaminated soil would be excavated for offsite soil recycling, thus eliminating the source of LNAPL from the site. In this manner, excavation and transport to an offsite soil recycling facility would be effective in achieving CAO 2 for the SWMUs.

The soil recycling technology would be effective in removing petroleum contaminants from soil. The recycling facility would provide NAVSTA Mayport a "Certificate of Recycling," thereby indemnifying them from future liabilities for reuse of the soil.

No specific waste or site characteristics have been identified that could impede the overall effectiveness of soil recycling, although, for optimal soil recycling conditions, the soil should have a moisture content less than 25 percent and have less than 15 percent very fine particles (e.g., clay).

*Useful Life* Excavation and transport to an offsite soil recycling facility would be permanent and irreversible. Further, destruction of contaminants via thermal desorption at the soil recycling facility would be permanent and irreversible. Contaminated soil would be removed, and the source of LNAPL would be eliminated.

Reliability. Alternatives 6 and 7-3 is evaluated for reliability based on O&M requirements and its demonstrated reliability.

*O&M* No unique O&M activities are required for this alternative.

*Demonstrated Reliability* Soil recycling is a reliable technology, as it has been demonstrated to be effective at reducing contaminant concentrations at similar petroleum-contaminated soil sites. A few offsite soil recycling facilities are within close proximity (e.g., 75 miles) to NAVSTA Mayport.

Because the contaminated soil would be treated offsite, any ineffectiveness of soil recycling to achieve clean soil levels (FAC 62-775) would not have an impact to receptors at NAVSTA Mayport, as opposed to an ineffective onsite treatment technology. Furthermore, this technology would have the flexibility to address any uncontrollable changes at the site in that an alternate offsite soil recycling facility could be selected to permit additional treatment or to accept higher concentrations of petroleum-contaminated soil.

Implementability. Alternatives 6 and 7-3 is evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve the CAOs.

*Constructability* This alternative would be relatively easy to implement. Construction tasks with this alternative only include: installing fencing as needed, building the decontamination pad, and constructing a stockpile area. Excavation and transport of contaminated soil are standard tasks in remediation projects, and this site does not pose difficult excavation activities.

*Time* The total time required to complete this alternative would be approximately 12 weeks, based on a 5-day, 10-hours-per-day work week. This would include the time necessary for site preparation, soil handling, analytical sampling, offsite soil recycling, backfilling excavation, and site restoration. Therefore, the time anticipated to achieve CAOs would be approximately 12 weeks.

Safety. Impacts to the community or the environment during implementation of this alternative are not expected. The area would be fenced in so that the community or station personnel would not have access to contaminated soil. Fugitive dust emissions would be controlled by covering soil containing petroleum hydrocarbons that is temporarily stockpiled onsite is being transported to a soil recycling facility.

Construction workers would conduct site work in the appropriate level of protectiveness during excavation activities to minimize dermal contact and inhalation of airborne contaminants.

6.2.3.3 **Environmental Criteria Evaluation** Although an ecological risk assessment was not completed on surface or subsurface soil at SWMUs 6 and 7, implementation of this alternative would not adversely impact the environment.

6.2.3.4 **Human Health Criteria Evaluation** Although a human health risk assessment was not completed on surface or subsurface soil at SWMUs 6 and 7, implementation of this alternative would not adversely impact the community or occupational workers. The excavation area would be fenced in to limit access to the site, and the stockpile area would be covered to eliminate dermal contact. Construction workers would implement an appropriate level of protection for excavation and soil-handling activities.

6.2.3.5 **Institutional Criteria Evaluation** The only institutional requirement for this alternative would be preparing and obtaining approval for closure of SWMUs 6 and 7.

6.2.3.6 **Cost** A cost estimate for Alternatives 6 and 7-3 was developed and is summarized in Table 6-5. The estimate includes direct and indirect costs (capital costs) for construction, equipment, services, labor, purchased services, recycling of soil, engineering expenses, legal fees and permitting, administrative activities, and contingency allowances. Appendix C provides the backup information used to develop the cost estimate.

Because contaminated soil would be treated offsite, O&M costs are not applicable for this alternative. A present worth analysis is not applicable because treatment duration would be anticipated to take 12 weeks. Technical oversight of the excavation contractor would be necessary for this alternative; however, long-term monitoring of the concentration of petroleum hydrocarbons or related organic compounds in groundwater would not be required. The components for a groundwater and LNAPL monitoring program are included in each of the LNAPL recovery alternatives 6&7-4 through 6&7-6.

6.2.4 Alternatives 6 and 7-4: Sumps with Total Fluids Pumping This alternative is currently being implemented as an IM at the SWMUs. Therefore, a description and evaluation of this alternative is not provided, with the following exceptions.

During July 1995, five 1-meter-diameter sumps were installed within the LNAPL area. Total fluids (groundwater and LNAPL) pumps were installed within the sumps and individually produce at a rate of approximately 1 gallon per minute (gpm). The OWTP treats the fluids extracted from the sumps and discharges the treated water to NAVSTA Mayport's wastewater treatment plant.

The IM workplan provides a detailed description of this alternative but does not include a plan for the O&M of the sump system. Currently, the Navy's contractor who installed the sumps and associated piping and recovery tanks is preparing an O&M plan. In addition to pumping water and LNAPL from the sumps, the following O&M activities are recommended to enhance and evaluate the efficiency of the sump system:

- Regularly measure water table elevations and LNAPL thickness in monitoring wells or piezometers throughout the LNAPL area (at least monthly and possibly more frequently during the initial months of operation).

## Table 6-5
## Cost Summary Table for Alternatives 6 and 7-3: Offsite Soil Recycling

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $14,700 |
| Equipment | $10,400 |
| Soil Handling | $472,900 |
| Soil Sampling and Analysis (Untreated Soil) | $72,900 |
| Soil Recycling | $828,800 |
| Site Restoration | $220,900 |
| Total Direct Cost (TDC) | $1,620,600 |
| | |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $32,400 |
| Administration and Permitting Fees (@ 2% of TDC) | $32,400 |
| Engineering and Design (@ 5% of TDC) | $81,000 |
| Construction Support Services (@ 10% of TDC) | $162,100 |
| Total Indirect Cost | $307,900 |
| | |
| **Total Capital Cost (Direct Cost plus Indirect Cost)** | **$1,928,500** |
| Contingency on Capital Cost (@ 10% of Total Capital Cost) | $192,900 |
| | |
| **TOTAL COST** | **$2,121,400** |

Notes: SWMU = solid waste management unit.
@ = at.
% = percent.

- Collect groundwater samples from wells hydraulically downgradient of the LNAPL area for biodegradation modeling and TRPH measurements.

An interim measures monitoring plan that includes these two elements and will be used to assess the effectiveness of the LNAPL recovery at SWMUs 6 and 7 is provided in Appendix D . The interim measures monitoring plan also provides data to assess whether modification of the recovery system is required (e.g., additional sumps for alternative 6&7-4 or implementation of either alternative 6&7-5 or 6&7-6) and/or additional sampling is necessary to conduct a human health or ecological risk assessment.

LNAPL thickness measurements would be used to evaluate the overall effectiveness of the alternative. To be effective, the alternative must manage the lateral migration of the LNAPL and remove the LNAPL. The results of LNAPL monitoring would be used to evaluate the effectiveness of the alternative with respect to the two objectives in the following manner.

The lateral extent of LNAPL would be defined by measuring LNAPL thicknesses when the system is in operation. If subsequent measurements indicate that it is not migrating beyond the defined lateral extent, the alternative would be considered effective at managing the migration of the LNAPL. Because water table fluctuations may affect the presence or absence of LNAPL in monitoring wells near the edge of the LNAPL plume, water levels would be considered when defining the extent of the LNAPL area.

After one year, if an average 15 percent decrease in LNAPL thickness across the LNAPL area is consistently measured in wells or piezometers, the alternative would be considered effective at removing LNAPL. Because LNAPL thickness fluctuates with changes in water table elevation, statistical analysis would be needed to evaluate whether the LNAPL thickness is consistently decreasing.

Although this alternative relies on the physical removal of LNAPL and not biodegradation, effectiveness of the alternative would be enhanced by biodegradation caused by naturally present microorganisms. To gauge the amount of biodegradation occurring, groundwater samples would be analyzed for the following parameters:

- methane and carbon dioxide,
- nitrite and nitrate,
- ammonia and kjeldahl-nitrogen,
- sulfide and sulfate,
- iron,
- pH (field and laboratory measurement),
- dissolved oxygen (field measurement), and
- oxidation-reduction potential (field measurement).

In addition to these parameters, samples would also be analyzed for TRPH. Trends in groundwater quality (e.g., an increase in the dissolved oxygen concentration and a decrease in TRPH concentrations) may be used as indicators that LNAPL removal is effective.

<u>6.2.5 Alternatives 6 and 7-5: Trenches with LNAPL Skimming</u> This alternative would involve constructing trenches in the LNAPL area. Skimming pumps (i.e., LNAPL-only pumps) would be installed in sumps within the trenches to collect

LNAPL. The OWTP would treat the LNAPL recovered from the trenches. This alternative could be used to augment or replace the existing IM described in Alternatives 6 and 7-4.

6.2.5.1 **Description** Major activities associated with this alternative include:

- site preparation,
- trench construction,
- soil-handling activities, and
- O&M activities.

Site Preparation. Site preparation would include activities prior to excavating the trenches.

The boundaries of the LNAPL area would be defined based on LNAPL measurements in existing monitoring wells and piezometers.

Because there are many underground utilities in the LNAPL area (including fuel transfer lines), utility maps would be reviewed and, if the maps do not provide sufficient detail to accurately locate the utilities, a geophysical survey should be conducted (e.g., ground-penetrating radar).

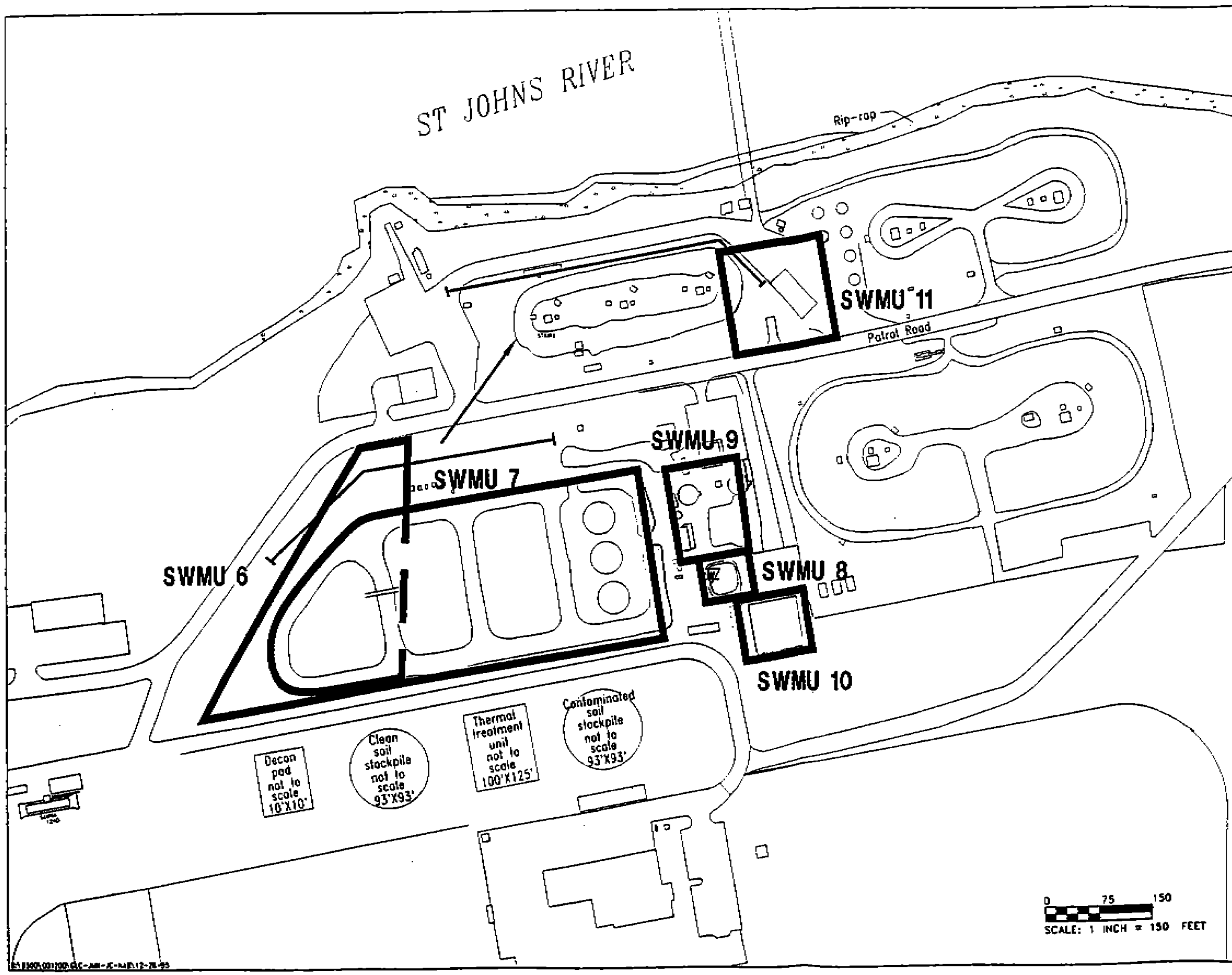
Once the LNAPL area is defined and utilities have been located, the proposed location and configuration of the trenches would be refined. After the location of the trenches has been determined, construction permits required by the station or local utility companies would be obtained.

Trench Construction. Trenches would be installed using standard construction equipment. Two trenches would be constructed, each approximately 400 feet long, 4 feet wide, and 15 feet deep. One trench would be south of Patrol Road, parallel to the road. A second trench would be at the leading edge of the LNAPL area, north and east of the waste oil storage tanks (Figure 6-6).

Trenches would be backfilled with stone to approximately 2 feet bls. The trenches would then be filled with soil to ground surface and compacted to reduce infiltration. For the purposes of this CMS, it is assumed that uncontaminated excavated soil could be used as backfill. Finally, a geomembrane would be placed over the trench to further reduce infiltration (Figure 6-7).

Sumps that contain skimming pumps would be constructed when the trench is being backfilled. Eight sumps would be installed, four within each trench. They would consist of a 1-foot-diameter sump installed below a 3-foot-square vault. The vault would house the pump controls and allow access to the sumps. Piping for the pump discharge would be connected to the OWTP load equalization tanks. Electrical power would be supplied from local lines.

Soil Handling Activities. During trench construction, uncontaminated soil that overlies the LNAPL area would be stockpiled separately from soil contaminated by the LNAPL. (Note that the LNAPL area lies outside of the source area.) The uncontaminated soil may be used to backfill the trenches or may be used for other construction projects on the station. For the purposes of this CMS, it is assumed that a source action would be implemented at the same time as an LNAPL action




**LEGEND**

- (arrow) Approximate direction of Light nonaqueous-phase liquid (LNAPL) migration
- (bar) Proposed trench location
- (heavy box) Approximate SWMU boundary

NOTE: SWMU=solid waste management unit

**FIGURE 6-6**
**ALTERNATIVE 6 AND 7-5**
**LOCATION MAP**

**RCRA CORRECTIVE MEASURES STUDY REPORT, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

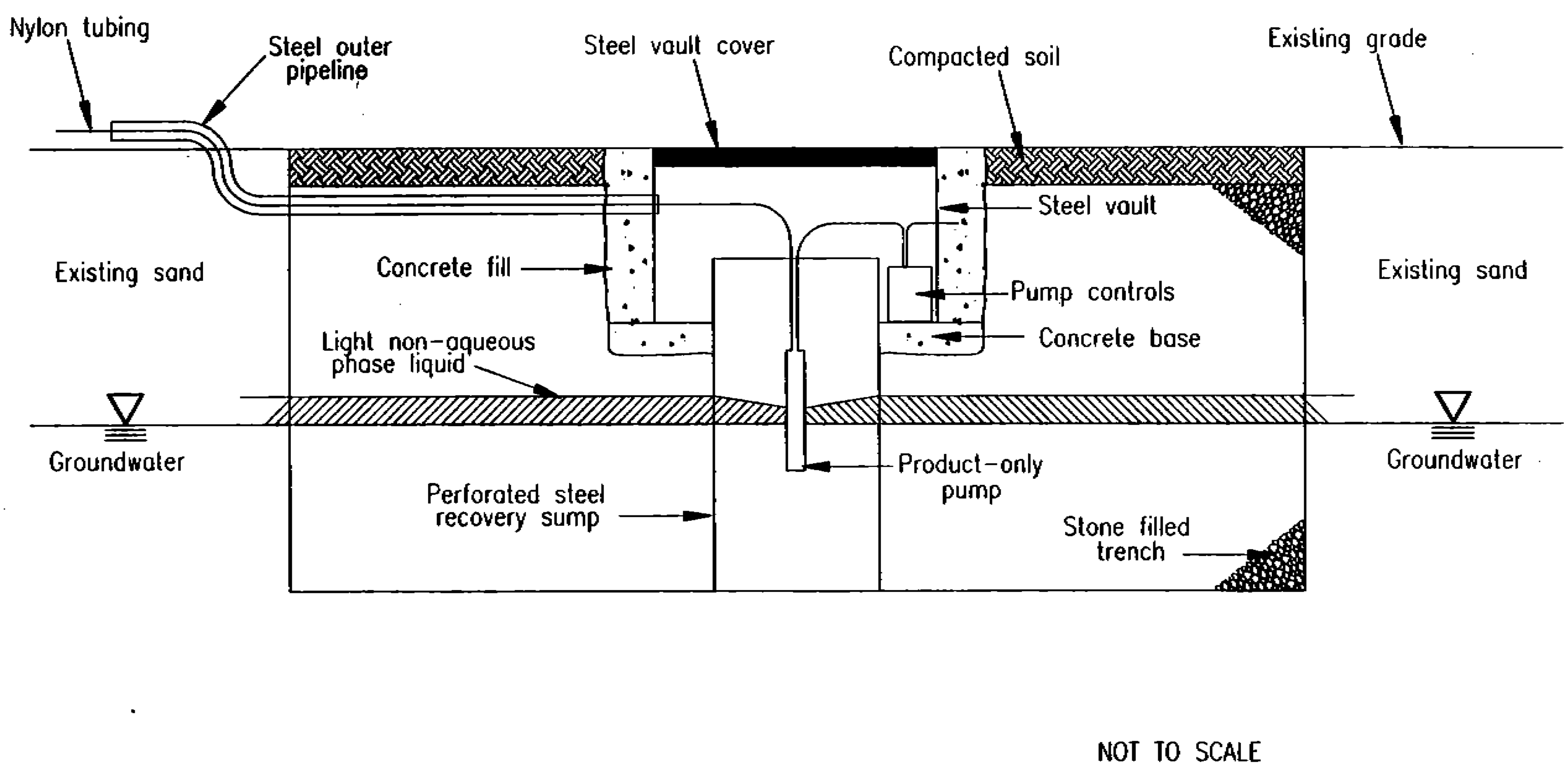



**FIGURE 6-7**
**COLLECTION TRENCH AND RECOVERY SUMP CONCEPTUAL MODEL**

**CORRECTIVE MEASURES STUDY**
**GROUP II SOLID WASTE MANAGEMENT UNIT (SWMUs)**

**U.S. NAVAL STATION**
**MAYPORT, FLORIDA**

H:\MAYPORT\CMS\JMK-GLC-JC\12-19-95

(Alternatives 6&7-1 through 6&7-3), and, therefore, contaminated soil excavated for constructing trenches could be treated with soil excavated from the source area (SWMUs 6 and 7).

O&M Activities. O&M activities for this alternative include recovery system monitoring, LNAPL thickness measurements, and groundwater monitoring, as necessary, to adjust the operation of the system and improve its effectiveness.

**6.2.5.2 Technical Criteria Evaluation** Alternatives 6 and 7-5 is evaluated in this Paragraph based on performance, reliability, implementability, and safety of the alternative.

Performance. Alternatives 6 and 7-5 is evaluated in the following paragraphs for performance based on the effectiveness and useful life of the alternative.

*Effectiveness* Under this alternative, trenches would be constructed and skimming pumps would be used to remove LNAPL collected by the trenches. In this manner, this alternative would comply with CAO 1.

To be effective, the alternative must manage the lateral migration of the LNAPL and remove LNAPL. Methods for evaluating the effectiveness of the alternative during operation are discussed under Alternatives 6 and 7-4 (Subsection 6.2.4).

The combination of trenches and skimming pumps has proven to be effective in removing LNAPL at other sites.

*Useful Life* LNAPL recovery would be most effective when the system begins operating. The effectiveness of the alternative would decrease as the LNAPL thickness decreases. The flow of LNAPL into the trench is governed by the head difference between LNAPL in the trench and in the formation. The head difference would be greatest initially; however, as LNAPL is removed from the formation, the head difference would decrease, and LNAPL flow into the trench would decrease.

Components of the alternative may last the life of the system (i.e., approximately 5 to 10 years); however, it may be necessary to replace the hydrophobic screens and other parts of the pumps during the lifetime of the alternative.

Reliability. Alternatives 6 and 7-5 is evaluated in the following paragraphs for reliability based on O&M requirements and its demonstrated reliability.

*O&M* O&M activities could be considered standard activities for corrective action, as no unique O&M activities are required for this alternative. Labor and materials to implement this alternative would be readily available.

*Demonstrated Reliability* Trenches and skimming pumps are reliable technologies and have been demonstrated to effectively recover LNAPL. If this alternative were ineffective in recovering LNAPL due to a temporary operational failure, neither human nor ecological receptors would be affected at NAVSTA Mayport.

The treatment system design would be flexible enough to address uncontrollable changes (such as the volume of LNAPL available for recovery) at the site. For example, if additional improvements to the system are necessary (e.g., groundwater drawdown), the system could easily be adapted to accommodate such action.

Implementability. Alternatives 6 and 7-5 is evaluated in the following paragraphs for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve the CAOs.

*Constructability* Two trenches would be constructed to implement this alternative. Standard construction methods would be used to construct the trenches; however, underground utilities, including fuel transfer lines, may prohibit installing trenches. An extensive evaluation of utility maps along with a geophysical survey (e.g., ground-penetrating radar) should be required before trench construction could begin.

Installing trenches and collecting LNAPL are standard remediation tasks, and this site poses no difficult installation challenges.

*Time* If this alternative were implemented, it is estimated that it would require 5 to 10 years of operation to achieve CAO 1.

Safety. Impacts to the community or the environment during implementation of this alternative are not expected. Safety precautions during construction to prevent harm to worker and station personnel include:

- fencing around construction equipment to reduce physical hazards to the community or station personnel and hazards from exposure to LNAPL-contaminated soil or volatile contaminants,
- covering trenches left open during construction to reduce the physical hazard to the community or station personnel,
- controlling fugitive dust emissions during construction activities through wetting soil,
- adhering to construction permits to avoid underground utilities,
- ceasing excavation operation if unmarked utilities are encountered,
- shoring open trenches, if required, and
- conducting site work in the appropriate level of protectiveness during excavation and loading activities to minimize dermal contact and inhalation of airborne contaminants.

6.2.5.3 **Environmental Criteria Evaluation** Although an ecological risk assessment was not completed, implementation of this alternative would not adversely impact the environment.

6.2.5.4 **Human Health Criteria Evaluation** Although a human health risk assessment was not completed, implementation of this alternative would not adversely impact the community or occupational workers.

6.2.5.5 **Institutional Criteria Evaluation** The only institutional requirement for this alternative would be preparing and obtaining approval for closure of SWMUs 6 and 7.

6.2.5.6 Cost A cost estimate for Alternatives 6 and 7-5 was developed and is summarized in Table 6-6. The estimate includes direct and indirect costs (capital costs) for construction, equipment, services, labor, purchased services, engineering expenses, legal fees and permitting, administrative activities, and contingency allowances. Appendix C provides the backup information used to develop the cost estimate.

O&M costs for this alternative include groundwater sampling (groundwater quality and TRPH), LNAPL thickness and water level measurements, system operation, and electricity for the skimming pumps. Because it is estimated that this alternative would take 5 to 10 years to complete, the present worth of the O&M costs were calculated based on a 7-year O&M period at a 6 percent interest rate.

6.2.6 Alternatives 6 and 7-6: Sumps with Groundwater Drawdown and LNAPL Skimming
This alternative would be a modification of the existing system described in Alternatives 6 and 7-4. The alternative would involve installing wells to supplement the existing sumps and installing groundwater-depression and LNAPL-skimming pumps in the sumps and wells. The groundwater-depression pumps would lower the water table in the vicinity of the sump or well, inducing LNAPL flow into the sump or well. The skimming pumps would recover the LNAPL that collects in the sump or well. The OWTP would treat the LNAPL recovered. Groundwater would be discharged to the sanitary sewer and treated by the Federally Owned Treatment Works (FOTW).

6.2.6.1 **Description** Major activities associated with this alternative include:

- site preparation,
- recovery well construction,
- soil-handling activities, and
- O&M activities.

Site Preparation. Site preparation would include activities prior to installing recovery wells.

The boundaries of the LNAPL area would be defined based on LNAPL measurements in existing monitoring wells and piezometers.

Because there are many underground utilities in the LNAPL area (including fuel transfer lines), utility maps would be reviewed and, if the maps do not provide sufficient detail to accurately locate the utilities, a geophysical survey should be conducted (e.g., ground-penetrating radar).

Once the LNAPL area is defined and utilities have been located, the proposed locations of the recovery wells would be refined. After the locations have been determined, construction permits required by the station or local utility companies would be obtained. Drilling permits would be obtained from the State of Florida.

Recovery Well Construction. Recovery wells would be installed using standard drilling equipment. It is estimated that approximately six wells would be installed. Each well would be constructed of 6-inch, inside-diameter schedule 40 PVC. The wells would be approximately 20 feet deep with a screen length of 15 feet and a riser length of 5 feet.

**Table 6-6**
**Cost Summary Table for Alternatives 6 and 7-5: Trenches with LNAPL Skimming**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $6,200 |
| Verify Utilities | $2,400 |
| GPR Survey | $8,800 |
| Trench Construction | $126,000 |
| Recovery Well and Vault Construction | $128,300 |
| Total Direct Cost (TDC) | $271,700 |
| | |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $5,400 |
| Administration and Permitting Fees (@ 2% of TDC) | $5,400 |
| Engineering and Design (@ 20% of TDC) | $54,300 |
| Construction Support Services (@ 10% of TDC) | $27,200 |
| Total Indirect Cost | $92,300 |
| | |
| **Total Capital Costs (Direct Cost plus Indirect Costs)** | **$364,000** |
| | |
| **Operation and Maintenance (O&M) Cost (Annual)** | |
| Groundwater Sampling and Analysis | $5,900 |
| System Operation | $11,500 |
| Electricity | $21,900 |
| Total O&M Cost | $39,300 |
| Present Worth of O&M (for 7 years @ 6% Interest Rate) | $219,700 |
| | |
| **Subtotal (Capital Cost plus O&M Cost)** | **$583,700** |
| Contingency on Subtotal (@ 10% of Total Capital plus O&M Costs) | $58,400 |
| | |
| **TOTAL COST** | **$642,100** |

Notes: @ = at.
% = percent.

Groundwater-depression and LNAPL-skimming pumps would be installed in each recovery well (Figure 6-8). It is estimated that groundwater would be pumped at a rate of approximately 1 gpm and would create a maximum water table drawdown of approximately 2 feet.

Piping from the LNAPL-skimming pumps would be connected to the OWTP for treatment of LNAPL. For the purpose of the CMS, it is assumed that groundwater beneath the LNAPL is not contaminated and piping from the groundwater-depression pumps would be connected to the FOTW for treatment of groundwater. Groundwater samples have not been collected from monitoring wells containing LNAPL. Therefore, before this alternative is implemented, groundwater samples should be collected at monitoring wells containing LNAPL to assess whether or not the FOTW can receive this liquid. Pump controls would be housed in sheds. Electrical power would be supplied from local lines.

Soil-Handling Activities. Soil-handling activities for this alternative would be similar to those described for Alternatives 6 and 7-5.

O&M Activities. O&M activities for this alternative include recovery system monitoring, LNAPL thickness measurements, and groundwater monitoring, as necessary, to adjust the operation of the system and improve its effectiveness.

**6.2.6.2 Technical Criteria Evaluation** Alternatives 6 and 7-6 is evaluated in this Paragraph based on performance, reliability, implementability, and safety of the alternative.

Performance. Alternatives 6 and 7-6 is evaluated in the following paragraphs for performance based on the effectiveness and useful life of the alternative.

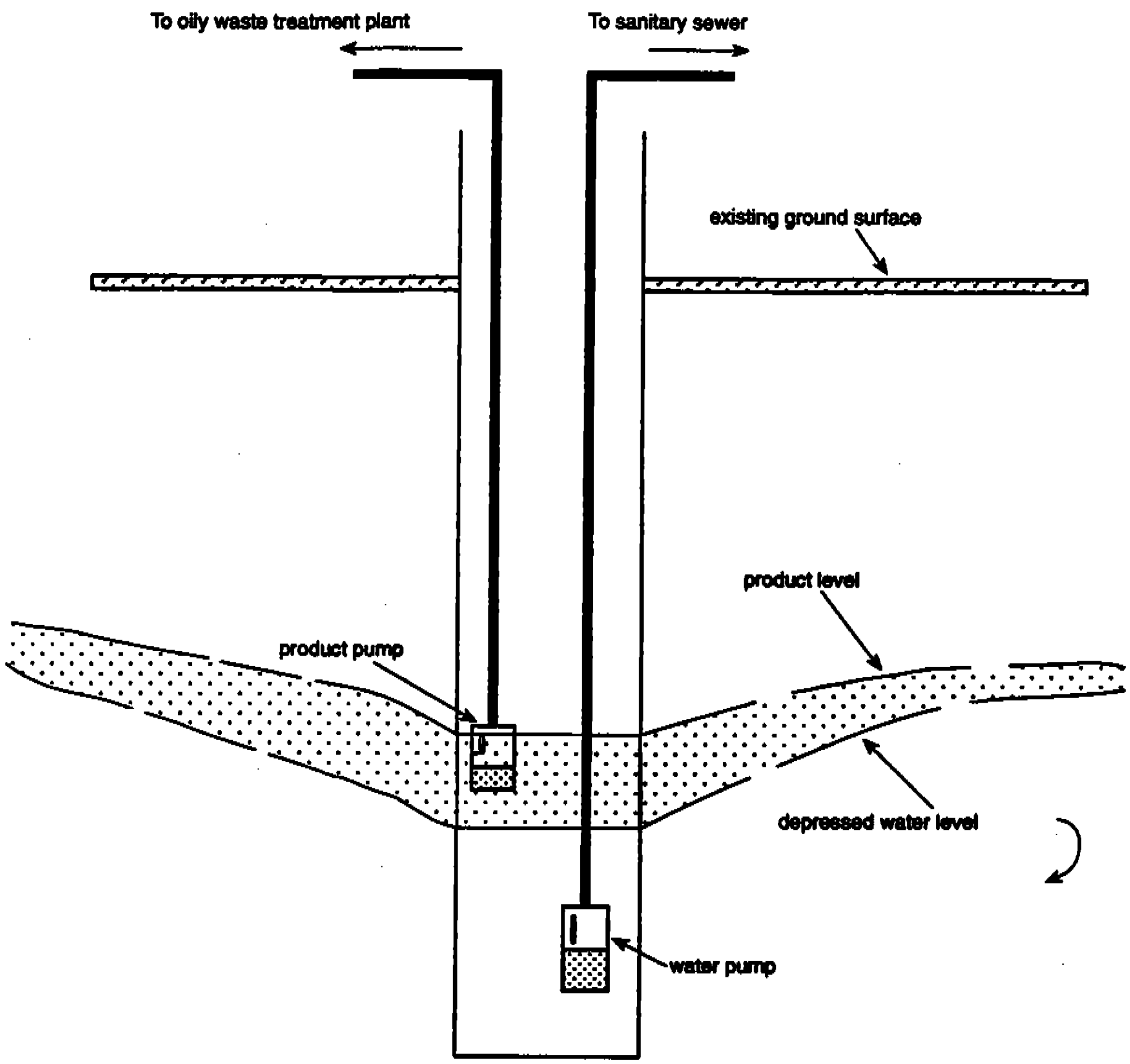
*Effectiveness* Under this alternative, wells would be installed and groundwater-drawdown and LNAPL-skimming pumps would be used to enhance LNAPL removal. The combination of wells with groundwater drawdown and LNAPL-skimming has proven to be effective in removing LNAPL at similar sites. In this manner, this alternative would comply with CAO 1.

To be effective, the alternative must manage the lateral migration of the LNAPL and remove LNAPL. Methods for evaluating the effectiveness of the alternative during operation are discussed under Alternatives 6 and 7-4 (see Subsection 6.2.4).

*Useful Life* LNAPL recovery would be most effective when the system begins operating. The effectiveness of the alternative would decrease as the LNAPL thickness decreases. The flow of LNAPL into the well is governed by the head difference between LNAPL in the well and in the formation. The head difference would be greatest initially; however, as LNAPL is removed from the formation, the head difference would decrease due to removal of LNAPL from the formation, and flow into the well would decrease.

Components of the alternative may last the life of the system (i.e., approximately 5 to 10 years); however, it may be necessary to replace the hydrophobic screens on the skimming pumps during the lifetime of the alternative.

Reliability. Alternatives 6 and 7-6 is evaluated for reliability based on O&M requirements and its demonstrated reliability.




Not to scale

**NOTES:**
SWMU = solid waste management unit
LNAPL = light nonaqueous-phase liquid

**FIGURE 6-8**
**CONCEPTUAL MODEL FOR ALTERNATIVE 6 AND 7 - 6: GROUNDWATER DEPRESSION AND LNAPL SKIMMING**

**CORRECTIVE MEASURES STUDY, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

8533-09 MAY DUAL PHASE 121995MAW

*O&M* The O&M activities could be considered standard O&M activities for corrective action, as no unique O&M activities are required for this alternative. Labor and materials to implement this alternative would be readily available.

*Demonstrated Reliability* Wells with groundwater drawdown and LNAPL-skimming are reliable technologies, and have been demonstrated to effectively recover LNAPL. If this alternative were ineffective at recovering LNPL, neither human nor ecological receptors would be affected at NAVSTA Mayport. The treatment system design would be flexible enough so that changes in the operation of the system based on real time data (e.g., pumping rate) could be implemented. For example, if increased groundwater drawdown is needed to induce LNAPL flow into the sumps, vacuum-enhanced recovery could be implemented. This would allow an increase in the groundwater pumping rate without lowering the elevation of the water table.

Implementability. Alternatives 6 and 7-6 is evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve the CAOs.

*Constructability* Approximately six wells would be installed to augment the existing sumps. Standard construction methods would be used to construct the wells; however, underground utilities, including fuel transfer lines, may inhibit the installation of wells in some locations. An extensive evaluation of utility maps along with a geophysical survey (e.g., ground-penetrating radar) would be required before well installation could begin.

The installation of wells are standard remediation tasks, and this site poses no unique technical challenges.

*Time* If this alternative were implemented, it is estimated that it would require 5 to 10 years of operation to achieve MPSs.

Safety. Impacts to the community or the environment during implementation of this alternative are not expected. Safety precautions during construction to prevent harm to the occupational worker and station personnel were discussed in Paragraph 6.2.5.2 and should be implemented for this alternative.

6.2.6.3 **Environmental Criteria Evaluation** Although an ecological risk assessment was not completed, implementation of this alternative would not adversely impact the environment.

6.2.6.4 **Human Health Criteria Evaluation** Although a human health risk assessment was not completed, implementation of this alternative would not adversely impact the community or workers.

6.2.6.5 **Institutional Criteria Evaluation** The only institutional requirement for this alternative would be preparing and obtaining approval for closure of SWMUs 6 and 7.

6.2.6.6 **Cost** A cost estimate for Alternatives 6 and 7-6 was developed and is summarized in Table 6-7. The estimate includes direct and indirect costs (capital costs) for construction, equipment, services, labor, purchased services, engineering expenses, legal fees and permitting, administrative activities, and contingency allowances. Appendix C provides the backup information used to develop the cost estimate.

O&M costs for this alternative include groundwater sampling (groundwater quality and TRPH), LNAPL thickness and water level measurements, system operation, and

## Table 6-7
## Cost Summary Table for Alternatives 6 and 7-6: Sumps with Groundwater Drawdown and LNAPL-Skimming

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $8,700 |
| Verify Utilities | $2,400 |
| GPR Survey | $8,800 |
| Well Construction | $98,500 |
| Total Direct Cost (TDC) | $118,400 |
| | |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $2,400 |
| Administration and Permitting Fees (@ 2% of TDC) | $2,400 |
| Engineering and Design (@ 20% of TDC) | $23,700 |
| Construction Support Services (@ 10% of TDC) | $11,800 |
| Total Indirect Cost | $40,300 |
| | |
| **Total Capital Costs (Direct Cost plus Indirect Costs)** | **$158,700** |
| | |
| **Operation and Maintenance (O&M) Cost (Annual)** | |
| Groundwater Sampling | $5,900 |
| System Operation | $11,500 |
| Electricity | $43,800 |
| Total O&M Cost | $61,200 |
| Present Worth of O&M (for 7 years @ 5% Interest Rate) | $342,000 |
| | |
| **Subtotal (Capital Cost plus O&M Cost)** | **$500,700** |
| Contingency on Subtotal (@ 10% of Total Capital Cost plus O&M) | $50,100 |
| | |
| **TOTAL COST** | **$550,800** |

Notes: SWMU = solid waste management unit.
@ = at.
% = percent.

electricity for the groundwater-depression and skimming pumps. Because it is estimated that this alternative would take 5 to 10 years to complete, the present worth of the O&M costs were calculated based on a 7-year O&M period at a 6 percent interest rate.

<u>6.3 CORRECTIVE ACTION ALTERNATIVES FOR SWMU 15</u>. This section presents the description and evaluation of corrective action alternatives for soil at SWMU 15.

Prior to initiating corrective action for SWMU 15, the following preconstruction documentation would be prepared and reviewed:

- design plans and specifications, as required,
- site-specific health and safety plan,
- site-specific QA plan,
- confirmatory sampling and analysis plan, and
- air emissions evaluation and permit documentation (if necessary).

<u>6.3.1 Alternative 15-1: Offsite Incineration</u> Alternative 15-1 consists of excavating pesticide-contaminated soil (i.e., soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs), transporting the excavated soil to a permitted, offsite, RCRA Subtitle C incineration facility, performing groundwater sampling, and conducting a potable water well survey.

6.3.1.1 Description Major activities associated with this alternative include:

- site preparation,
- soil-handling activities,
- confirmatory sampling and analysis of soil in open excavation,
- transportation of soil to offsite incinerator,
- backfilling the excavation,
- site restoration and demobilization,
- groundwater screening, and
- potable water well survey.

These activities are discussed in the following paragraphs.

<u>Site Preparation</u>. Site preparation activities would include activities prior to excavating contaminated soil at SWMU 15.

Temporary fencing, such as plastic silt fencing, would be constructed around the area to be excavated to prevent unauthorized access to the site. Warning signs indicating "Contaminated Area" would be posted at 100-foot intervals along the fence.

A decontamination pad would be constructed at the site for decontamination of equipment and vehicles. The pad would consist of a liner material on the adjacent parking area and would be bermed and graded toward a sump for collection of decontamination fluid.

<u>Soil Handling Activities</u>. Pesticide-contaminated soil would be excavated from SWMU 15. A trackhoe would be used to excavate and fill lined, rolloff bins for subsequent transportation to an offsite incineration facility. Dewatering would not be required, as soil to be excavated is in the vadose zone. The excavation

rate of soil would be controlled to correspond to the rate at which rolloffs could be supplied to the site from the incineration facility.

Figure 6-9 shows the three areas of SWMU 15 that require soil excavation, which is equivalent to 533 cy or approximately 630 tons of soil.

Confirmatory Sampling and Analysis of Soil in Open Excavation. Surface soil samples would be collected from the open excavation to verify that soil above MPSs has been removed. Based on a 50-foot grid pattern, 15 surface soil samples would be collected and sent to an offsite laboratory for analysis. Each sample would be analyzed for Appendix IX pesticides. If the sampling results indicate concentrations greater than MPSs, an additional 1 foot of soil would be excavated, and the open excavation would be sampled again.

Transportation to Offsite Incinerator. Based on specific contaminant concentrations, the soil would be sent to an offsite, permitted, RCRA Subtitle C incinerator. Before the contaminated soil could be transported, a soil sample would be collected and sent to an offsite laboratory for analysis, as required by the incineration facility. The sample would be analyzed for Appendix IX pesticides and other chemical or physical properties required. The results of the sample analyses would be sent to the incineration facility for subsequent approval to allow disposal at the facility.

After the soil has been approved and accepted by the incineration facility, excavated soil would be placed directly into rolloff bins, supplied by the incineration company, in preparation for transportation. Rolloffs would then be transported to the incineration facility by trucks.

Incineration destroys 4,4'-DDT, chlordane, and other organic constituents in soil through volatilization at high temperatures (in excess of 1,400 °F). This treatment process creates offgases and a solid ash residual, which both require treatment or disposal. Once soil has been transported to the offsite incineration facility, the responsibility for management of offgases and residuals lies with the incineration facility.

Backfilling the Excavation. Open excavation areas would be backfilled with onsite borrow material.

Site Restoration and Demobilization. Once the area has been backfilled, it would be seeded, fertilized, and mulched to promote grass growth. Hay would be used to protect the seed and fertilizer during initial development. Fence and decontamination materials would be removed and either used elsewhere onsite or disposed of. Any decontamination water generated during this site cleanup would be drummed, sampled and analyzed, and disposed of.

Groundwater Sampling. Analyses of groundwater samples collected during RFI field activities in 1993 and 1994 detected concentrations of alpha-, beta-, and delta-BHC and arsenic in the surficial aquifer. The Risk Assessment (RA) completed did not identify ecological risks due to exposure to groundwater. However, the RA identified a potential human health risk if the groundwater were to be used as a potable source. Because the RFI activities did not fully delineate the extent of the BHC and arsenic in groundwater and groundwater flow is estimated to potentially be in the direction of the neighboring town of Mayport, further

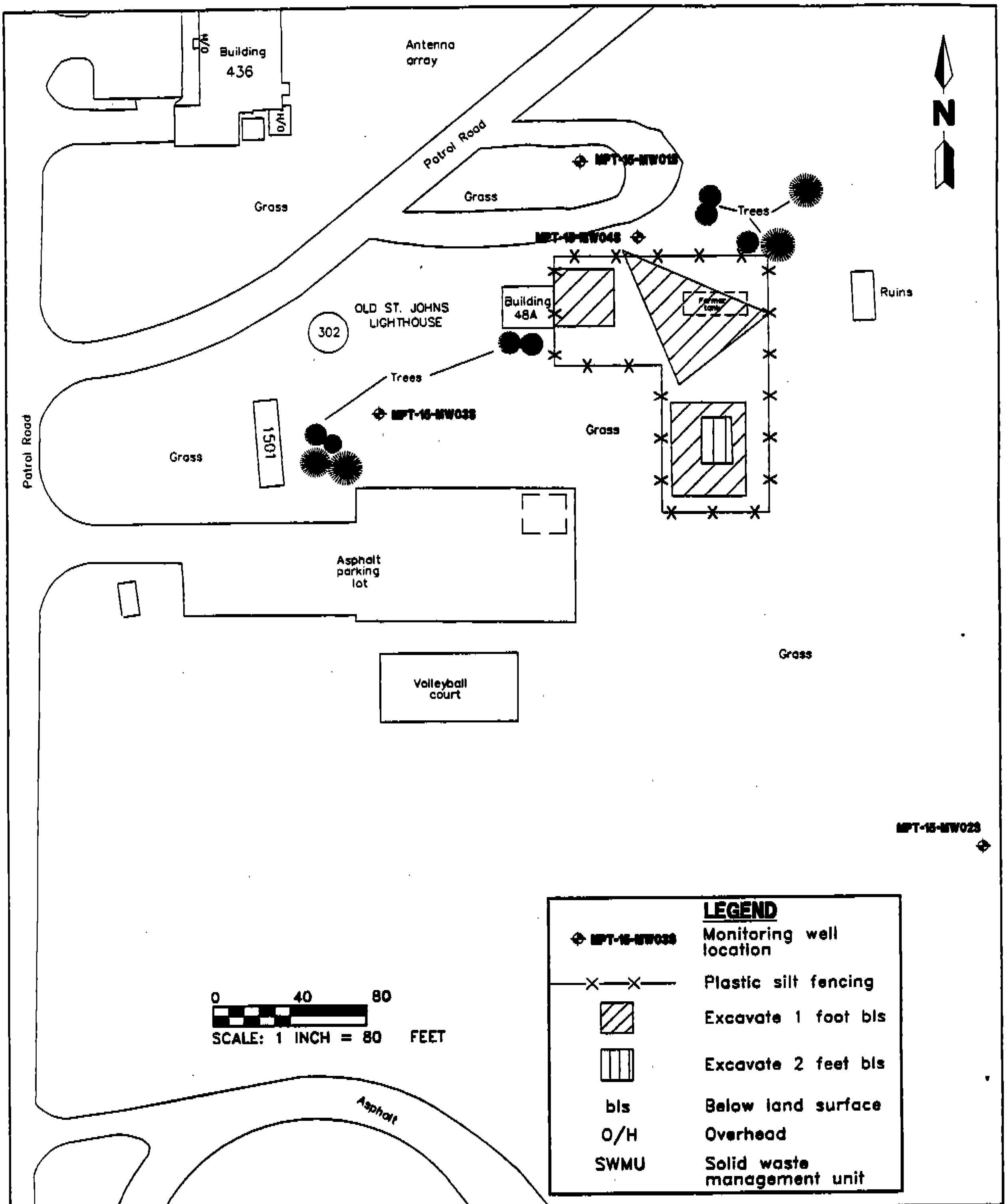



**FIGURE 6-9**
**SITE LAYOUT**
**ALTERNATIVE 15-1: OFFSITE TRANSPORT AND INCINERATION**

H:\9500\MAYFIGS\JMK-JC-NAB\12-28-95

**CORRECTIVE MEASURES STUDY REPORT, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

groundwater sampling activities should be conducted to better define flow pathways and the horizontal and vertical extent of the BHC and arsenic in groundwater. A potable water use survey also should be conducted in the neighboring town.

The following paragraphs summarize the steps recommended to accomplish these goals.

*Temporary Piezometer Installation and Water Level Measurements* Four temporary piezometers would be installed to measure water table elevations hydraulically downgradient of Building 48A. Water levels would be measured in the temporary piezometers, the six existing monitoring wells, and the existing piezometer at SWMU 15. The elevations would be plotted on a basemap and contoured to determine the groundwater flow direction.

*Groundwater Screening* Groundwater would be sampled by direct push technology (DPT) to identify the extent of the BHC and arsenic in groundwater. If BHC and arsenic is detected in initial groundwater screening locations, groundwater samples would be collected at areas further hydraulically downgradient from Building 48A.

Groundwater samples would be collected from two intervals at each screening location: one approximately 2 feet below the water table (i.e., approximately 5 feet bls) and one near the top of the clay layer (i.e., approximately 12 feet bls).

*Water Well Survey* A potable water well survey would be conducted for houses and businesses downgradient of SWMU 15. Typically, water wells screened in the surficial aquifer are not used as potable water sources due to excessive salinity; however, exceptions should be identified.

Because potable water wells are required to be permitted in the State of Florida, the water well survey would consist of a records search to determine the location, use, and depth of wells. To ensure that potable wells are identified, a door-to-door survey may also be conducted.

*Monitoring Well Installation* Based on results of groundwater screening, a location for permanent monitoring well(s) would be selected. The new well(s) would be positioned near the downgradient edge of the BHC and/or arsenic plume(s), if present, and screened at a depth determined by the results of the groundwater screening program. Existing and newly installed monitoring wells would then be sampled for Appendix IX pesticides and arsenic to assess the horizontal and vertical extent of contamination and whether or not the concentrations exceed Federal and State MCLs and guidance concentrations. In addition, existing and newly collected groundwater data will be used to conduct focused human health and ecological risk assessments. The human health risk assessment would be focused to groundwater as a receptor pathway and groundwater discharging to surface water as an ecological receptor pathway.

Based on the horizonal and vertical extent of BHC and arsenic, and comparison of the groundwater analytical results from monitoring wells to the Federal and State MCLs and the risk assessments, remedial alternatives (if warranted) will be evaluated either as interim measures or through a CMS focused at addressing groundwater at SWMU 15.

*Water Well Survey Results* Based on the results of the groundwater screening and the water well survey, a number of actions could follow. However, because none of these actions are anticipated, they are not included in the cost estimate for this alternative.

If BHC contamination is present in groundwater downgradient of Building 48A and has not migrated offsite and there are no hydraulically downgradient potable water wells, institutional controls would be implemented to restrict a potable well from being installed in the future. Sampling and analysis of the existing groundwater wells and new well(s) would continue on a regular basis.

If contamination is present in groundwater hydraulically downgradient of Building 48A and there are downgradient potable water wells in use, these wells would be sampled for BHC isomers and/or arsenic. At the same time, institutional controls could be placed to temporarily restrict the use of these wells. If the sampling results reveal concentrations of BHC and/or arsenic in potable wells in excess of MCLs, private treatment systems at each potable well could be installed, while an evaluation of groundwater treatment options for SWMU 15 was initiated. Monitoring of the existing groundwater wells and new well(s) would continue.

6.3.1.2 **Technical Criteria Evaluation** Alternative 15-1 is evaluated in this paragraph based on performance, reliability, implementability, and safety of the alternative.

Performance. Alternative 15-1 is evaluated for performance based on the effectiveness and useful life of the alternative.

*Effectiveness* Under this alternative, contaminated soil is excavated from the site and transported offsite for subsequent incineration at a permitted RCRA Subtitle C facility. Removal and offsite treatment of pesticide-contaminated soil would address risks posed to human and ecological receptors from exposure to soil. Groundwater monitoring and potable water well surveys would be conducted through this alternative. Monitoring of groundwater would provide additional data to evaluate the distribution of BHC and/or arsenic in groundwater, and the potable water well survey would provide data to assess whether or not there is a current human exposure to groundwater until the extent of BHC in groundwater is qualified. As a result, this alternative (offsite soil incineration and groundwater assessment) would be effective in achieving CAOs.

Because soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs would be excavated and treated offsite, the soil would be permanently removed from SWMU 15. Confirmatory sampling and analysis (Appendix IX pesticides) would verify the effectiveness of the alternative.

*Useful Life* Contaminated soil would be permanently removed from the site. The offsite incineration facility would destroy 4,4'-DDT, chlordane, and other organic constituents in soil. Once contaminated soil has been excavated and accepted by the disposal facility, the risks due to exposure to soil at SWMU 15 are permanently reduced.

Reliability. Alternative 15-1 is evaluated for reliability based on O&M requirements and its demonstrated reliability.

*O&M* O&M activities for this alternative include soil-handling activities and QA/QC personnel. These O&M activities are standard for corrective action; no unique O&M activities are required for this alternative. Labor and materials to implement this alternative would be readily available.

*Demonstrated Reliability* Excavation and offsite incineration is a demonstrated technology for removal and treatment of pesticide-contaminated soil. Several vendors are available that provide offsite incineration. The offsite facility would be responsible for the reliability of their treatment system, once the excavated soil has been accepted by the facility.

Implementability. Alternative 15-1 is evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve the MPSs.

*Constructability* No construction is necessary to excavate, transport, and treat soil offsite. Because this alternative would occur over a relatively short time frame, neither a field trailer nor other support facilities would be necessary. There are no unique site features at SWMU 15 that would cause adverse impacts during excavation activities.

For the purpose of the CMS, it is assumed that one permanent groundwater monitoring well and four temporary piezometers would be installed for this alternative. No unique difficulties are anticipated to perform these tasks.

*Time* It is anticipated that excavation, confirmatory sampling, and offsite disposal could occur in approximately 1 week. Temporary piezometers and the monitoring well would be installed concurrently and would require approximately 1 week. Sampling and analysis of groundwater would require approximately 2 months. As a result, the implementation of this alternative would require a total of approximately 3 months.

Safety. Impacts to the community or the environment during implementation of this alternative are not expected. The area would be fenced so that the community or station personnel would not have access to contaminated soil. No wetlands or sensitive habitats have been identified in the area of SWMU 15, and impact to the surrounding environment would be minimal due to the short duration of the activities.

During excavation of soil and installation of the piezometers and monitoring well, site workers would conduct work in the appropriate level of protectiveness. Dermal contact with surface soil and inhalation of airborne contaminants would be minimized.

6.3.1.3 **Environmental Criteria Evaluation** The ecological risk assessment completed for SWMU 15 identified unacceptable risks to small terrestrial wildlife (mammals and birds) based on exposure to soil through direct and indirect ingestion of soil and indirect ingestion of contaminated food. Sublethal effects were associated with exposure to 4,4'-DDT-contaminated soil.

Under this alternative, soil containing 4,4'-DDT at concentrations greater than MPSs would be excavated and removed from the site. As a result, the ecological risk posed by exposure to soil no longer exists and is eliminated both in the short- and long-term. Risk elimination would occur in approximately 3 months, as that is the amount of time required for this alternative.

6.3.1.4 **Human Health Criteria Evaluation** The human health risk assessment identified unacceptable risks associated with current and future exposure to soil. An unacceptable risk was found for a resident and site maintenance worker for exposure to soil through dermal contact and inhalation of particulates.

Under this alternative, 4,4'-DDT- and chlordane-contaminated soil at concentrations greater than MPSs would be excavated and removed from the site. As a result, the human risk posed by exposure to soil no longer exists and is eliminated both in the short- and long-term. Risk elimination would occur in approximately 3 months, as that is the amount of time required for this alternative.

Additionally, construction workers would wear the proper protective gear to prevent exposure to soil during excavation. Fencing and warning signs would prevent public access to the site.

6.3.1.5 **Institutional Criteria Evaluation** The only institutional requirement for Alternative 15-1 is preparing and obtaining approval for closure of SWMU 15.

6.3.1.6 **Cost** A cost estimate for Alternative 15-1 was developed and is summarized in Table 6-8. The estimate includes direct and indirect costs (capital costs) that included costs of construction, equipment, services, labor, purchased services, offsite treatment of soil, engineering expenses, legal fees and permitting, administrative activities, and contingency allowances. Appendix C provides the backup information used to develop the cost estimate presented in Table 6-8.

Since Alternative 15-1 will be completed in 3 months, no annual O&M costs were included. Annual monitoring is not necessary under this alternative and, as a result, has not been included.

**6.3.2 Alternative 15-2: Semipermeable Cover** Alternative 15-2 consists of capping SWMU 15 with a semipermeable cover (specifically, a geotextile and gravel), performing groundwater sampling, and conducting a potable water well survey.

6.3.2.1 **Description** Major activities associated with this alternative include:

- institutional controls,
- site preparation,
- capping with a geotextile and gravel,
- groundwater screening,
- potable water well survey, and
- O&M.

These activities are discussed in the following paragraphs.

Institutional Controls. Deed restrictions, or placing controls on the use of SWMU 15, would be implemented in accordance with local regulations. The deed restrictions would be placed on the capped area and parcels of land surrounding

## Table 6-8
## Cost Summary Table for Alternative 15-1: Offsite Incineration

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $5,500 |
| Equipment | $700 |
| Soil Handling | $14,600 |
| Confirmatory Sampling and Analysis | $5,600 |
| Offsite Transport and Incineration | $867,600 |
| Site Restoration | $4,900 |
| Groundwater Evaluation | $11,900 |
| Total Direct Cost (TDC) | $910,800 |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $18,200 |
| Administration and Permitting Fees (@ 2% of TDC) | $18,200 |
| Engineering and Design (@ 5% of TDC) | $45,600 |
| Construction Support Services (@ 3% of TDC) | $27,400 |
| Total Indirect Cost | $109,400 |
| **Total Capital Costs (Direct Cost plus Indirect Cost)** | **$1,020,200** |
| Contingency on Capital Cost (@ 10% of Total Capital Cost) | $102,000 |
| **TOTAL COST** | **$1,122,200** |

Notes: SWMU = solid waste management unit.
@ = at.
% = percent.

the cap. This would restrict future construction as well as the station's workers from excavating in the area and thus being exposed to contaminated soil.

<u>Site Preparation</u>. Minimal site preparation activities would be necessary for this alternative. Temporary fencing, such as plastic silt fencing, would be constructed around the area to prevent unauthorized access to the site. Warning signs stating "Contaminated Area" would be posted at regular intervals along the fence.

A decontamination pad would be constructed at the site for decontamination of equipment and vehicles. The pad would consist of a liner material on the adjacent parking area and would be bermed and graded toward a sump for collection of decontamination fluid.

<u>Capping.</u> The area shown in Figure 6-10 would be capped to contain pesticide-contaminated soil. The total surface area to be capped is approximately 30,000 square feet ($ft^2$). A geotextile and gravel cover would be installed to allow adequate drainage, while providing protection to human and ecological receptors. It is intended that the capped area be used by the station as a parking lot for maintenance vehicles. A description of the function and purpose of the capping material is included below.

*Geotextile* The purpose of the geotextile would be to isolate soil that exceeds MPSs. The geotextile would serve as a marker for contaminated soil. A polypropylene, needle-punched geotextile would be preferred, which would provide sufficient transmissivity and allow for adequate drainage. Polypropylene is highly inert and resistant to a wide variety of chemicals; as a result, the risk of pesticides degrading the geotextile is minimal.

*Gravel* A layer of gravel would be placed over the geotextile to prevent contact by human and ecological receptors. The gravel would allow drainage of water and would be subangular to subrounded to prevent ripping or puncture of the geotextile. Since the final use of this area is intended as a parking lot, a limerock was chosen to allow for adequate compaction. Based on vendor estimates, approximately 672 tons of gravel would be necessary to cover 30,000 $ft^2$ and provide a 6-inch lift.

<u>Groundwater Screening</u>. Refer to Paragraph 6.3.1.1 for a detailed description.

<u>O&M</u>. Annual O&M activities would be required to implement this alternative and would include inspection of the geotextile and gravel. If the gravel cover appears to have eroded, new gravel would be placed over the area to ensure the cap is performing its intended purpose.

6.3.2.2 **Technical Criteria Evaluation** Alternative 15-2 is evaluated in this Paragraph based on performance, reliability, implementability, and safety of the alternative.

<u>Performance</u>. Alternative 15-2 is evaluated for performance based on the effectiveness and useful life of the alternative.

*Effectiveness* Under this alternative, the mobility of pesticide chemicals would be contained through capping with a geotextile and gravel cover, and thus would adequately protect human and ecological receptors from risks posed by dermal

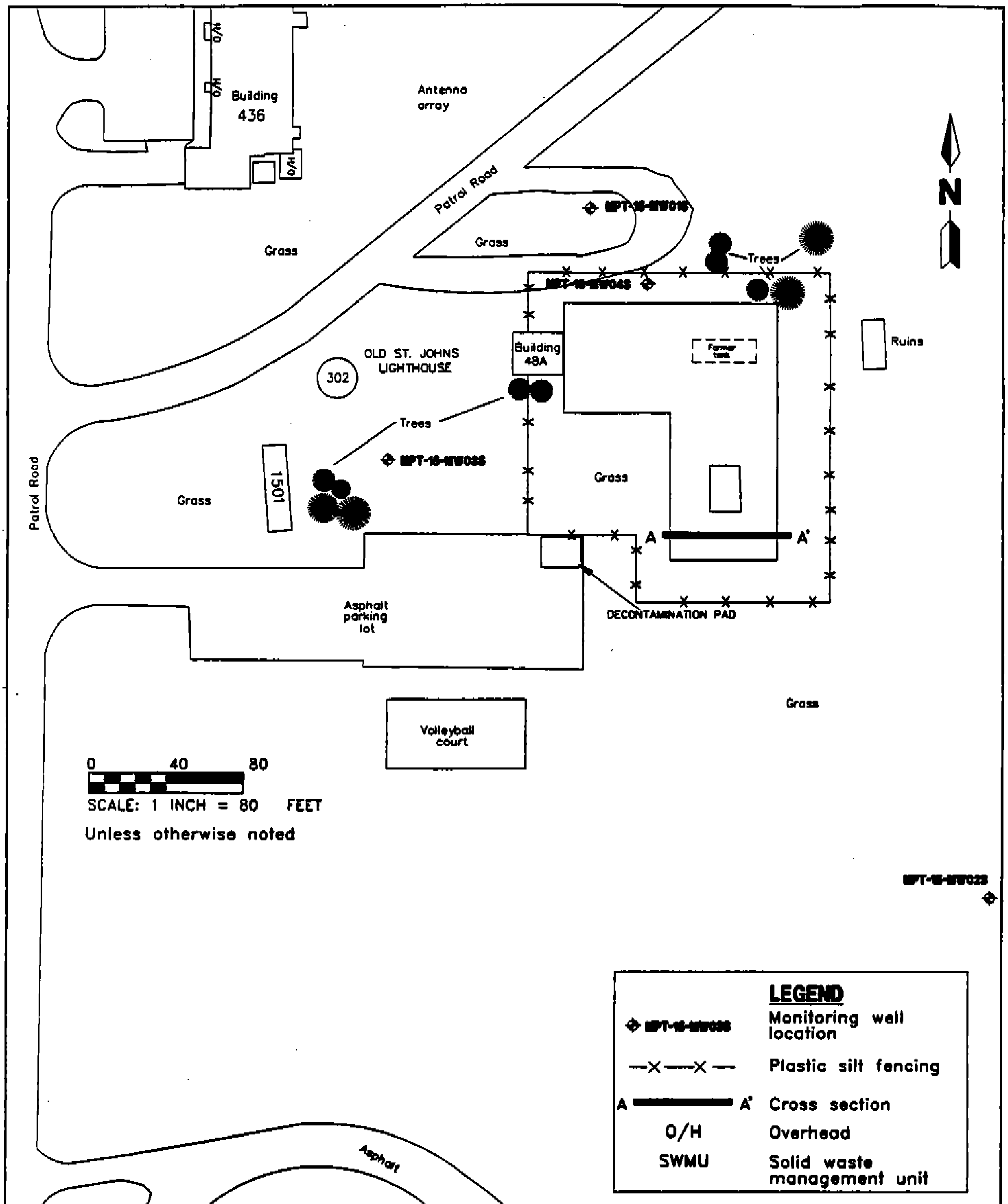



**FIGURE 6-10**
**SITE LAYOUT**
**ALTERNATIVE 15-2: CAPPING**

**CORRECTIVE MEASURES STUDY**
**GROUP II SWMUs**

**U.S. NAVAL STATION**
**MAYPORT, FLORIDA**

H:\9500\MAYFIGS\...\01-10-95

contact or inhalation of pesticide contaminants. Further, ecological receptors would be prevented from exposure to soil because the area would no longer provide an adequate habitat for terrestrial wildlife. Deed restrictions would also prevent unacceptable future uses of the land, including excavating soil or using the land for residential purposes.

Groundwater assessment and monitoring and potable water well surveys would be conducted through this alternative (see Paragraph 6.3.1.1). Assessment and monitoring of groundwater would further characterize the distribution of BHCs and arsenic in groundwater, and the potable water well survey would help identify human exposure to groundwater. As a result, this alternative (soil capping and groundwater assessment) is effective in achieving their respective CAOs.

The effectiveness of the capping material would be evaluated by examining the area on an annual basis to ensure that the geotextile is intact and the gravel adequately covers the area. It is not anticipated that specific site or waste characteristics would impede the effectiveness of this alternative.

*Useful Life* Geotextiles are resilient materials that are designed to resist breakdown. Once the area is capped, this alternative would be expected to provide adequate protection to human health and the environment indefinitely, as long as proper maintenance occurs on an annual basis.

<u>Reliability</u>. Alternative 15-2 is evaluated for reliability based on O&M requirements and demonstrated reliability.

*O&M* Although implementation of this alternative would take approximately 3 months from start to finish, annual O&M activities would be required and include maintaining the geotextile and gravel cover material. If the gravel cover appears to have eroded, new gravel would be placed at the site to ensure that the cap is performing its intended purpose.

This alternative does not propose annual groundwater sampling activities (because of leaving the soil containing pesticides in place and capped), but these efforts could be included pending the results of the groundwater sampling and analysis and the potable water well survey.

*Demonstrated Reliability* Capping is a demonstrated remedy for containing contaminated soil. This technology has been used successfully at other pesticide-contaminated sites.

<u>Implementability</u>. Alternative 15-2 is evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve CAOs.

*Constructability* No complex construction activities would be necessary for implementation of this alternative. Construction activities would take 3 months. One monitoring well is located along the boundary of the surface area to be capped. Special care would be taken to maintain the integrity of this monitoring well.

One permanent groundwater well and four temporary piezometers would be installed for this alternative. No unique difficulties are anticipated to perform these tasks.

*Time* Capping, including construction of the geotextile layer and placing of gravel, would take approximately 1 week. Installation of the piezometers and monitoring well, groundwater sampling, and potable water well survey would occur concurrently with capping activities and would take approximately 2 months. As a result, the implementation of this alternative would take less than 3 months.

Safety. Impacts to the community or the environment during implementation of this alternative are not expected. No wetlands or sensitive habitats have been identified in the area of SWMU 15, and impact to the surrounding environment would be minimal due to the short duration of the activities.

During installation of the cap, piezometers, and monitoring well, site workers would conduct work in the appropriate level of protectiveness. Dermal contact with surface soil and inhalation of airborne contaminants would be minimized.

**6.3.2.3 Environmental Criteria Evaluation** The ecological risk assessment completed for SWMU 15 identified unacceptable risks to small terrestrial wildlife (mammals and birds) based on exposure to soil through direct and indirect ingestion of soil and indirect ingestion of contaminated food. Sublethal effects were associated with exposure to 4,4'-DDT-contaminated soil.

Under this alternative, soil containing 4,4'-DDT at concentrations greater than MPSs would be capped. As a result, ecological receptor exposure to soil would be eliminated because the area would no longer be suitable for terrestrial wildlife habitat.

Thus, by implementing this alternative, the risk to ecological receptors has been eliminated, as the exposure pathway no longer exists. Therefore, this alternative is effective in the short- and long-term.

**6.3.2.4 Human Health Criteria Evaluation** The human health risk assessment identified unacceptable risks associated with current and future exposure to soil. An unacceptable risk was found for a resident and a site maintenance worker for exposure to soil through dermal contact and inhalation of particulates.

Under this alternative, a cap would be placed over the soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs. The cap would prevent exposure to soil through dermal contact, inhalation, or accidental ingestion. Once the cap material has been installed, the risk from exposure to soil has been eliminated. For further protection, a deed restriction would be instituted, prohibiting any excavation or residential activities at the SWMU.

During construction of the capping material and installation of monitoring wells, site workers would wear the proper level of protective clothing.

**6.3.2.5 Institutional Criteria Evaluation** Deed restrictions preventing site excavation and residential uses of the land would be required for implementation of this alternative. In addition, approval for closure of the SWMU would be necessary.

**6.3.2.6 Cost** A cost estimate for Alternative 15-2 was developed and is summarized in Table 6-9. The estimate includes direct and indirect costs (capital costs) that include costs of construction, equipment, services, labor, purchased services, capping of soil, engineering expenses, legal fees and permitting,

## Table 6-9
## Cost Summary Table for Alternative 15-2: Semipermeable Cover

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $6,000 |
| Equipment | $700 |
| Placement of Cap | $31,600 |
| Site Restoration | $2,500 |
| Groundwater Evaluation | $11,900 |
| Total Direct Cost (TDC) | $52,700 |
| | |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $1,100 |
| Administration and Permitting Fees (@ 4% of TDC) | $2,100 |
| Engineering and Design (@ 15% of TDC) | $7,900 |
| Construction Support Services (@ 5% of TDC) | $2,600 |
| Total Indirect Cost | $13,700 |
| | |
| **Total Capital Costs (Direct Cost plus Indirect Cost)** | **$66,400** |
| | |
| **Operation and Maintenance (O&M) Cost (Annual)** | |
| Replace Limerock Gravel | $2,700 |
| Total O&M Cost | $2,700 |
| Present Worth of O&M (Capitalized @ 6% Interest Rate) | $45,700 |
| | |
| **Subtotal (Capital Cost plus O&M Cost)** | **$112,100** |
| Contingency on Subtotal (@ 10%) | $11,200 |
| | |
| **TOTAL COST** | **$123,300** |

Notes: SWMU = solid waste management unit.
@ = at.
% = percent.

administrative activities, and contingency allowances. Appendix C provides the backup information used to develop the cost estimate presented in Table 6-9.

O&M costs for this alternative consist of the cost to replace gravel material. To maintain the integrity of the cap, replacement of gravel would be required on an indefinite basis. As a result, the annual O&M cost was capitalized.

<u>6.3.3 Alternative 15-3: Onsite, *Ex Situ* Biotreatment</u> Alternative 15-3 consists of constructing a lined treatment cell, adding nutrients and amendments, excavating the soil mixture, placing the soil in a lined treatment cell for anaerobic-aerobic degradation, removing treated soil, performing groundwater sampling, conducting a potable water well survey, and O&M.

6.3.3.1 **Description** This alternative is based on the biodegradability of 4,4'-DDT and chlordane in soil. Studies have shown that 4,4'-DDT will initially degrade to dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethene (DDE), and then eventually to dichlorodiphenylacetate (DDA), under anaerobic conditions (Kuhn and Suflita, 1989). DDA will then degrade further under aerobic conditions.

The rate of 4,4'-DDT transformation can be increased under anaerobic conditions through addition of carbon, mineral nutrients, blood meal, and surfactants. Continued anaerobic conditions in a reducing environment is recommended to further degrade 4,4'-DDT and DDE.

Based on the chemical structure of chlordane, anaerobic conditions would be required to biodegrade this substance. This biodegradation could be conducted under the same conditions as 4,4'-DDT. As a result, an optimum treatment cell would be designed to operate anaerobically, then aerobically to biodegrade by-products of 4,4'-DDT. Each component of the alternative is described in more detail below. Figure 6-11 shows the site layout and Figure 6-12 details the process flow for this alternative.

Major activities associated with this alternative include:

- pilot tests,
- site preparation,
- construction of lined treatment cell,
- addition of nutrients and amendments,
- soil-handling activities,
- confirmatory sampling and analysis of soil in open excavation,
- anaerobic cell operation,
- removal of water and aerobic cell operation,
- system operation,
- stockpiling of treated soil,
- backfilling excavated areas,
- site restoration and demobilization, and
- groundwater screening.

These activities are discussed in the following paragraphs.

<u>Pilot Tests</u>. Because biotreatment of 4,4'-DDT and chlordane is extremely site-specific, bench- and pilot-scale studies would be required. Each study would

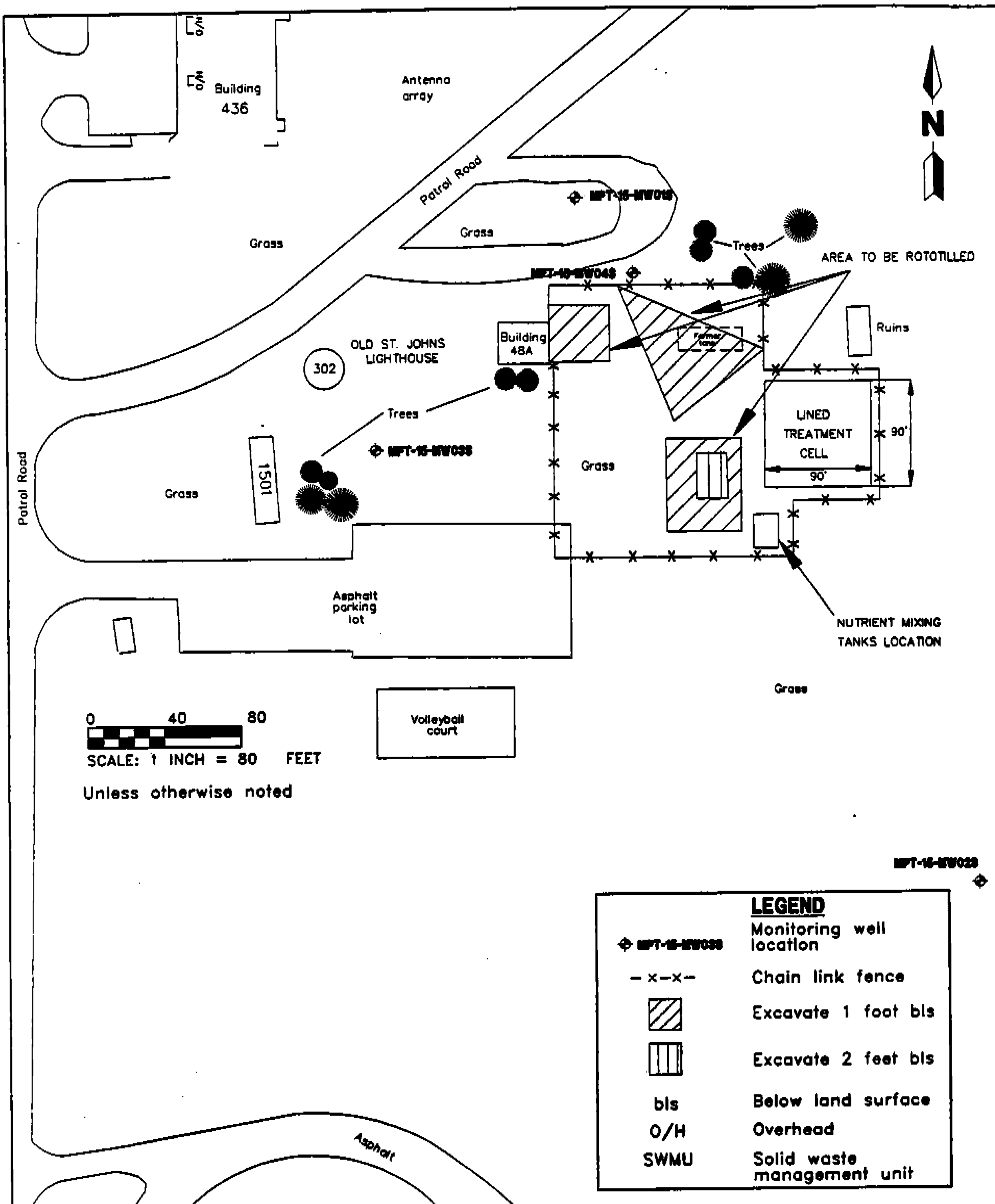
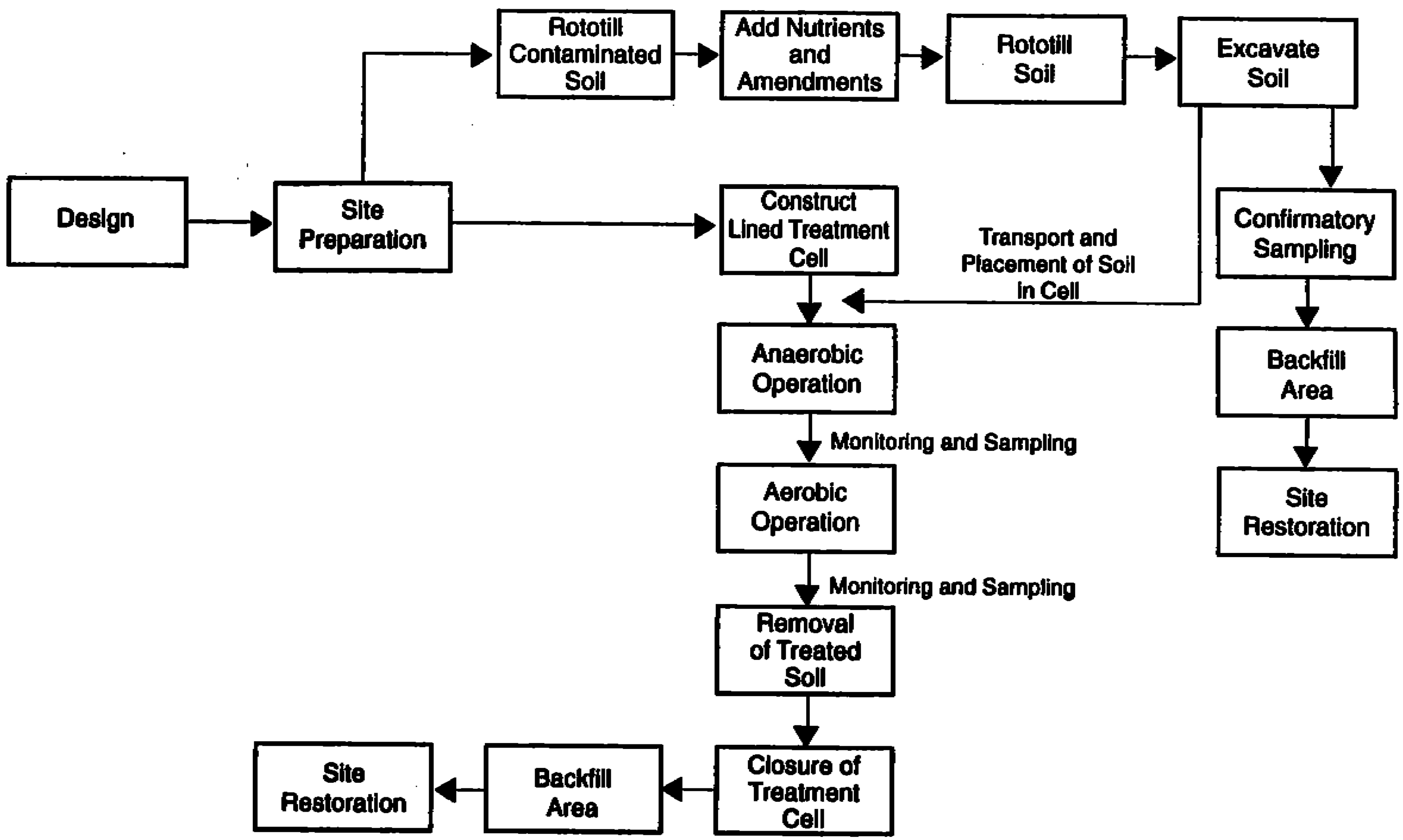



**FIGURE 6-11**
**SITE LAYOUT**
**ALTERNATIVE 15-3 *EX SITU* BIOTREATMENT**

**CORRECTIVE MEASURES STUDY**
**GROUP II SWMUs**

**U.S. NAVAL STATION**
**MAYPORT, FLORIDA**




**NOTES:**
SWMU = solid waste management unit

**FIGURE 6-12**
**PROCESS FLOW DIAGRAM FOR ALTERNATIVE 15-3:**
***EX SITU* BIOTREATMENT**

**CORRECTIVE MEASURES STUDY, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

6533-29 MAY PROCESS FLOW 121995MAW

involve examining the optimum ratio of nutrients, amendments, water, and temperature to create the conditions most conducive to each step of biodegradation.

Site Preparation. Activities prior to construction of the lined treatment cell and excavation of soil are included under site preparation.

Permanent fencing, such as a chain-linked fence, would be installed around the excavation and treatment area to limit public access during construction and treatment activities. Warning signs indicating "Contaminated Area" would be posted at 100-foot intervals along the length of the fence. The fence would remain in place until completion of *ex situ* biotreatment.

A decontamination pad would be constructed for decontamination of equipment and vehicles. This pad would consist of a liner material on the adjacent parking area and would be bermed and graded toward a sump for collection of decontamination fluid.

The lined treatment cell would require water for nutrient addition to create optimum conditions. A 2-inch PVC line would be connected to an existing water supply.

Construction of Lined Treatment Cell. An area adjacent to SWMU 15 would be excavated for construction of an imbedded, lined treatment cell. Approximately 750 cy of uncontaminated soil would be excavated and stockpiled for use as backfill.

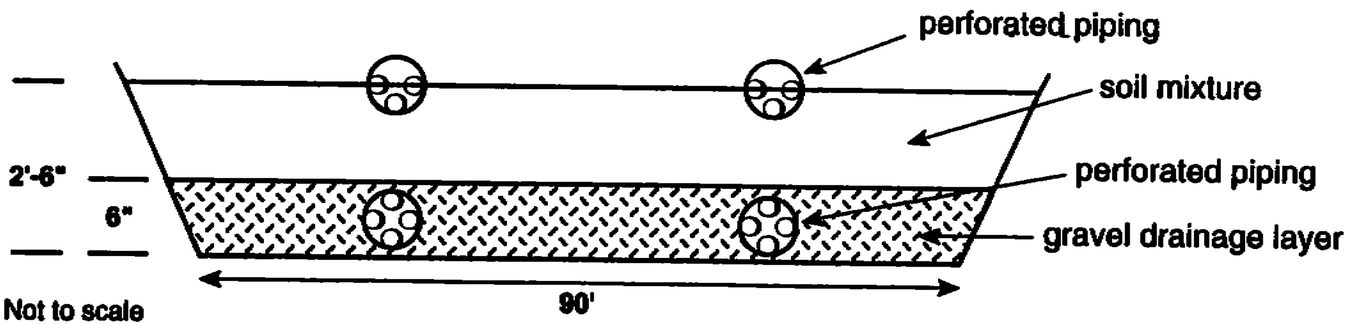
The treatment cell would be lined with high-density polypropylene (HDPE) and a 6-inch layer of gravel for drainage. A perforated piping system would be placed within the gravel layer. PVC piping would be placed over the cell for delivery of water amended with nutrients during anaerobic operation. This PVC piping would be connected to the perforated piping; thus, collected water is recirculated. During aerobic operation, the perforated piping would deliver air to the system. Figure 6-13 shows a cross section of the lined treatment system.

Addition of Nutrients and Amendments. To achieve optimum conditions for biodegradation, nutrients and amendments are required to stimulate degradation. Pesticide-contaminated soil would be mixed (via rototilling) in preparation for nutrient and amendment addition. Nitrogen, phosphate, and blood meal would be added in a dry form by layering the material over the mixed soil. A surfactant, a carbon source such as glucose, and a bacterial inoculum would be added to the soil in an aqueous form (via spraying). A mixing tank, pump, and hose would be necessary to prepare and deliver the aqueous form of these nutrients.

After the nutrients have been added, the soil would be remixed via rototilling to ensure that the pesticide-contaminated soil has been encompassed.

Soil-Handling Activities. The soil mixture would be excavated with a trackhoe for placement in the treatment cell. As estimated in Alternative 15-1, 533 cy or approximately 630 tons of soil would require excavation.

Confirmatory Sampling and Analysis of Soil in Open Excavation. Soil samples would be collected from the open excavation to verify that soil above MPSs has been removed. Based on a 50-foot grid pattern, 15 soil samples would be collected and




**NOTES:**
SWMU = solid waste management unit

**FIGURE 6-13**
**CROSS SECTION OF LINED TREATMENT CELL**
**ALTERNATIVE 15-3:**
***EX SITU* BIOTREATMENT**

**CORRECTIVE MEASURES STUDY, GROUP II SWMUs**

**U.S. NAVAL STATION**
**MAYPORT, FLORIDA**

8533-09 MAY LINED CELL FINAL 121996MAW

sent to an offsite laboratory for analysis. Each sample would be analyzed for Appendix IX pesticides. If the sampling results indicate concentrations greater than MPSs, an additional one foot of soil would be excavated, and the open excavation would be sampled again.

Anaerobic Cell Operation. The amended soil would be distributed throughout the lined treatment cell after excavation. Once the soil mixture is distributed, water would be added through the PVC piping system to create anaerobic conditions and a reducing environment.

During anaerobic operation of the treatment cell, water would be periodically recirculated through the system to supply additional nutrients and amendments. Water amended with nutrients would be supplied to the system through a PVC piping network at the top of the cell and would be recirculated by collecting spent water through the gravel underdrain. A storage tank would be located onsite to collect and store excess water collected during major storm events.

The cell is designed to remain open during treatment; however, if excessive microbial offgases are produced (e.g., methane and sulfides), an HDPE cover could be installed.

Monitoring of anaerobic treatment would include weekly measurements of methane, nitrogen, phosphate, pH, and redox potential. Carbon levels would be monitored on a monthly basis to evaluate amendment concentrations. Soil samples would be collected for Appendix IX pesticides on a monthly basis for the first 6 months and quarterly thereafter. Anaerobic conditions would be maintained until 4,4'-DDT and chlordane levels are below the MPSs.

The anaerobic treatment cell would operate from 1 to 3 years, depending upon specific soil conditions.

Removal of Water and Aerobic Cell Operation. Although levels of 4,4'-DDT and chlordane would have been reduced below MPSs through anaerobic treatment, degradation products formed, such as DDA, would require further degradation aerobically. To induce aerobic conditions, water would be removed from the cell through the drainage system and diverted to a sump. Air would then be circulated through the soil mixture via the perforated pipe at the top of the treatment cell. A blower would be attached to the piping to provide the required air.

Oxygen, carbon dioxide, pH, and mineral nutrients would be monitored on a weekly basis. Soil samples would be collected and analyzed for DDA on a monthly basis. The aerobic treatment system would be operated for approximately 90 days, which would be sufficient to reduce DDA levels by 90 percent.

System Operation. The treatment system is expected to be operated for approximately 3 years. As a result, nutrients and amendments would be supplied during that time. In addition, power must be supplied to the pumps and other equipment. There are no other O&M requirements associated with this alternative.

Stockpiling of Treated Soil. The treated soil would be removed from the treatment cell using a trackhoe and stockpiled.

Backfilling Excavated Areas. The excavated areas would be backfilled with uncontaminated and treated soil. The treatment cell excavation would also be backfilled with uncontaminated or treated soil.

Site Restoration and Demobilization. The treatment cell would be decommissioned by removing the HDPE liner, gravel, piping, and equipment. Materials would be decontaminated and either disposed of or reused.

Once the excavated areas have been backfilled, both areas would be seeded, fertilized, and mulched to promote grass growth. Hay would be used to protect the seed and fertilizer during initial development.

Groundwater Screening. Refer to Paragraph 6.3.1.1 for a detailed description.

6.3.3.2 **Technical Criteria Evaluation** Alternative 15-3 is evaluated in this paragraph based on performance, reliability, implementability, and safety of the alternative.

Performance. Alternative 15-3 is evaluated for performance based on the effectiveness and useful life of the alternative.

*Effectiveness* Under this alternative, contaminated soil would be excavated and treated onsite through *ex situ* biotreatment. The soil would be treated to levels below MPSs for 4,4'-DDT and chlordane. Groundwater assessment and potable water well surveys would be conducted through this alternative. Assessment of groundwater would further characterize the distribution of BHC isomers in groundwater and the potable water well survey would help identify human exposure to groundwater (Paragraph 6.3.1.1). As a result, this alternative (*ex situ* biotreatment and groundwater assessment) is effective in achieving CAOs.

Soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs would be excavated and treated in an engineered biotreatment cell. Treatment would continue until concentrations of 4,4'-DDT and chlordane have been sufficiently reduced to treatment levels (see Paragraph 4.2.2.3). Collecting confirmatory samples would be collected to ensure that soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs has been excavated and treated.

Initial studies (i.e., bench- and pilot-scale studies) would be completed prior to implementation of this alternative to determine the effectiveness of biotreatment. In addition, once the alternative is implemented, the effectiveness of the biotreatment cell would be evaluated periodically. During anaerobic treatment, the soil mixture would be monitored weekly for methane, nitrogen, phosphorous, pH, and redox potential and monthly for carbon levels. Soil samples would be collected monthly during initial startup and quarterly thereafter to evaluate concentrations of 4,4'-DDT and chlordane. During aerobic operation, oxygen and nutrient levels would be monitored weekly. Soil samples would be collected every month to ensure that degradation of by-products of 4,4'-DDT and chlordane, such as DDA, have been reduced.

*Useful Life* Biotreatment would reduce contaminant concentrations over a 3-year treatment period. Once biodegradation occurs, 4,4'-DDT and chlordane would have been permanently degraded, as the process can not be reversed.

Reliability. Alternative 15-3 is evaluated for reliability based on O&M requirements and its demonstrated reliability.

*O&M* O&M requirements for this alternative include purchase of nutrients and amendments for periodic addition to the treatment cell. Weekly monitoring and monthly sampling of the soil mixture in the treatment cell would also be conducted. The treatment cell would be examined to ensure that the piping network is not plugged and is delivering water at proper loading rates. These O&M activities are relatively standard and do not involve unique operations.

Labor and materials for implementation of this alternative are readily available and easy to obtain.

*Demonstrated Reliability* Biotreatment of pesticide-contaminated soil is an innovative technology that has not been widely used at full-scale applications. Several bench-scale studies have been conducted in which soil has been successfully treated through biodegradation. As a result, a bench- and pilot-scale study would be conducted prior to implementation of this alternative to calibrate biotreatment for SWMU 15 soil.

Implementability Alternative 15-3 is evaluated for implementability based on the relative ease of installation (i.e., constructability) and the time required to achieve CAOs.

*Constructability Ex situ* biotreatment would require construction of a biotreatment cell. Lined cells, such as the one proposed in this alternative, have been used in similar applications. Construction of the lined cell would require excavation of soil, installing a liner, constructing the water recirculation system, and placement of a gravel layer. Minimal utility hookups would be required to implement this alternative.

Addition of amendments to soil in a treatment cell has been conducted at similar sites and does not pose unique challenges. Excavation of soil and transport to the cell are standard remediation tasks and should not cause constructability problems.

For the purpose of the CMS, it is assumed that one permanent groundwater monitoring well and four temporary piezometers would be installed for this alternative. No unique difficulties are anticipated to perform these tasks.

*Time* Site preparation activities, construction of a lined treatment cell, excavation of contaminated soil, anaerobic-aerobic treatment, and site restoration would require approximately 3 years. Installation of the piezometers and well, groundwater sampling, and potable water well survey would be conducted concurrently with the operation of the lined treatment cell and would require approximately 2 months.

Safety. Impacts to the community or the environment during implementation of this alternative are not expected. No wetland or sensitive habitats have been identified in the area of SWMU 15, and impact to the surrounding environment would be minimal due to the short duration of the activities.

During installation and operation of the biotreatment cell, piezometers, and monitoring well, site workers would conduct work in the appropriate level of protectiveness. Dermal contact with surface soil and inhalation of airborne contaminants would be minimized.

**6.3.3.3 Environmental Criteria Evaluation** The ecological risk assessment completed for SWMU 15 identified unacceptable risks to small terrestrial wildlife (mammals and birds) based on exposure to soil through direct and indirect ingestion of soil and indirect ingestion of contaminated food. Sublethal effects were associated with exposure to 4,4'-DDT-contaminated soil.

Under this alternative, soil containing 4,4'-DDT at concentrations greater than MPSs would be excavated and treated. As a result, ecological receptor exposure to soil would be eliminated. In the short term, risks would not be eliminated, as it would take time to install the treatment system and treat the soil to acceptable levels. In the long-term, risks would be eliminated because pesticide-contaminated soil would be treated to concentrations below MPSs.

**6.3.3.4 Human Health Criteria Evaluation** The human health risk assessment identified unacceptable risks associated with current and future exposure to SWMU 15 soil. An unacceptable risk was found for a resident and site maintenance worker for exposure to SWMU 15 soil through dermal contact and inhalation of particulates.

Under this alternative, soil containing 4,4'-DDT and chlordane at concentrations greater than MPSs would be excavated and treated in an onsite biotreatment cell. During construction of the capping material and installation of monitoring wells, site workers would wear the proper level of protective clothing.

**6.3.3.5 Institutional Criteria Evaluation** Deed restrictions preventing site excavation and residential uses of the land would be required for implementation of this alternative. In addition, approval for closure of the SWMU would be necessary.

**6.3.3.6 Cost** A cost estimate for Alternative 15-3 was developed and is summarized in Table 6-10. The estimate includes direct and indirect costs (capital costs) that include costs of construction, equipment, services, labor, purchased services, offsite treatment of soil, engineering expenses, legal fees and permitting, administrative activities, and contingency allowances. Appendix C provides the backup information used to develop the cost estimate presented in Table 6-10.

O&M costs such as purchase of nutrients and amendments and power requirements were included for this alternative. Because this alternative would require approximately 3 years until completion, the present worth of the O&M costs were calculated based on a 3-year O&M period at a 6 percent interest rate.

## Table 6-10
## Cost Summary Table for Alternative 15-3: Onsite, *Ex Situ* Biotreatment

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Cost Item | Cost |
|---|---|
| **Direct Cost** | |
| Site Preparation | $17,800 |
| Equipment | $1,700 |
| Pilot Studies | $75,000 |
| Construct Lined Treatment Cell | $84,100 |
| Soil Handling | $57,700 |
| Confirmatory Sampling and Analysis of Treated Soil | $5,600 |
| Site Restoration | $23,700 |
| Groundwater Evaluation | $11,900 |
| Total Direct Cost (TDC) | $293,700 |
| **Indirect Cost** | |
| Health and Safety (@ 2% of TDC) | $5,900 |
| Administration and Permitting Fees (@ 2% of TDC) | $5,900 |
| Engineering and Design (@ 10% of TDC) | $44,000 |
| Construction Support Services (@ 10% of TDC) | $29,400 |
| Total Indirect Cost | $85,200 |
| **Total Capital Costs (Direct Cost plus Indirect Cost)** | **$378,900** |
| **Operation and Maintenance (O&M) Cost (Annual)** | |
| System Operation | $55,800 |
| Power Requirements, Labor, Monitoring, Analytical | $48,400 |
| Total O&M Cost | $104,200 |
| Present Worth of O&M (for 3 years @ 8% Interest Rate) | $278,500 |
| **Subtotal (Capital Cost plus O&M Cost)** | **$657,400** |
| Contingency on Subtotal (@ 10%) | $65,700 |
| **TOTAL COST** | **$723,100** |

Notes: SWMU = solid waste management unit.
@ = at.
% = percent.

# 7.0 JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION

This Chapter recommends and justifies a corrective action for contaminated sludge and soil and LNAPL at SWMUs 6 and 7 and pesticide-contaminated soil at SWMU 15. Corrective action alternatives for these SWMUs were developed in Chapter 5.0 and were individually evaluated in Chapter 6.0.

As specified in the CMS workplan, this Chapter presents a comparative evaluation of each alternative using three criteria: technical, environmental, and human health. This comparison is intended to provide the technical information required (i.e., the justification) to support the recommended action.

## 7.1 OVERALL APPROACH TO JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION.

A corrective action is chosen for each SWMU or group of SWMUs based on an evaluation of alternatives by three criteria: technical, environmental, and human health (Table 7-1). Corrective action alternatives for SWMUs 6, 7, and 15 are evaluated against these criteria in a tabular form so that trade-offs between health risks, environmental effects, and other pertinent factors are highlighted. This evaluation provides the basis, or the justification, for the recommended corrective action.

The recommended corrective action could be a single action, or it could be a combination of actions (i.e., alternatives described in Chapter 6.0, or portions thereof, could be combined to form an optimum site response).

One method of documenting the recommended corrective action, while allowing operational flexibility for future modifications, is to identify a "base action" (selected corrective action) and a "contingent action" (system modification). For example, Alternatives 6 and 7-4 could be designated as the base action, while Alternatives 6&7-5 and 6&7-6 could be designed as contingent actions if the base action is not as effective as anticipated.

The recommended corrective action for sludge, soil, and LNAPL at SWMUs 6 and 7 are discussed in Paragraphs 7.2.1.2 and 7.2.2.2, respectively. The recommended corrective action for soil at SWMU 15 is discussed in section 7.3.2.

## 7.2 JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION FOR SWMUS 6 AND 7.

This section provides the justification and recommendation of corrective action for soil, sludge, and LNAPL at SWMUs 6 and 7.

**7.2.1 Sludge and Soil at SWMUs 6 and 7** This Subsection provides an evaluation (justification) and recommends a corrective action for sludge and soil at SWMUs 6 and 7.

**7.2.1.1 Justification for Recommended Corrective Action** Table 7-2 provides the justification or evaluation of corrective action for sludge and soil at SWMUs 6 and 7.

**7.2.1.2 Recommended Corrective Action** The recommended corrective action for sludge and soil at SWMUs 6 and 7 is Alternatives 6 and 7-1, Onsite Thermal Desorption.

**Table 7-1**
**Criteria for Justification and Recommendation of Corrective Action**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Description |
|---|---|
| Technical | Four factors will be reviewed for the technical criteria:<br>• Performance Corrective measure or measures that are most effective at performing their intended functions and maintaining the performance over extended periods of time will be given preference.<br>• Reliability Corrective measure or measures that do not require frequent or complex operation and maintenance activities and that have been proven effective for waste and station conditions similar to those anticipated will be given preference.<br>• Implementability Corrective measure or measures that can be constructed and operated to reduce levels of contamination to attain applicable standards in the shortest period of time will be preferred.<br>• Safety Corrective measure or measures that pose the least threat to the safety of nearby residents, environments, and workers during implementation will be preferred. |
| Human Health | The corrective measure must comply with existing USEPA criteria, standards, or guidelines for the protection of human health. Corrective measures that provide the minimum level of exposure to contaminants and the maximum rate of reduction in exposure are preferred. |
| Environmental | The corrective measure posing the least adverse impact (or greatest improvement) in the shortest period of time on the environment will be favored. |

Notes: SWMU = Solid Waste Management Unit.
USEPA = U.S. Environmental Protection Agency.

## Table 7-2
## Justification of Corrective Action SWMUs 6 and 7, Sludge and Soil

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternatives 6 and 7-1: Onsite Thermal Desorption | Alternatives 6 and 7-2: Onsite, *Ex situ* Biotreatment | Alternatives 6 and 7-3: Offsite Soil Recycling |
|---|---|---|---|
| **Technical, Performance** | | | |
| Effectiveness of alternative to perform intended function. | Alternative would achieve CAO 2 and treatment levels. | Same as Alternatives 6 and 7-1. | Same as Alternatives 6 and 7-1. |
| Ability of alternative to maintain effectiveness over time. | Destruction (volatilization) of contaminants in soil via thermal desorption is permanent and irreversible. | Biodegradation of contaminants in soil over time is based on maintaining optimal microbial conditions. The degradation of petroleum constituents to their breakdown products is permanent and irreversible. | Destruction (volatilization) of contaminants in soil via thermal desorption is permanent and irreversible. |
| **Technical, Reliability** | | | |
| O&M activities required for alternative. | None anticipated. | Nutrients and amendments would be added to the treatment cell. Monitoring of treatment cell conditions and sampling of soil within the cell would also be conducted to maintain optimal biodegradation conditions and to ensure that treatment levels are being achieved. | None anticipated. |
| Frequency of O&M activities required. | NA | Monitoring and sampling - weekly. Equipment adjustments, nutrient amendments - biweekly. | NA |
| Proven effectiveness of alternative when implemented for similar sites. | Alternative is successful at treating petroleum-contaminated sludge and soil, as demonstrated at other sites with similar release characteristics. | Alternative is successful at treating petroleum-contaminated sludge and soil, as demonstrated at other sites with similar release characteristics. | Alternative is successful at treating petroleum-contaminated sludge and soil. FDEP has list of qualified and permitted thermal treatment facilities that reduce volatile contamination prior to recycling. |
| **Technical, Implementability** | | | |
| Constructability of alternative and ability to reduce levels of contamination. | Alternative is 99.99% effective in treating petroleum-contaminated sludge and soil to treatment levels. Alternative will be implemented at the SWMUs under NELP; system optimization and treatability information would be generated and used to design Alternatives 6 and 7-1. | Alternative may not be effective in attaining treatment levels. | Alternative is 99.99% effective in treating petroleum-contaminated sludge and soil to treatment levels. |

See notes at end of table.

## Table 7-2 (Continued)
## Justification of Corrective Action SWMUs 6 and 7, Sludge and Soil

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternatives 6 and 7-1: Onsite Thermal Desorption | Alternatives 6 and 7-2: Onsite, *Ex situ* Biotreatment | Alternatives 6 and 7-3: Offsite Soil Recycling |
|---|---|---|---|
| Time until alternative reduces levels of contamination. | 12 weeks. | 52 weeks. | 12 weeks. |
| **Technical, Safety** | | | |
| Threat to safety of nearby residents posed by implementing alternative. | None. A fence with warning signs would be constructed around the excavation and treatment area to limit access to the SWMUs during implementation. | None. Same as Alternatives 6 and 7-1. | None. A fence with warning signs would be constructed around the excavation and stockpile area to limit access to the SWMUs during implementation. |
| Threat to safety of workers posed by implementing alternative. | Minimal. Workers would wear PPE to minimize dermal contact with or inhalation of contaminants. | Minimal. Same as Alternatives 6 and 7-1. | Minimal. Same as Alternatives 6 and 7-1. |
| **Human Health** | | | |
| Compliance with existing USEPA and FDEP criteria, standards, and guidance. | Although a human health risk assessment was not completed for sludge and soil at SWMUs 6 and 7, implementing this alternative would comply with USEPA and FDEP criteria, standards, and guidance. The intent of FAC 62-775 would be maintained if this alternative were implemented. | Same as Alternatives 6 and 7-1. | Same as Alternatives 6 and 7-1. |
| Ability of alternative to reduce human exposure to contaminants. | Humans would not be exposed to contaminated sludge and soil during treatment. Treated soil would be returned to the excavation and the area would be revegated. In this manner, human exposure to contaminated sludge and soil would be minimized. | Human exposure to contaminated sludge and soil during treatment would be controlled through construction of a fence around the treatment area. Treated soil would be returned to the excavation and the area would be revegated. In this manner, human exposure to contaminated sludge and soil would be minimized. | Humans would not be exposed to contaminated sludge and soil during treatment. Since contaminated sludge and soil is transported offsite for thermal treatment, human exposure to contaminants would be minimized. |
| Ability of alternative to reduce contaminant exposure over time. | Destruction of contaminants in sludge and soil via thermal desorption is permanent and irreversible. | Biodegradation of contaminants in sludge and soil over time is based on maintaining optimal microbial conditions. The degradation of petroleum constituents to their breakdown products is permanent and irreversible. | Destruction (volatilization) of contaminants in sludge and soil via thermal desorption is permanent and irreversible. |

See notes at end of table.

## Table 7-2 (Continued)
## Justification of Corrective Action SWMUs 6 and 7, Sludge and Soil

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternatives 6 and 7-1: Onsite Thermal Desorption | Alternatives 6 and 7-2: Onsite, *Ex situ* Biotreatment | Alternatives 6 and 7-3: Offsite Soil Recycling |
|---|---|---|---|
| **Environmental** | | | |
| Time until adverse environmental impacts are addressed. | No adverse impacts to the environment were identified because no ecological risk assessment was completed for the SWMUs. | Same as Alternatives 6 and 7-1. | Same as Alternatives 6 and 7-1. |
| Improvements to environment realized through implementing alternative. | The source of LNAPL at SWMUs 6 and 7 would be permanently removed. | Same as Alternatives 6 and 7-1. | Same as Alternatives 6 and 7-1. |

Notes: SWMU = Solid Waste Management Unit.
CAO = Corrective Action Objective.
O&M = operation and maintenance.
NA = not applicable.
FDEP = Florida Department of Environmental Protection.
% = percent.
NELP = Navy Environmental Leadership Program.
PPE = personal protective equipment.
USEPA = U.S. Environmental Protection Agency.
FAC = Florida Administrative Code.
LNAPL = light nonaqueous-phase liquid.

Excavation and treatment via thermal desorption would remove the source of LNAPL at the SWMUs, treat sludge and soil to treatment levels, and protect human health and the environment. Implementation of Alternatives 6 and 7-1 would achieve CAOs.

Thermal treatment will be implemented during a technology demonstration for approximately 2,076 of the 29,800 cy of contaminated soil at SWMUs 6 and 7 under NELP. Under this program, a thermal treatment unit will be mobilized and staged at the site for thermal desorption. Operational data, such as optimal water content, drum residence time, operating temperature of the primary and secondary treatment unit, and production volume, will be obtained. Implementation of Alternatives 6 and 7-1 would profit from information generated under the NELP program: system optimization would be based on these data, mobilization and demobilization costs would not be incurred (assuming the technology demonstration is successful and the NELP contractor is contractually allowed to complete the project), and system operation would be maximized.

Implementing Alternatives 6 and 7-1 would not transfer contaminants offsite (as opposed to Alternatives 6 and 7-3) and would achieve CAO 2 in a shorter period of time (as opposed to Alternatives 6 and 7-2).

Because Alternatives 6 and 7-1 (thermal desorption) would be implemented over 12 weeks, access and easements to the treatment area would only be necessary for this relatively short period (compared to 52 weeks for Alternatives 6 and 7-2 [*ex situ* biotreatment]). Also, the excavation would only remain exposed for a shortened time period.

<u>7.2.2 LNAPL at SWMUs 6 and 7</u> This Subsection provides the evaluation (justification) and recommends a corrective action for LNAPL at SWMUs 6 and 7.

7.2.2.1 **Justification for Recommended Corrective Action** Table 7-3 provides the justification or evaluation of corrective action alternatives for LNAPL at SWMUs 6 and 7.

7.2.2.2 **Recommended Corrective Action** The recommended corrective action for LNAPL at SWMUs 6 and 7 is Alternatives 6 and 7-4, sumps with total fluids pumping.

This alternative is currently being implemented as part of an IM for SWMUs 6 and 7 (ABB-ES, 1994b). The alternative is recommended because it is currently being implemented, and, based on current site knowledge, other alternatives are not anticipated to be more effective at achieving CAO 1.

The effectiveness of the alternative should be assessed using the criteria described in Chapter 6.0. If data collected while the system is operating indicate that the corrective action is not effective, the system design is flexible enough that adjustments could be made to improve efficiency. One potential adjustment would be to drawdown groundwater to induce LNAPL flow into the sumps. This could be accomplished by replacing the total fluids pumps with dual-phase pumps (as described in Alternatives 6 and 7-6). If the recommended corrective action is not effective after adjustments, a supplemental alternative, such as trench installation (as described in Alternatives 6 and 7-5), may need to be implemented.

## Table 7-3
## Justification of Corrective Action SWMUs 6 and 7, LNAPL

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternatives 6 and 7-4: Sumps with Total Fluids Pumping | Alternatives 6 and 7-5: Trenches with LNAPL-Skimming | Alternatives 6 and 7-6: Sumps with Groundwater Drawdown and LNAPL-Skimming |
|---|---|---|---|
| **Technical, Performance** | | | |
| Effectiveness of alternative to perform intended function. | Ability of corrective action to achieve CAO 1 will be evaluated during the IM. | If IM does not achieve CAOs, this alternative may enhance effectiveness of the system. | Same as for Alternatives 6 and 7-5. |
| Ability of alternative to maintain effectiveness over time. | LNAPL currently present at the SWMUs would be permanently removed; however, the source of LNAPL (sludge and soil) must be removed so that LNAPL would no longer be generated. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |
| **Technical, Reliability** | | | |
| O&M activities required for alternative. | Maintenance of equipment, groundwater elevation measurements, LNAPL thickness measurements, and biodegradation monitoring. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |
| Frequency of O&M activities required. | Monthly | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |
| Proven effectiveness of alternative when implemented for similar sites. | Alternative is successful at removing LNAPL at other sites with similar release characteristics. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |
| **Technical, Implementability** | | | |
| Constructability of alterative and ability to reduce levels of contamination. | Alternative is currently being implemented as part of an IM. | Underground utilities may prevent the installation of trenches. | Would include only minor modifications to the existing IM. |
| Time until alternative reduces levels of contamination. | Estimated 5 to 10 years. | Estimated 5 to 10 years from implementation. | Estimated 5 to 10 years from implementation. Actual time may be less because this alternative is more aggressive than the others. |

See notes at end of table.

**Table 7-3 (Continued)**
**Justification of Corrective Action SWMUs 6 and 7, LNAPL**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternatives 6 and 7-4: Sumps with Total Fluids Pumping | Alternatives 6 and 7-5: Trenches with LNAPL-Skimming | Alternatives 6 and 7-6: Sumps with Groundwater Drawdown and LNAPL-Skimming |
|---|---|---|---|
| **Technical, Safety** | | | |
| Threat to safety of nearby residents posed by implementing alternative. | None. A fence limits access to area where alternative is being implemented. Migration of contaminants in air is not expected. | None. Same as for Alternatives 6 and 7-4. | None. Same as for Alternatives 6 and 7-4. |
| Threat to safety of workers posed by implementing alternative. | Minimal. Workers would wear PPE to minimize dermal contact with or inhalation of contaminants. | Minimal. Same as for Alternatives 6 and 7-4. | Minimal. Same as for Alternatives 6 and 7-4. |
| **Human Health** | | | |
| Compliance with existing USEPA and FDEP criteria, standards, and guidance. | Although a human health risk assessment was not completed for LNAPL at SWMUs 6 and 7, implementing this alternative would comply with USEPA and FDEP criteria, standards, and guidance. The intent of FAC 62-775 would be maintained if this alternative were implemented. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |
| Ability of alternative to reduce human exposure to contaminants. | Humans are currently not exposed to LNAPL and would not be exposed to LNAPL during treatment. LNAPL would be treated in the OWTP along with other oily waste received from other sources. LNAPL separated by the OWTP would be recycled. Water separated by the OWTP would be discharged to the sanitary sewer. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |
| Ability of alternative to reduce contaminant exposure over time. | LNAPL removal is permanent. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |

See notes at end of table.

## Table 7-3 (Continued)
## Justification of Corrective Action SWMUs 6 and 7, LNAPL

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternatives 6 and 7-4: Sumps with Total Fluids Pumping | Alternatives 6 and 7-5: Trenches with LNAPL-Skimming | Alternatives 6 and 7-6: Sumps with Groundwater Drawdown and LNAPL-Skimming |
|---|---|---|---|
| **Environmental** | | | |
| Time until adverse environmental impacts are addressed. | No adverse impacts to the environment were identified because no ecological risk assessment was completed for the SWMUs. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |
| Improvements to environment realized through implementing alternative. | LNAPL at SWMUs 6 and 7 would be removed. | Same as for Alternatives 6 and 7-4. | Same as for Alternatives 6 and 7-4. |

Notes: SWMU = Solid Waste Management Unit.
LNAPL = light, non-aqueous phase liquid.
CAO = Corrective Action Objective.
IM = Interim Measure.
O&M = operation and maintenance.
PPE = personal protective equipment.
USEPA = U.S. Environmental Protection Agency.
FDEP = Florida Department of Environmental Protection.
FAC = Florida Administrative Code.
OWTP = Oily Waste Treatment Plant.

**7.3 JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION FOR SWMU 15.** This Section provides the evaluation (justification) and recommends a corrective action for soil at SWMU 15.

**7.3.1 Justification for Recommended Corrective Action** Table 7-4 provides the justification or evaluation of corrective action alternatives for soil at SWMU 15.

**7.3.2 Recommended Corrective Action** Currently, an innovative *in situ* biological treatment technology is being implemented at the SWMU that is intended to reduce the concentrations of pesticides in soil at SWMU 15. At the end of the treatment period for the technology demonstration, the concentrations of 4,4'-DDT and chlordane in soil would be measured. If concentrations of these substances are greater than MPSs (see Paragraph 4.2.2.3), implementation of Alternative 15-2 would be recommended. Alternative 15-2, which includes capping and groundwater assessment and monitoring, would protect human health and the environment and achieve CAOs.

Alternative 15-2 addresses risks to human health and the environment by providing a barrier to prevent exposure to unacceptable levels of 4,4'-DDT and chlordane in soil. The cost of Alternative 15-2 is estimated to be approximately $500,000 to $1,000,000 lower than Alternatives 15-3 and 15-1, respectively.

Implementation of Alternative 15-2 would occur over a short period of time and would provide a functional parking area for the station. No excavation activities would be required for this alternative, and, as a result, the possibility of transferring contaminants offsite would be eliminated.

**Table 7-4**
**Justification of Corrective Action SWMU 15**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternative 15-1: Offsite Incineration | Alternative 15-2: Semipermeable Cover | Alternative 15-3: Onsite, *Ex situ* Biotreatment |
|---|---|---|---|
| **Technical, Performance** | | | |
| Effectiveness of alternative to perform intended function. | Alternative would be effective in achieving CAOs. | Same as Alternative 15-1. | Pending the results of bench and pilot scale studies, this alternative is predicted to achieve CAOs. |
| Ability of alternative to maintain effectiveness over time. | Soil would be excavated and transported offsite, thereby removing contaminated soil from the site permanently. | Capping would prevent human and ecological exposure to pesticide-contaminated soil. Periodic inspection of the cap would be required to maintain the effectiveness of this alternative. | *Ex situ* biotreatment would reduce concentrations of contaminants permanently. |
| **Technical, Reliability** | | | |
| O&M activities required for alternative. | None anticipated. | Replacement of gravel and inspection of the geotextile. | Nutrients and amendments would be added to the treatment cell. Monitoring of treatment cell conditions and sampling of soil within the cell would also be conducted. |
| Frequency of O&M activities required. | NA | Annual | Weekly to quarterly. |
| Proven effectiveness of alternative when implemented for similar sites. | Excavation and offsite treatment has been used at various sites with success. | Semipermeable caps have been used as barriers to dermal contact in similar applications. | *Ex situ* Biotreatment is an innovative treatment technology for pesticide-contaminated soil. This method has only been tested at bench-scale and pilot-scale levels and has not been tested on a full-scale application. |
| **Technical, Implementability** | | | |
| Ability of alternative to reduce levels of contamination or attain MPSs. | Would attain MPSs and reduce contaminant concentrations through excavating and transporting soil to a permitted RCRA Subtitle C incineration facility. | This alternative does not reduce contaminant concentrations. Exposure to contaminants would be prevented through capping. | This alternative would reduce concentrations of 4,4'-DDT and chlordane to below MPSs by excavating the contaminated soil and inducing biodegradation. This would be verified during bench and pilot scale studies. |

See notes at end of table.

## Table 7-4 (Continued)
## Justification of Corrective Action SWMU 15

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternative 15-1: Offsite Incineration | Alternative 15-2: Semipermeable Cover | Alternative 15-3: Onsite, *Ex situ* Biotreatment |
|---|---|---|---|
| **Technical, Implementability (Continued)** | | | |
| Time until alternative reduces levels of contamination or attains MPSs. | 3 months. | The cap would be constructed in about 3 months. This alternative does not treat contaminants. | 3 years. |
| **Technical, Safety** | | | |
| Threat to safety of nearby residents posed by implementing alternative. | None. Fencing and warning signs would prevent unauthorized access during implementation of this alternative. | None. Capping would prevent dermal contact to contaminated soil. Deed restrictions would prevent excavation and other unacceptable uses of the land in the future. Fencing and warning signs would be constructed around the area during installation of the cap. | None. Access to the biotreatment cell would be restricted by use of fencing and warning signs during implementation of this alternative. |
| Threat to safety of workers posed by implementing alternative. | Minimal. Site workers would wear the appropriate level of PPE while excavating soil. | None. Contaminated soil would not be exposed during construction of the cap. | Same as Alternative 15-1. |
| **Human Health** | | | |
| Compliance with existing USEPA and FDEP criteria, standards, and guidance. | Implementing this alternative would comply with USEPA and FDEP criteria, standards, and guidance. | Same as Alternative 15-1. | Same as Alternative 15-1. |
| Ability of alternative to reduce human exposure to contaminants. | During excavation and offsite transport and treatment, humans would not be exposed to contaminated soil. After implementation of this alternative humans would no longer be exposed to site-related contaminants. | Capping would eliminate human exposure to site-related contaminants through dermal contact. Deed restrictions would also prevent any future unacceptable uses of the land. | Under this alternative, soil would be excavated and treated onsite. The soil would be treated to below MPSs, thereby reducing human exposure to contaminants. |

See notes at end of table.

**Table 7-4 (Continued)**
**Justification of Corrective Action SWMU 15**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Criterion | Alternative 15-1: Offsite Incineration | Alternative 15-2: Semipermeable Cover | Alternative 15-3: Onsite, Ex situ Biotreatment |
|---|---|---|---|
| **Human Health (Continued)** | | | |
| Ability of alternative to reduce contaminant exposure over time. | Removal of contaminants and treatment offsite would reduce exposure to contaminants immediately and eliminate exposure in the future. | Exposure to contaminants would be eliminated as soon as the cap has been constructed. | Treatment of contaminants in the biotreatment cell would reduce exposure to contaminants in the long term (after the 3-year treatment period). In the short term, contaminant exposure would be minimized by fencing and warning signs posted around the treatment area. |
| **Environmental** | | | |
| Time until adverse environmental impacts are addressed. | 3 months. | 3 months. | 3 years. |
| Improvements to environment realized through implementing alternative. | Site-related contaminants would be eliminated. Site would be restored to its original condition. | Ecological receptors would no longer be exposed to site-related contaminants. | Site-related contaminants would be eliminated. Site would be restored to its original condition. |

Notes: SWMU = Solid Waste Management Unit.
CAO = Corrective Action Objective.
O&M = operation and maintenance.
NA = not applicable.
MPS = Media Protection Standard.
RCRA = Resource Conservation and Recovery Act.
DDT = dichlorodiphenyltrichloroethane.
PPE = personal protective equipment.
USEPA = U.S. Environmental Protection Agency.
FDEP = Florida Department of Environmental Protection.

## REFERENCES


ABB Environmental Services, Inc. (ABB-ES), 1993, Interim Measures Workplan, Solid Waste Management Units 6 and 7, U.S. Naval Station (NAVSTA), Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), North Charleston, South Carolina.

ABB-ES, 1994a, Resource Conservation and Recovery Act (RCRA) Clean Closure Equivalency Demonstration Petition, Neutralization Basin, SWMU 12, U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina, May (Draft).

ABB-ES, 1994b, Interim Measures Workplan, Solid Waste Management Units 6 and 7, Sludge Drying Beds Area, US. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, May (Draft).

ABB-ES, 1995a, Corrective Action Management Plan, U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina.

ABB-ES, 1995b, RCRA Corrective Action Program General Information Report, U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina.

ABB-ES, 1995c, RCRA Facility Investigation Group II Solid Waste Management Units (SWMUs); U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

ABB-ES, 1995d, Corrective Action Management Plan, U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina.

ABB-ES, 1995e, Corrective Measures Study Workplan, U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina.

A.T. Kearney, Inc., 1989, RCRA Facility Assessment of the U.S. NAVSTA, Mayport, Jacksonville, Florida: prepared for the U.S. Environmental Protection Agency (USEPA), Atlanta, Georgia, September.

E.C. Jordan Company, 1988a, Closure Plan, Neutralization Basin at Building 1241, U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina, April.

E.C. Jordan Company, 1988b, Groundwater Monitoring Plan, Neutralization Basin at Building 1241: U.S. NAVSTA, Mayport Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina.

E.C. Jordan Company, 1989, Addendum A to the Closure Plan, U.S. NAVSTA, Mayport, Florida: prepared for SOUTHNAVFACENGCOM, Charleston, South Carolina, April.

Environmental and Geotechnical Engineering Network, Inc. (EnGen), 1995, Bioaugmentation Corrective Action Submittal Package, Solid Waste Management Unit 15: prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

Kuhn and Suflita, 1989, Dehalogenation of Pesticides by Anaerobic Microorganisms in Soil and Groundwater: a review.

## REFERENCES (Continued)

U.S. Environmental Protection Agency (USEPA), 1988a, RCRA Corrective Action Plan, Interim Final; Office of Solid Waste and Emergency Response (OSWER) Directive 9902.3, EPA/530-SW-88-028, June 1988.

USEPA, 1988b. RCRA Corrective Action Interim Measures Guidance, Interim Final; OSWER Directive 9902.4, EPA/530-SW-88-029, June 1988.

## APPENDIX A

## REGULATORY REQUIREMENTS

**Table A-1**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMUs 6, 7, 8, 9, 10, and 11**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Archeological and Historical Preservation Act [40 CFR Part 6] | Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain resulting from a Federal construction project or a Federally licensed activity or program. | A determination should be made that no historical or archeological data would be disturbed because of activity associated with corrective action at the SWMUs. |
| Clean Air Act (CAA) Regulations, Emissions Standards [40 CFR Part 50] | This rule provides emissions standards, which are promulgated to attain the National Ambient Air Quality Standards (NAAQSs), for hazardous air pollutants likely to cause an increase in mortality or a serious illness to humans. | Emissions standards and monitoring requirements promulgated in this rule apply to corrective actions that involve the discharge to air (e.g., air stripping) of pollutants regulated under the CAA. The state of Florida has jurisdiction for the implementation of these regulations through the State Implementation Plan. |
| CAA Regulations, New Source Performance Standards (NSPS) [40 CFR Part 60] | Establishes NSPS for specified sources that are similar to a source that has established NSPSs (such as air stripping technologies). The NSPSs limit the emissions of a number of different pollutants, including the six criteria pollutants list (carbon monoxide, nitrogen dioxide, volatile organic compounds, sulfur dioxide, particulate matter, and lead), for which NAAQSs are established, as well as fluorides, sulfuric acid mist, and total reduced sulfur (including hydrogen sulfide [$H_2S$]). | This rule may be a requirement for a new source that is similar to a source that has established NSPSs (such as thermal treatment). If it is determined that corrective action would create potential air impacts, the action or the equipment for the action may qualify as a new source; therefore, these requirements should be met. |
| Department of Transportation (DOT) Rules for Transportation of Hazardous Materials [49 CFR 107] | Establishes the procedures for packaging, labeling, and transporting of hazardous materials. | These requirements would apply to any company contracted to transport hazardous material from the site for laboratory analysis, treatment, or disposal. |
| Endangered Species Act [40 CFR Part 302(h), Appendix A] | Requires corrective action to avoid jeopardizing the continued existence of Federally-listed endangered or threatened species. Requirements include notification to the USEPA and minimization of adverse effects to such endangered species. | When choosing a corrective action, minimization of impact to endangered species existing in and around the OWTP SWMUs will be considered. |
| Federal Facilities Compliance Act of 1992 (HR 2194) | Amends the Solid Waste Disposal Act to clarify provisions concerning the application of certain requirements to federal facilities, such as providing a conditional exception to RCRA's domestic sewage exclusion for FOTWs. In general, it allows state agencies and the USEPA to enforce hazardous waste laws at government sites. | This Act expands the domestic sewage exclusion to FOTWs. Therefore, hazardous waste may enter the FOTW at NAVSTA Mayport and be excluded from coverage under the Solid Waste Disposal Act. In addition, when wastewater is considered a hazardous waste under RCRA, but is mixed with domestic waste as it flows through the sewer system to the FOTW, the FOTW would not be required to meet the additional regulatory requirements for a RCRA facility. |

See notes at end of table.

## Table A-1 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMUs 6, 7, 8, 9, 10, and 11

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Hazardous Materials Transportation Act, Hazardous Materials Transportation Regulations [49 CFR Parts 171, 173, 178, and 179] | Provides requirements for packaging, labeling, manifesting, and transporting of hazardous materials. | If off-site disposal of a hazardous material is considered for the OWTP SWMUs, contaminated materials would need to be handled, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations. |
| Archeological and Historical Preservation Act [40 CFR Part 6] | Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain resulting from a Federal construction project or a Federally licensed activity or program. | A determination should be made that no historical or archeological data would be disturbed because of activity associated with corrective action at the SWMUs. |
| Clean Air Act (CAA) Regulations, Emissions Standards [40 CFR Part 50] | This rule provides emissions standards, which are promulgated to attain the National Ambient Air Quality Standards (NAAQSs), for hazardous air pollutants likely to cause an increase in mortality or a serious illness to humans. | Emissions standards and monitoring requirements promulgated in this rule apply to corrective actions that involve the discharge to air (e.g., air stripping) of pollutants regulated under the CAA. The state of Florida has jurisdiction for the implementation of these regulations through the State Implementation Plan. |
| CAA Regulations, New Source Performance Standards (NSPS) [40 CFR Part 60] | Establishes NSPS for specified sources that are similar to a source that has established NSPSs (such as air stripping technologies). The NSPSs limit the emissions of a number of different pollutants, including the six criteria pollutants list (carbon monoxide, nitrogen dioxide, volatile organic compounds, sulfur dioxide, particulate matter, and lead), for which NAAQSs are established, as well as fluorides, sulfuric acid mist, and total reduced sulfur (including hydrogen sulfide ($H_2S$)). | This rule may be a requirement for a new source that is similar to a source that has established NSPSs (such as thermal treatment). If it is determined that corrective action would create potential air impacts, the action or the equipment for the action may qualify as a new source; therefore, these requirements should be met. |
| Department of Transportation (DOT) Rules for Transportation of Hazardous Materials [49 CFR 107] | Establishes the procedures for packaging, labeling, and transporting of hazardous materials. | These requirements would apply to any company contracted to transport hazardous material from the site for laboratory analysis, treatment, or disposal. |
| Endangered Species Act [40 CFR Part 302(h), Appendix A] | Requires corrective action to avoid jeopardizing the continued existence of Federally-listed endangered or threatened species. Requirements include notification to the USEPA and minimization of adverse effects to such endangered species. | When choosing a corrective action, minimization of impact to endangered species existing in and around the OWTP SWMUs will be considered. |
| Federal Facilities Compliance Act of 1992 (HR 2194) | Amends the Solid Waste Disposal Act to clarify provisions concerning the application of certain requirements to federal facilities, such as providing a conditional exception to RCRA's domestic sewage exclusion for FOTWs. In general, it allows state agencies and the USEPA to enforce hazardous waste laws at government sites. | This Act expands the domestic sewage exclusion to FOTWs. Therefore, hazardous waste may enter the FOTW at NAVSTA Mayport and be excluded from coverage under the Solid Waste Disposal Act. In addition, when wastewater is considered a hazardous waste under RCRA, but is mixed with domestic waste as it flows through the sewer system to the FOTW, the FOTW would not be required to meet the additional regulatory requirements for a RCRA facility. |

See notes at end of table.

## Table A-1 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMUs 6, 7, 8, 9, 10, and 11

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Hazardous Materials Transportation Act, Hazardous Materials Transportation Regulations [49 CFR Parts 171, 173, 178, and 179] | Provides requirements for packaging, labeling, manifesting, and transporting of hazardous materials. | If off-site disposal of a hazardous material is considered for the OWTP SWMUs, contaminated materials would need to be handled, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations. |
| NEPA Regulations; Protection of Floodplains [EO 11988, 40 CFR Part 6, Appendix A, and 40 CFR Part 6.302(b)] | Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial values of floodplains. | The potential effects of any action at the OWTP SWMUs will be evaluated to ensure that the planning and decision making reflect consideration of flood hazards and floodplains management. The OWTP SWMUs are within the floodplain of the St. Johns River. |
| Occupational Safety and Health Act (OSHA) Regulations, General Industry Standards [29 CFR Part 1910] | Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements. | Requirements apply to all corrective action activities at the OWTP SWMUs. |
| OSHA Regulations, Occupational Health and Safety Regulations [29 CFR Part 1910, Subpart Z] | Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals. | Standards are applicable for worker exposure to OSHA hazardous chemicals during corrective action. |
| OSHA Regulations, Recordkeeping, Reporting, and Related Regulations [29 CFR Part 1904] | Provides recordkeeping and reporting requirements applicable to corrective action. | These requirements apply to all site contractors and subcontractors and must be followed during all site work. |
| OSHA Regulations, Health and Safety Standards [29 CFR Part 1926] | Specifies the type of safety training, equipment, and procedures to be used during site investigation and corrective action. | All phases of corrective action should be executed in compliance with this regulation. |
| RCRA Regulations, Contingency Plan and Emergency Procedures [40 CFR Part 264, Subpart D] | Outlines requirements for emergency procedures to be followed in the event of an emergency such as an explosion, fire, or other emergency event. | The requirements established in this rule should be met for corrective actions involving the management of hazardous waste. |
| RCRA Regulations, Corrective Action Management Units (CAMUs) and Temporary Units (TUs); Corrective Action Provisions Under Subtitle C [40 CFR Part 260, 264, 265, 268, 270, and 271] | This rule establishes CAMUs and TUs as two options for corrective actions at permitted RCRA facilities. | If on-site treatment, storage, or disposal of a hazardous waste is considered in a corrective action, the requirements of the CAMU/TU Rule should be met. |
| RCRA Regulations, General Facility Standards [40 CFR Subpart B, 264.10-264.18] | Sets the general facility requirements including general waste analysis, security measures, inspections, and training requirements. Section 264.18 establishes that a facility located in a 100-year floodplain must be designed, constructed, and maintained to prevent washout of any hazardous wastes by a 100-year flood. | If corrective action involves construction of an on-site treatment facility, the requirements of this rule would need to be met during corrective action. These requirements do not apply to above-ground treatment or storage of hazardous waste before it is injected underground. |

See notes at end of table.

**Table A-1 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMUs 6, 7, 8, 9, 10, and 11**

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Hazardous and Solid Waste Amendments (HSWA) 1984 [Section 3004 (u) and (v) Corrective Action Requirements] | Establishes standards for owners and operators of permitted hazardous waste facilities (i.e., preparedness and prevention, contingency plan and emergency procedures, recordkeeping and reporting, groundwater monitoring). | Corrective action must meet the requirements established in this rule. |
| RCRA Regulations, Hazardous Waste Permits Program [40 CFR Part 270] | Establishes requirements for obtaining permits to treat, store, or dispose of hazardous wastes. | Any corrective action involving the treatment or containment of RCRA hazardous waste is subject to these permitting requirements. |
| RCRA Regulations, Identification and Listing of Hazardous Waste [40 CFR 261] | Defines those wastes subject to the regulation as hazardous wastes under 40 CFR Parts 262-265. | These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into corrective action. |
| RCRA Regulations, Interim Status Treatment, Storage, and Disposal (TSD) Facility Standards; Thermal Treatment [40 CFR Part 265, Subpart P] | Establishes general operating, waste analysis, monitoring and inspection, and closure requirements for owners and operators of thermal treatment facilities other than incinerators. Prohibits open burning of hazardous waste, except for open burning and detonation of waste explosives. | The requirements established in this rule apply to interim status facilities (i.e., those in operation or under construction on November 19, 1980) and would not apply to on-site thermal treatment actions. However, if contaminated media are sent to an off-site interim status thermal treatment facility, that facility would be subject to these requirements. |
| RCRA Regulations, Land Disposal Restrictions (LDRs) [40 CFR Part 268] | Establishes restrictions on land disposal of untreated hazardous wastes and provides standards for treatment of hazardous wastes prior to land disposal. Universal Treatment Standards (UTSs) for organic hazardous substances that are subject to LDRs became effective on December 19, 1994. | Contaminated media designated for off-site disposal that exhibit the RCRA-hazardous waste toxicity characteristic will have to be treated until concentrations are below the characteristic levels established under RCRA before disposal. |
| RCRA Regulations, Manifest System, Recordkeeping, and Reporting [40 CFR Part 264, Subpart E] | Outlines procedures for manifesting hazardous waste for owners and operators of on-site and off-site facilities that treat, store, or dispose of hazardous waste. | These regulations apply if a corrective action involves the treatment, storage, or disposal of hazardous waste off-site (e.g., disposal of soil to a thermal treatment or soil recycling facility). |
| RCRA Regulations, Miscellaneous Units [40 CFR Part 264, Subpart X] | These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, and wetlands that may have adverse effects on human health and the environment. | The design of proposed corrective action alternatives, not specifically regulated under other subparts of RCRA, must prevent the release of hazardous constituents and future impacts on the environment. This subpart would apply to on-site construction of any treatment facility that is not previously defined under RCRA. |
| RCRA Regulations, Preparedness and Prevention [40 CFR Part 264, Subpart C] | Outlines requirements for safety equipment and spill control for hazardous waste facilities. Facilities must be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment. | Safety and communication equipment should be incorporated into all aspects of the corrective action process. Base personnel and local authorities should be familiarized with site operations under these requirements. |

See notes at end of table.

## Table A-1 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMUs 6, 7, 8, 9, 10, and 11

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Releases from Solid Waste Management Units [40 CFR Part 264, Subpart F] | Establishes the requirements for solid waste management units (SWMUs) at RCRA regulated TSDFs. The scope of the regulation encompasses groundwater protection standards, point of compliance, compliance period, and requirements for groundwater monitoring. | The requirements set forth in this rule apply to the releases that have occurred at the OWTP SWMUs. |
| RCRA Regulations, Standards Applicable to Generators of Hazardous Waste [40 CFR Part 262] | Establishes standards for generators of hazardous wastes that address waste accumulation, preparation for shipment, and completion of the uniform hazardous waste manifest. These requirements are integrated with DOT regulations. The rules specify that all hazardous waste shipments must be accomplished by an appropriate manifest. | If corrective action involves off-site transportation of hazardous waste (e.g., contaminated soil), the material must be manifested and shipped in proper containers that are accurately marked and labeled, and the transporter must display proper placecards. |
| RCRA Regulations, Standards Applicable to Transporters of Hazardous Waste [40 CFR Part 263, Subpart A] | Establishes procedures for transportation of hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262. | If corrective action involves off-site transportation of hazardous waste (e.g., contaminated soil) for treatment and/or disposal, transporters must meet these requirements. |
| RCRA Regulations, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities [40 CFR Part 264] | Establishes minimum national standards defining the acceptable management of hazardous wastes for owners and operators of facilities that treat, store, or dispose of hazardous wastes. | Corrective actions involving management of wastes at an off-site TSD facility would be subject to this rule. |
| RCRA Regulations, Use and Management of Containers [40 CFR Part 264, Subpart I] | Sets standards for the storage of containers of hazardous waste. | This requirement would apply if corrective action involves the storage of a hazardous waste (e.g., contaminated soil) in containers prior to treatment or off-site transportation. |
| Chapter 62-2, FAC Florida Air Pollution Rules - October, 1992 | Establishes permitting requirements for owners or operators of any source which emits any air pollutant. This rule also establishes ambient air quality standards for sulfur dioxide, $PM_{10}$, carbon monoxide, lead, and ozone. | These requirements are applicable for facilities treating wastes off-site using a technology that could result in the release of regulated contaminants to the atmosphere, such as may occur during thermal treatment. |
| Chapter 62-25, FAC Florida Regulation of Stormwater Discharge - May, 1993 | Establishes requirements for discharges of untreated stormwater to ensure protection of the surface water of the state. | Corrective actions should consider the impact of construction on discharge of untreated stormwater. |
| Chapter 62-272, FAC Ambient Air Quality Standards - December, 1994 | Establishes ambient air quality standards necessary to protect human health and public welfare. It also establishes maximum allowable increases in ambient concentrations for subject pollutants to prevent significant deterioration of air quality in areas where ambient air quality standards are being met. Approved air quality monitoring methods are also specified. | These standards should be met for corrective actions involving the possible release of contaminants to the atmosphere. |

See notes at end of table.

## Table A-1 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMUs 6, 7, 8, 9, 10, and 11

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Chapter 62-273, FAC Air Pollution Episodes - September, 1994 | In order to prevent episode conditions (defined as a "condition which exists when meteorological conditions and rates of discharge of air pollutants combine to produce pollutant levels in the atmosphere which, if sustained, can lead to a substantial threat to the health of the people") from continuing or from developing into more severe conditions, action must be taken. This rule classifies an air episode as an air alert, warning or emergency and establishes criteria for determining the level of the air episode. It also establishes response requirements for each level. The rule applies to industrial polluters. | These requirements apply to corrective actions using off-site treatment facilities that potentially involve discharge of contaminants to the atmosphere (i.e., thermal treatment). |
| Chapter 62-532, FAC Florida Water Well Permitting and Construction Requirements - March, 1992 | Establishes minimum standards for location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established. | The requirements should be met for corrective actions involving construction, repair, or abandonment of monitoring, extraction, or injection wells. |
| Chapter 62-710, FAC Florida Used Oil Management Regulations - January, 1990 | Establishes a program for handlers of used oil, which includes registration, reporting, and recordkeeping requirements. | This requirement applies to handlers of used oil that may be disposed off-site during corrective action at the OWTP SWMUs. |
| Chapter 62-730, FAC Florida Hazardous Waste Rules - October, 1993 | Adopts, by reference, appropriate sections of 40 CFR and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes. | Corrective action at the OWTP SWMUs is subject to the requirements of this rule. |
| Chapter 62-736, FAC Florida Rules on Hazardous Waste Warning Signs - July, 1991 | Requires warning signs at National Priority List (NPL) and Florida Department of Environmental Protection (FDEP) identified hazardous waste sites to inform the public of the presence of potentially harmful conditions. | This requirement should be met for sites that have been identified by the FDEP as potentially harmful, such as the OWTP SWMUs at NAVSTA Mayport. |
| Chapter 62-770, FAC Florida Petroleum Contaminated Site Cleanup Criteria - February, 1990 | Establishes a cleanup process to be followed at all petroleum-contaminated sites. Cleanup levels for G-II groundwater are provided for sites contaminated with gasoline or kerosene/mixed products. | Bilge water containing oils was disposed at SWMUs 6 and 7; the oils were not from gasoline or kerosene. However, groundwater in the surficial aquifer at NAVSTA Mayport is classified as G-II; therefore, corrective action at the OWTP SWMUs should comply with the substantive requirements of this rule. |
| Chapter 62-775, FAC Florida Soil Thermal Treatment Facilities Regulations - November, 1992 | Establishes criteria for thermal treatment of petroleum-contaminated media. Outlines procedures for excavating, receiving, handling, and stockpiling contaminated soil prior to thermal treatment in both stationary and mobile facilities. | The cleanup levels specified for total recoverable petroleum hydrocarbons (TPH), volatile organic halocarbons (VOH), metals, and benzene, toluene, ethylbenzene, and xylenes (BTEX) do not apply to soil classified as hazardous. However, procedures outlined for excavating, receiving, handling, and stockpiling contaminated soil prior to thermal treatment should be followed if thermal treatment is selected as a corrective action for the OWTP SWMUs. |

See note at end of table.

## Table A-1 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMUs 6, 7, 8, 9, 10, and 11

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|

**Notes:**
CAA = Clean Air Act.
CAMU = Corrective Action Management Unit.
CFR = Code of Federal Regulation.
CWA = Clean Water Act.
DOT = Department of Transportation.
EO = Executive Order.
FAC = Florida Administrative Code.
FDEP = Florida Department of Environmental Protection.
FOTW = Federally Owned Treatment Work.
$H_2S$ = Hydrogen Sulfide.
HR = House Rule.
LDRs = Land Disposal Restrictions.
MCLs = Maximum Contaminant Levels.
MCLGs = Maximum Contaminant Level Goals.
NAAQSs = National Ambient Air Quality Standards.
NAVSTA = Naval Station.
NEPA = National Environmental Policy Act.
NMFS = National Marine Fisheries Service.
NSPS = New Source Performance Standards.
OSHA = Occupational Safety and Health Act.
POTW = Publicly Owned Treatment Work.
RCRA = Resource Conservation and Recovery Act.
SDWA = Safe Drinking Water Act.
SMCLs = Secondary Maximum Contaminant Levels.
SWMUs = Solid Waste Management Unit.
TSDF = Transportation, Storage, and Disposal Facility.
TU = Temporary Unit.
USEPA = U.S. Environmental Protection Agency.
USFWS = U.S. Fish and Wildlife Service.
UTSs = Universal Treatment Standards.
WQS = Water Quality Standard.

## Table A-2
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 12

Corrective Measures Study, Group II SWMUs
U.S. Naval Station
Mayport, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Archeological and Historical Preservation Act [40 CFR Part 6] | Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain resulting from a Federal construction project or a Federally licensed activity or program. | A determination should be made that no historical or archeological data would be disturbed because of activity associated with corrective action at the SWMUs. |
| Clean Air Act (CAA) Regulations, Emissions Standards [40 CFR Part 50] | This rule provides emissions standards, which are promulgated to attain the National Ambient Air Quality Standards (NAAQSs), for hazardous air pollutants likely to cause an increase in mortality or a serious illness to humans. | Emissions standards and monitoring requirements promulgated in this rule apply to corrective actions that involve the discharge to air (e.g., air stripping) of pollutants regulated under the CAA. The state of Florida has jurisdiction for the implementation of these regulations through the State Implementation Plan. |
| CAA Regulations, New Source Performance Standards (NSPS) [40 CFR Part 60] | Establishes NSPS for specified sources that are similar to a source that has established NSPSs (such as air stripping technologies). The NSPSs limit the emissions of a number of different pollutants, including the six criteria pollutants list (carbon monoxide, nitrogen dioxide, volatile organic compounds, sulfur dioxide, particulate matter, and lead), for which NAAQSs are established, as well as fluorides, sulfuric acid mist, and total reduced sulfur (including hydrogen sulfide [$H_2S$]). | This rule may be a requirement for a new source that is similar to a source that has established NSPSs (such as thermal treatment). If it is determined that corrective action would create potential air impacts, the action or the equipment for the action may qualify as a new source; therefore, these requirements should be met. |
| CWA Regulations, National Pretreatment Standards [40 CFR Part 403] | Sets pretreatment standards through the National Categorical Standards or the General Pretreatment Regulations for the introduction of pollutants from non-domestic sources into Publicly Owned Treatment Works (POTWs) in order to control pollutants that pass through, cause interference, or are otherwise incompatible with treatment processes at a POTW. | If groundwater is discharged to a POTW or federally owned treatment works (FOTW), the discharge must meet local limits imposed by the POTW. |
| Department of Transportation (DOT) Rules for Transportation of Hazardous Materials [49 CFR 107] | Establishes the procedures for packaging, labeling, and transporting of hazardous materials. | These requirements would apply to any company contracted to transport hazardous material from the site for laboratory analysis, treatment, or disposal. |
| Endangered Species Act [40 CFR Part 302(h), Appendix A] | Requires corrective action to avoid jeopardizing the continued existence of Federally-listed endangered or threatened species. Requirements include notification to the USEPA and minimization of adverse effects to such endangered species. | When choosing a corrective action, minimization of impact to endangered species existing in and around SWMU 12 will be considered. |
| Federal Facilities Compliance Act of 1992 (HR 2194) | Amends the Solid Waste Disposal Act to clarify provisions concerning the application of certain requirements to federal facilities, such as providing a conditional exception to RCRA's domestic sewage exclusion for FOTWs. In general, it allows state agencies and the USEPA to enforce hazardous waste laws at government sites. | This Act expands the domestic sewage exclusion to FOTWs. Therefore, hazardous waste may enter the FOTW at NAVSTA Mayport and be excluded from coverage under the Solid Waste Disposal Act. In addition, when wastewater is considered a hazardous waste under RCRA, but is mixed with domestic waste as it flows through the sewer system to the FOTW, the FOTW would not be required to meet the additional regulatory requirements for a RCRA facility. |

See notes at end of table.

**Table A-2 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMU 12**

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Hazardous Materials Transportation Act, Hazardous Materials Transportation Regulations [49 CFR Parts 171, 173, 178, and 179] | Provides requirements for packaging, labeling, manifesting, and transporting of hazardous materials. | If off-site disposal of a hazardous material is considered at SWMU 12, it would need to be handled, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations. |
| NEPA Regulations; Protection of Floodplains [EO 11988, 40 CFR Part 6, Appendix A, and 40 CFR Part 6.302(b)] | Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial values of floodplains. | The potential effects of any action at SWMU 12 will be evaluated to ensure that the planning and decision making reflect consideration of flood hazards and floodplains management. SWMU 12 is within the floodplain of the St. Johns River. |
| Occupational Safety and Health Act (OSHA) Regulations, General Industry Standards [29 CFR Part 1910] | Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements. | Requirements apply to all corrective action activities at SWMU 12. |
| OSHA Regulations, Occupational Health and Safety Regulations [29 CFR Part 1910, Subpart Z] | Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals. | Standards are applicable for worker exposure to OSHA hazardous chemicals during corrective action. |
| OSHA Regulations, Recordkeeping, Reporting, and Related Regulations [29 CFR Part 1904] | Provides recordkeeping and reporting requirements applicable to corrective action. | These requirements apply to all site contractors and subcontractors and must be followed during all site work. |
| OSHA Regulations, Health and Safety Standards [29 CFR Part 1926] | Specifies the type of safety training, equipment, and procedures to be used during site investigation and corrective action. | All phases of corrective action should be executed in compliance with this regulation. |
| RCRA Regulations, Contingency Plan and Emergency Procedures [40 CFR Part 264, Subpart D] | Outlines requirements for emergency procedures to be followed in the event of an emergency such as an explosion, fire, or other emergency event. | The requirements established in this rule should be met for corrective actions involving the management of hazardous waste. |
| RCRA Regulations, Corrective Action Management Units (CAMUs) and Temporary Units (TUs); Corrective Action Provisions Under Subtitle C [40 CFR Part 260, 264, 265, 268, 270, and 271] | This rule establishes CAMUs and TUs as two options for corrective actions at permitted RCRA facilities. | If on-site treatment, storage, or disposal of a hazardous waste is considered in a corrective action at SWMU 12, the requirements of the CAMU/TU Rule should be met. |
| RCRA Regulations, General Facility Standards [40 CFR Subpart B, 264.10-264.18] | Sets the general facility requirements including general waste analysis, security measures, inspections, and training requirements. Section 264.18 establishes that a facility located in a 100-year floodplain must be designed, constructed, and maintained to prevent washout of any hazardous wastes by a 100-year flood. | If corrective action involves construction of an on-site treatment facility, the requirements of this rule would need to be met during corrective action. These requirements do not apply to above-ground treatment or storage of hazardous waste before it is injected underground. |

See notes at end of table.

## Table A-2 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 12

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Hazardous and Solid Waste Amendments (HSWA) 1984 [Section 3004 (u) and (v) Corrective Action Requirements] | Establishes standards for owners and operators of permitted hazardous waste facilities (i.e., preparedness and prevention, contingency plan and emergency procedures, recordkeeping and reporting, groundwater monitoring). | Corrective action must meet the requirements established in this rule. |
| RCRA Regulations, Hazardous Waste Permits Program [40 CFR Part 270] | Establishes requirements for obtaining permits to treat, store, or dispose of hazardous wastes. | Any corrective action involving the treatment or containment of RCRA hazardous waste is subject to these permitting requirements. |
| RCRA Regulations, Identification and Listing of Hazardous Waste [40 CFR 261] | Defines those wastes subject to the regulation as hazardous wastes under 40 CFR Parts 262-265. | These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into corrective action. |
| RCRA Regulations, Manifest System, Recordkeeping, and Reporting [40 CFR Part 264, Subpart E] | Outlines procedures for manifesting hazardous waste for owners and operators of on-site and off-site facilities that treat, store, or dispose of hazardous waste. | These regulations apply if a corrective action involves the treatment, storage, or disposal of hazardous waste off-site. |
| RCRA Regulations, Miscellaneous Units [40 CFR Part 264, Subpart X] | These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, and wetlands that may have adverse effects on human health and the environment. | The design of proposed corrective action alternatives, not specifically regulated under other subparts of RCRA, must prevent the release of hazardous constituents and future impacts on the environment. This subpart would apply to on-site construction of any treatment facility that is not previously defined under RCRA. |
| RCRA Regulations, Preparedness and Prevention [40 CFR Part 264, Subpart C] | Outlines requirements for safety equipment and spill control for hazardous waste facilities. Facilities must be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment. | Safety and communication equipment should be incorporated into all aspects of the corrective action process. Base personnel and local authorities should be familiarized with site operations under these requirements. |
| RCRA Regulations, Releases from Solid Waste Management Units [40 CFR Part 264, Subpart F] | Establishes the requirements for solid waste management units (SWMUs) at RCRA regulated TSDFs. The scope of the regulation encompasses groundwater protection standards, point of compliance, compliance period, and requirements for groundwater monitoring. | The requirements set forth in this rule apply to releases that have occurred at SWMU 12. |
| RCRA Regulations, Standards Applicable to Generators of Hazardous Waste [40 CFR Part 261] | Establishes standards for generators of hazardous wastes that address waste accumulation, preparation for shipment, and completion of the uniform hazardous waste manifest. These requirements are integrated with DOT regulations. These rules specify that all hazardous waste shipments must be accomplished by an appropriate manifest. | If an alternative involves the off-site transportation of hazardous waste, the material must be shipped in proper containers that are accurately marked and labeled, and the transporter must display proper placecards. |

See notes at end of table.

## Table A-2 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 12

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Standards Applicable to Transporters of Hazardous Waste [40 CFR Part 263, Subpart A] | Establishes procedures for transportation of hazardous waste within the U.S. If the transportation requires a manifest under 40 CFR Part 262. | If corrective action involves off-site transportation of hazardous waste for treatment and/or disposal, transporters must meet these requirements. |
| RCRA Regulations, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities [40 CFR Part 264] | Establishes minimum national standards defining the acceptable management of hazardous wastes for owners and operators of facilities that treat, store, or dispose of hazardous wastes. | Corrective actions involving management of wastes at an off-site TSD facility would be subject to this rule. |
| RCRA Regulations, Use and Management of Containers [40 CFR Part 264, Subpart I] | Sets standards for the storage of containers of hazardous waste. | This requirement would apply if corrective action involves the storage of a hazardous waste in containers prior to treatment or off-site transportation. |
| Chapter 62-2, FAC Florida Air Pollution Rules - October, 1992 | Establishes permitting requirements for owners or operators of any source which emits any air pollutant. This rule also establishes ambient air quality standards for sulfur dioxide, $PM_{10}$, carbon monoxide, lead, and ozone. | These requirements are applicable to facilities treating wastes off-site using a technology that could result in the release of regulated contaminants to the atmosphere. |
| Chapter 62-25, FAC Florida Regulation of Stormwater Discharge - May, 1993 | Establishes requirements for discharges of untreated stormwater to ensure protection of the surface water of the state. | Corrective actions should consider the impact of construction of discharge of untreated stormwater. |
| Chapter 62-272, FAC Ambient Air Quality Standards - December, 1994 | Establishes ambient air quality standards necessary to protect human health and public welfare. It also establishes maximum allowable increases in ambient concentrations for subject pollutants to prevent significant deterioration of air quality in areas where ambient air quality standards are being met. Approved air quality monitoring methods are also specified. | These standards should be met for corrective actions involving the possible release of contaminants to the atmosphere. |
| Chapter 62-273, FAC Air Pollution Episodes - September, 1994 | In order to prevent episode conditions (defined as a "condition which exists when meteorological conditions and rates of discharge of air pollutants combine to produce pollutant levels in the atmosphere which, if sustained, can lead to a substantial threat to the health of the people") from continuing or from developing into more severe conditions, action must be taken. This rule classifies an air episode as an air alert, warning or emergency and establishes criteria for determining the level of the air episode. It also establishes response requirements for each level. | These requirements apply to corrective actions using off-site treatment facilities that potentially involve discharge of contaminants to the atmosphere. |
| Chapter 62-532, FAC Florida Water Well Permitting and Construction Requirements - March, 1992 | Establishes minimum standards for location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established. | The requirements should be met for corrective actions involving construction, repair, or abandonment of monitoring, extraction, or injection wells. |

See notes at end of table.

## Table A-2 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 12

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Chapter 62-730, FAC Florida Hazardous Waste Rules - October, 1993 | Adopts, by reference, appropriate sections of 40 CFR and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes. | Corrective action at SWMU 12 is subject to the requirements of this rule. |
| Chapter 62-736, FAC Florida Rules on Hazardous Waste Warning Signs - July, 1991 | Requires warning signs at National Priority List (NPL) and Florida Department of Environmental Protection (FDEP) identified hazardous waste sites to inform the public of the presence of potentially harmful conditions. | This requirement should be met for sites that have been identified by the FDEP as potentially harmful, such as SWMU 12. |

Notes:
CAA = Clean Air Act.
CAMU = Corrective Action Management Unit.
CFR = Code of Federal Regulation.
CWA = Clean Water Act.
DOT = Department of Transportation.
EO = Executive Order.
FAC = Florida Administrative Code.
FDEP = Florida Department of Environmental Protection.
FOTW = Federally Owned Treatment Work.
$H_2S$ = Hydrogen Sulfide.
HR = House Rule.
LDRs = Land Disposal Restrictions.
MCLs = Maximum Contaminant Levels.
MCLGs = Maximum Contaminant Level Goals.
NAAQSs = National Ambient Air Quality Standards.
NAVSTA = Naval Station.
NEPA = National Environmental Policy Act.
NMFS = National Marine Fisheries Service.
NSPS = New Source Performance Standards.
OSHA = Occupational Safety and Health Act.
POTW = Publicly Owned Treatment Work.
RCRA = Resource Conservation and Recovery Act.
SDWA = Safe Drinking Water Act.
SMCLs = Secondary Maximum Contaminant Levels.
SWMUs = Solid Waste Management Unit.
TSDF = Transportation, Storage, and Disposal Facility.
TU = Temporary Unit.
USEPA = U.S. Environmental Protection Agency.
USFWS = U.S. Fish and Wildlife Service.
UTSs = Universal Treatment Standards.
WQS = Water Quality Standard.

## Table A-3
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 15

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Archeological and Historical Preservation Act [40 CFR Part 6] | Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain resulting from a Federal construction project or a Federally licensed activity or program. | A determination should be made that no historical or archeological data would be disturbed because of activity associated with corrective action at SWMU 15. |
| Clean Air Act (CAA) Regulations, Emissions Standards [40 CFR Part 50] | This rule provides emissions standards, which are promulgated to attain the National Ambient Air Quality Standards (NAAQSs), for hazardous air pollutants likely to cause an increase in mortality or a serious illness to humans. | Emissions standards and monitoring requirements promulgated in this rule apply to corrective actions that involve the discharge to air (e.g., air stripping) of pollutants regulated under the CAA. The state of Florida has jurisdiction for the implementation of these regulations through the State Implementation Plan. |
| CAA Regulations, New Source Performance Standards (NSPS) [40 CFR Part 60] | Establishes NSPS for specified sources that are similar to a source that has established NSPSs (such as air stripping technologies). The NSPSs limit the emissions of a number of different pollutants, including the six criteria pollutants list (carbon monoxide, nitrogen dioxide, volatile organic compounds, sulfur dioxide, particulate matter, and lead), for which NAAQSs are established, as well as fluorides, sulfuric acid mist, and total reduced sulfur (including hydrogen sulfide [$H_2S$]). | This rule may be a requirement for a new source that is similar to a source that has established NSPSs (such as thermal treatment). If it is determined that corrective action would create potential air impacts, the action or the equipment for the action may qualify as a new source; therefore, these requirements should be met. |
| Department of Transportation (DOT) Rules for Transportation of Hazardous Materials [49 CFR 107] | Establishes the procedures for packaging, labeling, and transporting of hazardous materials. | These requirements would apply to any company contracted to transport hazardous material from the site for laboratory analysis, treatment, or disposal. |
| Endangered Species Act [40 CFR Part 302(h), Appendix A] | Requires corrective action to avoid jeopardizing the continued existence of Federally-listed endangered or threatened species. Requirements include notification to the USEPA and minimization of adverse effects to such endangered species. | When choosing a corrective action, minimization of impact to endangered species existing in and around SWMU 15 will be considered. |
| Federal Facilities Compliance Act of 1992 (HR 2194) | Amends the Solid Waste Disposal Act to clarify provisions concerning the application of certain requirements to federal facilities, such as providing a conditional exception to RCRA's domestic sewage exclusion for FOTWs. In general, it allows state agencies and the USEPA to enforce hazardous waste laws at government sites. | This Act expands the domestic sewage exclusion to FOTWs. Therefore, hazardous waste may enter the FOTW at and be excluded from coverage under the Solid Waste Disposal Act. In addition, when wastewater is considered a hazardous waste under RCRA, but is mixed with domestic waste as it flows through the sewer system to the FOTW, the FOTW would not be required to meet the additional regulatory requirements for a RCRA facility. |
| Hazardous Materials Transportation Act, Hazardous Materials Transportation Regulations [49 CFR Parts 171, 173, 178, and 179] | Provides requirements for the packaging, labeling, manifesting, and transporting of hazardous materials. | If off-site disposal of a hazardous material is considered for SWMU 15, contaminated materials would need to be handled, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations. |

See notes at end of table.

## Table A-3 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 15

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Occupational Safety and Health Act (OSHA) Regulations, General Industry Standards [29 CFR Part 1910] | Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements. | Requirements apply to all corrective action activities at the OWTP SWMUs. |
| OSHA Regulations, Occupational Health and Safety Regulations [29 CFR Part 1910, Subpart Z] | Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals. | Standards are applicable for worker exposure to OSHA hazardous chemicals during corrective action. |
| OSHA Regulations, Recordkeeping, Reporting, and Related Regulations [29 CFR Part 1904] | Provides recordkeeping and reporting requirements applicable to remedial activities. | These requirements apply to all site contractors and subcontractors and must be followed during all site work. |
| OSHA Regulations, Health and Safety Standards [29 CFR Part 1926] | Specifies the type of safety training, equipment, and procedures to be used during site investigation and corrective action. | All phases of corrective action should be executed in compliance with this regulation. |
| RCRA Regulations, Contingency Plan and Emergency Procedures [40 CFR Part 264, Subpart D] | Outlines requirements for emergency procedures to be followed in the event of an emergency such as an explosion, fire, or other emergency event. | The requirements established in this rule should be met for corrective actions involving the management of hazardous waste. |
| RCRA Regulations, Corrective Action Management Units (CAMUs) and Temporary Units (TUs); Corrective Action Provisions Under Subtitle C [40 CFR Part 260, 264, 265, 268, 270, and 271] | This rule establishes CAMUs and TUs as two options for corrective actions at permitted RCRA facilities. | If on-site treatment, storage, or disposal of a hazardous waste is considered in a corrective action, the requirements of the CAMU/TU Rule should be met. |
| RCRA Regulations, General Facility Standards [40 CFR Subpart B, 264.10-264.18] | Sets the general facility requirements including general waste analysis, security measures, inspections, and training requirements. Section 264.18 establishes that a facility located in a 100-year floodplain must be designed, constructed, and maintained to prevent washout of any hazardous wastes by a 100-year flood. | If corrective action involves construction of an on-site treatment facility, the requirements of this rule would need to be met during corrective action. These requirements do not apply to above-ground treatment or storage of hazardous waste before it is injected underground. |
| RCRA Regulations, Hazardous and Solid Waste Amendments (HSWA) 1984 [Section 3004 (u) and (v) Corrective Action Requirements] | Establishes standards for owners and operators of permitted hazardous waste facilities (i.e., preparedness and prevention, contingency plan and emergency procedures, recordkeeping and reporting, groundwater monitoring). | Corrective action must meet the requirements established in this rule. |
| RCRA Regulations, Hazardous Waste Permits Program [40 CFR Part 270] | Establishes requirements for obtaining permits to treat, store, or dispose of hazardous wastes. | Any corrective action involving the treatment or containment of RCRA hazardous waste is subject to these permitting requirements. |
| RCRA Regulations, Identification and Listing of Hazardous Waste [40 CFR 261] | Defines those wastes subject to the regulation as hazardous wastes under 40 CFR Parts 262-265. | These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into corrective action. |

**Table A-3 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMU 15**

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, General Facility Standards [40 CFR Subpart B, 264.10-264.18] | Sets the general facility requirements including general waste analysis, security measures, inspections, and training requirements. Section 264.18 establishes that a facility located in a 100-year floodplain must be designed, constructed, and maintained to prevent washout of any hazardous wastes by a 100-year flood. | If corrective action involves construction of an on-site treatment facility, the requirements of this rule would need to be met during corrective action. These requirements do not apply to above-ground treatment or storage of hazardous waste before it is injected underground. |
| RCRA Regulations, Hazardous and Solid Waste Amendments (HSWA) 1984 [Section 3004 (u) and (v) Corrective Action Requirements] | Establishes standards for owners and operators of permitted hazardous waste facilities (i.e., preparedness and prevention, contingency plan and emergency procedures, recordkeeping and reporting, groundwater monitoring). | Corrective action must meet the requirements established in this rule. |
| RCRA Regulations, Hazardous Waste Permits Program [40 CFR Part 270] | Establishes requirements for obtaining permits to treat, store, or dispose of hazardous wastes. | Any corrective action involving the treatment or containment of RCRA hazardous waste is subject to these permitting requirements. |
| RCRA Regulations, Identification and Listing of Hazardous Waste [40 CFR 261] | Defines those wastes subject to the regulation as hazardous wastes under 40 CFR Parts 262-265. | These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into corrective action. |

See notes at end of table.

**Table A-3 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMU 15**

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Land Disposal Restrictions (LDRs) [40 CFR Part 268] | Establishes restrictions on land disposal of untreated hazardous wastes and provides standards for treatment of hazardous wastes prior to land disposal. Universal Treatment Standards (UTSs) for organic hazardous substances that are subject to LDRs became effective on December 19, 1994. | Contaminated media designated for off-site disposal that exhibit the RCRA-hazardous waste toxicity characteristic will have to be treated until concentrations are below the characteristic levels established under RCRA before disposal. |
| RCRA Regulations, Manifest System, Recordkeeping, and Reporting [40 CFR Part 264, Subpart E] | Outlines procedures for manifesting hazardous waste for owners and operators of on-site and off-site facilities that treat, store, or dispose of hazardous waste. | These regulations apply if a corrective action involves the treatment, storage, or disposal of hazardous waste off-site. |
| RCRA Regulations, Miscellaneous Units [40 CFR Part 264, Subpart X] | These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, and wetlands that may have adverse effects on human health and the environment. | The design of proposed corrective action alternatives, not specifically regulated under other subparts of RCRA, must prevent the release of hazardous constituents and future impacts on the environment. This subpart would apply to on-site construction of any treatment facility that is not previously defined under RCRA. |
| RCRA Regulations, Preparedness and Prevention [40 CFR Part 264, Subpart C] | Outlines requirements for safety equipment and spill control for hazardous waste facilities. Facilities must be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment. | Safety and communication equipment should be incorporated into all aspects of the corrective action process. Base personnel and local authorities should be familiarized with site operations under these requirements. |
| RCRA Regulations, Releases from Solid Waste Management Units [40 CFR Part 264, Subpart F] | Establishes the requirements for solid waste management units (SWMUs) at RCRA regulated TSDFs. The scope of the regulation encompasses groundwater protection standards, point of compliance, compliance period, and requirements for groundwater monitoring. | The requirements set forth in this rule apply to the releases that have occurred at SWMU 15. |
| RCRA Regulations, Standards Applicable to Generators of Hazardous Waste [40 CFR Part 261] | Establishes standards for generators of hazardous wastes that address waste accumulation, preparation for shipment, and completion of the uniform hazardous waste manifest. These requirements are integrated with DOT regulations. These rules specify that all hazardous waste shipments must be accomplished by an appropriate manifest. | If corrective action involves off-site transportation of hazardous waste (e.g., contaminated soil), the material must be manifested and shipped in proper containers that are accurately marked and labeled, and the transporter must display proper placecards. |
| RCRA Regulations, Standards Applicable to Transporters of Hazardous Waste [40 CFR Part 263, Subpart A] | Establishes procedures for transportation of hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262. | If corrective action involves off-site transportation of hazardous waste (e.g., contaminated soil) for treatment and/or disposal, transporters must meet these requirements. |
| RCRA Regulations, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities [40 CFR Part 264] | Establishes minimum national standards defining the acceptable management of hazardous wastes for owners and operators of facilities that treat, store, or dispose of hazardous wastes. | Corrective actions involving management of wastes at an off-site TSD facility would be subject to this rule. |

See notes at end of table.

## Table A-3 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 15

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Use and Management of Containers [40 CFR Part 264, Subpart I] | Sets standards for the storage of containers of hazardous waste. | This requirement would apply if corrective action involves the storage of a hazardous waste (e.g., contaminated soil) in containers prior to treatment or off-site transportation. |
| Safe Drinking Water Act (SDWA) Regulations, Maximum Contaminant Level Goals (MCLGs) [40 CFR Part 141] | Establishes drinking water quality goals at levels of no known or anticipated adverse health effects with an adequate margin of safety. These criteria do not consider treatment feasibility or cost elements. | If MCLGs are greater than zero, these standards should be met for groundwater that is a current or potential source of drinking water, assuming that the treatment technique chosen, is capable of achieving this standard. Groundwater in the surficial aquifer at SWMU 15 is classified as G-II, designated for potable use. |
| SDWA Regulations, National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) [40 CFR Part 141] | Establishes enforceable standards for potable water distribution systems for specific contaminants that have been determined to adversely effect human health. These standards, MCLs, are protective of human health for individual chemicals and are developed using MCLGs, available treatment technologies, and cost data. Secondary Maximum Contaminant Levels (SMCLs) are located at 40 CFR Part 143. | MCLs can be used for groundwater or surface waters that are current or potential drinking water sources. Groundwater in the surficial aquifer at SWMU 15 is classified as G-II, designated for potable use. |
| Chapter 62-2, FAC Florida Air Pollution Rules - October, 1992 | Establishes permitting requirements for owners or operators of any source which emits any air pollutant. This rule also establishes ambient air quality standards for sulfur dioxide, $PM_{10}$, carbon monoxide, lead, and ozone. | These requirements are applicable for facilities treating wastes off-site using a technology that could result in the release of regulated contaminants to the atmosphere. |
| Chapter 62-25, FAC Florida Regulation of Stormwater Discharge - May, 1993 | Establishes requirements for discharges of untreated stormwater to ensure protection of the surface water of the state. | Corrective actions should consider the impact of construction of the discharge of untreated stormwater. |
| Chapter 62-272, FAC Ambient Air Quality Standards - December, 1994 | Establishes ambient air quality standards necessary to protect human health and public welfare. It also establishes maximum allowable increases in ambient concentrations for subject pollutants to prevent significant deterioration of air quality in areas where ambient air quality standards are being met. Approved air quality monitoring methods are also specified. | These standards should be met for corrective actions involving the possible release of contaminants to the atmosphere. |
| Chapter 62-273, FAC Air Pollution Episodes - September, 1994 | In order to prevent episode conditions (defined as a "condition which exists when meteorological conditions and rates of discharge of air pollutants combine to produce pollutant levels in the atmosphere which, if sustained, can lead to a substantial threat to the health of the people") from continuing or from developing into more severe conditions, action must be taken. This rule classifies an air episode as an air alert, warning or emergency and establishes criteria for determining the level of the air episode. It also establishes response requirements for each level. | These requirements apply to corrective actions using off-site treatment facilities that potentially involve the discharge of contaminants to the atmosphere. |

See notes at end of table.

**Table A-3 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMU 15**

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Chapter 62-520, FAC Groundwater Classes, Standards, and Exemptions - October, 1994 | Establishes the groundwater classification system for the State and provides qualitative minimum criteria for groundwater based on the classification. Groundwater at SWMU 15 is classified as G-II, designated for potable water use. This rule adopts the Federal primary and secondary drinking water standards and establishes some State standards that are more stringent than Federal standards. Like Federal MCLs, these standards are considered for cleanups of groundwater that is a current or potential source of drinking water. | Groundwater subject to this rule must be "free from" contaminants in concentrations that are harmful to the organisms responsible for treatment or stabilization of the groundwater; are carcinogenic, mutagenic, teratogenic, or toxic to human beings; are acutely toxic to indigenous species of significance to the aquatic community; pose a serious danger to the public health, safety, or welfare; create or constitute a nuisance; or impair the reasonable and beneficial uses of the adjacent waters. "Free from" is further defined in the Florida Groundwater Guidance Concentrations. |
| Chapter 62-532, FAC Florida Water Well Permitting and Construction Requirements - March, 1992 | Establishes minimum standards for location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established. | The requirements should be met for corrective actions involving construction, repair, or abandonment of monitoring, extraction, or injection wells. |
| Chapter 62-550, FAC Florida Drinking Water Standards - September, 1994 | Established to implement the Federal Safe Drinking Water Act by adopting the national primary and secondary drinking water standards and by creating additional rules to fulfill state and federal requirements for community water distribution systems. | MCLs are applicable to groundwater that is classified as a potable water supply source. Groundwater in the surficial aquifer at SWMU 15 is classified as G-II, designated for potable use. |
| Chapter 62-730, FAC Florida Hazardous Waste Rules - October, 1993 | Adopts, by reference, appropriate sections of 40 CFR and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes. | Corrective action at SWMU 15 is subject to the requirements of this rule. |
| Chapter 62-736, FAC Florida Rules on Hazardous Waste Warning Signs - July, 1991 | Requires warning signs at National Priority List (NPL) and Florida Department of Environmental Protection (FDEP) identified hazardous waste sites to inform the public of the presence of potentially harmful conditions. | This requirement should be met for sites that have been identified by the FDEP as potentially harmful, such as SWMU 15. |

See notes at end of table.

**Table A-3 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMU 15**

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|

Notes:

AWQC = Ambient Water Quality Criteria.
CAA = Clean Air Act.
CAMU = Corrective Action Management Unit.
CFR = Code of Federal Regulation.
CWA = Clean Water Act.
DOT = Department of Transportation.
EO = Executive Order.
FAC = Florida Administrative Code.
FDEP = Florida Department of Environmental Protection.
FOTW = Federally Owned Treatment Work.
$H_2S$ = Hydrogen Sulfide.
HR = House Rule.
LDRs = Land Disposal Restrictions.
MCLs = Maximum Contaminant Levels.
MCLGs = Maximum Contaminant Level Goals.
NAAQSs = National Ambient Air Quality Standards.
NAVSTA = Naval Station.
NEPA = National Environmental Policy Act.
NMFS = National Marine Fisheries Service.
NPDES = National Pollutant Discharge Elimination System.
NSPS = New Source Performance Standards.
OSHA = Occupational Safety and Health Act.
POTW = Publicly Owned Treatment Work.
RCRA = Resource Conservation and Recovery Act.
SDWA = Safe Drinking Water Act.
SMCLs = Secondary Maximum Contaminant Levels.
SWMUs = Solid Waste Management Unit.
TSDF = Transportation, Storage, and Disposal Facility.
TU = Temporary Unit.
USEPA = U.S. Environmental Protection Agency.
USFWS = U.S. Fish and Wildlife Service.
UTSs = Universal Treatment Standards.
WQS = Water Quality Standard.

## Table A-4
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 16

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Archeological and Historical Preservation Act [40 CFR Part 6] | Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain resulting from a Federal construction project or a Federally licensed activity or program. | A determination should be made that no historical or archeological data would be disturbed because of activity associated with corrective action at SWMU 16. |
| Clean Air Act (CAA) Regulations, Emissions Standards [40 CFR Part 50] | This rule provides emissions standards, which are promulgated to attain the National Ambient Air Quality Standards (NAAQSs), for hazardous air pollutants likely to cause an increase in mortality or a serious illness to humans. | Emissions standards and monitoring requirements promulgated in this rule apply to corrective actions that involve discharge to air of pollutants regulated under the CAA. The state of Florida has jurisdiction for the implementation of these regulations through the State Implementation Plan. |
| CAA Regulations, New Source Performance Standards (NSPS) [40 CFR Part 60] | Establishes NSPS for specified sources that are similar to a source that has established NSPSs (such as air stripping technologies). The NSPSs limit the emissions of a number of different pollutants, including the six criteria pollutants list (carbon monoxide, nitrogen dioxide, volatile organic compounds, sulfur dioxide, particulate matter, and lead), for which NAAQSs are established, as well as fluorides, sulfuric acid mist, and total reduced sulfur (including hydrogen sulfide [$H_2S$]). | This rule may be a requirement for a new source that is similar to a source that has established NSPSs (such as thermal treatment). If it is determined that corrective action would create potential air impacts, the action or the equipment for the action may qualify as a new source; therefore, these requirements should be met. |
| Department of Transportation (DOT) Rules for Transportation of Hazardous Materials [49 CFR 107] | Establishes the procedures for packaging, labeling, and transporting of hazardous materials. | These requirements are applicable to any company contracted to transport hazardous material from the site for laboratory analysis, treatment, or disposal. |
| Endangered Species Act [40 CFR Part 302(h), Appendix A] | Requires corrective action to avoid jeopardizing the continued existence of Federally-listed endangered or threatened species. Requirements include notification to the USEPA and minimization of adverse effects to such endangered species. | When choosing a corrective action, minimization of impact to endangered species existing in and around SWMU 16 will be considered. |
| Federal Facilities Compliance Act of 1992 (HR 2194) | Amends the Solid Waste Disposal Act to clarify provisions concerning the application of certain requirements to federal facilities, such as providing a conditional exception to RCRA's domestic sewage exclusion for FOTWs. In general, it allows state agencies and the USEPA to enforce hazardous waste laws at government sites. | This Act expands the domestic sewage exclusion to FOTWs. Therefore, hazardous waste may enter the FOTW at and be excluded from coverage under the Solid Waste Disposal Act. In addition, when wastewater is considered a hazardous waste under RCRA, but is mixed with domestic waste as it flows through the sewer system to the FOTW, the FOTW would not be required to meet the additional regulatory requirements for a RCRA facility. |
| Hazardous Materials Transportation Act, Hazardous Materials Transportation Regulations [49 CFR Parts 171, 173, 178, and 179]. | Provides requirements for packaging, labeling, manifesting, and transporting of hazardous materials. | If off-site disposal of a hazardous material is considered for the OWTP SWMUs, contaminated materials would need to be handled, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations. |

See notes at end of table.

## Table A-4 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 16

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| NEPA Regulations; Protection of Floodplains [EO 11988, 40 CFR Part 6, Appendix A, and 40 CFR Part 6.302(b)] | Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial values of floodplains. | The potential effects of any action at SWMU 16 will be evaluated to ensure that the planning and decision making reflect consideration of flood hazards and floodplains management, including restoration and preservation of natural, undeveloped floodplains. SWMU 16 is located within the floodplain of the St. Johns River. |
| Occupational Safety and Health Act (OSHA) Regulations, General Industry Standards [29 CFR Part 1910] | Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements. | Requirements apply to all corrective action activities at SWMU 16. |
| OSHA Regulations, Occupational Health and Safety Regulations [29 CFR Part 1910, Subpart Z] | Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals. | Standards are applicable for worker exposure to OSHA hazardous chemicals during corrective action. |
| OSHA Regulations, Recordkeeping, Reporting, and Related Regulations [29 CFR Part 1904] | Provides recordkeeping and reporting requirements applicable to corrective action. | These requirements apply to all site contractors and subcontractors and must be followed during all site work. |
| OSHA Regulations, Health and Safety Standards [29 CFR Part 1926] | Specifies the type of safety training, equipment, and procedures to be used during site investigation and corrective action. | All phases of corrective action should be executed in compliance with this regulation. |
| RCRA Regulations, Contingency Plan and Emergency Procedures [40 CFR Part 264, Subpart D] | Outlines requirements for emergency procedures to be followed in the event of an emergency such as an explosion, fire, or other emergency event. | The requirements established in this rule should be met for corrective actions involving the management of hazardous waste. |
| RCRA Regulations, Corrective Action Management Units (CAMUs) and Temporary Units (TUs); Corrective Action Provisions Under Subtitle C [40 CFR Part 260, 264, 265, 268, 270, and 271] | This rule establishes CAMUs and TUs as two options for corrective actions at permitted RCRA facilities. | If on-site treatment, storage, or disposal of a hazardous waste is considered in a corrective action, the requirements of the CAMU/TU Rule should be met. |
| RCRA Regulations, General Facility Standards [40 CFR Subpart B, 264.10-264.18] | Sets the general facility requirements including general waste analysis, security measures, inspections, and training requirements. Section 264.18 establishes that a facility located in a 100-year floodplain must be designed, constructed, and maintained to prevent washout of any hazardous wastes by a 100-year flood. | If corrective action involves construction of an on-site treatment facility, the requirements of this rule would need to be met during corrective action. These requirements do not apply to above-ground treatment or storage of hazardous waste before it is injected underground. |
| RCRA Regulations, Hazardous and Solid Waste Amendments (HSWA) 1984 [Section 3004 (u) and (v) Corrective Action Requirements] | Establishes standards for owners and operators of permitted hazardous waste facilities (i.e., preparedness and prevention, contingency plan and emergency procedures, recordkeeping and reporting, groundwater monitoring). | Corrective action must meet the requirements established in this rule. |

See notes at end of table.

## Table A-4 (Continued)
## Synopsis of Potential Federal and State Regulatory Requirements for SWMU 16

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Hazardous Waste Permits Program [40 CFR Part 270] | Establishes requirements for obtaining permits to treat, store, or dispose of hazardous wastes. | Any corrective action involving the treatment or containment of RCRA hazardous waste is subject to these permitting requirements. |
| RCRA Regulations, Identification and Listing of Hazardous Waste [40 CFR 261] | Defines those wastes subject to the regulation as hazardous wastes under 40 CFR Parts 262-265. | These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into corrective action. |
| RCRA Regulations, Land Disposal Restrictions (LDRs) [40 CFR Part 268] | Establishes restrictions on land disposal of untreated hazardous wastes and provides standards for treatment of hazardous wastes prior to land disposal. Universal Treatment Standards (UTSs) for organic hazardous substances that are subject to LDRs became effective on December 19, 1994. | Contaminated media designated for off-site disposal that exhibit the RCRA-hazardous waste toxicity characteristic will have to be treated until concentrations are below the characteristic levels established under RCRA before disposal. |
| RCRA Regulations, Manifest System, Recordkeeping, and Reporting [40 CFR Part 264, Subpart E] | Outlines procedures for manifesting hazardous waste for owners and operators of on-site and off-site facilities that treat, store, or dispose of hazardous waste. | These regulations apply if a corrective action involves the treatment, storage, or disposal of hazardous waste off-site. |
| RCRA Regulations, Miscellaneous Units [40 CFR Part 264, Subpart X] | These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, and wetlands that may have adverse effects on human health and the environment. | The design of proposed treatment alternatives, not specifically regulated under other subparts of RCRA, must prevent the release of hazardous constituents and future impacts on the environment. This subpart would apply to on-site construction of any treatment facility that is not previously defined under the RCRA regulation. |
| RCRA Regulations, Preparedness and Prevention [40 CFR Part 264, Subpart C] | Outlines requirements for safety equipment and spill control for hazardous waste facilities. Facilities must be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment. | Safety and communication equipment should be incorporated into all aspects of the corrective action process. Base personnel and local authorities should be familiarized with site operations under these requirements. |
| RCRA Regulations, Releases from Solid Waste Management Units [40 CFR Part 264, Subpart F] | Establishes the requirements for solid waste management units (SWMUs) at RCRA regulated TSDFs. The scope of the regulation encompasses groundwater protection standards, point of compliance, compliance period, and requirements for groundwater monitoring. | The requirements set forth in this rule apply to the releases that have occurred at the OWTP SWMUs. |

See notes at end of table.

**Table A-4 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMU 16**

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| RCRA Regulations, Standards Applicable to Generators of Hazardous Waste [40 CFR Part 261] | Establishes standards for generators of hazardous wastes that address waste accumulation, preparation for shipment, and completion of the uniform hazardous waste manifest. These requirements are integrated with DOT regulations. These rules specify that all hazardous waste shipments must be accomplished by an appropriate manifest. | If corrective action involves off-site transportation of hazardous waste, the material must be manifested and shipped in proper containers that are accurately marked and labeled, and the transporter must display proper placecards. |
| RCRA Regulations, Standards Applicable to Transporters of Hazardous Waste [40 CFR Part 263, Subpart A] | Establishes procedures for transportation of hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262. | If corrective action involves off-site transportation of hazardous waste (e.g., contaminated soil) for treatment and/or disposal, transporters must meet these requirements. |
| RCRA Regulations, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities [40 CFR Part 264] | Establishes minimum national standards defining the acceptable management of hazardous wastes for owners and operators of facilities that treat, store, or dispose of hazardous wastes. | Corrective actions involving management of wastes at an off-site TSD facility would be subject to this rule. |
| RCRA Regulations, Use and Management of Containers [40 CFR Part 264, Subpart I] | Sets standards for the storage of containers of hazardous waste. | This requirement would apply if corrective action involves the storage of a hazardous waste in containers prior to treatment or off-site transportation. |
| Chapter 62-2, FAC Florida Air Pollution Rules - October, 1992 | Establishes permitting requirements for owners or operators of any source which emits any air pollutant. This rule also establishes ambient air quality standards for sulfur dioxide, $PM_{10}$, carbon monoxide, lead, and ozone. | These requirements are applicable for a corrective action that could result in the release of regulated contaminants to the atmosphere. |
| Chapter 62-25, FAC Florida Regulation of Stormwater Discharge - May, 1993 | Establishes requirements for discharges of untreated stormwater to ensure protection of the surface water of the state. | Corrective actions should consider the impact of construction of the discharge of untreated stormwater. |
| Chapter 62-272, FAC Ambient Air Quality Standards - December, 1994 | Establishes ambient air quality standards necessary to protect human health and public welfare. It also establishes maximum allowable increases in ambient concentrations for subject pollutants to prevent significant deterioration of air quality in areas where ambient air quality standards are being met. Approved air quality monitoring methods are also specified. | These standards should be met for corrective actions involving the possible release of contaminants to the atmosphere. |

See notes at end of table.

**Table A-4 (Continued)**
**Synopsis of Potential Federal and State Regulatory Requirements for SWMU 16**

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Standards and Requirements | Synopsis | Consideration in the Corrective Action Process |
|---|---|---|
| Chapter 62-273, FAC Air Pollution Episodes - September, 1994 | In order to prevent episode conditions (defined as a "condition which exists when meteorological conditions and rates of discharge of air pollutants combine to produce pollutant levels in the atmosphere which, if sustained, can lead to a substantial threat to the health of the people") from continuing or from developing into more severe conditions, action must be taken. This rule classifies an air episode as an air alert, warning or emergency and establishes criteria for determining the level of the air episode. It also establishes response requirements for each level. | These requirements apply to corrective actions using off-site treatment facilities that potentially involve discharge of contaminants to the atmosphere. |
| Chapter 62-730, FAC Florida Hazardous Waste Rules - October, 1993 | Adopts, by reference, appropriate sections of 40 CFR and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes. | Corrective action at the OWTP SWMUs is subject to the requirements of this rule. |
| Chapter 62-736, FAC Florida Rules on Hazardous Waste Warning Signs - July, 1991 | Requires warning signs at National Priority List (NPL) and Florida Department of Environmental Protection (FDEP) identified hazardous waste sites to inform the public of the presence of potentially harmful conditions. | This requirement should be met for sites that have been identified by the FDEP as potentially harmful, such as SWMU 16. |

Notes:
AWQC = Ambient Water Quality Criteria.
CAA = Clean Air Act.
CAMU = Corrective Action Management Unit.
CFR = Code of Federal Regulation.
CWA = Clean Water Act.
DOT = Department of Transportation.
EO = Executive Order.
FAC = Florida Administrative Code.
FDEP = Florida Department of Environmental Protection.
FOTW = Federally Owned Treatment Work.
$H_2S$ = Hydrogen Sulfide.
HR = House Rule.
LDRs = Land Disposal Restrictions.
MCLs = Maximum Contaminant Levels.
MCLGs = Maximum Contaminant Level Goals.
NAAQSs = National Ambient Air Quality Standards.
NAVSTA = Naval Station.
NEPA = National Environmental Policy Act.
NMFS = National Marine Fisheries Service.
NPDES = National Pollutant Discharge Elimination System.
NSPS = New Source Performance Standards.
OSHA = Occupational Safety and Health Act.
POTW = Publicly Owned Treatment Work.
RCRA = Resource Conservation and Recovery Act.
SDWA = Safe Drinking Water Act.
SMCLs = Secondary Maximum Contaminant Levels.
SWMUs = Solid Waste Management Unit.
TSDF = Transportation, Storage, and Disposal Facility.
TU = Temporary Unit.
USEPA = U.S. Environmental Protection Agency.
USFWS = U.S. Fish and Wildlife Service.
UTSs = Universal Treatment Standards.
WQS = Water Quality Standard.

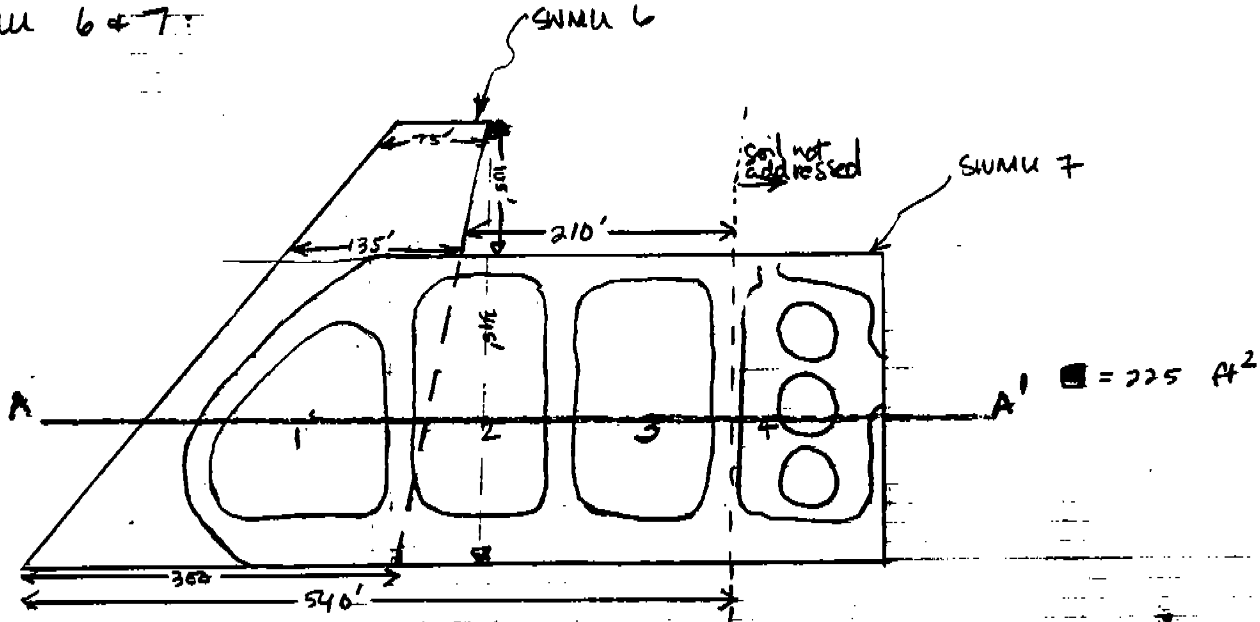
# APPENDIX B

# VOLUME ESTIMATES

# APPENDIX B-1
# VOLUME ESTIMATE SWMUs 6&7 SLUDGE AND SOIL

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| NS Mayport<br>Volume Est. Contam Sludge/Soil<br>SWMU 6&7 | SAB | 8533-29 |
| | CHK. BY<br>JH | DATE<br>6/5/95 |

SWMU 6 & 7:




Assumptions:

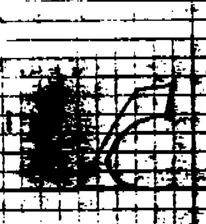
1) Sludge/soil in beds 1, 2, and 3 are source of LNAPL (RFI, ABB-ES, 1995)

2) Sludge/soil in bed 4 is not source of LNAPL and will not be addressed

3) Sludge/soil in SWMU 6 (that lies beneath SWMU 7) is a source of LNAPL and will be addressed.

4) Sludge/soil in vadose zone will be addressed — avg. depth to water table over SWMU 6&7 is ~7 feet (taken from bottom of sludge beds)

5) see attached cross section for depths of contamination:

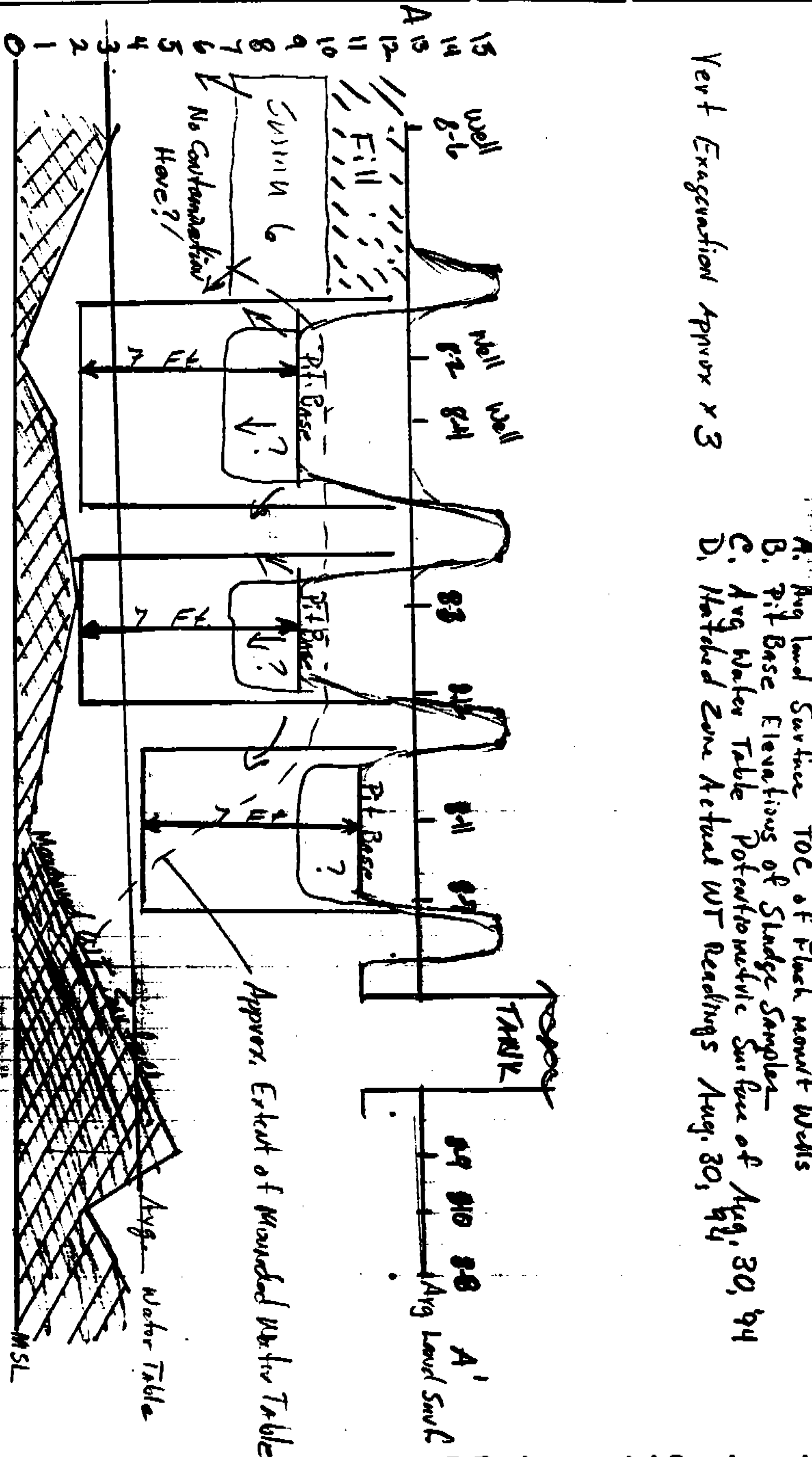
Area 1  depth of contam = 7'

Area 2 → [1] [2] depth = 6'

Area 3 → (1)(2)(3) depth = 5'

Area 4 → [3] depth = 7'

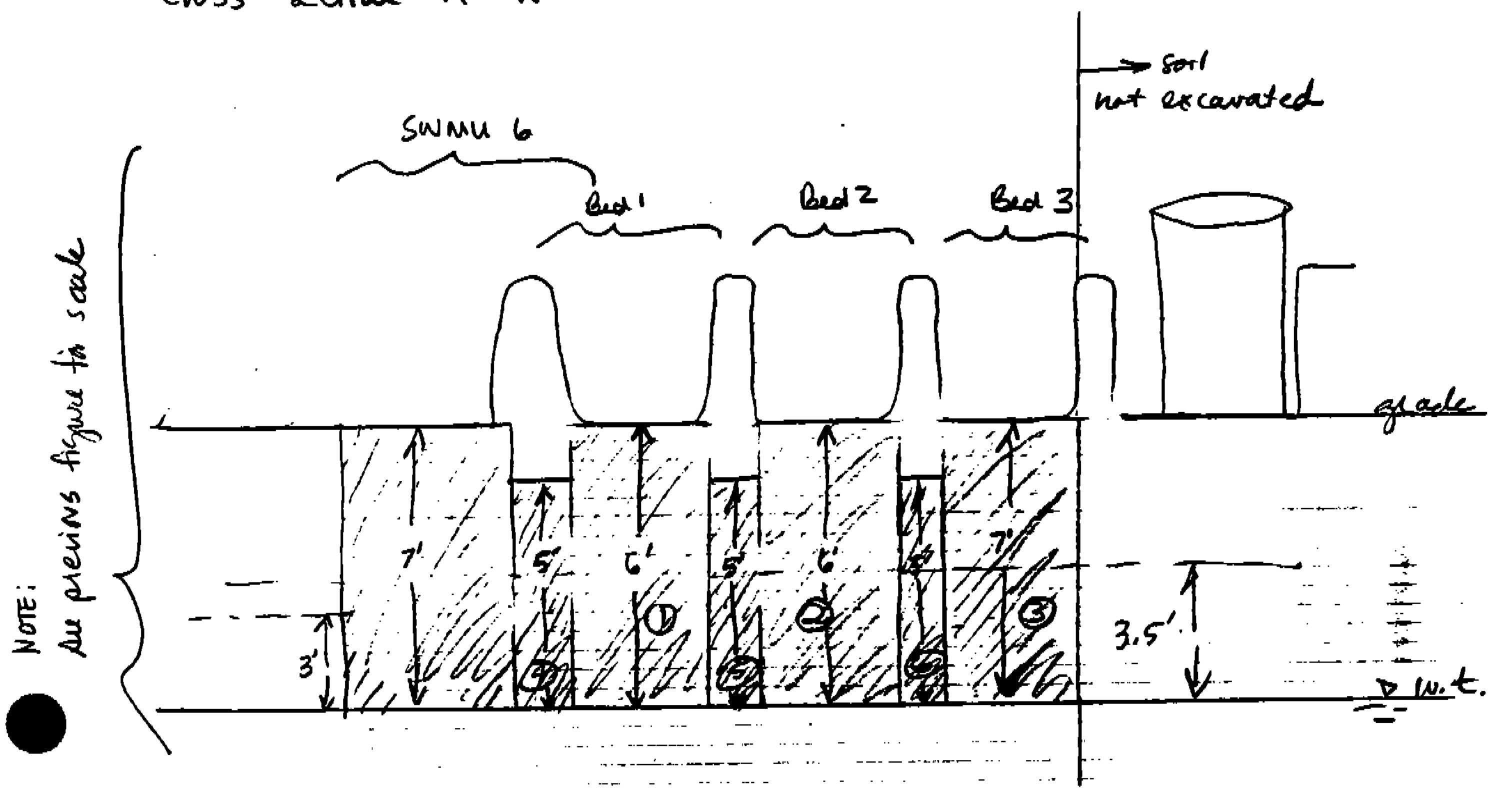
| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| SWMU 6-7 Sludge Soil Contamination Extent | LWS | 8533-08 |
| | CHK. BY RH | DATE 6/6/95 |




?1. Should we include mounding of surface water within Pits? For distribution of contaminants?
2. Would SWMU 6 have caused contamination from the land Surface to the Water Table?

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| NS Mayport Volume Est. - Custom Sludge/Soil SWMU 6+7 | SCB | 8533.29 |
| | CHK. BY TJH | DATE 6/5/95 |

Cross section A - A'




① From RFI (ABB ES, 1995), depth to water table below beds is approximately 6 to 7'.

② From RFI, vadose soil beneath beds 1, 2 and 3 is source of LNAPL (see shaded areas beneath beds) - ① ② and ③)

③ Berm materials are considered "clean" because beds were constructed from excavation of "clean" fill. However, there would be some smearing between beds in vadose zone. See additional shading between beds ④ ⑤ and ⑥)

④ RFI indicates that SWMU 6 was originally excavated 6' below grade, and then filled to surface grade. It is estimated that top of bed would lie ~ 3' below grade.

pg 3 of

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| NS Mayport<br>Cartan Sludge/Soil 820MU667 | SAB | 8533.29 |
| | CHK BY | DATE |
| | [illegible] | 6/5/95 |

Volumes:

Note: surface areas determined by box method.

Area 1 

Area = Area of trapezoid − area in cutout

$= \frac{1}{2}(b+t)h$ (area of trapezoid) − 34,875 (area of cut out) (determined by box method from figure on page 1)

$= \frac{1}{2}(300+75)\,345 - 34{,}875$

$= 64{,}688 - 34{,}875$

$= 29{,}813$ feet$^2$

Volume = 29,813 × 7′

≅ 208,700 feet$^3$

Area 2 (1)(2)

Area = Bed 1 + Bed 2

= 17,100 + 18,225

= 35,325 ft$^2$

All areas & volumes determined by box method

Volume = 35,325 × 6′

≅ 212,000 ft$^3$

Area 3 (000)

Area = Area of whole − Area of inside

= 92,925 − Area 2

= 92,925 − 53,500

= 39,425 ft$^2$

Volume = 39,425 × 5′

≅ 197,000 ft$^3$

FORM 00.01 REV. 4/81

ABB Environmental Services, Inc.

| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| NB Mayport Contam Soil/Sludge — SWMU 6+7 | SAB | 8533.29 |
| | CHK. BY | DATE |
| | BA | 6/7/95 |

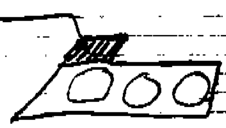
**Area 4 (3)**

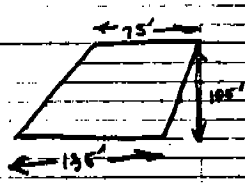
Area = Bed 3
= 18,225 $ft^2$

Volume = 18,225 × 7'
= 127,600 $ft^3$

6/12/95 -

The IM being completed for SWMUs 6+7 includes installation of sumps for free product recovery. One sump will be located within the northern most portion of SWMU 6. Therefore, the volume of soil to be removed must be decreased by an area:






Area = $\frac{1}{2}(b+t)h$
= $\frac{1}{2}(135+75)(105)$
= 11,025 sq ft

Volume = (11,025)(7')
= 77,175 cu ft.
≅ 77,000 $feet^3$

| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| NS Mayport<br>Volume of Soil/Sludge SWMU 6+7 | SaB | 8533.29 |
| | CHK. BY | DATE |
| | [illegible] | 6/5/95 |

Total Volume = Area 1 + Area 2 + Area 3 + Area 4

= 208,700 + 212,000 + 197,000 + 127,600

= 745,300 $ft^3$ − Area in [illegible] for sump

= 745,300 − 77,000

= 668,300 $ft^3$

≅ 24,800 cy

Density (from RFI) $= \frac{1.4 \text{ grams}}{cm^3} \cdot \frac{2.205 \times 10^{-3} \text{ lbs}}{\text{gram}} \cdot \frac{1 \text{ ton}}{2000 \text{ lb}} \cdot \frac{cm^3}{1.308 \times 10^{-6} \text{ cy}}$

= 1.18 ton/cy

Bulking factor (say 20% expansion upon excavation)

24,800 cy × 1.2 ≅ 29,800 cy

Weight of soil

(29,800 cy) (1.18 ton/cy) ≅ 35,200 tons

| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| NS Mayport<br>Volume of Contam Sludge/Soil for CMS | SGB | 8533.29 |
| | CHK. BY<br>TJA | DATE<br>6/5/95 |

Under NELP, some sludge/soil will be treated via thermal desorption:

Vendor = Southwest Soil Remediation, Inc.
Technology = Low Temperature Thermal Desorption
Contract = Fixed Price
Contract Value = $198,000
Processing Fee = 30$ ton

To determine tons to be treated under NELP, assume that other incidental costs – mobilization, demobilization, utilities, etc. will cost ≈ 5$/ton.

Therefore, total cost per ton is 35$.

Therefore, total tons treated under NELP ⇒

$$\frac{\$198,000}{\$35} \cong 5,600 \text{ tons}$$

Therefore, volume left to be addressed in CMS =

35,250 − 5,600 = **29,600 tons** ✓

or 25,100 cy ✓

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| NS Mayport CMS | Seb | 8533.29 |
| | CHK BY: [illegible] | DATE: 6/13/95 |

Volume of Clean Fill to be excavated and "saved" for fill material:

Area 1 ⇒  depth of cantum = 3'

Area 2 →  depth = 9'

**Area 1**

Area = Area of trapezoid − area in cutout − area removed because of sump

= (64,688 − 11,025) − 34,875

= 18,788 sq ft

Volume = (18,788) (3)

≅ 56,400 cu ft

≅ 2100 cy

**Area 2**

Area = Area of whole − area of inside

= 92,925 − 53,500

= 39,425 sq. ft.

Volume = (39,425) (9)

= 354,825 cu ft.

≅ 13,200 cy

Total volume of Clean fill to be "set aside" ⇒

2100 + 13,200 = 15,300 cy

bulking factor → (15,300)(1.2) = <u>18,400</u> cy

**APPENDIX B-2**
**VOLUME ESTIMATE SWMUs 6&7 LNAPL**

| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| SWMUs 6 & 7 LNAPL | TJH | 08533.29 |
| | CHK. BY | DATE |
| | LDP | 6.27.95 |

Volumes of LNAPL on the water table were calculated in the Interim Measures (IM) Workplan.

The total volume = 60,000 gallons.

For further clarification see the IM Workplan

# APPENDIX B-3
# VOLUME ESTIMATE SWMU 15 SOIL

## VOLUME OF CONTAMINATED SOIL - SWMU 15 - ESTIMATE RATIONALE

The volume of pesticide-contaminated soil was calculated by including areas where analytical data indicated detections of 4,4'-DDT and chlordane in surface soil above MPSs.

Volume of Soil Containing 4,4'-DDT 4,4'-DDT was detected in surface soil at a concentration of 790 ppm in the southeastern portion of the SWMU (MPT-15-SS23), and at a concentration of 1.5 ppm in the northwestern portion of the SWMU (MPT-15-SS07). Only one surface soil sample was collected adjacent to MPT-15-SS23, and only one surface soil sample was collected adjacent to MPT-15-SS07. As a result, there are areas surrounding these samples where the concentrations of 4,4'-DDT in soil are unknown. Therefore, the areal extent of concentrations of 4,4'-DDT in excess of 1 ppm was estimated based on detections and non-detections of the chemical in outlying surface soil samples. The attached figure shows these estimated areas.

Additionally, no subsurface soil samples were collected at MPT-15-SS23. The detection of 790 ppm of 4,4'-DDT in the surface soil sample collected at this location suggests that 4,4'-DDT would most likely be found at some lower concentration in subsurface soil. As a result, a fate and transport model described by Jury, et. al. (1990), was performed to estimate the concentration of 4,4'-DDT in subsurface soil. The model assumed that the initial pesticide spill (containing 4,4'-DDT) penetrated the soil to 2 feet bls. The model results indicated that 4,4'-DDT would not have migrated in subsurface soil below 3 feet. Model assumptions, data, and results are attached.

Based on the modelling results, a 15 by 20 by 3 foot area surrounding surface soil sample MPT-15-SS23 was assumed to have 4,4'-DDT exceeding the MPS, and a 30 by 40 by 2 foot area surrounding the area described above is assumed to have concentrations of 4,4'-DDT in excess of the MPS (see attached figure).

The total volume of soil contaminated with 4,4'-DDT for the purposes of the CMS is approximately 321 $yd^3$. The attached calculation sheets show in more detail how the volume of soil contaminated with 4,4'-DDT was estimated.

Volume of Soil Containing Chlordane Chlordane was detected in two surface soil samples at SWMU 15 at concentrations of 9 and 5.6 ppm (in surface soil samples MPT-15-SS16 and MPT-15-SS05, respectively). These samples were located in the northeast area of the SWMU. Additional surface soil samples were not collected in the immediate vicinity of these locations. As a result, the areal extent of surface soil containing chlordane in excess of the MPS was estimated based on detections and nondetections of chlordane in outlying surface soil samples. The attached figure shows the areal extent of chlordane contamination.

One subsurface soil sample was collected from location MPT-15-SS05, and chlordane was detected at a concentration of 0.18 ppm. This concentration is well below the MPS for chlordane. Since no subsurface soil sample was collected from MPT-15-SS16, the concentration of chlordane in subsurface soil was estimated. This was accomplished by backcalculating the conditions at MPT-15-SS05; which indicate that a 97% reduction in chlordane concentration could be expected in subsurface soil at MPT-15-SS16. As a result, the chlordane concentration in subsurface soil at MPT-15-SS16 would be approximately 0.28 ppm, which is below the MPS. An attached sheet shows this calculation.

As a result, the total volume of soil contaminated with chlordane for the purposes of the CMS is approximately 211 $yd^3$. The attached calculation sheets show in more detail how the volume of soil contaminated with chlordane was calculated.

Total Volume of Soil Containing 4,4'-DDT and Chlordane The total volume of soil at SWMU 15 containing either 4,4'-DDT or chlordane in excess of media protection standards is: 533 $yd^3$ or 14,400 $ft^3$.

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| NAVAL STATION Mayport<br>Group II SWMUs – SWMU 15<br>Volumes of Contam. Media | TJH | 08533.29 |
| | CHK. BY | DATE |
| | LDP | 6.5.95 |

Assumptions

1) Evaluating three different areas: the two areas containing 4,4'-DDT in concentrations exceeding 1 ppm and the one area containing chlordane in concentrations exceeding 2.75 ppm.

2) For area surrounding 790 ppm 4,4'-DDT detection used a leaching model to predict depth of contamination. Model generated a depth btwn 2 and 3 ft. Assumed 3 ft for small area and 2 ft for a larger area as shown on the figure.

3) All other areas contamination was assumed to not exceed 1 ft bls.

4) Planimeter used to calculate volumes.

Area 1: large area surrounding 790 ppm DDT hit
Area 2: Small area surrounding 790 ppm DDT hit
Area 3: Area surrounding 1.5 ppm DDT hit
Area 4: Area surrounding 9 ppm chlordane hit
Area 5: 30' by 40' medium area surrounding 790 ppm DDT hit

Vernier unit = 0.01 in

**Area 1** Scale 1" = 60'

| Try # | Start | Finish | Difference | Average | Area(in²) | Area(ft²) |
|---|---|---|---|---|---|---|
| ① | 5257 | 5396 | 139 | | | |
| ② | 5502 | 5641 | 139 | 139.7 | 1.397 | 5,029 |
| ③ | 5554 | 5695 | 141 | | | |

$1.397 in^2 \cdot \frac{3600 ft^2}{1 in^2} = 5,029 ft^2$

**Area 2** Scale 1" = 60'

| Try # | Start | Finish | Difference | Average | Area (in²) | Area (ft²) |
|---|---|---|---|---|---|---|
| ① | 0694 | 0699 | 5 | | | |
| ② | 0736 | 0741 | 5 | 5.67 | 0.0567 | 204 |
| ③ | 1278 | 1285 | 7 | | | |

$0.0567 in^2 \cdot \frac{3600 ft^2}{in^2} = 204 ft^2$

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| NAVAL Station Mayport SWMU 15 volumes of Contaminated Media | JH | 08533.29 |
| | CHK. BY LDP | DATE 6.5.95 |

Area 3 Scale 1" = 60'

| Try # | Start | Finish | Difference | Avg. | Area (in²) | Area (ft²) |
|---|---|---|---|---|---|---|
| 1 | 7283 | 7347 | 64 | | | |
| 2 | 8167 | 8229 | 62 | 62.3 | 0.623 | 2,243 |
| 3 | 6274 | 6335 | 61 | | | |

$0.623\ in^2 \cdot \frac{3600\ ft^2}{1\ in^2} = 2,243\ ft^2$

Area 4 Scale 1" = 60'

| Try# | Start | Finish | Difference | Avg. | Area (in²) | Area (ft²) |
|---|---|---|---|---|---|---|
| 1 | 5465 | 5625 | 160 | | | |
| 2 | 4759 | 4917 | 158 | 158.7 | 1.587 | 5,713 |
| 3 | 5509 | 5667 | 158 | | | |

$1.587\ in^2 \cdot \frac{3600\ ft^2}{1\ in^2} = 5713\ ft^2$

Area 5 $30' \times 40' = 1200\ ft^2$

So compute Total volume of soil affected by 790ppm DDT detection

The difference btwn Area 1 & Area 5 is contaminated up to 1 ft bls so:

$5,029\ ft^2 - 1200\ ft^2 = 3,829\ ft^2$ $3,829\ ft^2 \cdot 1\ ft =$ **$3,829\ ft^3$**

Difference Btwn Area 5 & Area 2 is contaminated up to 2ft bls

$1,200\ ft^2 - 204\ ft^2 = 996\ ft^2$ $996\ ft^2 \cdot 2\ ft =$ **$1,992\ ft^3$**

Area 2 is contaminated up to 3ft

So: $204\ ft^2 \cdot 3\ ft =$ **$612\ ft^3$**

Total Volume = **$6,433\ ft^3$**

| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| Naval Station Mayport | TJH | 08533.29 |
| SWMU 15 Volumes of Contaminated Media | CHK. BY LDP | DATE 6.5.95 |

Total volume of soil affected by 1.5 ppm DDT hit is 1 ft bls and Area 3

So: $2{,}243\,ft^2 \cdot 1\,ft = \boxed{2{,}243\,ft^3}$

Total volume of soil affected by 9 ppm Chlordane detection is 1 ft bls ~~of~~ Area 4

So: $5{,}713\,ft^2 \cdot 1\,ft = \boxed{5{,}713\,ft^3}$

Sum of all volumes is:

$6{,}433\,ft^3 + 2{,}243\,ft^3 + 5{,}713\,ft^3 = 14{,}389\,ft^3 \sim \boxed{14{,}400\,ft^3}$

In cubic yards:

$14{,}389\,ft^3 \cdot \frac{1\,cy}{27\,cf} = \boxed{533\,yd^3}$

In tons assuming 1.4 g/cm³ density

$14{,}400\,ft^3 \cdot \frac{1.4\,g}{cm^3} \cdot \left(\frac{2.54\,cm}{1\,in}\right)^3 \left(\frac{12\,in}{1\,ft}\right)^3 \left(\frac{2.2\,lbs}{1\,kg}\right)\left(\frac{1\,kg}{1000\,g}\right) = 1{,}255{,}903 \sim 1{,}260{,}000$

(16.387) (1728)

$1{,}260{,}000\,lbs \cdot \frac{1\,ton}{2{,}000\,lbs} =$ 630 tons of soil to be removed

FORM 00.01 REV. 4/81

ABB Environmental Services, Inc.

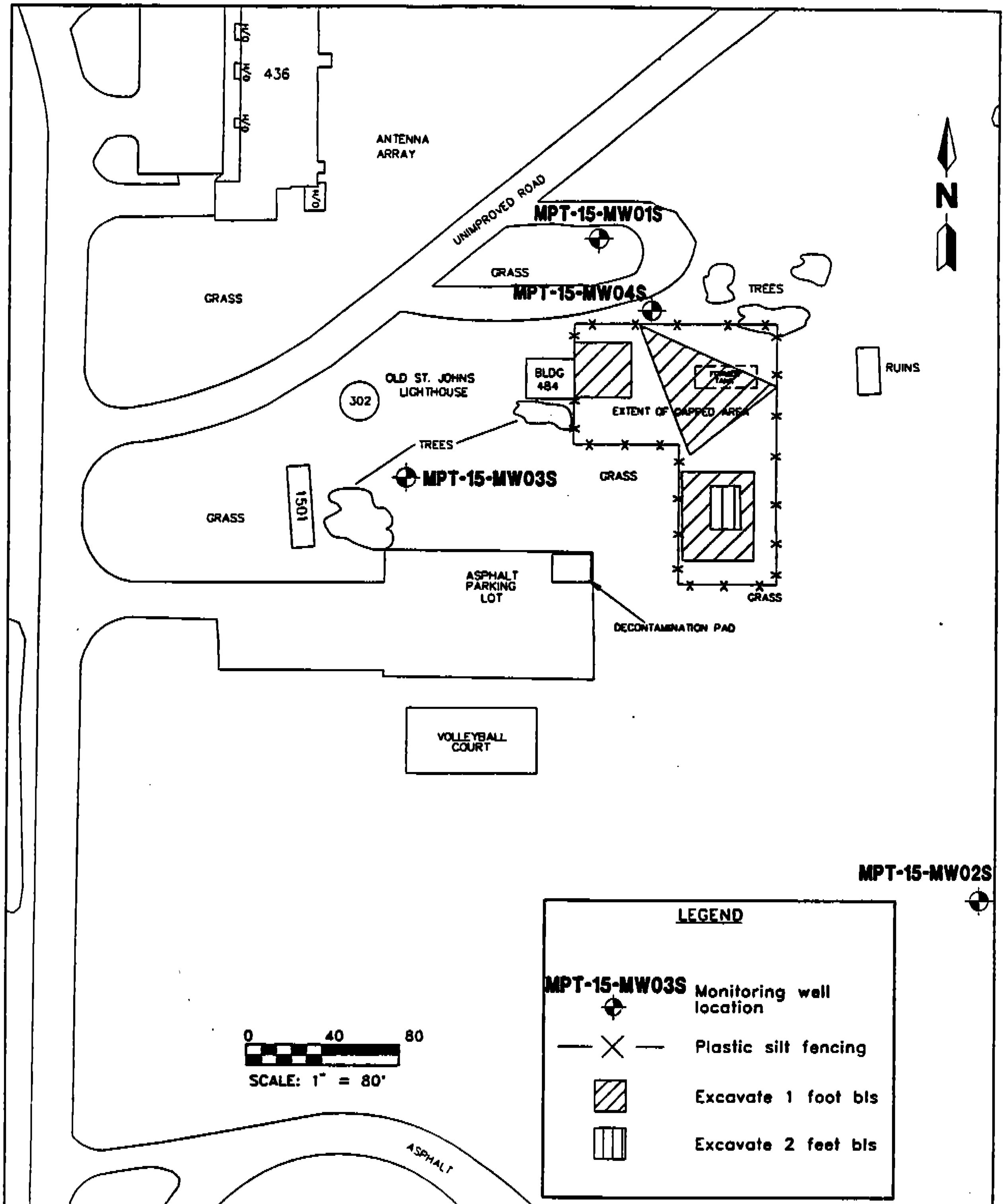



**FIGURE 6-9**
**SITE LAYOUT**
**ALTERNATIVE 15-1: OFFSITE TRANSPORT AND INCINERATION**

**CORRECTIVE MEASURES STUDY REPORT, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

## Modeling DDT Concentrations in Soil

The highest concentration of DDT detected at SWMU 15 was detected in the surface soil sample from MPT-15-SS23. Because no subsurface soil sample was collected at this location, The depth of DDT contamination in the soil is not known. A fate and transport model described by Jury et. al. (1990) was used to estimate the depth of the DDT contamination.

### Model Inputs

The following inputs were used for this model:

Soil bulk density - 1.4 g/cm$^3$ - calculated by averaging bulk density measurements for soil across the facility (ABB-ES, 1995).

Soil volumetric water content - two values were used 0.20 and 0.07 - calculated using the soil bulk density and the percent moisture. Values of 5 and 15 percent moisture were used to calculate the volumetric water content in order to represent the wide range measured in soil across the facility (ABB-ES, 1995). See attached worksheets for calculations.

Soil volumetric air content - two values were used 0.15 and 0.28 - calculated using the soil volumetric water content and the porosity. See attached worksheets for calculations.

Soil porosity - 0.35 (ABB-ES, 1995)

Fraction of organic carbon - 0.003 - calculated by averaging TOC concentrations measured in soil (approximately 2,800 mg/kg) and converting to a dimensionless number. See attached worksheets for calculations.

Air boundary layer thickness - 0.5 cm (Jury et. al., 1990)

Infiltration rate - 0.1 cm/day.- calculated from the annual rainfall assuming 25 percent of rainfall infiltrates (ABB-ES, 1995). See attached worksheets for calculations.

Initial concentration - 2,100 ppm - back calculated from the concentration measured in the surface soil sample from MPT-15-SS23. See attached worksheets for calculations.

Henry's Law constant - 0.000513

Organic carbon partitioning coefficient ($k_{oc}$) - 230,000 cm$^3$/g

Half life - 5,500 days

Top of contaminated zone - 0.001 cm below ground surface

Thickness of contaminated zone - 60 cm - Assuming that DDT and it's carrier contaminated the top two feet of soil when it was initially spilled.

**Model Results**

The model was run twice using the different values for volumetric water and air content (see attached printouts). The Jury model only accounts for the fate and transport of DDT alone, it does not account for the facilitated transport of DDT by the carrier during the initial release. To provide for facilitated transport, it was assumed that the initial release of DDT and it's carrier reached a depth of 2 feet (approximately 60 cm). In run, the contamination initially present in the top 60 cm of soil as a result of the release did not reach a depth of 90 cm (approximately 3 feet) after 21 years. It is possible that the DDT was carried deeper than 2 feet below ground surface during the initial release. However, even if the initial release carried DDT deeper than 2 feet, the results of the model indicate that further downward migration after the release is not expected.

The maximum concentration of DDT reported by the model after 21 years was 795 mg/kg. This is consistent with the 790 mg/kg of DDT detected in the sample from MPT-15-SS23. A close correlation between these values is expected because the 790 mg/kg was used to calculate the initial concentration of 2,100 mg/kg used in the model. The initial concentration was calculated using a first order reaction (half-life). Because of DDT's chemical properties, minimal transport is expected and the primary fate for this compound in the model is degradation (half-life decay).

RUN #1
PROJECT TITLE = Mayport SWMU 15 DDT
JOB # = 8533-29
DATE = 6/6/95
NAME = Mark Woodruff

SOIL PROPERTIES

| | | |
|---|---|---|
| SOIL BULK DENSITY (G/CM3) | = | 1.4 |
| SOIL VOLUMETRIC WATER CONTENT (DIM) | = | .2 |
| SOIL VOLUMETRIC AIR CONTENT (DIM) | = | .15 |
| TOTAL SOIL POROSITY (DIM) | = | .35 |
| FRACTION OF ORGANIC CARBON (DIM) | = | .003 |

TRANSPORT PROPERTIES

| | | |
|---|---|---|
| AIR BOUNDARY LAYER THICKNESS (CM) | = | .5 |
| INFILTRATION RATE (CM/DAY) | = | .1 |

CHEMICAL DATA

| | | |
|---|---|---|
| CHEMICAL NAME | = | DDT |
| INITIAL CONCENTRATION (PPM) | = | 2100 |
| HENRY'S LAW CONSTANT (DIM) | = | .000513 |
| ORGANIC CARBON PART COEF (CM3/G) | = | 230000 |
| HALF LIFE (DAYS) | = | 5500 |
| DEPTH TO TOP OF CONTAMINANTS (CM) | = | .001 |
| THICKNESS OF CONTAMINANT ZONE (CM) | = | 60 |

CONCENTRATION(PPM) AS A FUNCTION OF TIME AND DEPTH

| DEPTH(CM) | TIME(DAYS) | | | | |
|---|---|---|---|---|---|
| | 1.0 | 1101.0 | 2201.0 | 3301.0 | 4401.0 |
| 0.000 | 1073.008 | 29.499 | 14.292 | 8.314 | 5.233 |
| 30.000 | 2099.735 | 1827.926 | 1591.302 | 1385.309 | 1205.981 |
| 60.000 | 1141.478 | 1160.094 | 1091.631 | 1001.927 | 907.993 |
| 90.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

CONCENTRATION(PPM) AS A FUNCTION OF TIME AND DEPTH

| DEPTH(CM) | TIME(DAYS) | | | | |
|---|---|---|---|---|---|
| | 5501.0 | 6601.0 | 7701.0 | 0.0 | 0.0 |
| 0.000 | 3.444 | 2.332 | 1.611 | 0.000 | 0.000 |
| 30.000 | 1049.868 | 913.963 | 795.651 | 0.000 | 0.000 |
| 60.000 | 816.346 | 729.903 | 649.947 | 0.000 | 0.000 |
| 90.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

FLUX (MICROGRAMS/CM*CM/DAY) AND LOSS (PERCENT)
AS A FUNCTION OF TIME

| TIME(DAYS) | FLUX | LOSS |
|---|---|---|
| 1.0 | -3.517 | 0.0046 |
| 1101.0 | -0.099 | 0.2324 |
| 2201.0 | -0.050 | 0.2933 |
| 3301.0 | -0.030 | 0.3268 |
| 4401.0 | -0.019 | 0.3477 |
| 5501.0 | -0.013 | 0.3616 |
| 6601.0 | -0.009 | 0.3712 |
| 7701.0 | -0.007 | 0.3780 |

CAUTION: THE USE OF TOO LARGE TIME STEPS MAY CAUSE THE ESTIMATED CUMULATIVE VOLATILIZATION LOSSES TO BE ERRONEOUS. USE THE ESTIMATED TOTAL LOSSES AT INFINITE TIME AS FOLLOWS.

THE TOTAL FRACTION VOLATILIZED IS APPROXIMATELY 0.0105 ASSUMING ZERO WATER EVAPORATION AND LARGE KH (SEE JURY APP. B)

RUN #2
PROJECT TITLE = Mayport SWMU 15 DDT
JOB # = 8533-29
DATE = 6/6/95
NAME = Mark Woodruff

SOIL PROPERTIES

| | | |
|---|---|---|
| SOIL BULK DENSITY (G/CM3) | = | 1.4 |
| SOIL VOLUMETRIC WATER CONTENT (DIM) | = | .07 |
| SOIL VOLUMETRIC AIR CONTENT (DIM) | = | .28 |
| TOTAL SOIL POROSITY (DIM) | = | .35 |
| FRACTION OF ORGANIC CARBON (DIM) | = | .003 |

TRANSPORT PROPERTIES

| | | |
|---|---|---|
| AIR BOUNDARY LAYER THICKNESS (CM) | = | .5 |
| INFILTRATION RATE (CM/DAY) | = | .1 |

CHEMICAL DATA

| | | |
|---|---|---|
| CHEMICAL NAME | = | DDT |
| INITIAL CONCENTRATION (PPM) | = | 2100 |
| HENRY'S LAW CONSTANT (DIM) | = | .000513 |
| ORGANIC CARBON PART COEF (CM3/G) | = | 230000 |
| HALF LIFE (DAYS) | = | 5500 |
| DEPTH TO TOP OF CONTAMINANTS (CM) | = | .001 |
| THICKNESS OF CONTAMINANT ZONE (CM) | = | 60 |

CONCENTRATION(PPM) AS A FUNCTION OF TIME AND DEPTH

| DEPTH(CM) | TIME(DAYS) 1.0 | 1101.0 | 2201.0 | 3301.0 | 4401.0 |
|---|---|---|---|---|---|
| 0.000 | 1518.484 | 90.700 | 51.286 | 34.012 | 24.131 |
| 30.000 | 2099.735 | 1827.926 | 1591.302 | 1385.309 | 1205.981 |
| 60.000 | 1089.652 | 1022.400 | 928.062 | 833.106 | 743.560 |
| 90.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

CONCENTRATION(PPM) AS A FUNCTION OF TIME AND DEPTH

| DEPTH(CM) | TIME(DAYS) 5501.0 | 6601.0 | 7701.0 | 0.0 | 0.0 |
|---|---|---|---|---|---|
| 0.000 | 17.781 | 13.427 | 10.314 | 0.000 | 0.000 |
| 30.000 | 1049.868 | 913.963 | 795.651 | 0.000 | 0.000 |
| 60.000 | 661.196 | 586.422 | 519.077 | 0.000 | 0.000 |
| 90.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

FLUX (MICROGRAMS/CM*CM/DAY) AND LOSS (PERCENT)
AS A FUNCTION OF TIME

| TIME(DAYS) | FLUX | LOSS |
|---|---|---|
| 1.0 | -4.977 | 0.0054 |
| 1101.0 | -0.299 | 0.5722 |
| 2201.0 | -0.170 | 0.7672 |
| 3301.0 | -0.113 | 0.8882 |
| 4401.0 | -0.081 | 0.9719 |
| 5501.0 | -0.060 | 1.0328 |
| 6601.0 | -0.045 | 1.0785 |
| 7701.0 | -0.035 | 1.1135 |

CAUTION: THE USE OF TOO LARGE TIME STEPS MAY CAUSE THE ESTIMATED CUMULATIVE VOLATILIZATION LOSSES TO BE ERRONEOUS. USE THE ESTIMATED TOTAL LOSSES AT INFINITE TIME AS FOLLOWS.

THE TOTAL FRACTION VOLATILIZED IS APPROXIMATELY 0.0244 ASSUMING ZERO WATER EVAPORATION AND LARGE KH (SEE JURY APP. B)

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Maypor<br>Group II SWMUs: Volumes of Contaminated Media | TJH | 08533.29 |
| | CHK. BY<br>LDP | DATE<br>6.7.95 |

Calculation for Chlordane contamination is Subsurface Soil

| Sample location | Media | Concentration |
|---|---|---|
| MPT-15-SSx1 | Surface Soil | 9.0 ppm |
| | Subsurface Soil | ? |
| MPT-15-SSx2 | Surface Soil | 5.6 ppm |
| | Subsurface Soil | 0.18 ppm |

- Surface Soil 5.6 ppm yields subsurface soil = 0.18 ppm

Set up calculation to estimate subsurface soil concentration at sample location MPT-15-SS

Assume straight line effects

$$\frac{0.18\ ppm}{5.6\ ppm} = \frac{x\ ppm}{9.0\ ppm}$$

$$(9.0\ ppm)(0.18\ ppm) = (5.6\ ppm)(x\ ppm)$$

$$\frac{1.62}{5.6} = x$$

$$x = 0.289 \sim 0.29\ ppm$$

0.29 ppm is below MPS for chlordane in subsurface soil.

# APPENDIX B-4
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 6&7-1

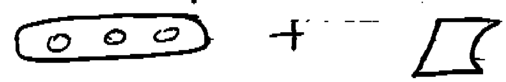
| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| Mayport CMS<br>Alternative 6&7-1 Calculations | TJH<br>CHK. BY<br>LDP | 08533.29<br>DATE<br>6·28·95 |

Fencing: Additional fencing needed = 800 ft
Existing fence pull back & reuse = 838 ft } No new fencing necessary

Volumes of soil are in Appendix B-1 for Excavation Purposes

Volume of Backfill Material necessary ⇒

Surface area = 92,925 sq ft + 18,788 sq ft

=  (see App B-1)

= 111,700 sq ft } area for seeding & mulching as well

Volume assuming 9 ft of soil necessary

= 111,700 ft² (9')

= 1,005,300 cu ft

≅ 37,000 cy (compacted in place volume)

25,100 cy of backfill from treated soil (see App B-1)

Amount still needed

37,000 cy
− 25,100 cy
11,900 cy

obtain soil from stockpiled clean soil

18,400 cy (see App B-1) (stockpiled clean soil)
− 11,900 cy (needed for backfill)
6,500 cy (of clean soil to be disposed

FORM 00.01 REV. 4/81

ABB Environmental Services, Inc.

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Alternative 6 & 7-1 Calculations | TJH | 08533.29 |
| | CHK. BY | DATE |
| | LDP | 6/28/95 |

Need to calculate treatment rate for unit to determine how long treatment will take

29,600 tons of soil to be treated (see App B-1)

Treatment Rate = 30 to 40 tons per hr

① Assume 30 tons/hr

$$\frac{29,600 \text{ tons}}{30 \text{ tons/hr}} \cong 990 \text{ hrs}$$

② Assume 7 dys/wk, 24 hrs/dy (vendor quote)

$$\frac{990 \text{ hrs}}{24 \frac{\text{hrs}}{\text{dy}}} \cong 42 \text{ days}$$

③ $$\frac{42 \text{ days}}{7 \text{ days/wk}} \cong 6 \text{ wks}$$

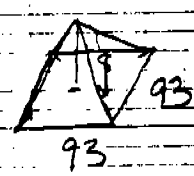
plus 10 days on each end for mob/demob (5 day weeks for this - 4 weeks total)
plus 2 wks downtime

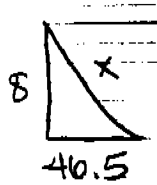
≅ 12 wks total

Each wk →

$$\frac{30 \text{ tons}}{\text{hr}} \cdot \frac{24 \text{ hrs}}{\text{dy}} \cdot \frac{7 \text{ dy}}{\text{wk}} = 5,040 \text{ ton} \cdot \frac{\text{cy}}{1.18 \text{ tons}} \cong 4,300 \text{ cy}$$

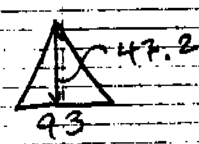
Cover for [illegible]



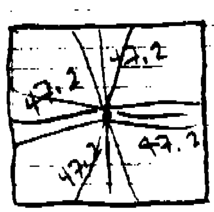




$8^2 + 46.5^2 = x^2$

$x = 47.2$ ft




$A = \frac{1}{2}bh = \frac{1}{2}(93)(47.2)$
$= 2,195 \text{ ft}^2$




Surface Area needed for cover
$= 4(2,195 \text{ ft}^2) = 8,780 \text{ ft}^2$
say $9,000 \text{ ft}^2$

# APPENDIX B-5
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 6&7-2

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Alternative 6A7-2 Calculations | JH | 08533.29 |
| | CHK. BY | DATE |
| | LDP | 6/28/95 |

Fencing - see Alternative 6A7-1
Excavating, Soil Handling and Site Restoration: see Alternative 6A7-1.

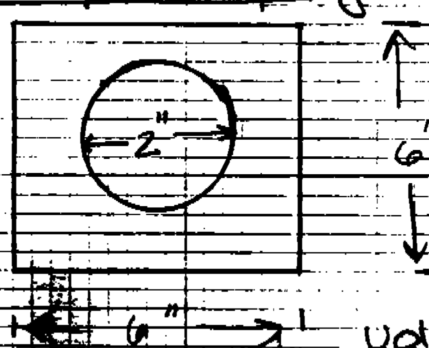
Treatment Cell
Cell will be 200' x 1,000'
Will have 5 Aerated Soil Piles
Each pile will be 10' tall and 25' wide
Each pile will be 10' apart from the next
The last pile will be 17.5' from the containment berm

Estimate length of Piping Necessary — 965 ft = 1,000 ft − 2(17.5 ft) = 965 ft
3 pipes will go through each pile

$5 \text{ piles} \cdot 3 \frac{\text{pipes}}{\text{pile}} \cdot \frac{965 \text{ ft}}{\text{pipe}} = 14,475 \text{ feet} \sim 14,500 \text{ ft}$

assumed that we wouldn't need all that piping
14,500 ft − approx. 250 ft = 14,250 ft

Estimate quantity of gravel necessary



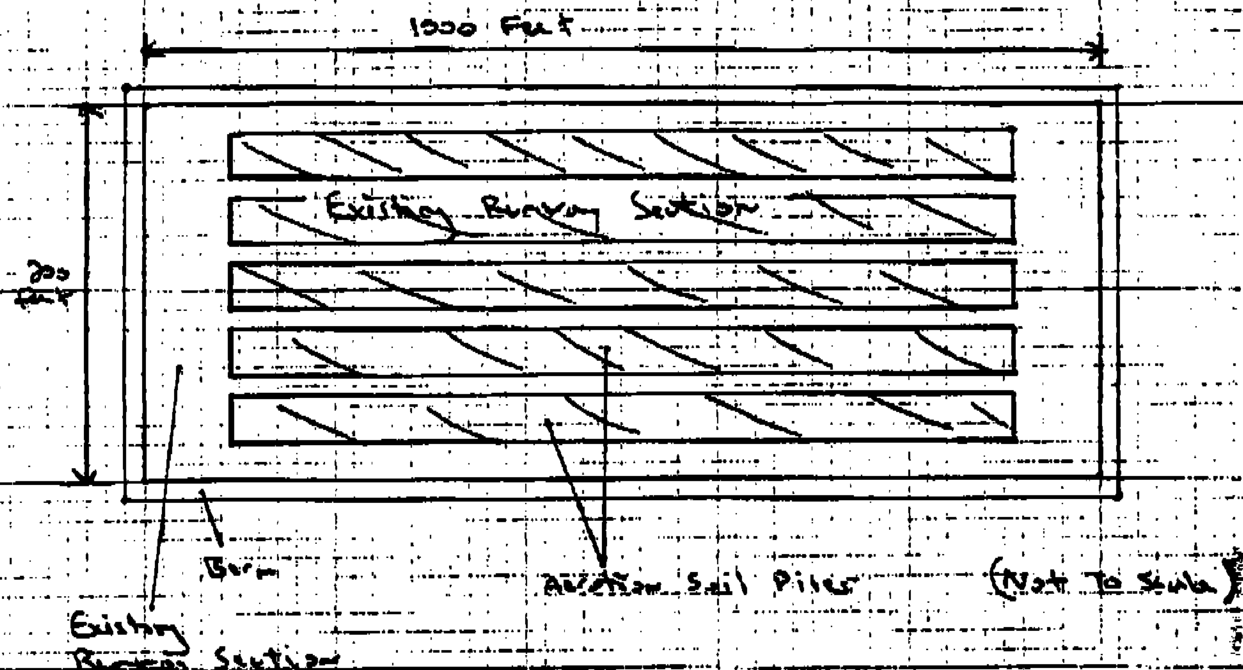

Area of gravel
$= (6'' \times 6'') - \pi(1'')^2 = 32.8 \text{ in}^2$
$32.8 \text{ in}^2 \cdot \left(\frac{1 \text{ ft}}{12 \text{ in}}\right)^2 = 0.23 \text{ ft}^2$

Volume for 5 piles
$= 0.23 \text{ ft}^2 \cdot 14,250 \text{ ft} = 3,277 \text{ ft}^3$
$3,277 \text{ ft}^3 \cdot \frac{1 \text{ cy}}{27 \text{ ft}^3} = 121 \text{ yd}^3$

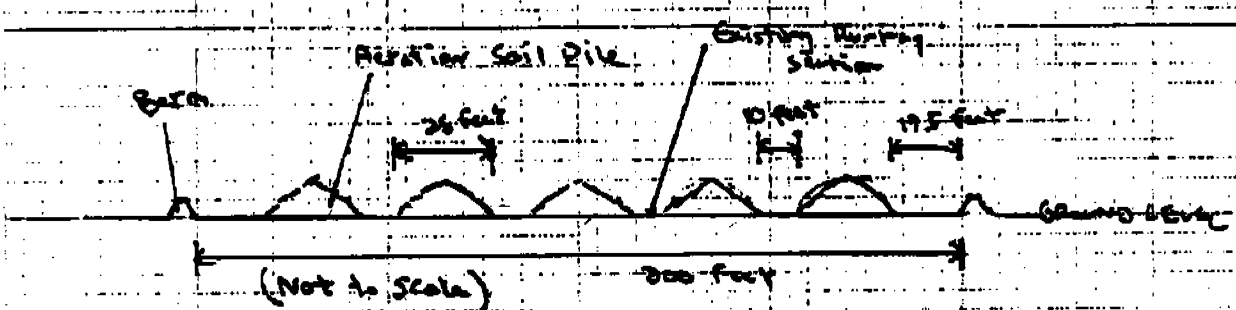
assume we will only need about 105 $yd^3$ based on site conditions.

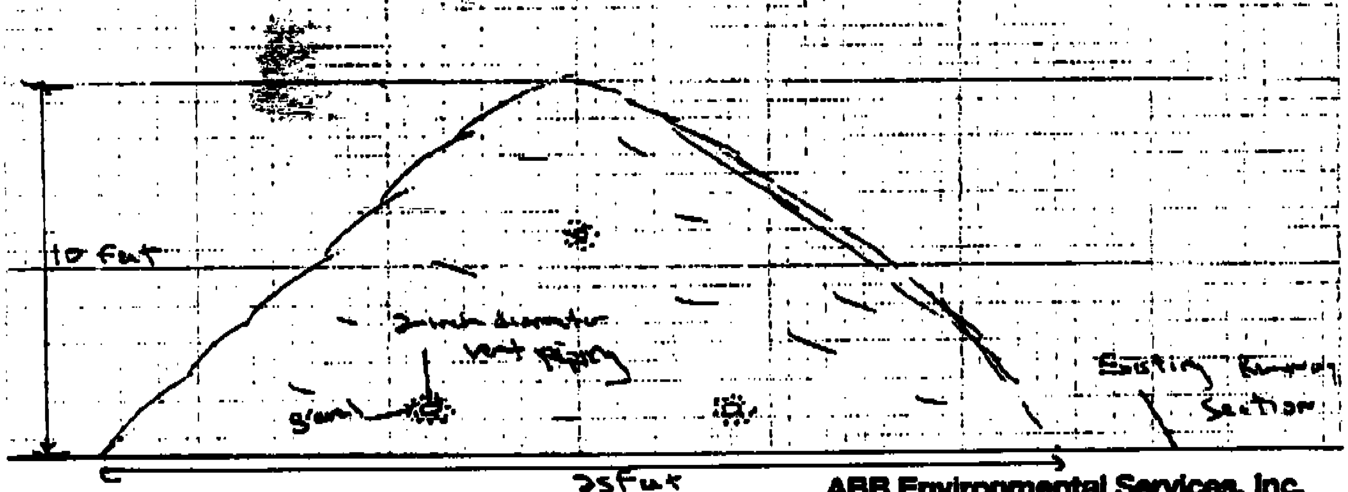
| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Muggport CMS (SMWU 6+7) | DB | 8533.29 |
| | CHK. BY | DATE |
| | [illegible] | 6/21/95 |

Aeration Soil Pile Treatment Pad : Plan View




END VIEW



# APPENDIX B-6
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 6&7-3

| PROJECT | COMP. BY | JOB NO. |
| --- | --- | --- |
| Alternative 647-3 Calculations | JH | 08533.29 |
| | CHK. BY LDP | DATE 6.28.95 |

Fencing: see Alt. 647-1

Soil Handling & Site Restoration: see Alt 647-1

Loading Contaminated Soil & Transporting Contaminated Soil

Load = 25,100 $yd^3$ or 29,600 tons } see App. B-1

Transport = 25,100 $yd^3$ or 29,600 tons }

Soil Recycling = 25,100 $yd^3$ or 29,600 tons } see App B-1

# APPENDIX B-7
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 6&7-5

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Alternative 6&7-S Calculations | DH | 08533.29 |
| | CHK. BY LDP | DATE 6.27.95 |

Trench Length = Calculated 400 ft of length per trench
So total = 800 ft since there are 2 trenches

Assumed 4 skimmers, per trench
will have 1 standard skimming unit and 3 pump skimmer and controlling units per trench.

Gravel/Stone Required

400 ft of length per trench / width = 4 ft

Area = 400' · 4' = 1,600 ft²

Assume 6.5 ft of gravel rqd.

$1{,}600\ ft^2 \cdot 6.5\ ft = 10{,}400\ ft^3$

For 2 trenches

$10{,}400\ ft^3 \cdot 2 = 20{,}800\ ft^3$

$20{,}800\ ft^3 \cdot \frac{1\ yd^3}{27\ ft^3} = \boxed{770\ yd^3}$

Compacted Soil

Assume 2 ft of depth needed

$1{,}600\ ft^2/\text{trench} \cdot 2\ ft = 3{,}200\ ft^3/\text{trench} \cdot 2\ \text{trenches}$

$= \boxed{6{,}400\ ft^3}$

Geomembrane = 3,200 ft² based on area calculations noted above

Electricity

Assume 100 kW operating 7 days/wk, 24 hrs/day, 365 days/yr

$100\ kW\left(24\ hrs/day\right)\left(365\ \frac{days}{yr}\right) = 876{,}000\ kWH$

# APPENDIX B-8
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 6&7-6

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Alternative 6&7-6 Calculations | JH | 08533.29 |
| | CHK. BY | DATE |
| | LDP | 6.27.95 |

Number of Dual-phase Pumps

Assumed 50 ft Radius of Influence for each well

11 wells would be necessary to capture all of the LNAPL.

Only 6 wells would need to be added since 5 sumps are already at SWMUs 6&7 (Based on IM Workplan)

# APPENDIX B-9
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 15-1

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Alternative 15-1: Off-site Incineration calculations | DH | 08533.29 |
| | CHK. BY LDP | DATE 6.27.95 |

Fencing – LF calculated based on figure in Chapter 6
Total rqd = 890 LF

Excavation – Based on volume of contaminated media (see beginning of appendix)

To determine # of rolloffs needed for transportation
Assume each rolloff can handle 35,000 lbs
we have 630 tons of soil

$$630 \text{ tons} \cdot \frac{2,000 \text{ lbs}}{\text{ton}} = 1.26 \times 10^6 \text{ lbs}$$

$$\text{Number of rolloffs} = \frac{1.26 \times 10^6 \text{ lbs}}{35,000 \text{ lbs/rolloff}} = \boxed{36 \text{ rolloffs}}$$

Confirmatory samples 100 ft grid w/ other discretionary sampling points = 15 samples

# APPENDIX B-10
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 15-2

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| NAVAL Station Mayport, SWMU 15 Alternative 15-2 | JH | 08533.29 |
| SWMU 15 Surface Area Calculation for capping | CHK. BY: LDP | DATE: 6.5.95 |

For capping need to determine limits of area that we want capped. Included limits of DDT and chlordane contamination in one analysis.

Attached Figure shows L-shaped capping area chosen. Based on choosing some areas that do not have data and assuming they may have some concentrations of contaminants in surface soil.

Used a planimeter to calculate the area:

1 vernier unit = $0.01 \text{ in}^2$

1" = 60'

| Try # | Start | Finish | Differ. | Ave. | Area (in²) | Area (ft²) |
|---|---|---|---|---|---|---|
| ① | 7717 | 8542 | 825 | | | |
| ② | 9314 | 0146 | 832 | 828.3 | 8.283 | 29,819 |
| ③ | 9594 | 0422 | 828 | | | |

$8.283 \text{ in}^2 \cdot \frac{3600 \text{ ft}^2}{1 \text{ in}^2} = 29818.8 \text{ ft}^2$

$\approx 29,819 \text{ ft}^2$

See attached figure to better show area

So total area required for capping = $29,819 \text{ ft}^2$

so assume $30,000 \text{ ft}^2$ or $3,334 \text{ yd}^2$ ← for geotextile

Now [illegible] determine amount of gravel required for a [illegible] over the whole area

$30,000 \text{ ft}^2 \cdot 6 \text{ inches} \cdot \frac{1 \text{ ft}}{12 \text{ inches}} = 15,000 \text{ ft}^3$

$15,000 \text{ ft}^3 \cdot \frac{1 \text{ yd}^3}{27 \text{ ft}^3} = 555 \text{ yd}^3$

Vendor said to fill this volume crushed limerock @ 672 tons would be necessary

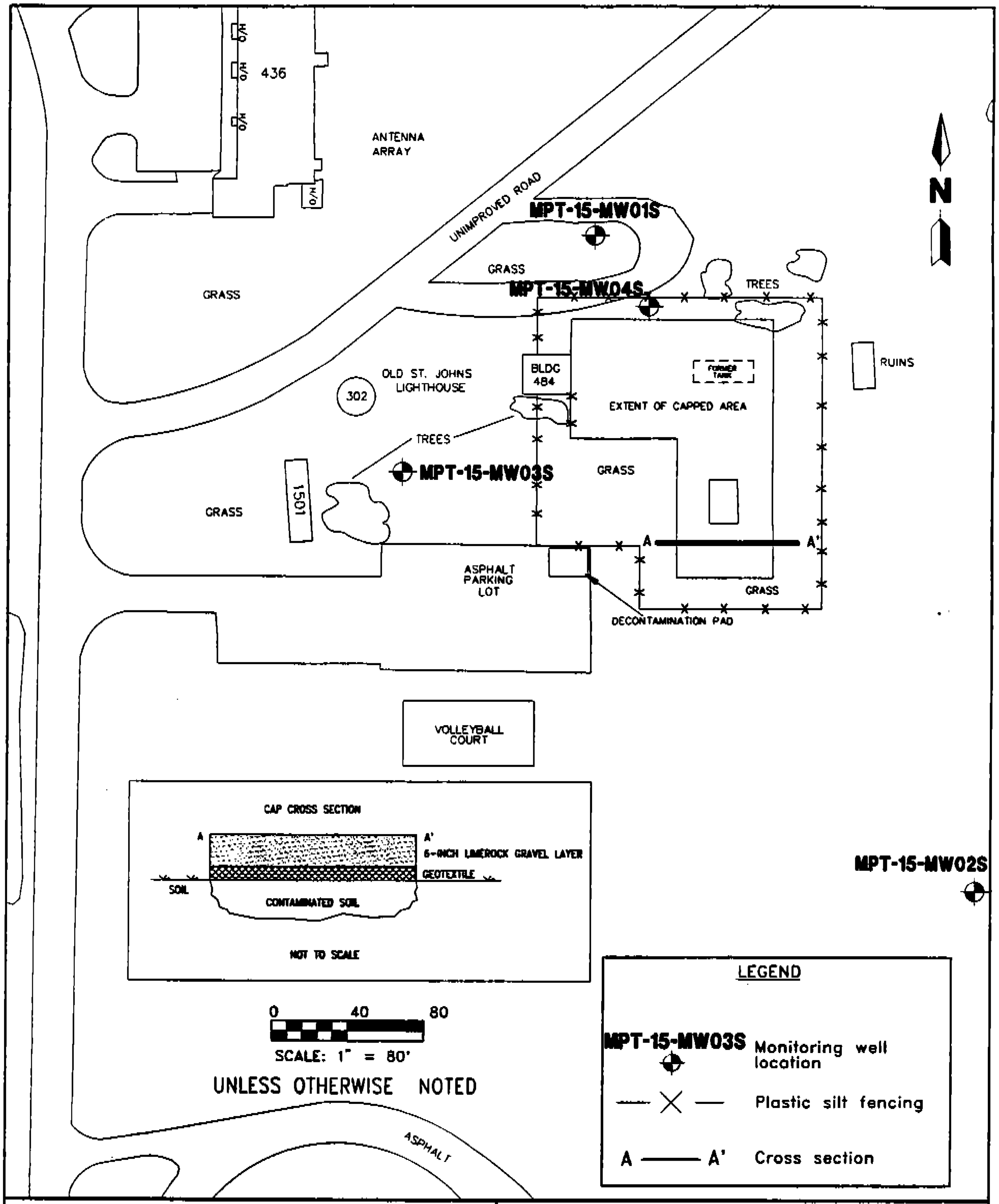



**FIGURE 6-10**
**SITE LAYOUT**
**ALTERNATIVE 15-2: CAPPING**

**CORRECTIVE MEASURES STUDY REPORT, GROUP II SWMUs**

**U.S. NAVAL STATION MAYPORT, FLORIDA**

H:\MAYPORT\MAYFIGS\JMK\07-11-95

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Alternative 15-2: Capping | JH | 08533.29 |
| | CHK. BY LDP | DATE 6.27.95 |

Fencing calculated based on figure in text — total = 980 LF

For replacing crushed limerock: Assumed 1/4 of original qty of limerock would be necessary every year.

So $\frac{1}{4} \cdot 672$ tons = **168 tons/yr**

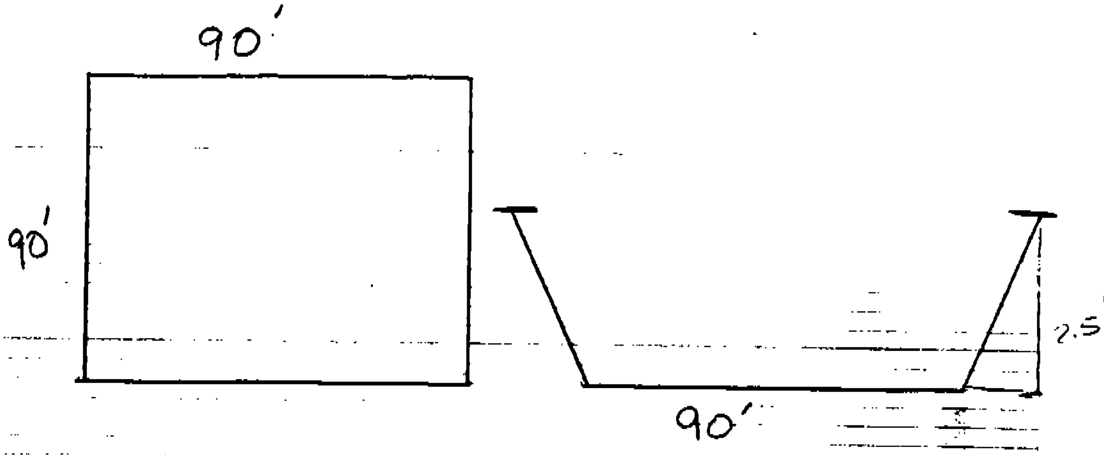
Confirmatory Samples: Based on a 100 ft. grid w/ other discretionary sampling pts = 15 samples

# APPENDIX B-11
# QUANTITY OF MATERIALS NECESSARY FOR ALTERNATIVE 15-3

| PROJECT | COMP. BY | JOB NO. |
|---|---|---|
| Alternative 15-3: Ex-situ Biotreatment Calculations | JH | 08533.29 |
| | CHK. BY | DATE |
| | LOP | 6.27.95 |

Excavation quantity has already been calculated.

Determine amount of HDPE liner necessary for treatment cell. The cell will be 90' x 90' x 2.5'. However more height will be used when estimating amount of liner necessary since some will be necessary on the ground above.




So – 90' · 90' = 8,100 $ft^2$ (for bottom of cell)

For sideslopes there will be 4 ea 90' wide and assume 4 ft tall to allow for overslopes, etc

So.

90' · 4' = 360 $ft^2$ · 4 = 1,440 $ft^2$

Total = 8,100 $ft^2$ + 1,440 $ft^2$ = **9,540 $ft^2$**

Amount of gravel necessary for drainage

A 6" layer of gravel will be placed along the bottom of the cell

Therefore: 90' x 90' x 0.5' = 4,050 $ft^3$ necessary

$$4{,}050\ ft^3 \cdot \frac{1\ yd^3}{27\ ft^3} = \boxed{150\ yd^3}$$

Confirmatory Sampling – 100 foot grid w/ other discretionary samples = 15 samples

# APPENDIX C

# COST BACKUP INFORMATION

## ALTERNATIVE 6&7-1

| | | | |
|---|---|---|---|
| **DIRECT COSTS** | | | |
| Site Preparation | | | |
| Dismantle Existing Fencing | 838 LF | $6.00 | $5,028 |
| Install Fencing at Perimeter | 800 LF | $6.00 | $4,800 |
| Gate | 1 LS | $1,420.00 | $1,420 |
| Decontamination Pad | 1 LS | $500.00 | $500 |
| Water Connection | 100 LF | $15.00 | $1,500 |
| Abandon Monitoring Wells | 1 LS | $1,210.00 | $1,210 |
| Signs | 25 ea | $10.00 | $250 |
| Equipment for Use During Treatment | | | |
| Toilet | 6 wk | $25.00 | $150 |
| Trailer | 2 mon | $150.00 | $300 |
| Washing Equipment | 1 LS | $960.00 | $960 |
| Storage Cabinet | 1 LS | $100.00 | $100 |
| Cover for Clean Soil Stockpile | 9,000 sf | $0.60 | $5,400 |
| Analytical Sampling before Treatment | | | |
| Sample Collection | 1 LS | $2,139.00 | $2,139 |
| Sample Analyses | 1 LS | $26,426.00 | $26,426 |
| Labor | 1,008 hr | $75.00 | $75,600 |
| Thermal Treatment Unit | | | |
| Mob/Demob | 1 ea | $100,000.00 | $100,000 |
| Processing Fee | 29,600 tons | $32.00 | $947,200 |
| Soil Handling | | | |
| Excavate Clean Soil | 18,400 cy | $2.50 | $46,000 |
| Stockpile Clean Soil | 18,400 cy | $4.00 | $73,600 |
| Excavate Dirty Soil | 25,100 cy | $2.25 | $56,475 |
| Haul Dirty Soil to Trmt Area | 25,100 cy | $2.50 | $62,750 |
| Stockpile Dirty Soil | 25,100 cy | $2.00 | $50,200 |
| Handle/Load Treated Soil | 25,100 cy | $2.00 | $50,200 |
| Haul Treated Soil | 25,100 cy | $2.50 | $62,750 |
| Backfill Treated Soil | 25,100 cy | $2.50 | $62,750 |
| Backfill Rest of Excavation | 11,900 cy | $7.00 | $83,300 |
| Handling of Decon Water | | | |
| 55-gallon drums | 5 ea | $100.00 | $500 |
| Analytical Sampling/Treated Soil | | | |
| Sample Collection | 1 LS | $9,300.00 | $9,300 |
| Sample Analyses | 1 LS | $61,746.00 | $61,746 |
| Site Cleaning | | | |
| Compact Backfilled Soil | 111,700 SF | $0.10 | $11,170 |
| Seed/Mulch Area | 111,700 SF | $0.05 | $5,585 |
| Dismantle Water Con | 1 LS | $100.00 | $100 |

| | | | |
|---|---|---|---|
| Dispose Remaining Clean Soil | 6,500 cy | $10.00 | $65,000 |
| **TOTAL DIRECT COSTS** | | | **$1,874,409** |
| **INDIRECT COSTS** | | | |
| Health and Safety (@2%) | | | $37,488 |
| Administration and Permitting Fees (@2%) | | | $37,488 |
| Engineering and Design (@5%) | | | $93,720 |
| Construction Support Services (@5%) | | | $93,720 |
| **TOTAL INDIRECT COSTS** | | | **$262,417** |
| **TOTAL CAPITAL COSTS** | | | **$2,136,826** |
| **CONTINGENCY (@10%)** | | | **$213,683** |
| **TOTAL COST OF ALTERNATIVE 6,7-1** | | | **$2,350,509** |

## ALTERNATIVE 6&7-2

| DIRECT COSTS | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| <u>Site Preparation</u> | | | | |
| Dismantle Existing Fence | 838 | LF | $6.00 | $5,028 |
| Install Fence at Perimeter | 800 | LF | $6.00 | $4,800 |
| 20' Wide Access Gate | 1 | Gate | $1,420.00 | $1,420 |
| Decontamination Pad | 1 | LS | $500.00 | $500 |
| Water Connection | 500 | LF | $15.00 | $7,500 |
| Abandon Monitoring Wells | 1 | LS | $1,210.00 | $1,210 |
| Signs | 36 | ea | $10.00 | $360 |
| | | | | |
| <u>Equipment for Use During Treatment</u> | | | | |
| Toilet | 52 | wk | $25.00 | $1,300 |
| Trailers (2) | 24 | mon | $150.00 | $3,600 |
| Decon Equipment | 1 | LS | $12,000.00 | $12,000 |
| Pumps, Tools, Minor Equipment | 1 | LS | $2,000.00 | $2,000 |
| Cover for Clean Soil Stockpile | 9,000 | sf | $0.60 | $5,400 |
| Drums for DeCon Water | 20 | drums | $40.00 | $800 |
| | | | | |
| <u>Treatment Pad Construction</u> | | | | |
| *Berm and Pad Construction* | | | | |
| 2' - 3' Jersey Barriers | 2,400 | LF | $30.00 | $72,000 |
| Concrete/Asphalt | 240 | 50 lb. ba | $15.00 | $3,600 |
| Crushed Stone/Gravel | 105 | cy | $150.00 | $15,750 |
| 4" Dia. Pipe (air and water lines) | 14,250 | ft | $0.20 | $2,850 |
| 2" slotted piping and screen | 14,250 | ft | $1.00 | $14,250 |
| Blower System | 1 | ea. | $8,000.00 | $8,000 |
| Timer System | 4 | ea. | $400.00 | $1,600 |
| Valves/Solenoid valves | 1 | LS | $1,000.00 | $1,000 |
| Electrical Hookup | 1 | LS | $1,000.00 | $1,000 |
| | | | | |
| *Water System* | | | | |
| Water Hookup | 1 | LS | $1,000.00 | $1,000 |
| Pumps, Piping, Sprinklers | 1 | LS | $4,200.00 | $4,200 |
| Storage Tank (Mob. and Setup) | 1 | LS | $45,000.00 | $45,000 |
| Tank Rental | 12 | mo. | $3,200.00 | $38,400 |
| | | | | |
| *Berm/Water System Construction (approx. 15 days)* | | | | |
| Front End Loader | 8 | days | $850.00 | $6,800 |
| Operator | 80 | hrs | $28.00 | $2,240 |
| Laborer (2) | 300 | hrs | $22.00 | $6,600 |
| Foreman | 150 | hrs | $40.00 | $6,000 |
| Construction Oversight | 300 | hrs | $70.00 | $21,000 |
| Airfare, Lodging, etc. | 1 | LS | $5,000.00 | $5,000 |
| | | | | |
| <u>Analytical Sampling before Treatment</u> | | | | |
| Sample Collection | 500 | hrs | $75.00 | $37,500 |
| Sample Analyses (FAC 62-775) | 54 | samples | $490.00 | $26,460 |
| Sample Supplies | 1 | LS | $2,200.00 | $2,200 |

| | | | | |
|---|---|---|---|---|
| <u>Soil Handling</u> | | | | |
| Excavate Clean Soil | 18,400 | cy | $2.50 | $46,000 |
| Stockpile Clean Soil | 18,400 | cy | $4.00 | $73,600 |
| Excavate Contaminated Soil | 25,100 | cy | $2.25 | $56,475 |
| Stockpile Contaminated Soil [in Treatment Pad] | 25,100 | cy | $7.00 | $175,700. |
| <u>System Operation</u> | | | | |
| Labor/Troubleshooting | 600 | hrs | $50.00 | $30,000 |
| Nutrients | 1 | LS | $3,000.00 | $3,000 |
| Monitoring Tests | | | | |
| - Nutrient, pH, moisture (5/wk) | 260 | tests | $90.00 | $23,400 |
| - Bacterial Enumeration (5/mo | 120 | tests | $120.00 | $14,400 |
| - TRPH (5/wk) | 260 | tests | $75.00 | $19,500 |
| - GC/FID Analysis (12/mo) | 144 | tests | $175.00 | $25,200 |
| Electricity | 65,000 | kwh | $0.08 | $5,200 |
| ODCs (sample bottles, etc.) | 14 | ea | $300.00 | $4,200 |
| Consulting Engineer | 440 | hrs | $80.00 | $35,200 |
| <u>Analytical Sampling after Treatment</u> | | | | |
| Sample Collection | 200 | hrs | $75.00 | $15,000 |
| Sample Analyses (FAC 62-775) | 105 | samples | $490.00 | $51,450 |
| Sample Supplies | 1 | LS | $2,200.00 | $2,200 |
| <u>Site Restoration</u> | | | | |
| Backfill Treated Soil | 25,100 | cy | $2.50 | $62,750 |
| Backfill Rest of Excavation | 11,900 | cy | $7.00 | $83,300 |
| Compact Backfilled Soil | 111,700 | SF | $0.10 | $11,170 |
| Seed/Mulch Area | 111,700 | SF | $0.05 | $5,585 |
| Dismantle Water Con | 1 | LS | $100.00 | $100 |
| Dispose Remaining Clean Soil | 6,500 | cy | $10.00 | $65,000 |
| TOTAL DIRECT COSTS | | | | $1,176,798 |
| INDIRECT COSTS | | | | |
| Health and Safety (@2%) | | | | $23,536 |
| Administration and Permitting Fees (@2%) | | | | $23,536 |
| Engineering and Design (@10%) | | | | $117,680 |
| Construction Support Services (@10%) | | | | $117,680 |
| TOTAL INDIRECT COSTS | | | | $282,432 |
| TOTAL CAPITAL COSTS | | | | $1,459,230 |
| CONTINGENCY (@10%) | | | | $145,923 |
| TOTAL COST OF ALTERNATIVE 6,7-2 | | | | $1,605,152 |

## ALTERNATIVE 6&7-3

| DIRECT COSTS | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| Site Preparation | | | | |
| Dismantle Existing Fence | 838 | LF | $6.00 | $5,028 |
| Install Fence at Perimeter | 800 | LF | $6.00 | $4,800 |
| 20' Wide Access Gate | 1 | Gate | $1,420.00 | $1,420 |
| Decontamination Pad | 1 | LS | $500.00 | $500 |
| Water Connection | 100 | LF | $15.00 | $1,500 |
| Abandon Monitoring Wells | 1 | LS | $1,210.00 | $1,210 |
| Signs | 25 | ea | $10.00 | $250 |
| Equipment for Use During Mobilization | | | | |
| Toilet | 12 | wk | $25.00 | $300 |
| Trailers (2) | 6 | mon | $150.00 | $900 |
| Washing Equipment | 1 | LS | $960.00 | $960 |
| Pumps, Tools, Minor Equipment | 1 | LS | $2,000.00 | $2,000 |
| Cover for Clean Soil Stockpile | 9,000 | sf | $0.60 | $5,400 |
| Drums for DeCon Water | 20 | drums | $40.00 | $800 |
| Analytical Sampling before Treatment | | | | |
| Sample Collection | 500 | hrs | $75.00 | $37,500 |
| Sample Analyses (FAC 62-775) | 54 | samples | $490.00 | $26,460 |
| Sanple Analysis - PCBs | 54 | samples | $125.00 | $6,750 |
| Sample Supplies | 1 | LS | $2,200.00 | $2,200 |
| Soil Handling | | | | |
| Excavate Clean Soil | 18,400 | cy | $2.50 | $46,000 |
| Stockpile Clean Soil | 18,400 | cy | $4.00 | $73,600 |
| Excavate Contaminated Soil | 25,100 | cy | $5.00 | $125,500 |
| Load Contaminated Soil | 25,100 | cy | $2.00 | $50,200 |
| Transport Contaminated Soil [approx. 120 miles round trip] | 29,600 | tons | $6.00 | $177,600 |
| Soil Recycling | | | | |
| Soil Recycling | 29,600 | tons | $28.00 | $828,800 |
| Site Restoration | | | | |
| Backfill Clean Soil | 18,400 | cy | $3.00 | $55,200 |
| Backfill Rest of Excavation | 18,600 | cy | $8.00 | $148,800 |
| Compact Backfilled Soil | 111,700 | SF | $0.10 | $11,170 |
| Seed/Mulch Area | 111,700 | SF | $0.05 | $5,585 |
| Dismantle Water Con | 1 | LS | $100.00 | $100 |
| TOTAL DIRECT COSTS | | | | $1,620,533 |
| INDIRECT COSTS | | | | |
| Health and Safety (@2%) | | | | $32,411 |
| Administration and Permitting Fees (@2%) | | | | $32,411 |
| Engineering and Design (@5%) | | | | $81,027 |

| | |
|---|---|
| Construction Support Services (@10%) | $162,053 |
| TOTAL INDIRECT COSTS | $307,901 |
| TOTAL CAPITAL COSTS | $1,928,434 |
| CONTINGENCY (@10%) | $192,843 |
| TOTAL COST OF ALTERNATIVE 6,7-3 | $2,121,278 |

## ALTERNATIVE 6&7-5

| DIRECT COSTS | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| <u>Site Preparation</u> | | | | |
| Decontamination Pad | 1 | LS | $500.00 | $500 |
| Trailer/Office | 1 | mo | $200.00 | $200 |
| Housing for Controls and Electricity | 2 | ea | $2,500.00 | $5,000 |
| General Site Mob/Demob | 1 | LS | $500.00 | $500 |
| | | | | |
| <u>Utility Map Search</u> | | | | |
| Labor (Scientist) | 40 | hr | $30.00 | $1,200 |
| Labor (Engineer) | 40 | hr | $30.00 | $1,200 |
| | | | | |
| <u>GPR Survey</u> | | | | |
| Mob/Demob | 1 | LS | $800.00 | $800 |
| Geophysical Survey | 1 | LS | $8,000.00 | $8,000 |
| | | | | |
| <u>Trench Construction</u> | | | | |
| Mob/Demob | 1 | LS | $10,000.00 | $10,000 |
| Trench Machine Including labor and moving | 800 | LF | $145.00 | $116,000 |
| | | | | |
| <u>Recovery Well and vault Construction</u> | | | | |
| Steel vault | 8 | ea | $1,630.00 | $13,040 |
| Vault Covers | 8 | ea | $81.25 | $650 |
| Recovery Sump | 8 | ea | $364.00 | $2,912 |
| Standard Skimming Units | 2 | ea | $3,790.00 | $7,580 |
| Pump Skimmer and Controlling Units | 6 | ea | $2,100.00 | $12,600 |
| Coarse Stone | 770 | cy | $30.00 | $23,100 |
| Compacted Soil | 6,400 | cf | $3.00 | $19,200 |
| Geomembrane | 3,200 | sf | $1.00 | $3,200 |
| Concrete pads | 8 | ea | $104.00 | $832 |
| Piping | 1,300 | ft | $15.00 | $19,500 |
| Electrical Hookup | 1,300 | ft | $7.50 | $9,750 |
| Holding tank for product recovery | 1 | LS | $2,000.00 | $2,000 |
| Labor (Geologist, 1x3wks@8hrs) | 120 | hr | $30.00 | $3,600 |
| Labor (Engineer, 1x3wks@8hrs) | 120 | hr | $30.00 | $3,600 |
| Labor (Technician, 2x3wks@8hrs) | 240 | hr | $20.00 | $4,800 |
| Labor (Senior Hydrogeologist, 1x2dys@8hrs) | 16 | hr | $45.00 | $720 |
| Lodging/PD (3@3wks) | 15 | dy | $80.00 | $1,200 |
| | | | | |
| **TOTAL DIRECT COSTS** | | | | $271,684 |
| | | | | |
| **INDIRECT COSTS** | | | | |
| Health and Safety (@2%) | | | | $5,434 |
| Administration and Permitting Fees (@2%) | | | | $5,434 |
| Engineering and Design (@20%) | | | | $54,337 |
| Construction Support Services (@10%) | | | | $27,168 |
| | | | | |
| **TOTAL INDIRECT COSTS** | | | | $92,373 |

| | | | |
|---|---|---|---|
| **TOTAL CAPITAL COSTS** | | | **$364,057** |
| **OPERATION AND MAINTENANCE (annual)** | | | |
| <u>Annual Groundwater monitoring</u> | | | |
| Sample Analysis | 10 ea | $210.73 | $2,107 |
| Labor (Geologist, 1x1wk@8hrs) | 40 hrs | $30.00 | $1,200 |
| Labor (Engineer, 1X1wk@8hrs) | 40 hrs | $30.00 | $1,200 |
| Evaluation Report | 48 hrs | $30.00 | $1,440 |
| <u>Monthly Water Level Measurements and Free Product Measurements (converted to an annual value)</u> | | | |
| Labor (Geologist, 1x24dys@8hrs) | 192 hr | $30.00 | $5,760 |
| Labor (Engineer, 1x24dys@8hrs) | 192 hr | $30.00 | $5,760 |
| <u>Other</u> | | | |
| Electricity | 438,000 kwH | $0.05 | $21,900 |
| Annual Operation and Maintenance | | | $39,367 |
| **TOTAL OPERATION AND MAINTENANCE COSTS (7 years @ 6% interest rate)** | | | **$219,748** |
| **TOTAL CAPITAL COSTS AND OPERATION AND MAINTENANCE COSTS** | | | **$583,805** |
| **CONTINGENCY (@10%)** | | | **$58,380** |
| **TOTAL COST OF ALTERNATIVE 6&7-5** | | | **$642,185** |

## ALTERNATIVE 6&7-6

| DIRECT COSTS | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| Site Preparation | | | | |
| Decontamination Pad | 1 | LS | $500.00 | $500 |
| Trailer/Office | 1 | mo | $200.00 | $200 |
| Housing for Controls and Electricity | 3 | ea | $2,500.00 | $7,500 |
| General Site Mob/Demob | 1 | LS | $500.00 | $500 |
| Utility Map Search | | | | |
| Labor (Scientist) | 40 | hr | $30.00 | $1,200 |
| Labor (Engineer) | 40 | hr | $30.00 | $1,200 |
| GPR Survey | | | | |
| Mob/Demob | 1 | LS | $800.00 | $800 |
| Geophysical Survey | 1 | LS | $8,000.00 | $8,000 |
| Well Construction | | | | |
| Well Screen (15 ft. per well) | 6 | ea | $620.93 | $3,726 |
| Well Riser (5 ft. per well) | 6 | ea | $184.70 | $1,108 |
| Well Cap | 6 | ea | $57.64 | $346 |
| Mobilization of Auger Drill Rig | 1 | LS | $3,000.00 | $3,000 |
| Well Completion | 6 | ea | $75.00 | $450 |
| Well Development | 6 | ea | $75.00 | $450 |
| Dual Phase Pumps | 11 | ea | $5,750.00 | $63,250 |
| Compressor | 3 | ea | $850.00 | $2,550 |
| Piping | 1,000 | ft | $3.00 | $3,000 |
| Electrical Hookup | 1,300 | ft | $7.50 | $9,750 |
| Holding tank for product recovery | 1 | LS | $2,000.00 | $2,000 |
| Labor (Geologist, 1x2wks@8hrs) | 80 | hr | $30.00 | $2,400 |
| Labor (Engineer, 1x2wks@8hrs) | 80 | hr | $30.00 | $2,400 |
| Labor (Technician, 1x2wks@8hrs) | 80 | hr | $20.00 | $1,600 |
| Labor (Senior Hydrogeologist) | 2 | hr | $45.00 | $90 |
| Lodging/PD (3x2wks) | 30 | dy | $80.00 | $2,400 |
| **TOTAL DIRECT COSTS** | | | | $118,420 |
| **INDIRECT COSTS** | | | | |
| Health and Safety (@2%) | | | | $2,368 |
| Administration and Permitting Fees (@2%) | | | | $2,368 |
| Engineering and Design (@20%) | | | | $23,684 |
| Construction Support Services (@10%) | | | | $11,842 |
| **TOTAL INDIRECT COSTS** | | | | $40,263 |
| **TOTAL CAPITAL COSTS** | | | | $158,682 |
| **OPERATION AND MAINTENANCE (annual)** | | | | |
| Annual Groundwater monitoring | | | | |
| Sample Analysis | 10 | ea | $210.73 | $2,107 |

| | | | |
|---|---|---|---|
| Labor (Geologist, 1x1wk@8hrs) | 40 hrs | $30.00 | $1,200 |
| Labor (Engineer, 1X1wk@8hrs) | 40 hrs | $30.00 | $1,200 |
| Evaluation Report | 48 hrs | $30.00 | $1,440 |
| Monthly Water Level Measurements and Free Product Measurements (converted to an annual value) | | | |
| Labor (Geologist, 1x24dys@8hrs) | 192 hrs | $30.00 | $5,760 |
| Labor (Engineer, 1x24dys@8hrs) | 192 hrs | $30.00 | $5,760 |
| Other | | | |
| Electricity | 876,000 kwH | $0.05 | $43,800 |
| Annual Operation and Maintenance Costs | | | $61,267 |
| **TOTAL OPERATION AND MAINTENANCE COSTS (7 years @ 6% interest rate)** | | | **$341,994** |
| **TOTAL CAPITAL COSTS AND OPERATION AND MAINTENANCE COSTS** | | | **$500,676** |
| **CONTINGENCY (@10%)** | | | **$50,068** |
| **TOTAL COST OF ALTERNATIVE 6&7-6** | | | **$550,744** |

## ALTERNATIVE 15-1

| DIRECT COSTS | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| <u>Site Preparation</u> | | | | |
| Fencing | 890 | LF | $5.00 | $4,450 |
| Decontamination Pad | 1 | LS | $500.00 | $500 |
| Signs | 9 | ea | $10.00 | $90 |
| General Site Mob/Demob | 1 | LS | $500.00 | $500 |
| | | | | |
| <u>Equipment</u> | | | | |
| Storage Cabinet | 1 | LS | $100.00 | $100 |
| Pressure Washer | 5 | dy | $30.00 | $150 |
| Tank for Decontamination Water | 1 | mo | $400.00 | $400 |
| | | | | |
| <u>Excavation of Soil</u> | | | | |
| Backhoe | 1 | LS | $1,400.00 | $1,400 |
| Bulldozer | 1 | LS | $1,400.00 | $1,400 |
| Pickup | 1 | wk | $300.00 | $300 |
| Trackhoe Rental | 5 | dy | $1,000.00 | $5,000 |
| Trackhoe Operator | 40 | hr | $40.00 | $1,600 |
| Laborer (2) | 80 | hr | $30.00 | $2,400 |
| Site Superintendant | 50 | hr | $50.00 | $2,500 |
| | | | | |
| <u>Confirmatory Sampling</u> | | | | |
| Surface soil sample analysis | 15 | ea | $261.69 | $3,925 |
| Geologist | 16 | hr | $60.00 | $960 |
| Engineer | 16 | hr | $45.00 | $720 |
| | | | | |
| <u>Off-site Transport and Incineration</u> | | | | |
| Initial sampling prior to approval | 1 | ea | $389.00 | $389 |
| Approval fees | 1 | LS | $300.00 | $300 |
| Transportation | 36 | ea | $3,080.00 | $110,880 |
| Incineration and Disposal | 1,260,000 | lb | $0.60 | $756,000 |
| | | | | |
| <u>Handling of Decon Water</u> | | | | |
| 55-gallon drums | 5 | ea | $100.00 | $500 |
| | | | | |
| <u>Clearing/Closure Activities</u> | | | | |
| Bulldozer | 1 | dy | $1,400.00 | $1,400 |
| Laborer | 8 | hr | $30.00 | $240 |
| Fertilize, Seed, and Mulch | 2,000 | sy | $0.50 | $1,000 |
| Remove temporary fencing | 890 | LF | $2.00 | $1,780 |
| | | | | |
| <u>Water Level Measurements and Sampling Costs</u> | | | | |
| 40 PVC screen | 20 | LF | $5.00 | $100 |
| Riser for piezometer | 9 | LF | $2.25 | $20 |
| Water level meter | 2 | dys | $20.00 | $40 |
| Terra-Probe Rental w/ Operator | 2 | dys | $500.00 | $1,000 |
| Terra-Probe Mob/Demob | 200 | mi | $0.21 | $42 |
| Teflon tubing | 300 | LF | $2.00 | $600 |

| | | | |
|---|---|---|---|
| Sample vials | 20 ea | $4.00 | $80 |
| Pesticide Analysis | 10 ea | $150.88 | $1,509 |
| Labor (Geologist) | 32 hrs | $30.00 | $960 |
| Labor (Engineer) | 8 hrs | $30.00 | $240 |
| Labor (Sr Hydrologist) | 16 hrs | $45.00 | $720 |
| Lodging/PD (2dys/2people @$80/dy) | 2 dys | $160.00 | $320 |
| | | | |
| <u>Water Well Survey</u> | | | |
| Labor (Engineer) | 40 hrs | $30.00 | $1,200 |
| Labor (Sr Engineer) | 8 hrs | $40.00 | $320 |
| Lodging/PD (5dys/1 person @$80/dy) | 5 dys | $80.00 | $400 |
| | | | |
| <u>Groundwater Monitoring Well Installation</u> | | | |
| Well installation w/ Materials | 15 LF | $14.00 | $210 |
| Well Construction | 1 LS | $125.00 | $125 |
| Well Completion | 1 LS | $75.00 | $75 |
| Well Development | 1 LS | $75.00 | $75 |
| Mob/Demob | 1 LS | $1,000.00 | $1,000 |
| Lodging/PD (assume 1dys/2people @$80/dy) | 1 dys | $160.00 | $160 |
| Decon | 3 hrs | $100.00 | $300 |
| Pesticide Analysis | 1 ea | $150.88 | $151 |
| Labor (Engineer) | 8 hrs | $30.00 | $240 |
| Labor (Geologist) | 8 hrs | $30.00 | $240 |
| | | | |
| <u>Evaluation Report</u> | | | |
| Labor (Engineer) | 48 hrs | $30.00 | $1,440 |
| Labor (Sr. Engineer) | 8 hrs | $30.00 | $240 |
| Other Direct Costs | 1 LS | $100.00 | $100 |
| | | | |
| **TOTAL DIRECT COSTS** | | | **$910,791** |
| | | | |
| **INDIRECT COSTS** | | | |
| Health and Safety (@2%) | | | $18,216 |
| Administration and Permitting Fees (@2%) | | | $18,216 |
| Engineering and Design (@5%) | | | $45,540 |
| Construction Support Services (@3%) | | | $27,324 |
| | | | |
| **TOTAL INDIRECT COSTS** | | | **$109,295** |
| | | | |
| **TOTAL CAPITAL COSTS** | | | **$1,020,086** |
| | | | |
| **CONTINGENCY (@10%)** | | | **$102,009** |
| | | | |
| **TOTAL COST OF ALTERNATIVE 15-1** | | | **$1,122,095** |

## ALTERNATIVE 15-2

| DIRECT COSTS | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| <u>Site Preparation</u> | | | | |
| Fencing | 980 | LF | $5.00 | $4,900 |
| Decontamination Pad | 1 | LS | $500.00 | $500 |
| Signs | 10 | ea | $10.00 | $100 |
| General Site Mob/Demob | 1 | LS | $500.00 | $500 |
| | | | | |
| <u>Equipment</u> | | | | |
| Storage Cabinet | 1 | LS | $100.00 | $100 |
| Pressure Washer | 5 | dy | $30.00 | $150 |
| Tank for Decontamination Water | 1 | mo | $400.00 | $400 |
| | | | | |
| <u>Placement of Cap</u> | | | | |
| Grad-all | 1 | LS | $1,550.00 | $1,550 |
| Bulldozer | 1 | LS | $1,400.00 | $1,400 |
| Pickup | 1 | LS | $500.00 | $500 |
| Frontend Loader | 1 | LS | $800.00 | $800 |
| Backhoe (tracked) | 1 | LS | $1,400.00 | $1,400 |
| Dump Truck | 1 | LS | $725.00 | $725 |
| Laborer | 16 | hr | $30.00 | $480 |
| Site Superintendant | 160 | hr | $50.00 | $8,000 |
| Geotextile (installed cost) | 3,334 | sy | $2.60 | $8,668 |
| Crushed Limerock | 672 | ton | $12.00 | $8,064 |
| | | | | |
| <u>Handling of Decon Water</u> | | | | |
| 55-gallon drums | 5 | ea | $100.00 | $500 |
| | | | | |
| <u>Clearing/Closure Activities</u> | | | | |
| Remove temporary fencing | 980 | LF | $2.00 | $1,960 |
| | | | | |
| <u>Water Level Measurements and Sampling Costs</u> | | | | |
| 40 PVC screen | 20 | LF | $5.00 | $100 |
| Riser for piezometer | 9 | LF | $2.25 | $20 |
| Water level meter | 2 | dys | $20.00 | $40 |
| Terra-Probe Rental w/ Operator | 2 | dys | $500.00 | $1,000 |
| Terra-Probe Mob/Demob | 200 | mi | $0.21 | $42 |
| Teflon tubing | 300 | LF | $2.00 | $600 |
| Sample vials | 20 | ea | $4.00 | $80 |
| Pesticide Analysis | 10 | ea | $150.88 | $1,509 |
| Labor (Geologist) | 32 | hrs | $30.00 | $960 |
| Labor (Engineer) | 8 | hrs | $30.00 | $240 |
| Labor (Sr Hydrologist) | 16 | hrs | $45.00 | $720 |
| Lodging/PD (2dys/2people @$80/dy) | 2 | dys | $160.00 | $320 |
| | | | | |
| <u>Water Well Survey</u> | | | | |
| Labor (Engineer) | 40 | hrs | $30.00 | $1,200 |
| Labor (Sr Engineer) | 8 | hrs | $40.00 | $320 |
| Lodging/PD (5dys/1 person @$80/dy) | 5 | dys | $80.00 | $400 |

| | | | |
|---|---|---|---|
| Groundwater Monitoring Well Installation | | | |
| Well installation w/ Materials | 15 LF | $14.00 | $210 |
| Well Construction | 1 LS | $125.00 | $125 |
| Well Completion | 1 LS | $75.00 | $75 |
| Well Development | 1 LS | $75.00 | $75 |
| Mob/Demob | 1 LS | $1,000.00 | $1,000 |
| Lodging/PD (assume 1dys/2people @$80/dy) | 1 dys | $160.00 | $160 |
| Decon | 3 hrs | $100.00 | $300 |
| Pesticide Analysis | 1 ea | $150.88 | $151 |
| Labor (Engineer) | 8 hrs | $30.00 | $240 |
| Labor (Geologist) | 8 hrs | $30.00 | $240 |
| | | | |
| Evaluation Report | | | |
| Labor (Engineer) | 48 hrs | $30.00 | $1,440 |
| Labor (Sr. Engineer) | 8 hrs | $30.00 | $240 |
| Other Direct Costs | 1 LS | $100.00 | $100 |
| | | | |
| TOTAL DIRECT COSTS | | | $52,604 |
| | | | |
| INDIRECT COSTS | | | |
| Health and Safety (@2%) | | | $1,052 |
| Administration and Permitting Fees, Includes Deed Restriction (@4%) | | | $2,104 |
| Engineering and Design (@15%) | | | $7,891 |
| Construction Support Services (@5%) | | | $2,630 |
| | | | |
| TOTAL INDIRECT COSTS | | | $13,677 |
| | | | |
| TOTAL CAPITAL COSTS | | | $66,281 |
| | | | |
| OPERATION AND MAINTENANCE COSTS (annual) | | | |
| Replacement of Crushed Limerock Gravel | 168 ton | $12.00 | $2,016 |
| Dump Truck | 1 LS | $725.00 | $725 |
| | | | |
| Annual Operation and Maintenance Costs | | | $2,741 |
| TOTAL OPERATION AND MAINTENANCE COSTS (capitalized @ 6% interest rate) | | | $45,683 |
| | | | |
| TOTAL CAPITAL COSTS AND OPERATION AND MAINTENANCE COSTS | | | $111,965 |
| | | | |
| CONTINGENCY (@ 10%) | | | $11,196 |
| | | | |
| TOTAL COST OF ALTERNATIVE 15-2 | | | $123,161 |

## ALTERNATIVE 15-3

| DIRECT COSTS | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| <u>Site Preparation</u> | | | | |
| Fencing (8 ft. chain link) | 995 | LF | $12.40 | $12,338 |
| Access Gate | 2 | ea | $1,420.00 | $2,840 |
| Decontamination Pad | 1 | LS | $500.00 | $500 |
| Signs | 12 | ea | $10.00 | $120 |
| Water Connection (2" PVC piping) | 100 | LF | $15.00 | $1,500 |
| General Site Mob/Demob | 1 | LS | $500.00 | $500 |
| <u>Equipment</u> | | | | |
| Storage Cabinet | 1 | LS | $100.00 | $100 |
| Pressure Washer | 5 | dy | $30.00 | $150 |
| Tank for Decontamination Water | 1 | mo | $400.00 | $400 |
| Treatment Shed | 1 | LS | $1,000.00 | $1,000 |
| <u>Testing</u> | | | | |
| Bench-scale testing | 1 | LS | $25,000.00 | $25,000 |
| Pilot-scale testing | 1 | LS | $50,000.00 | $50,000 |
| <u>Construction of Lined Treatment Cell</u> | | | | |
| Cell Construction (Mob/Demob, equip, labor) | 12 | dy | $3,500.00 | $42,000 |
| Liner System (60ml HDPE installed) | 9,540 | sf | $2.00 | $19,080 |
| Gravel (drainage) | 150 | cy | $15.00 | $2,250 |
| Water/Air piping (includes drainage and delivery piping) | 1,800 | lf | $1.00 | $1,800 |
| Fittings, Connections, etc. | 1 | LS | $2,500.00 | $2,500 |
| Installation Labor (3 @10hrs/dy@10days) | 300 | hr | $55.00 | $16,500 |
| <u>Nutrient and Amendment Delivery</u> | | | | |
| 15,000 gallon water storage tank | 1 | LS | $20,000.00 | $20,000 |
| Nutrient mixing tank | 1 | LS | $3,000.00 | $3,000 |
| Surfactant Storage Tank | 1 | LS | $5,000.00 | $5,000 |
| Metering pumps | 2 | ea | $500.00 | $1,000 |
| Heating system | 1 | LS | $10,000.00 | $10,000 |
| Water recirculation pump | 1 | LS | $1,000.00 | $1,000 |
| Air recirculation (compressor) | 1 | LS | $2,000.00 | $2,000 |
| Rototiller rental and labor | 1,400 | sy | $0.80 | $1,120 |
| <u>Excavation of Soil</u> | | | | |
| Backhoe | 1 | LS | $1,400.00 | $1,400 |
| Bulldozer | 1 | LS | $1,400.00 | $1,400 |
| Pickup | 1 | wk | $300.00 | $300 |
| Trackhoe Rental | 5 | dy | $1,000.00 | $5,000 |
| Trackhoe Operator | 40 | hr | $40.00 | $1,600 |
| Laborer (2) | 80 | hr | $30.00 | $2,400 |
| Site Superintendant | 50 | hr | $50.00 | $2,500 |
| <u>Confirmatory Sampling</u> | | | | |
| Surface soil sample analysis | 15 | ea | $261.69 | $3,925 |

| | | | |
|---|---|---|---|
| Geologist | 16 hr | $60.00 | $960 |
| Engineer | 16 hr | $45.00 | $720 |
| <u>Handling of Decon Water</u> | | | |
| 55-gallon drums | 10 ea | $100.00 | $1,000 |
| <u>Removal of Treated Soil from Cell</u> | | | |
| Backhoe | 1 LS | $1,400.00 | $1,400 |
| Pickup | 1 LS | $300.00 | $300 |
| Trackhoe Rental | 5 dy | $1,000.00 | $5,000 |
| Trackhoe Operator | 40 hr | $40.00 | $1,600 |
| Laborer (2) | 80 hr | $30.00 | $2,400 |
| Site Superintendant | 50 hr | $50.00 | $2,500 |
| <u>Closure of Treatment Cell</u> | | | |
| Removal of piping, gravel, and liner | 6 dy | $3,000.00 | $18,000 |
| <u>Clearing/Closure Activities</u> | | | |
| Bulldozer | 2 dy | $1,400.00 | $2,800 |
| Laborer (1@8hrs/dy@2days) | 16 hr | $30.00 | $480 |
| Fertilize, Seed, and Mulch | 4,000 sy | $0.50 | $2,000 |
| Remove temporary fencing | 1,205 LF | $2.00 | $2,410 |
| <u>Water Level Measurements and Sampling Costs</u> | | | |
| 40 PVC Screen | 20 LF | $5.00 | $100 |
| Riser for piezometer | 9 LF | $2.25 | $20 |
| Water level meter | 2 dys | $20.00 | $40 |
| Terra-Probe Rental w/ Operator | 2 dys | $500.00 | $1,000 |
| Terra-Probe Mob/Demob | 200 mi | $0.21 | $42 |
| Teflon tubing | 300 LF | $2.00 | $600 |
| Sample vials | 20 ea | $4.00 | $80 |
| Pesticide Analysis | 10 ea | $150.88 | $1,509 |
| Labor (Geologist) | 32 hrs | $30.00 | $960 |
| Labor (Engineer) | 8 hrs | $30.00 | $240 |
| Labor (Sr Hydrologist) | 16 hrs | $45.00 | $720 |
| Lodging/PD (2dys/2people @$80/dy) | 2 dys | $160.00 | $320 |
| <u>Water Well Survey</u> | | | |
| Labor (Engineer) | 40 hrs | $30.00 | $1,200 |
| Labor (Sr Engineer) | 8 hrs | $40.00 | $320 |
| Lodging/PD (5dys/1 person @$80/dy) | 5 dys | $80.00 | $400 |
| <u>Groundwater Monitoring Well Installation</u> | | | |
| Well installation w/ Materials | 15 LF | $14.00 | $210 |
| Well Construction | 1 LS | $125.00 | $125 |
| Well Completion | 1 LS | $75.00 | $75 |
| Well Development | 1 LS | $75.00 | $75 |
| Mob/Demob | 1 LS | $1,000.00 | $1,000 |
| Lodging/PD (assume 1dys/2people @$80/dy) | 1 dys | $160.00 | $160 |
| Decon | 3 hrs | $100.00 | $300 |

| | | | |
|---|---|---|---|
| Pesticide Analysis | 1 ea | $150.88 | $151 |
| Labor (Engineer) | 8 hrs | $30.00 | $240 |
| Labor (Geologist) | 8 hrs | $30.00 | $240 |
| | | | |
| <u>Evaluation Report</u> | | | |
| Labor (Engineer) | 48 hrs | $30.00 | $1,440 |
| Labor (Sr. Engineer) | 8 hrs | $30.00 | $240 |
| Other Direct Costs | 1 LS | $100.00 | $100 |
| | | | |
| **TOTAL DIRECT COSTS** | | | $293,700 |
| | | | |
| **INDIRECT COSTS** | | | |
| Health and Safety (@2%) | | | $5,874 |
| Administration and Permitting Fees (@2%) | | | $5,874 |
| Engineering and Design (@15%) | | | $44,055 |
| Construction Support Services (@10%) | | | $29,370 |
| | | | |
| **TOTAL INDIRECT COSTS** | | | $85,173 |
| | | | |
| **TOTAL CAPITAL COSTS** | | | $378,873 |
| | | | |
| **OPERATION AND MAINTENANCE COSTS (annual)** | | | |
| <u>Nutrients and Amendments</u> | | | |
| Fertilizer | 10,300 lb | $0.50 | $5,150 |
| Surfactant | 1,266 lb | $5.00 | $6,330 |
| Glucose | 37,980 lb | $1.00 | $37,980 |
| Blood Meal | 1,266 lb | $5.00 | $6,330 |
| | | | |
| <u>Other</u> | | | |
| Power requirements | 100,000 kwh | $0.10 | $10,000 |
| Oversight Labor (4 hr/wk, 50wks) | 200 hr | $75.00 | $15,000 |
| Monitoring | 12 mo | $950.00 | $11,400 |
| Analytical | 1 LS | $12,000.00 | $12,000 |
| | | | |
| Annual Operation and Maintenance Costs | | | $104,190 |
| **TOTAL OPERATION AND MAINTENANCE COSTS (3 years @ 6% interest rate)** | | | $278,500 |
| | | | |
| **TOTAL CAPITAL COSTS AND OPERATION AND MAINTENANCE COSTS** | | | $657,373 |
| | | | |
| **CONTINGENCY (@10%)** | | | $65,737 |
| | | | |
| **TOTAL COST OF ALTERNATIVE 15-3** | | | $723,111 |

# APPENDIX D

## INTERIM MEASURE MONITORING PLAN FOR RECOVERY SUMPS WITH TOTAL FLUIDS PUMPING AT SOLID WASTE MANAGEMENT UNITS 6 AND 7

## Appendix D
## Interim Measure Monitoring Plan for Recovery Sumps with Total Fluids Pumping at Solid Waste Management Units 6 and 7

**D.1 Introduction** This interim measure monitoring plan for the recovery of light nonaqueous phase liquid (LNAPL) at Solid Waste Management Units (SWMUs) 6 and 7 was written to comply with the State regulatory requirement, *Florida Petroleum Contaminated Site Cleanup Criteria* (Florida Administrative Code [FAC] 62-770). The interim measure is currently being implemented by five 36-inch diameter sumps with surface skimming pumps for total fluids recovery of LNAPL (Figure D-1).

The interim measure was previously discussed in Chapter 3.0 of the Corrective Measure Study for the Group II SWMUs (ABB Environmental Services, Inc. [ABB-ES], 1996). This Appendix provides a workplan for monitoring the effectiveness of the recovery of LNAPL during the interim measure. The monitoring program also provides guidance for assessing whether or not alternatives or additions to the current interim measure recovery system are warranted, and if human health and/or ecological risk assessments are necessary. The need to conduct additional recovery of hydrocarbon related constituents dissolved in groundwater will be based on the success of the interim measure and the results of the human health and ecological risk assessments, if required.

In order for the interim measure to be considered effective, two objectives should be met.

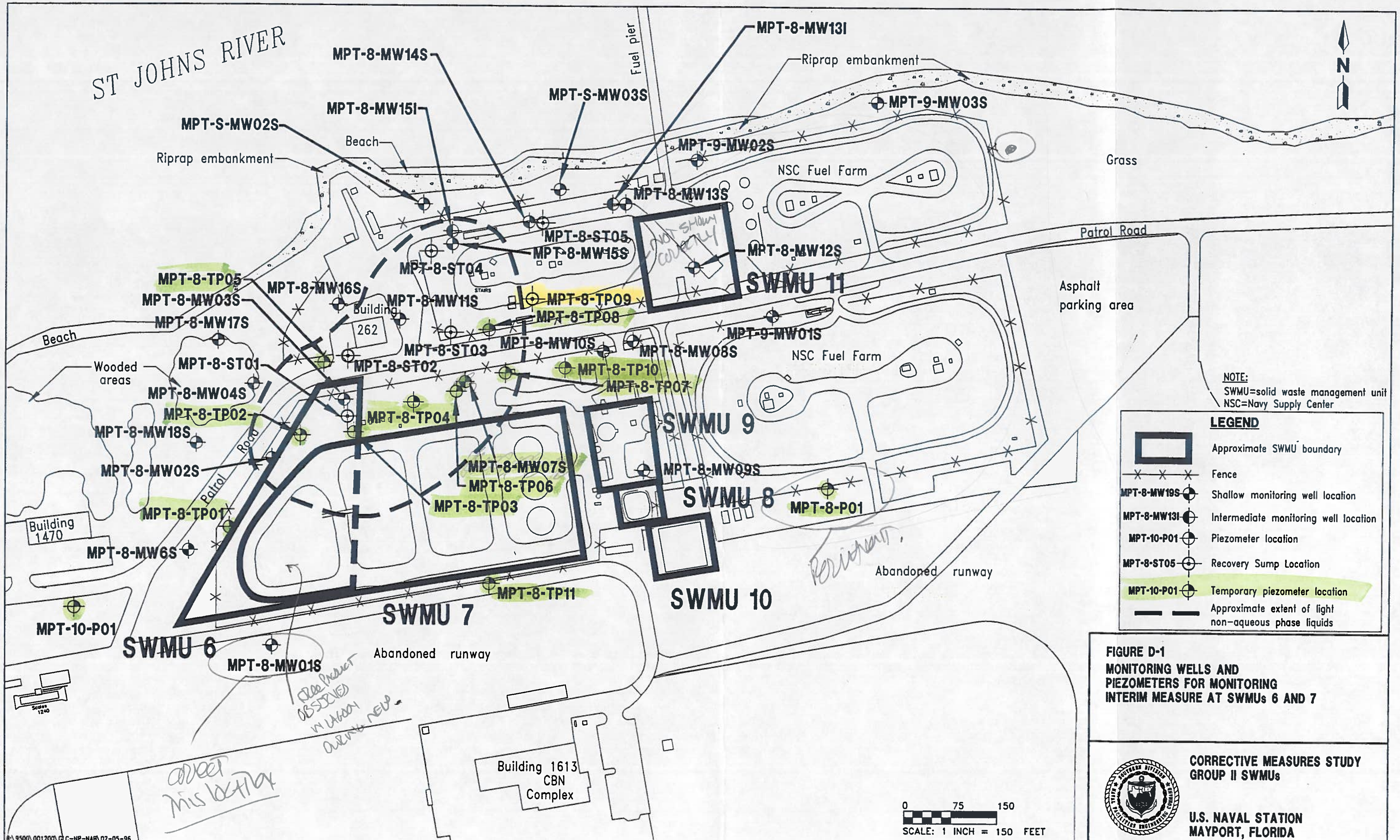
1) The interim measure must manage the lateral migration of the LNAPL.

2) The interim measure must remove LNAPL to a thickness of less than 0.1 inch. —TOUGH TO DO!

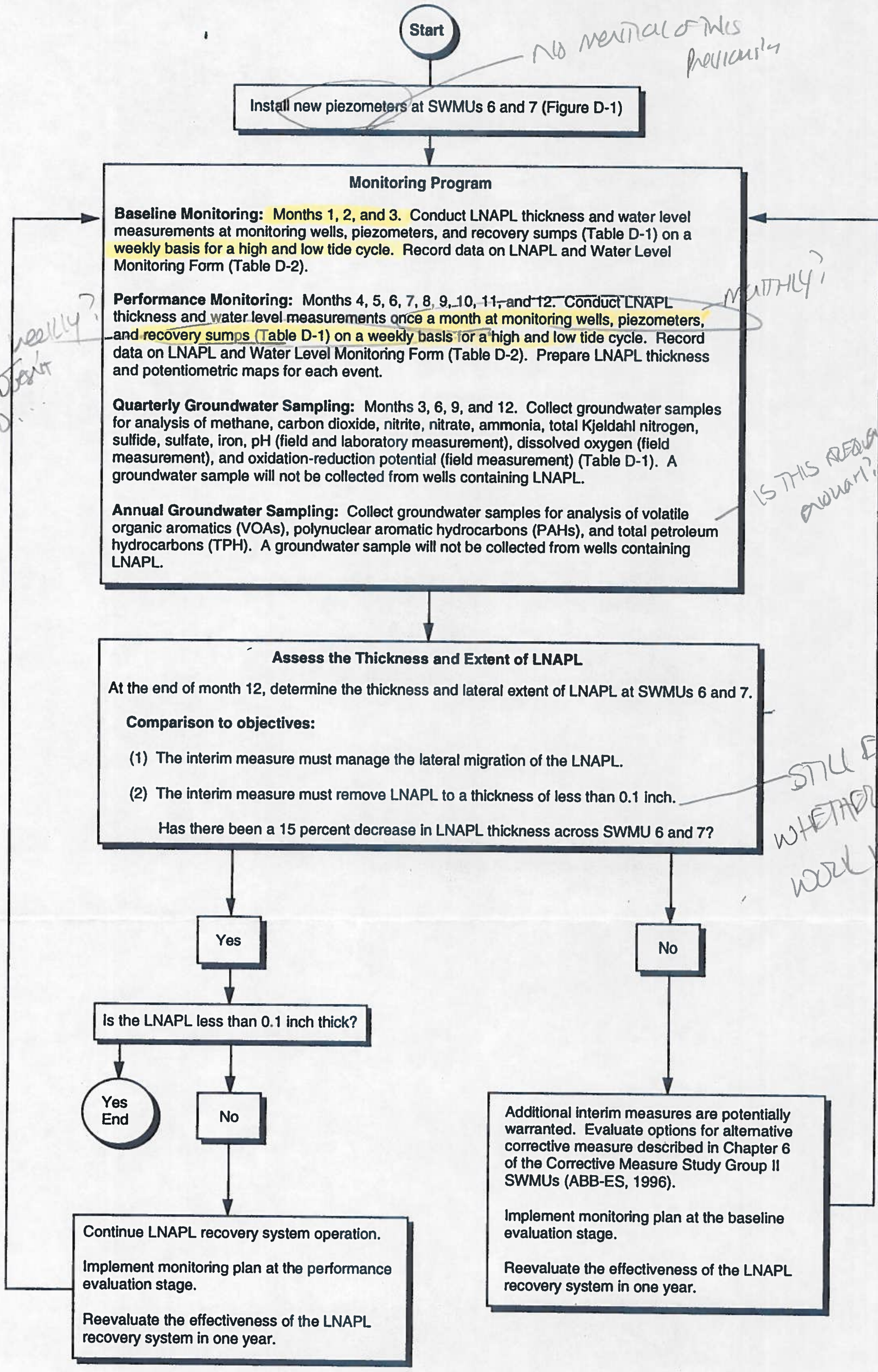
LNAPL thickness and groundwater level measurements obtained during this proposed monitoring plan will be evaluated to assess the effectiveness of the interim measure with respect to the two objectives. Chemical analysis of groundwater samples will be used to assess whether or not biodegradation is occurring, and the need for conducting human health and ecological risk assessments. Monitoring activities detailed in this plan include:

- defining LNAPL thickness and extent,
- obtaining regular measurements of water table elevations and LNAPL thickness in monitoring wells or piezometers throughout the LNAPL area, and
- collecting groundwater samples from monitoring wells hydraulically upgradient and downgradient of the LNAPL area for biodegradation modeling, total petroleum hydrocarbons (TPHs) measurements, and analysis of volatile organic aromatics (VOAs) and polynuclear aromatic hydrocarbons (PAHs).

A flow diagram illustrating the logic of the interim measure monitoring program is provided on Figure D-2.



ST JOHNS RIVER
MPT-8-MW14S
MPT-8-MW13I
Riprap embankment
Fuel pier
MPT-S-MW03S
MPT-9-MW03S
MPT-8-MW15I
MPT-S-MW02S
Beach
Riprap embankment
MPT-9-MW02S
NSC Fuel Farm
Grass
MPT-8-MW13S
MPT-8-ST05
MPT-8-MW15S
MPT-8-MW12S
Patrol Road
MPT-8-ST04
SWMU 11
MPT-8-TP05
MPT-8-MW16S
MPT-8-MW03S
MPT-8-MW11S
MPT-8-TP09
Asphalt parking area
Building 262
MPT-8-TP08
MPT-8-MW17S
Beach
MPT-9-MW01S
MPT-8-ST03
MPT-8-MW10S
MPT-8-MW08S
NSC Fuel Farm
Wooded areas
MPT-8-ST01
MPT-8-ST02
MPT-8-TP10
MPT-8-TP07
MPT-8-MW04S
NOTE:
SWMU=solid waste management unit
NSC=Navy Supply Center
MPT-8-TP02
MPT-8-TP04
SWMU 9
MPT-8-MW18S
Patrol Road
MPT-8-MW02S
MPT-8-MW07S
MPT-8-TP06
MPT-8-MW09S
SWMU 8
MPT-8-P01
MPT-8-TP03
MPT-8-TP01
Building 1470
MPT-8-MW6S
Abandoned runway
MPT-8-TP11
SWMU 10
SWMU 7
MPT-10-P01
SWMU 6
MPT-8-MW01S
Abandoned runway
Building 1613 CBN Complex
LEGEND
Approximate SWMU boundary
Fence
MPT-8-MW19S Shallow monitoring well location
MPT-8-MW13I Intermediate monitoring well location
MPT-10-P01 Piezometer location
MPT-8-ST05 Recovery Sump Location
MPT-10-P01 Temporary piezometer location
Approximate extent of light non-aqueous phase liquids
N
0 75 150
SCALE: 1 INCH = 150 FEET
FIGURE D-1
MONITORING WELLS AND PIEZOMETERS FOR MONITORING INTERIM MEASURE AT SWMUs 6 AND 7
CORRECTIVE MEASURES STUDY GROUP II SWMUs
U.S. NAVAL STATION MAYPORT, FLORIDA




8533-09-TKB FIG D-2 020696MAW

NOTES:
LNAPL = light nonaqueous-phase liquid
SWMU = solid waste management unit

FIGURE D-2
FLOW DIAGRAM FOR INTERIM MEASURE AT SWMUs 6 AND 7

CORRECTIVE MEASURES STUDY
GROUP II SWMUs

U.S. NAVAL STATION
MAYPORT, FLORIDA

**D.2 Determination of LNAPL Thickness and Extent** The initial thickness and extent of LNAPL at SWMUs 6 and 7 will be determined using product thickness measurements and water level data obtained from existing monitoring wells and existing and newly installed piezometers (Table D-1 and Figure D-1). A baseline round of weekly LNAPL thickness and water table elevation measurements (Section D.3) will be obtained after installation of the new piezometers. Subsequent to the baseline round of measurements, performance evaluation measurements will be collected on a monthly basis.

After the interim measure recovery system has been in operation for one year, the change in thickness and extent of LNAPL at SWMUs 6 and 7 will be based upon comparison of the baseline (weekly) measurements with the performance (monthly) measurements. This comparison will be used to assess the overall effectiveness of the interim measure at reducing the thickness and extent of the LNAPL. A 15 percent decrease in the LNAPL thickness across the SWMU 6 and 7 area, as determined from the comparison of baseline and performance rounds of measurements, will be the criteria used to assess whether or not the LNAPL recovery system is adequately controlling the LNAPL.

WHERE DID THIS # COME FROM BASED ON SIZE CHARACTERISTICS & TYPE OF SYSTEM.

**D.3 Water Table Elevation and LNAPL Thickness Measurements** Because groundwater table fluctuations occur during tidal cycles and seasonal changes, which may affect the presence or absence of LNAPL in monitoring wells near the edge of the LNAPL plume, these factors will be considered when determining the extent of the LNAPL area. The groundwater level measurement should be made first in wells or piezometers closest to the St. Johns River, and then in an order of increasing distance from the river.

The depth to LNAPL and groundwater will be made by obtaining direct readings from a measuring tape that has an attached electric oil/water interface probe. The probe will be suspended into a well or piezometer and slowly lowered until either the LNAPL or water is encountered. The measurement will be recorded to a precision of 0.01 foot and referenced to the notch or designated point on the north side of a monitoring well or piezometer. The measurements will be converted to elevations relative to the National Geodetic Vertical Datum of 1929, and used to construct thickness maps of the LNAPL and potentiometric maps of the water table zone of the surficial aquifer. The measuring tape will be properly decontaminated (ABB-ES, 1991) after LNAPL and water level measurements are made at each well or piezometer.

Water table and LNAPL thickness readings will be documented in a field log book for wells and piezometers in the vicinity of SWMUs 6 and 7. Figure D-1 depicts existing and proposed wells and piezometers for this monitoring plan. Table D-2 provides an example of a form to be used when recording the measurements. Water table and LNAPL thickness measurements will be recorded while the LNAPL recovery system is in operation and during high and low tide. The times of lowtide and hightide are available in local newspapers and also will be documented. It is anticipated that each measurement event will occur over one or two days, depending on when the tidal cycles occur.

Water table elevation and LNAPL thickness measurements will be collected once per week at both high and low tide during the first three months (baseline round). Subsequently, performance evaluation measurements will be made once per month during a corresponding high and low tide cycle.

## Table D-1
## Summary of LNAPL and Water Level Measurements and Groundwater Sampling Events

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

| Well, Piezometer or Recovery Sump Number | LNAPL and Groundwater Level Measurement | Quarterly Sampling Event | Annual Sampling Event |
|---|---|---|---|
| MPT-8-MW01S | Yes | Yes | Yes |
| MPT-8-MW02S[1] | Yes | No | No |
| MPT-8-MW03S[1] | Yes | No | No |
| MPT-8-MW04S | Yes | Yes | Yes |
| MPT-8-MW05S[2] | Yes | No | No |
| MPT-8-MW06S | Yes | Yes | Yes |
| MPT-8-MW07S[1] | Yes | No | No |
| MPT-8-MW08S | Yes | Yes | Yes |
| MPT-8-MW09S | Yes | Yes | Yes |
| MPT-8-MW10S | Yes | Yes | Yes |
| MPT-8-MW11S | Yes | Yes | Yes |
| MPT-8-MW12S | Yes | Yes | Yes |
| MPT-8-MW13S | Yes | Yes | Yes |
| MPT-8-MW13I | Yes | Yes | Yes |
| MPT-8-MW14S | Yes | Yes | Yes |
| MPT-8-MW15S | Yes | Yes | Yes |
| MPT-8-MW15I | Yes | Yes | Yes |
| MPT-8-MW16S | Yes | Yes | Yes |
| MPT-8-MW17S | Yes | Yes | Yes |
| MPT-8-MW18S | Yes | Yes | Yes |
| MPT-8-P01S | Yes | No | No |
| MPT-10-P01S | Yes | No | No |
| MPT-S-MW02S | Yes | Yes | Yes |
| MPT-S-MW03S | Yes | Yes | Yes |
| MPT-9-MW01S | Yes | No | No |
| MPT-9-MW02S | Yes | Yes | Yes |
| MPT-9-MW03S | Yes | No | No |
| MPT-8-ST01[1] | Yes | No | No |
| MPT-8-ST02[1] | Yes | No | No |
| MPT-8-ST03[1] | Yes | No | No |
| MPT-8-ST04 | Yes | No | No |
| MPT-8-ST05 | Yes | No | No |

[1] The monitoring well, piezometer or sump may contain LNAPL
[2] Monitoring well not shown on Figure 1, please refer to Plate 1 in the NAVSTA Mayport General Information Report (ABB-ES, 1995)

Notes: Quarterly and Annual Sampling events are described in Section D.4
LNAPL = light non-aqueous phase liquid.
NAVSTA = Naval Station.
MW = monitoring well.
P = piezometer.
ST = recovery sump.

## Table D-2
## Example LNAPL and Water Level Monitoring Form

Corrective Measures Study
Group II SWMUs
NAVSTA Mayport, Jacksonville, Florida

Date: 1-1-96
Activity: Monthly Water/LNAPL Measurements Recordings
Sampler Identification: Shannon Buckley

Peak High Tide: 0900
Peak Low Tide: 1300
Page 1 of 1

| Well Location | LNAPL Present? (Yes/No) | Top of Casing (TOC) (feet msl) | LNAPL Level from TOC (feet) | Water Level from TOC (feet) | LNAPL Thickness (feet) | Time of Measurement | Groundwater Sample[1] Quarterly (Q) Annual (A) or None (N) | Notes |
|---|---|---|---|---|---|---|---|---|
| MPT-9-MW03S | No | 14.59 | 0.0 | 4.5 | 0.0 | 0730 | N | |
| MPT-9-MW02S | Yes | 10.08 | 10.01 | 10.21 | 0.2 | 0736 | N | |
| MPT-8-MW03S | Yes | 11.9 | 11.42 | 11.72 | 0.3 | 0743 | N | |
| MPT-8-MW13S | | | | | | | | |
| MPT-8-MW13I | | | | | | | | |
| MPT-S-MW03S | | | | | | | | |
| MPT-8-MW14S | | | | | | | | |
| MPT-8-MW15S | | | | | | | | |
| MPT-8-MW15I | | | | | | | | |
| MPT-8-MW11S | | | | | | | | |
| MPT-8-MW16S | | | | | | | | |
| MPT-8-MW17S | | | | | | | | |
| MPT-8-MW04S | | | | | | | | |
| MPT-8-MW14S | | | | | | | | |
| MPT-8-MW15S | | | | | | | | |

[1] Analytical Parameters include those specified in Section D.4 of the Monitoring Plan.

Notes: SWMU = solid waste management unit
LNAPL = light non-aqueous phase liquid
msl = mean sea level; National Geodetic Vertical Datum of 1929

After the first yearly evaluation period, the frequency of LNAPL and groundwater level measurements should be monthly, unless the LNAPL recovery system is modified. A new baseline round followed by monthly performance rounds should be conducted for any year where a modification is made to the LNAPL recovery system that results in an increase in the volume of fluid, either LNAPL or groundwater, being recovered.

D.4 Groundwater Sampling Groundwater sampling will be conducted to obtain data to assess whether or not biodegradation is occurring (quarterly event) and the need to conduct human health and ecological risk assessments (annual event). Groundwater samples will be collected using low-flow purging and sampling described in the U.S. Naval Station (NAVSTA) Mayport General Information Report (ABB-ES, 1995). The analytical data packages for the quarterly and annual events will be Naval Energy and Environmental Support Activity Level E (U.S. Environmental Protection Agency [USEPA] Level II). The analytical data will not be validated. The following paragraphs describe the quarterly and annual groundwater sampling events.

Quarterly Groundwater Sampling Events. The sump recovery system relies on the physical removal of LNAPL and not biodegradation. However, the effectiveness of the interim measure would be enhanced by biodegradation caused by naturally present microorganisms. To assess whether biodegradation is occurring, groundwater samples from monitoring wells and piezometers will be analyzed for the following parameters:

- methane (USEPA Method 8015 Modified)
- carbon dioxide (determined from alkalinity USEPA 310.1)
- nitrite (USEPA Method 354.1)
- nitrate (USEPA Methods 353.2 or 354.1)
- ammonia (USEPA 350.1)
- total Kjeldahl nitrogen (USEPA Method 351.2)
- sulfide (USEPA Method 9030)
- sulfate (USEPA Method 375.4)
- iron (USEPA Method 6010)
- pH (field and laboratory measurement [USEPA 150.1])
- dissolved oxygen (field measurement) and
- oxidation-reduction potential (field measurement).

Groundwater samples for assessing biodegradation will be collected quarterly from monitoring wells in the vicinity of SWMUs 6 and 7 (Table D-1). Figure D-1 depicts existing monitoring wells along with existing and proposed piezometers. Table

D-2 provides an example of a groundwater sampling record to be used when collecting samples.

Annual Groundwater Sampling Events Annual groundwater sampling events will be conducted to collect samples for chemical analysis. The results of the chemical analysis will be used to assess whether or not human health and or ecological risk assessments are warranted and if remediation is required for hydrocarbon related organic compounds that are dissolved in groundwater. Groundwater samples will be collected on a yearly basis (at the end of each year(s) of system operation) from monitoring wells and/or piezometers (Table D-1 and Figure D-1). Groundwater samples will be analyzed for VOAs (USEPA Method 8020), PAHs (USEPA Method 8100), and TPH (USEPA Method 9073). A groundwater sample will not be collected from wells that contain LNAPL.

D.5 Annual Interim Measure Report A report on the interim measure will be prepared at the end of each year of operation. The report will include sections that describe whether or not the recovery system is meeting the objectives of the interim measure based on LNAPL and water level measurement data, an evaluation of whether or not naturally occurring organisms are contributing to the decrease in TPH concentrations, and if the annual groundwater sampling data suggest that human health and or ecological risk assessments are warranted. The following paragraphs describe information that will be included in the report:

LNAPL thickness and Water Level Measurements The effectiveness of the interim measure to manage the lateral migration of the LNAPL and removal to a thickness of less than 0.1 inch will be based on LNAPL thickness and water level measurements. The thickness and lateral extent of LNAPL will be determined after the recovery system has been operating for one year. Product thickness maps for each monitoring event will be produced to illustrate the variation in LNAPL thickness and extent over time. Potentiometric surface maps will also be produced for each monitoring event to illustrate the variation in groundwater flow direction over time. Because the LNAPL thickness fluctuates with changes in groundwater table elevation, a statistical analysis would be performed to evaluate the average decrease in LNAPL thickness.

The interim measure will be considered effective at removing LNAPL if the LNAPL decreases in thickness by 15 percent across the LNAPL area (based on comparison of the baseline data to the performance data, Section D.2). This criteria will also be used as the basis for suggesting that modifications to the recovery system to increase the recovery of LNAPL will not be necessary. The existing LNAPL recovery system should continue to be operated and evaluated on a yearly basis or until the LNAPL thickness is reduced to less than 0.1 inch.

Quarterly Groundwater Sampling Events Results from the quarterly groundwater sampling events for indicator parameters will be used to evaluate the effectiveness of the interim measure to be enhanced by biodegradation caused by naturally present microorganisms. An example would be to assess trends such as an increase in the dissolved oxygen concentration and a decrease in TPH concentrations.

Annual Groundwater Sampling Events Human health or ecological risk assessments may be warranted either during or at the conclusion of the interim measure. The results of human health and ecological risk assessments along with comparison of the detected chemical concentration to applicable promulgated regulatory criteria will be used to assess whether or not remediation is warranted for hydrocarbon related compounds dissolved in groundwater. Analytical results from the annual monitoring event(s) will be compared (screened against) with Florida Groundwater Guidance Concentrations (FDEP, 1994), Ambient Water Quality Criteria (USEPA, 1991), Class III marine surface water quality criteria (FAC 62-302), and background concentrations for groundwater and surface water that are presented in the NAVSTA Mayport General Information Report (ABB-ES, 1995).

The need for the risk assessments could be warranted based on one or more of the following:

- detection of LNAPL in monitoring wells located along the St. Johns River, and

- detection of VOA or PAH target analytes in groundwater samples from monitoring wells located along the St. Johns River at concentrations that exceed the screening concentrations.

The purpose of monitoring program is to assess the success of the interim measure and determine whether or not additional evaluations are warranted. As a result, the monitoring program does not specifically address the type or level of analyses required for conducting human health or ecological risk assessments. Therefore, the interim measure monitoring results for LNAPL thickness, potentiometric surface, quarterly, and annual groundwater sampling events will be used, if necessary, to design a sampling and analysis plan that would address the specific data requirements for human health and/or ecological risk assessments.

This may include collecting groundwater samples from a specific monitoring well(s) and conducting the sampling and analysis as described in the NAVSTA Mayport General Information Report (ABB-ES, 1995). Specific data for the ecological risk assessment may also include groundwater and/or sediment samples for chemical characterization and toxicity testing using aquatic or benthic animals.

## REFERENCES

ABB Environmental Services, Inc. (ABB-ES), 1991, RFI Workplan, Volumes I, II, and III (Interim Final): prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), North Charleston, South Carolina, October.

ABB-ES, 1995, Resource Conservation and Recovery Act (RCRA) Corrective Action Program General Information Report, U.S. Naval Station Mayport (Volumes I and II): prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina, July.

ABB-ES, 1996, Corrective Measure Study Group II Solid Waste Management Units, U.S. Naval Station Mayport (Volumes I and II): prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina, January.

Florida Department of Environmental Protection, 1994, Florida Groundwater Guidance Concentrations: Division of Water Facilities, Bureau of Groundwater Protection, June.

U.S. Environmental Protection Agency (USEPA), 1991b, Water Quality Criteria Summary, Office of Science and Technology, Health and Ecological Criteria Division, Washington, D.C., May.

# APPENDIX E

# RESPONSE TO REGULATORY COMMENTS

## PROJECT REVIEW COMMENTS

**Corrective Measures Study**
**Group II Solid Waste Management Units (SWMUs)**
**U.S. Naval Station**
**Mayport Florida**

---

## INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), under the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract, No. N62467-89-D-0317, is conducting a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) on behalf of the U.S. Navy at Naval Station (NAVSTA) Mayport, Mayport, Florida. This investigation is being conducted in accordance with the Hazardous and Solid Waste Amendment (HSWA) permit No. FL9-170-024-260, issued by the U.S. Environmental Protection Agency (USEPA) on March 25, 1988, and revised and reissued June 15, 1993.

The purpose of this document is to respond to comments made by the Florida Department of Environmental Protection (FDEP) in a memorandum dated October 5, 1995, and correspondence dated October 16, 1995, and comments from the USEPA (no date) concerning the draft Corrective Measures Study for Group II Solid Waste Management Units (SWMUs), dated July 1995. The following sections of this response to comments document provides point-by-point responses to FDEP and USEPA comments.

**Corrective Measures Study**
**Group II Solid Waste Management Units (SWMUs)**
**U.S. Naval Station**
**Mayport Florida**

Response to FDEP Comments in Memorandum Dated October 5, 1995

1. **Page 4-2, Section 4.2.1.1, proposes a Corrective Action Objective (CAO) for SWMUs 6, 7, 8, 9, 10, and 11 as, "Eliminate petroleum-contaminated sludge and soil at SWMUs 6 and 7 that contribute to the presence of LNAPL." I suggest that the CAO be broadened to consider all contaminated media including contaminated groundwater and phreatic soils.**

   The CAOs for SWMU 6 and 7 were formulated based on consideration of data collected during the RFI and review of regulatory requirements. Data collected during the RFI indicate that petroleum hydrocarbons in sludge and soil in the vadose zone beneath SWMUs 6 and 7 were the likely source of LNAPL present on the water table in the vicinity of these SWMUs. No regulatory requirements were identified as being directly applicable to the presence of any allowable concentrations of petroleum hydrocarbons in unsaturated soils beneath these SWMUs.

   The cleanup of soils containing petroleum hydrocarbons and LNAPL at these SWMUs is based on the assumption that sludge and soil in the vadose zone beneath SWMUs 6 and 7 was the source of LNAPL as well as the source of any dissolved constituents present in groundwater and any contamination of phreatic soil. The soil containing petroleum hydrocarbons will be excavated and treated (Florida Administrative Code [FAC] 62-775.400) to produce residual concentrations that are not likely to cause adverse effects to groundwater. The wording of the CAO will be broadened to include impacts to other media.

   If, after completion of the recommended corrective measures (treatment of sludge and soil via thermal desorption and interim measures for LNAPL removal), LNAPL was still present on the water table in excess of 0.1 inch, additional corrective measures (such as examining technologies for groundwater and phreatic soil) could be taken. The need for additional corrective measures, if any, should be evaluated during the proposed interim measures monitoring program (please refer to Appendix D in the CMS).

2. **Page 4-3, provides a rationale for not considering a CAO for protection of ecological receptors, "An assumption of no risk to aquatic life resulting from potential exposure to groundwater was made because groundwater would be diluted at least five times as it discharges to the St. Johns River." this is not consistent with present Department policy and is not sufficient justification for not including a CAO for ecological protectiveness. This issue could possibly be resolved with more thoughtful formulation of CAOs (refer to Comment No. 1).**

   Comment acknowledged. Groundwater flow and analytical data do not suggest that there is a current exposure to ecological receptors at the St. Johns River from SWMUs 6 and 7. The groundwater flow of the surficial aquifer at the OWTP area is generally toward the north and ultimately discharges into the St. Johns River (please refer to Figure 3-2). Groundwater flow velocities for water are estimated at 69 to 87 feet per year. Based on analytical results from groundwater samples collected from monitoring wells MPT-8-MW19S and MPT-8-MW20S, petroleum hydrocarbons and related chemicals have not reached the St. Johns River in an area that appears (Figure 3-2) to be directly hydraulically downgradient from SWMUs 6 and 7.

The retardation of the petroleum hydrocarbons moving toward the St. Johns River may be related to factors such as the fine-grained sandy matrix of the surficial aquifer, the viscosity of the petroleum hydrocarbons, and tidal fluctuations causing smearing of the petroleum hydrocarbons over a large area. Based on these findings and assumptions, a CAO for the protection of ecological receptors does not appear warranted at this time.

Data collected during the monitoring program for the interim measures removal of LNAPL could be used to assess the effectiveness of LNAPL recovery, whether or not the recovery system is limiting LNAPL migration toward the St. Johns River, and the need for additional sampling activities to evaluate potential human health or ecological risk, if warranted.

3. **Page 4-6, highlights a potential public health threat. Obtaining public health data to resolve this potential threat should be the Navy's principal concern (i.e., is the water table aquifer being used as a potable water source?). Has the RAB been briefed about this issue? In addition, "Evaluate the distribution of benzene hexachloride (BHC) isomers in groundwater at SWMU 15" is not a CAO, but a data gap. If groundwater is contaminated and poses a potential risk, a CAO is needed to define the objectives and resolve the risk and contamination.**

Additional investigation of groundwater at SWMU 15 is warranted, as stated in the Group II RFI and CMS reports. The additional groundwater assessment is proposed to follow the completion of the technology demonstration because it is not known if the bioaugmentation of *in situ* soil at SWMU 15 may mobilize the pesticides. Evaluation of BHC in groundwater will be deleted from this CAO. The results of the investigation will be used to develop an additional CAO, if applicable, and, if required, assess corrective measures to mitigate the horizontal and vertical extent of the groundwater contamination.

The Navy is making every effort to complete the study of SWMU 15 as soon as possible and has proposed that these studies be completed under the next phase of the Navy Environmental Leadership program (NELP) technology demonstrations. It is anticipated that the groundwater investigation under NELP would be implemented in 1996. The schedule for completing these studies will be communicated during NAVSTA Mayport partnering meetings to FDEP and USEPA. The NAVSTA Mayport RAB has been briefed on this issue.

4. **Table 5-1 screens out *insitu* treatment technologies such as soil vapor extraction and biodegradation. Based on the Departments's knowledge of SWMUs 6 and 7, the stated**

**reasons for not considering these technologies in alternative formulation do not seem justified. The Navy may be missing good opportunities to achieve cleanup goals at minimal cost by not considering potentially applicable *insitu* treatment technologies.**

The Navy considered *in situ* technologies during the development of corrective action alternatives at SWMUs 6 and 7. However, *in situ* technologies were not considered to be preferred for four reasons. First, in order for LNAPL removal to be effective in the short-term, the source of LNAPL production (i.e., sludge and soil) must be removed. Therefore, excavation and removal of the source was considered a priority versus an *in situ* technology that could take years to complete. If the recommended corrective measures for LNAPL removal at SWMUs 6 and 7 are not effective, an *in situ* technology may be considered. Second, the effectiveness of *in situ* technologies is questionable because of the hydrogeologic setting at SWMU 6 and 7 which includes factors such as seasonal and tidal water table fluctuations of approximately 0.5 to 3 feet. Third, the thickness of the vadose zone (ranging from approximately 3 to 10 feet beneath the land surface) at SWMUs 6 and limited amount of paved (impermeable) land surface would result in an ineffective (short circuited) soil vapor extraction system. Fourth, the LNAPL could be toxic to biological organisms; therefore, until it is removed, this technology is inappropriate.

5. **Section 7, the department makes the following suggestion before the Navy chooses the preferred alternative for SWMUs 6 and 7. The Navy's Mayport project manager should talk with the Cecil Field project manager to obtain empirically based performance, cost, and management data on remediation projects that involve large-scale excavation and on-site thermal-treatment of petroleum contaminated soil.**

The Navy is aware of the referenced NAS Cecil Field project. The Navy is in contact with the NAS Cecil Field project manager and will address "lessons learned" from that project when developing the design for the preferred alternatives for SWMUs 6 and 7.

6. **The proposed preferred alternative for SWMU 15 seems to be both protective and practical (once the potable groundwater issue is resolved; refer to section 2.3).**

The effectiveness of *in situ* bioremediation at SWMU 15 will be evaluated after the technology demonstration for NELP has been completed. At that time, data will be collected to evaluate reduction in contaminant concentration, mobility of contaminants, ease of implementation, and other factors. If pesticide chemicals remain at the site at levels greater than media protection standards, the Navy will implement Alternative 15-2, Capping. Additionally, please refer to the response to the comment in Section 2.3.

**Corrective Measures Study**
**Group II Solid Waste Management Units (SWMUs)**
**U.S. Naval Station**
**Mayport Florida**

Response to FDEP Comments in Correspondence Dated October 16, 1995

1. **Evaluation of any potential groundwater threat from SWMU 15 to the shallow groundwater in Mayport should be a priority item for the Navy, as we have previously discussed.**

   Comment acknowledged. Please refer to the response to the comment in Section 2.3.

2. **When on-site thermal desorption occurs at SWMU 6 and 7, stormwater protection measures, such as berming must be used. When these activities are accomplished, only clean soil or treated soil from the area that has been certified by testing as meeting clean soil criteria may be used for this purpose.**

   Stormwater protection measures, such as berming, were not specifically considered in evaluation of the technical feasibility of this alternative in the CMS. It is agreed that these measures must be considered during the design for the implementation of this technology.

   Treated soil would be analyzed and would not be returned to the excavation unless the requirements of FAC 62-770.400 are achieved.

3. **As pointed out in Mr. Brown's second comment (section 2.2 FDEP Comment No. 2), the stated Department policy regarding contaminated groundwater as it discharges into surface water is that a dilution factor may not be applied in the evaluation of potential effects. This has been noted in other Mayport documents, and has been previously stated, the groundwater must be evaluated based on its non-diluted nature.**

   Comment acknowledged. Please refer to the response to the comment in Section 2.2.

**Corrective Measures Study**
**Group II Solid Waste Management Units (SWMUs)**
**U.S. Naval Station**
**Mayport Florida**

Response to USEPA Comments

1. **Because soil treated via thermal desorption will be returned to the excavation area, address this technology's ability to effectively treat volatile metals such as arsenic and lead. These metals may pose a risk to groundwater at SWMUs 6 and 7.**

   Concentrations of arsenic detected in groundwater samples are below Federal and State MCL of 50 micrograms per liter ($\mu g/\ell$). The maximum detected concentration of arsenic in sludge samples from SWMU 7 was 10.6 milligrams per kilogram (mg/kg). Based on this and other lower concentrations of arsenic detected in sludge and soil samples from SWMU 7, it is not likely to leach out of the soil and result in groundwater concentrations above the MCL.

   The maximum detected concentration of lead in sludge samples from SWMU 7 is 281 mg/kg. This concentration is below Florida Soil Cleanup Goals (FDEP, 1995) and USEPA Region III risk-based screening concentrations (USEPA, 1995).

   The Florida Administrative Code (FAC) 62-775 stipulates acceptable maximum concentrations for arsenic and lead in soil after thermal treatment. Soil exiting the treatment unit should be tested to ensure that the requirements of FAC 62-775 are met. Soil that contains concentrations of metals below the treatment criteria is acceptable for use as backfill material.

2. **Provide sampling evidence to support the claim made on page 4-10 of the CMS that the soil berms surrounding the sludge drying beds are not contaminated.**

   The berms are assumed not to contain petroleum hydrocarbons because they were constructed with "clean" dredge material and according to Navy personnel, overtopping of the sludge drying bed berms has not occurred. Additionally, during implementation of the thermal desorption technology, the berms will be sampled to ensure that they do not contain petroleum hydrocarbons at concentrations that are considered by FDEP to represent "excessively contaminated" soil (please refer to the response to the comment in Section 4.4).

3. **Except for the top 3 feet of clean fill in SWMU 6, the remaining soil to the water table should be assumed to be contaminated unless sampling shows otherwise.**

   SWMU 6 was excavated to a depth of 6 feet beneath the land surface (A.T. Kearney, 1989), and the central and southern part of SWMU 6 underlie SWMU 7. At the area where SWMU 6 does not lie beneath SWMU 7, the soil in the interval from 3 feet below land surface to the water table is likely to contain petroleum hydrocarbons and related volatile and semivolatile organic compounds (please refer to Appendix B-1).

4. **Page 6-7 indicates that soil will be excavated and stockpiled for treatment and that soil in the open excavation containing visible contamination or has an organic vapor reading of 50 parts per million (ppm) or greater would be excavated. Because treatment levels for soil (page 4-8 of the CMS) exiting the thermal treatment unit must achieve total petroleum concentrations of no greater than 50 ppm and this concentration must be confirmed at an off-site laboratory, justify the use of a 50 ppm reading from field screening equipment for the excavation of screening concentration. Consider that field screening equipment may not be accurate at levels at or below 50 ppm and that field screening during the RFI yielded considerable lower total petroleum hydrocarbon (TPH) concentrations than did off-site analysis during the RFI (e.g., 600 ppm compared to 22,000 ppm: see Table 4-9 of the Group II RFI).**

   The use of an organic vapor analysis instrument to determine the quantity of soil to excavate for treatment was based on the Florida regulation FAC 62-770.200(2). This regulation states that "excess soil contamination" or "excessively contaminated soil" is defined as soil saturated with petroleum products or soil that causes a total petroleum hydrocarbon reading of 500 ppm for Gasoline Analytical Group or 50 ppm for Kerosene Analytical Group or Mixed Product Analytical Group (FDEP, 1994).

   The excessive soil concentration for the gasoline petroleum group was based by FDEP on soil samples that exhibited organic vapor measurements with a flame ionizing detector (FID) of 500 ppm and had corresponding laboratory measurements for total recoverable petroleum hydrocarbon of 10 to 20 ppm (FDEP, 1994).

   The excessive soil concentration for the Kerosene Analytical Group or Mixed Product Analytical Group of 50 ppm was based by FDEP on soil samples with organic vapor measurements of 50 ppm containing fuel of this group at near saturation limits (FDEP, 1994). The Kerosene Analytical Group or Mixed Product Analytical Group value for "excessively contaminated soil" is applicable only where vapors from gasoline are not present (FDEP, 1994).

   The data in Table 4-9 are a comparison of laboratory results with a nondispersive infrared (NDIR) analyzer, which is similar to the laboratory analytical method and requires the use of a solvent to extract the petroleum hydrocarbons. The variance in analytical results was attributed to the limited linear rage of the NDIR instrument, which was calibrated at a lower range of detection limits. The NDIR provided reasonable confidence in determining horizontal and vertical extent of contamination at total petroleum hydrocarbon concentrations near 1 ppm.

5. **The storage or disposal of soil already removed from the northern area of SWMU 6 for the installation of an LNAPL recovery sump was not discussed. The soil should be treated.**

Soil excavated from the northern edge of SWMU 6 during the installation of the LNAPL recovery sumps was placed in the westernmost sludge drying bed of SWMU 7. This soil will be treated along with "excessively contaminated" unsaturated soil beneath SWMU 6 and 7.

6. **Provide an explanation of how NAVSTA Mayport will ensure that batches of treated soil will be staged separately according to composite-sampling groups while awaiting analytical results from the off-site laboratory. According to page 6-10 of the CMS, samples should be collected on an hourly basis and composites constructed over an 8-hour period. Given the 24-hour, seven days per week treatment schedule proposed in the CMS, and assuming a 7-day turn-around from the off-site laboratory, as many as 21 discrete piles (3 piles per day times 7 days) would accumulate and would need to remain separated during the first week of treatment. Explain how this will be achieved in order to insure that inadvertently treated batches are not returned to the excavation area.**

FAC 62-775 and Guidelines for the Assessment and Remediation for Petroleum Contaminated Soil (FDEP, 1994) state the frequency of samples to be collected for treated soil exiting a thermal treatment unit. Based on these documents, at least three piles would be created per day to ensure that treated soil meets clean soil requirements. If thermal desorption is selected as the preferred alternative, the design would stipulate how the piles will be maintained, marked, and separated until the analytical results for each pile are received. No piles would be returned to the excavation area or used as fill material until analytical results indicate that the soil is clean according to the requirements of FAC 62-770.

7. **There is no plan to remediate soil beneath sludge drying bed 4 because the sludge in drying bed 4 was removed and placed in sludge drying bed 3. Provide evidence that the soil beneath the drying bed to the depth of the water table is not contaminated.**

Presently, three tanks are located in the sludge drying bed formerly known as sludge drying bed No. 4 of SWMU 7. Soil beneath this bed was not included in the estimate of contaminated soil presented in the CMS because, prior to constructing the tanks, sludge and soil were excavated from the bed and placed in the adjacent bed. If, upon completion of the corrective measures for SWMU 6 and 7, LNAPL was still present on the groundwater table, additional measures may be taken, which may include removal of soil beneath the tanks. At this time, however, this soil is not considered to be the primary source of LNAPL production at the SWMUs and was therefore not considered in the volume estimate.

8. **This corrective action alternative assumes that the horizontal extent of soil contamination at SWMU 6 and 7 is limited to directly below sludge drying beds 1, 2, and 3. This assumes no contamination in the subsurface berm materials (despite the mounded water table) and no horizontal migration of contaminants beyond the areal extent of SWMU 6 and 7,**

**assumptions which are highly unlikely given the extent of LNAPL in the OWTP area. Provide additional evidence to support these conclusions, or propose an expanded area of excavation.**

As stated in the CMS, sludge and soil will be excavated based on visible staining and noticeable odor. If, during excavation of the sludge and soil for treatment, it appears that more sludge and soil should be excavated rather than included in the original volume estimate, the additional material would be excavated and treated. These issues would be considered during the design.

9. **The hand-drawn figures in Appendix B-1 do not clearly indicate the proposed extent of excavation. Upon addressing the aforementioned issues, submit a figure which clearly presents the extent of excavation.**

Shading will be added to the hand-drawn figures in Appendix B-1 to illustrate the areas at SWMUs 6 and 7 that were assumed to be contaminated. Additional details will be provided in the construction plan.

10. **At the time the draft CMS was completed (July 1995), LNAPL recovery sumps had been installed but were not fully operational. There are concerns about the effective implementation of corrective measures such as LNAPL recovery due to incomplete hydrogeological characterization of the site (see General Comment numbers 8, 9, and 13), primarily in tidally influenced areas of the site, such as Group II. In the response to the issues and concerns associated with the RFI and CMS, provide information on the preliminary effectiveness of the LNAPL recovery sumps if such information is available. Figure 3-1 (LNAPL Recovery Sump Locations) may underestimate the areal extent of LNAPL. It presents a significantly smaller areal extent of LNAPL than that presented in Figure 4-6 of the Group II RFI. Also, only three of the four wells which were not sampled during the RFI due to LNAPL presence are shown in Figure 3-1. The fourth well, MPT-8-MW15S is located approximately 140 feet northeast of the northeastern boundary of the LNAPL plume depicted in Figure 3-1, thus indicating a larger LNAPL areal extent. Additionally, page 4-3 of the CMS implies that LNAPL is present at SWMU 11, yet the areal extent of LNAPL depicted in Figure 4-6 is at least 300 feet southwest of SWMU 11. In the response to this issue, provide justification for the areal extent of LNAPL presented in Figure 3-1 of the Group II CMS.**

Since the draft CMS was issued, data has been generated on the operation of the sumps for LNAPL recovery at SWMUs 6 and 7. Chapter 3.0 of the CMS will be updated to reflect these changes.

11. **The CMS indicates that a description and evaluation of the recommended alternative for treating LNAPL at SWMUs 6 and 7, LNAPL recovery sumps with total fluids pumping, was not provided because it is currently being implemented as an interim measure (IM). However, the IM workplan (which reportedly contains a detailed description of the alternative) was not available for review. Page 6-30 states that the IM workplan does not**

**include an operation and maintenance plan for the sump system. A full evaluation of this alternative cannot be made until a detailed description and evaluation of this system is provided.**

Comment acknowledged. A plan to evaluate the performance of the IM is included as Appendix D. Please refer to the response to the comment in Section 4.10.

12. **Although *in situ* biodegradation is the recommended corrective action for soil at SWMU 15, the CMS contains very little information about this technology. It is not even addressed in Table 7-4, Justification of Corrective Action SWMU 15, and Chapter 6.0, Description and Evaluation of Corrective Action Alternatives, has a description of every alternative except *in situ* biodegradation. An excerpt from a Bioaugmentation Corrective Action Submittal Package (Environmental and Geotechnical Engineering Network, Inc. [EnGen], 1995) contains a general description of the in situ biodegradation system. It does not address any site specific information such as soil properties, operation and maintenance requirements, and the time needed to completely treat all of the contaminated soil.**

**At the time the CMS Report was completed (July 1995), the *in situ* biodegradation interim measure at SWMU 15 had not been implemented. If it has been initiated and is at a stage where soil samples have been collected (i.e., 60 days from initiation) and analyzed, submit these sampling results with other documentation submitted in response to this review report. Also provide an evaluation of Bac-Terra's (aka., BR-650) effectiveness in treating pesticides and arsenic, the latter of which, although unaddressed in the CMS, does contribute to cancer risks associated with surface soil at SWMU 15. The CMS states that the Bac-Terra submittal[1] does not claim that the product contains microorganisms capable of degrading pesticides. Given that the Bac-Terra submittal specifically addresses the unit's capability of degrading most other constituent classes (VOCs, SVOCs, petroleum hydrocarbons, stabilized heavy metal salts), it seems likely that it would also have explicitly stated any abilities to biodegrade pesticides. As it does not claim to biodegrade pesticides, justify the selection of this product for an interim measure for a CAO to treat pesticide-contaminated soils. Although the CMS generally fails to acknowledge the risks posed by arsenic and heavy metals in soil, they were quantified and documented in the Group II RFI and, therefore, NAVSTA should evaluate the ability of *in situ* biodegradation to degrade arsenic, mercury, chromium and zinc. The CMS must also address the effectiveness of other SWMU 15 corrective action alternatives (e.g., *ex situ* biodegradation) to lessen the risks posed by these constituents. Finally, the CMS must consider the potential effects that *in situ* biodegradation might have on groundwater. For example, the possibility that the fluids used in the infiltration system might mobilize soil contaminants and cause them to migrate to groundwater and then into the St. Johns River must be addressed.**

**Corrective Measures Study**
**Group II Solid Waste Management Units (SWMUs)**
**U.S. Naval Station**
**Mayport Florida**

---

1 **Given that this interim measure is funded under the NELP which promotes innovative technologies, address whether the product is in the development stage or is commercially available. If it is already commercially available, the company selling Bac-Terra may have information on its past effectiveness in treating pesticides and arsenic. Provide such information in the response to the issues and concerns raised in this review report if it is available.**

NELP promotes the use of new and innovative technologies, including implementing proven technologies in new and innovative ways. Although *in situ* bioremediation has been widely used on petroleum-contaminated soil, there is little empirical data to support the use of an *in situ* bioremediation technology on pesticide-contaminated soil. However, NELP is supporting the evaluation of *in situ* bioremediation of pesticide-contaminated soil at SWMU 15.

The effectiveness of *in situ* bioremediation at SWMU 15 will be evaluated after the technology demonstration has been completed. At this time, data will be collected to evaluate reduction in contaminant concentration, mobility of contaminants, ease of implementation, and other factors. If pesticide chemicals remain at the site at levels greater than media protection standards, the Navy would recommend implementing Alternative 15-2, Capping.

## References

A.T. Kearney, Inc., 1989, RCRA Facility Assessment of the Naval Station Mayport, Jacksonville, Florida: prepared for the U.S. Environmental Protection Agency, Atlanta, Georgia, September.

ABB-Environmental Services, Inc. (ABB-ES), 1995a, Resource Conservation and Recovery Act (RCRA) Facility Investigation, Group II SWMUs U.S. Naval Station Mayport, Mayport, Florida (Volumes I and II): prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), North Charleston, South Carolina, June.

ABB-ES, 1995b, Corrective Measures Study, Group II Solid Waste Management Unit, U.S. Naval Station Mayport, Mayport, Florida (Volumes I and II): prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina, July.

Florida Department of Environmental Protection (FDEP), 1994, Guidelines for Assessment and Remediation of Petroleum Contaminated Soil, Engineering Support Section, Division of Waste Management, Bureau of Waster Cleanup, FDEP, May.

FDEP, 1995, Memorandum from Ligia Mora-Applegate to Tim Bahr, Subject: Cleanup Goals for Military Sites in Florida; Technical Review Section, Bureau of Waste Cleanup, FDEP, Tallahassee, Florida, April.

U.S. Environmental Protection Agency, 1995, EPA Region III Risk-Based Concentration Table, Roy L. Smith, March 7.